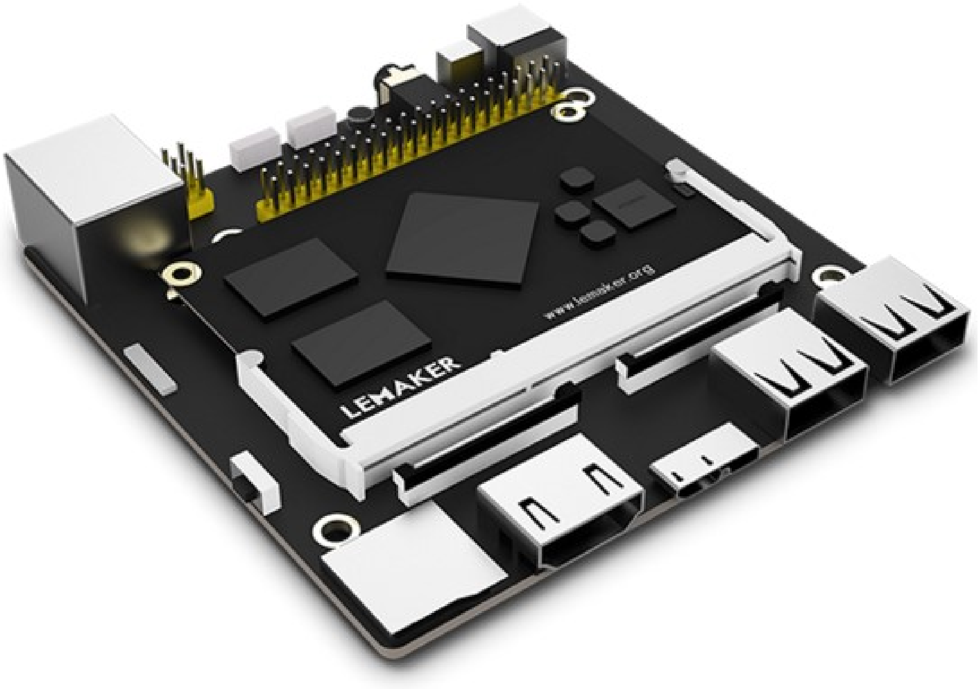
LeMaker Guitar User Manual

(The first edition)



Revision History

Revision	Data	Author	Description
1.0	2015-11-12	LeMaker	

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1 Introduction

1.1 What is LeMaker Guitar?

LeMaker Guitar is a high cost-effective SBC (single-board computer) designed by LeMaker team, which enables you to build your own individual and versatile system. In fact, it is a complete mini-computer, including all the required elements such as processor, memory, network, and other interface. LeMaker Guitar adapts actions S500 SOC, quad-core ARM® Cortex™-A9 CPU, 1GB/2GB DDR3 SDRAM and 8GB EMMC.

In order to make the users be more convenient to DIY their own platform. LeMaker team designed LeMaker Guitar by core board & base board, which significantly reduce the redesign period of personalized customization. If you don't want spend any time and any effort to design your base board, fortunately LeMaker team also offers three types of base board: Base Board Rev.B, Base Board Rev.C and Base Board Rev.D. Base Board Rev.B is also called standard revision; Base Board Rev.C is also called enhanced revision; Base Board Rev.D is also called fever-level revision. We recommend using the core board & Base Board Rev.B.

LeMaker Guitar has an excellent compatibility with multiply software support. Basically all mainstream Linux-based operating system can run on LeMaker Guitar, Such as Lemuntu, Android, Ubuntu-mate, LeMedia, Arch Linux and so on.

1.2 What is Linux

Linux is the operating system (OS) used for your LeMaker Guitar. Its role is exactly the same as Windows, Mac OS X, Android (in fact, Android is based on a Linux kernel), iOS or any other OS you care to mention. That role is to provide a platform for everything else to run on. It talks to the hardware and it talks to you, the user.

But what makes Linux different to any other OS out there? Well, for a start it's free, immensely powerful, high customisable and the best bit is it's been created for users by users. However to call Linux 'an operating system' is a bit of an understatement. It's not 'one operating system' in the same way that Windows 8 or Mac OS X is. No, it is many operating systems… hundreds even!

Linux consists of different components, each of which has many different variants. These have all been wrapped into easy-to-install distributions to meet different needs. Want a simple desktop replacement? There's a Linux distribution for that. Want a home media server? There's a distribution for that too. If you can think of it, someone in the Linux community is probably already developing for it.

Lemuntu

Lemuntu is a free operating system based on Debian Jessie optimized for LeMaker SBC and an official Linux distribution of LeMaker community. In order to take full advantage of SBC hardware resources and improve the user experience of SBC, it is necessary to optimize the operating system. Lemuntu is a running more stable, using less memory and lightweight Linux operating system.

Android

Android is a mobile operating system based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touchscreen mobile devices such as smartphones and tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear). The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touchscreen input, it has also been used in game consoles, digital cameras, regular PCs, and other electronics.

Ubuntu-mate

Ubuntu MATE is a free and open source Linux distribution and an official derivative of Ubuntu. Its main differentiation from Ubuntu is that it uses the MATE desktop environment as its default user interface, based on GNOME 2 which was used for Ubuntu versions prior to 11.04, instead of the Unity graphical shell that is the default user interface for the Ubuntu desktop.

LeMedia

LeMedia is a multimedia operating system customized with Debian and Kodi for LeMaker SBC. LeMedia was created by LeMaker Team that embraces the idea of "Share, Innovation, Opensource, Education and Commonweal", LeMedia can runs on LeMaker SBC as a media center to play games and view most videos, music, pictures, and other digital media files from local and network storage media or the Internet.

Arch Linux

Arch Linux is a Linux distribution for computers based on IA-32 and x86-64 architectures. It is composed predominantly of free and open-source software, and supports community involvement. The design approach of the development team follows the KISS principle ("keep it simple, stupid") as the general guideline, and focuses on elegance, code correctness, minimalism and simplicity, and expects the user to be willing to make some effort to understand the system's operation. A package manager written specifically for Arch Linux, pacman, is used to install, remove and update software packages. Arch Linux uses a rolling release model, such that a regular system update is all that is needed to obtain the latest Arch software; the installation images released by the Arch team are simply up-to-date snapshots of the main system components.

Note that in this user manual, all the operations and tutorials are based on LeMaker Guitar Base Board Rev.B and Lemuntu.

1.3 What accessories you need?

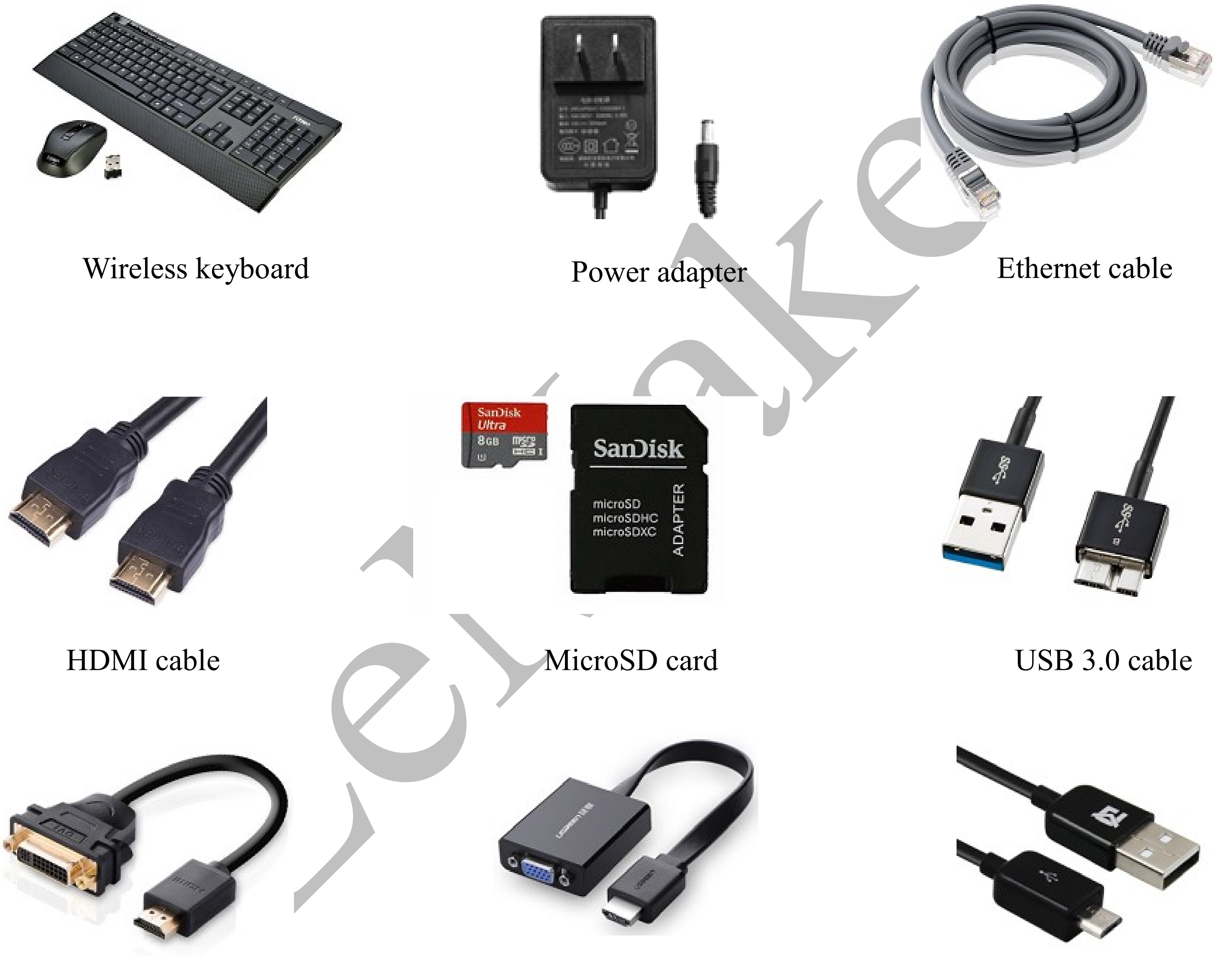
To enjoy playing your LeMaker Guitar, you will need some necessary accessories as below:

Table 1.1: Accessories table

Micro SD card	We recommend a 4GB or greater class 10 MicroSD card
Display and connectivity cables	Any HDMI/DVI/VGA monitor or TV should work as a display. If the display uses DVI or VGA as input interface, we need a HDMI-to-DVI cable or HDMI-to-VGA cable.
Keyboard and mouse	Any standard USB keyboard and mouse should work
Power supply	Use a 5~12V@2A power adapter supply to power your LeMaker Guitar. Plug specification is inner diameter 2.1mm and outer diameter 5.5mm with standard center-positive.

Internet connection	To update or download software, we recommend that you connect to the internet either via an Ethernet cable or a WI-FI adapter.
USB3.0/2.0 cable	To boot OS from EMMC NAND Flash, we connect to LeMaker Guitar via USB3.0/2.0 cable (A/M-Micro-B) to write the firmware into EMMC NAND Flash.

The photos of accessories are showed as below:



Wireless keyboard

Power adapter

Ethernet cable

HDMI cable

MicroSD card

USB 3.0 cable

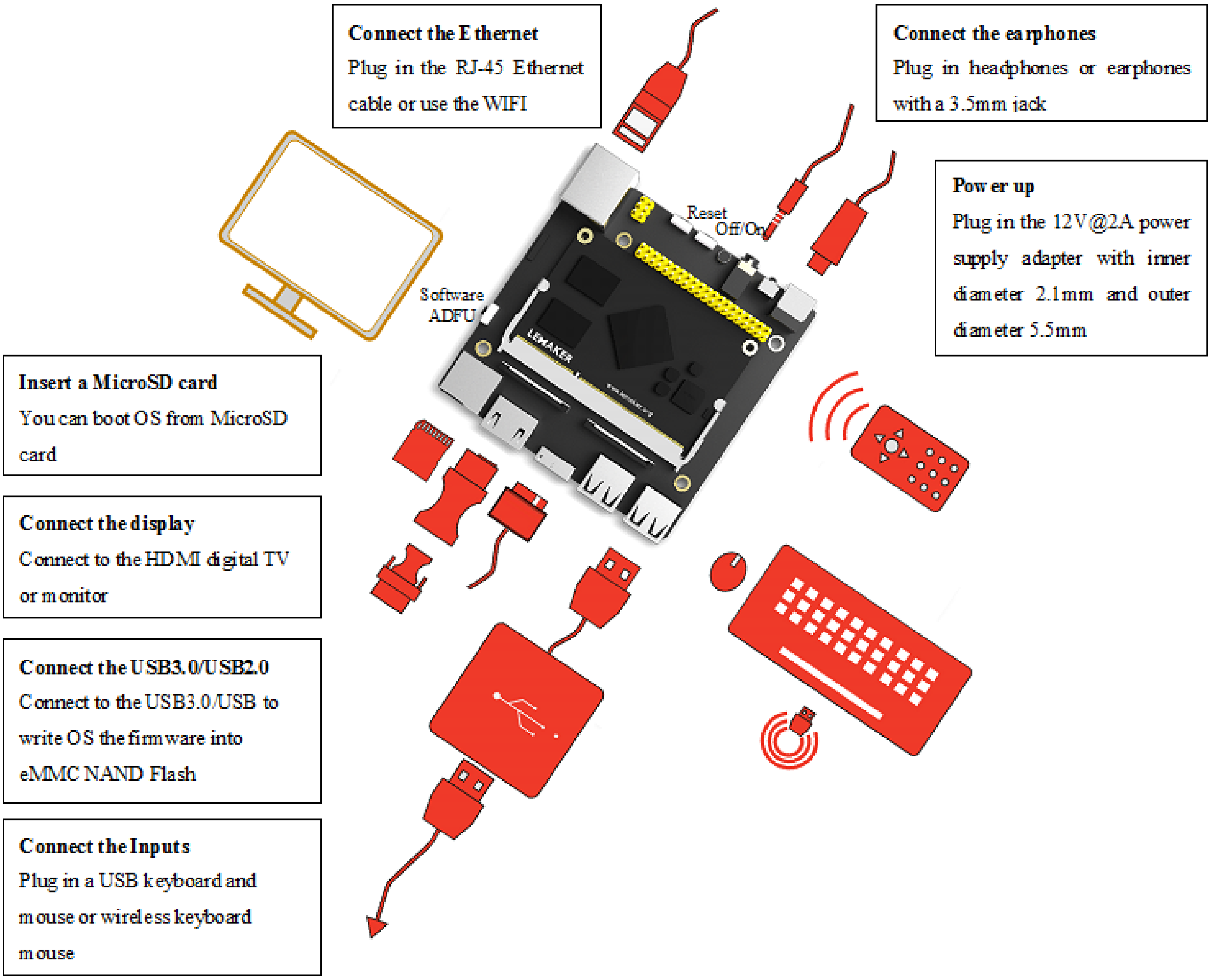
HDMI-to-DVI cable

HDMI-to-VGA cable

USB2.0 cable

Figure 1.1: List of the accessories

1.4 How to connect the accessories



Connect the Ethernet
Plug in the RJ-45 Ethernet cable or use the WIFI

Connect the earphones
Plug in headphones or earphones with a 3.5mm jack

Power up
Plug in the 12V@2A power supply adapter with inner diameter 2.1mm and outer diameter 5.5mm

Insert a MicroSD card
You can boot OS from MicroSD card

Connect the display
Connect to the HDMI digital TV or monitor

Connect the USB3.0/USB2.0
Connect to the USB3.0/USB to write OS the firmware into eMMC NAND Flash

Connect the Inputs
Plug in a USB keyboard and mouse or wireless keyboard mouse

Figure 1.2: The accessories connected to LeMaker Guitar

（Notice: Please pay attention that do not hot pull out or insert the core board when it is powered on, otherwise the SOC maybe be burnt down!）

1.5 See also

[1] LeMaker Guitar product home page: http://www.lemaker.org/product-guitar-index.html.

[2] LeMaker Guitar specification: http://www.lemaker.org/product-guitar-specification.html.

[3] Arch Linux community: https://www.archlinux.org/.

[4] Ubuntu-mate: http://ubuntu-mate.org/.

[5] Kodi - a free and open source media player: http://kodi.tv/.

[6] Debian - https://www.debian.org/

2 Install OS image

There are two ways to boot the operating system for LeMaker Guitar, one way is booting from MicroSD card, another way is booting from EMMC NAND Flash on core board. Assume that Linux OS has been successfully installed on a MicroSD card and the EMMC NAND Flash. When you have inserted the MicroSD card into MicroSD card slot, the operating system will preferentially boot from MicroSD card. But if you want to boot operating system from EMMC NAND Flash, you must remove the MicroSD card from MicroSD card slot. There are two OS image file formats for LeMaker Guitar: **.img** file for writing to a MicroSD card, **.fw** file for writing to EMMC NAND Flash. You can download the OS image files from LeMaker Guitar Resource and use the tool **7-Zip** in Windows or the command **7za** in Linux to extract the archive file.

Windows:

Install the 7-zip tool and then decompress and extract the archive file.

Linux:

```
sudo apt-get install p7zip-full

7za x [imagefilename].7z
```

If you want to boot operating system from MicroSD card, you will need to install an operating system into a MicroSD card. But if you want boot operating system from EMMC NAND Flash on core board, you need to install an operating system into EMMC NAND Flash. There are a hardware “ADFU” (Actions Device Firmware Upgrade) button on core board and a software “ADFU” button on base board to enter the ADFU mode, but we recommend using the software “ADFU” button on base board to enter the ADFU mode. The instructions below will teach you how to write an OS image into a MicroSD card or EMMC NAND Flash.

Note that the hardware “ADFU” can be explained that when we cut off the data line between EMMC and NAND Flash by the hardware “ADFU” button, as a result, the controller can’t find the external storage medium, and then enter the ADFU mode. The software “ADFU” is explained that u-boot will detect the state of this the software “ADFU” button on boot, and then call related functions to enter

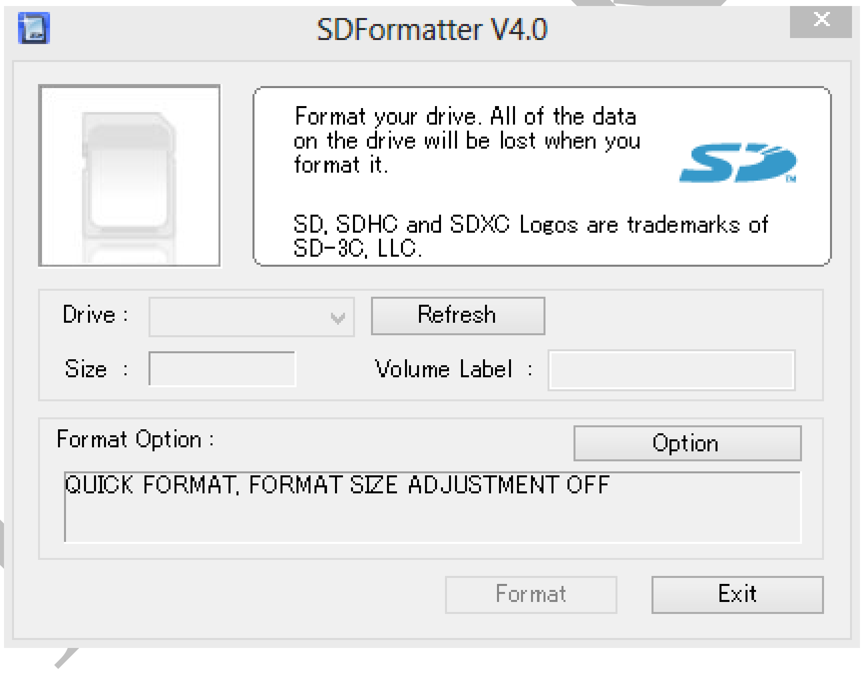
ADFU mode. If something has wrong in u-boot, you can use the hardware ADFU button to enter ADFU mode for writing OS firmware into EMMC NAND Flash.

2.1 Write OS image into MicroSD card on Windows

Step 1: Insert your MicroSD card into your computer or card reader. The size of the MicroSD card should be larger than the OS image size, generally 4GB or greater.

Step 2: Format the MicroSD card. You should download and install a MicroSD card format tool: SDFormatter. Start the tool as Administrator, In the "Options" menu, set "FORMAT TYPE" option to QUICK, set "FORMAT SIZE ADJUSTMENT" option to "ON". And then click “OK” to finish options setting and click “Format” to format SD card.

SDFormatter Download Link: http://mirror.lemaker.org/SDFormatter_v4.zip



SDFormatter V4.0

Format your drive. All of the data on the drive will be lost when you format it.

SD, SDHC and SDXC Logos are trademarks of SD-3C, LLC.

Drive :

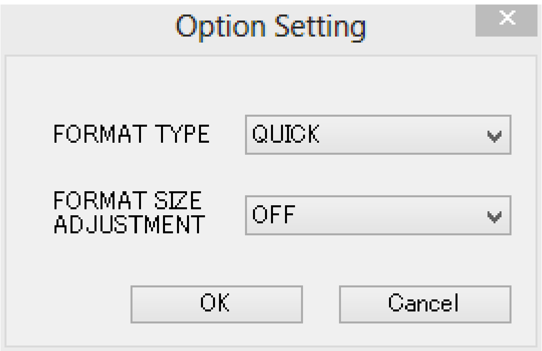
Size :

Volume Label :

Format Option :

QUICK FORMAT, FORMAT SIZE ADJUSTMENT OFF

Figure 2.1: SDFormatter



FORMAT TYPE QUICK

FORMAT SIZE ADJUSTMENT OFF

Figure 2.2: SDFormatter Setting

Step 3: Write OS image to MicroSD card. You should download and install OS image writing tool: Win32Diskimager. Start the tool as Administrator. Open the unzipped image file, and then click the "write" button to write the OS image into the MicroSD card. Wait patiently to successfully complete the writing.

Win32Diskimager Download Link: http://mirror.lemaker.org/Win32DiskImage_v0.9.5_install.zip

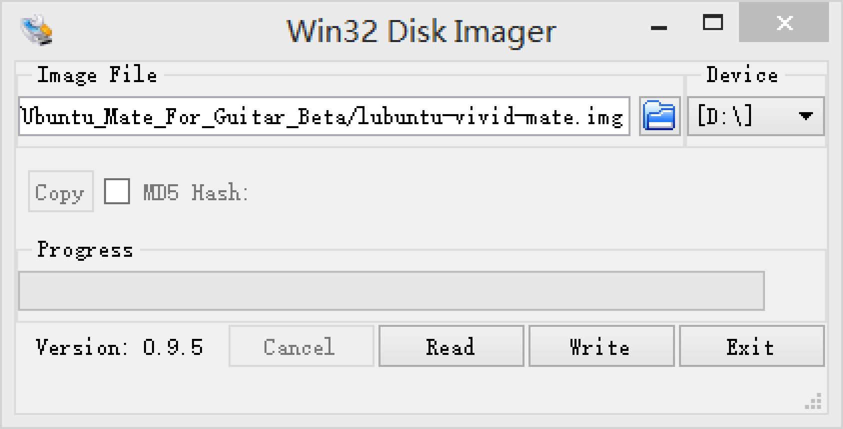


Image File: Ubuntu_Mate_For_Guitar_Beta/lubuntu-vivid-mate.img

Device: [D:\]

□ MD5 Hash:

Version: 0.9.5

Figure 2.3: Win32 Disk Imager

2.2 Write OS image into MicroSD card on Linux

Step 1: Insert your MicroSD card into your computer or card reader. The size of the MicroSD card should be larger than the OS image size, Generally 4GB or greater.

Step 2: In the commad terminal, check the MicroSD card node

```
sudo fdisk -l
```

Step 3: Install the **ddrescue** tool for writing OS image into the MicroSD card

Debian / Ubuntu Linux:

```
sudo apt-get install ddrescue
```

RedHat /Fedora /CentOS Linux:

```
yum -y install ddrescue
```

Step 4: Write OS image into MicroSD card

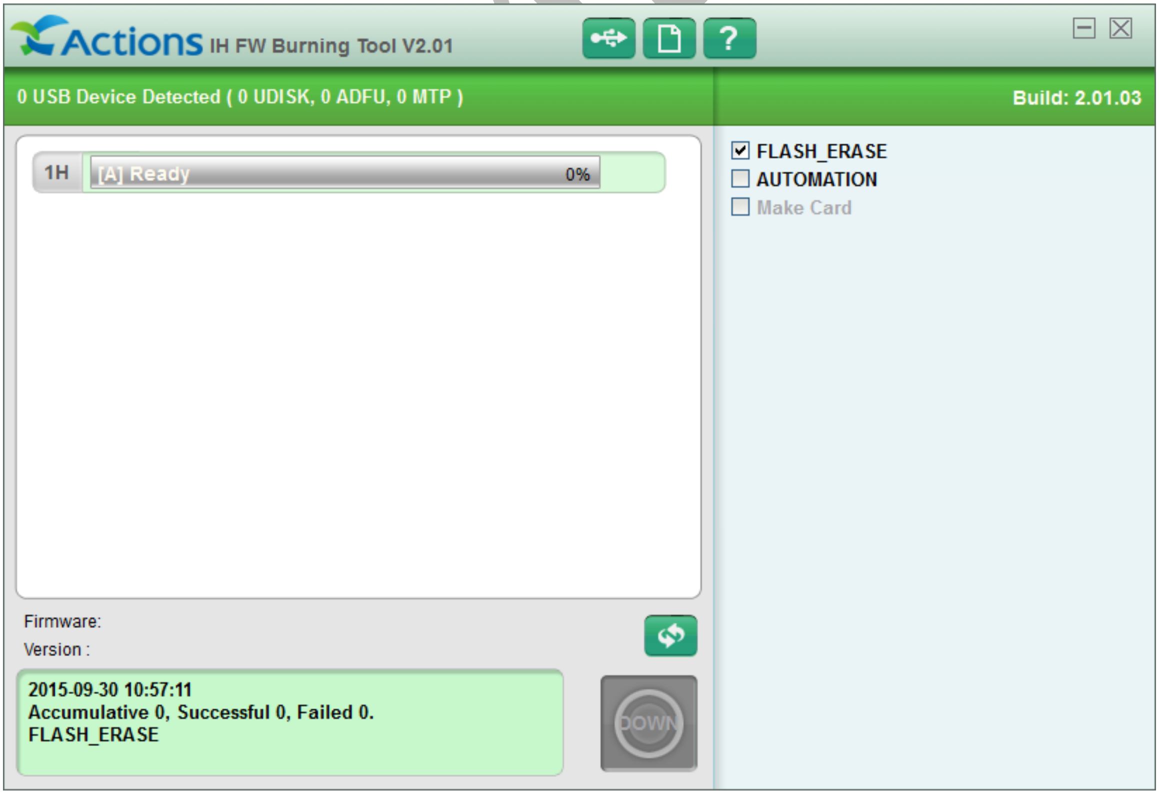
```
sudo dd_rescue -A [path]/[imagename].img dev/sdx

sync
```

Wait patiently to successfully complete writing.

2.3 Write OS firmware into EMMC on Windows

Step 1: Download and install the firmware burning tool: IH FW Burning Tool, and the start the tool as Administrator.

Download Link: http://mirror.lemaker.org/IH_FW_Burning_Tool_For_Windowns_V2.01.03.zip



0 USB Device Detected (0 UDISK, 0 ADFU, 0 MTP)

Build: 2.01.03

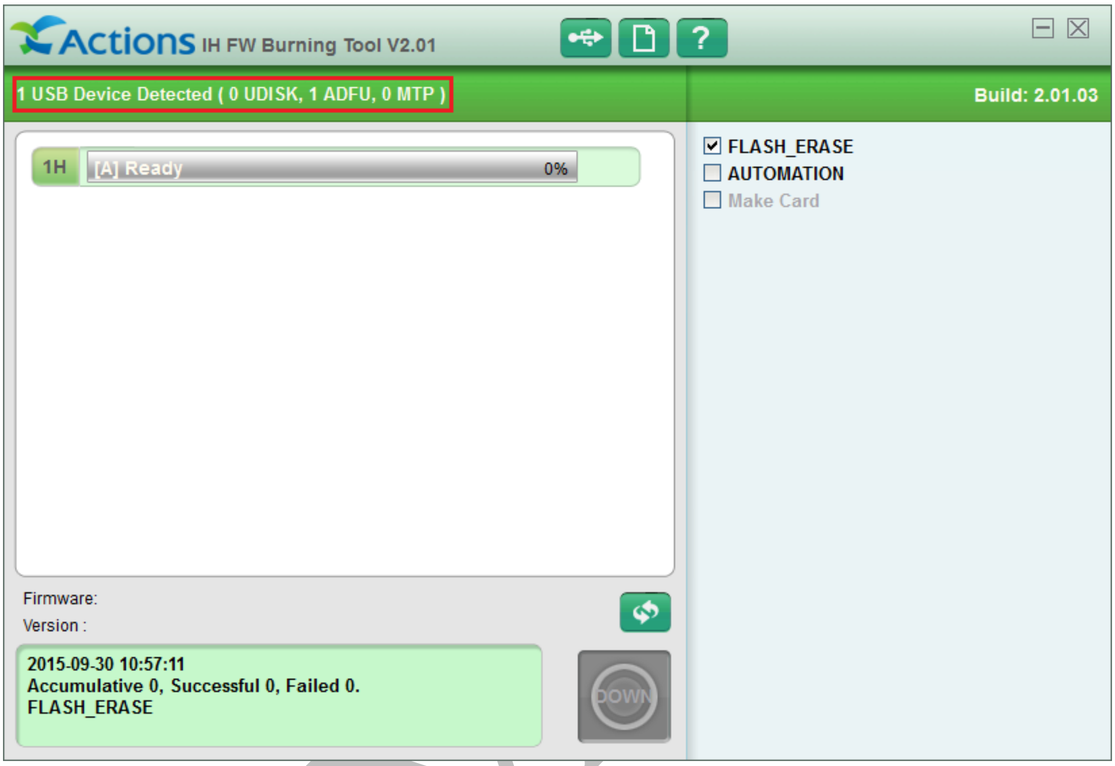
[A] Ready

☑ FLASH_ERASE
☐ AUTOMATION
☐ Make Card

2015-09-30 10:57:11
Accumulative 0, Successful 0, Failed 0.
FLASH_ERASE

Figure 2.4: IH FW Burning Tool

Step 2: Press and hold "ADFU" button, Connect to LeMaker Guitar via USB3.0/USB2.0 cable. Release "ADFU" button when LeMaker Guitar is powered on and enters the ADFU mode. You will find IH FW Burning Tool detects 1 USB Device (ADFU).



1 USB Device Detected (0 UDISK, 1 ADFU, 0 MTP)

Build: 2.01.03

1H [A] Ready 0%

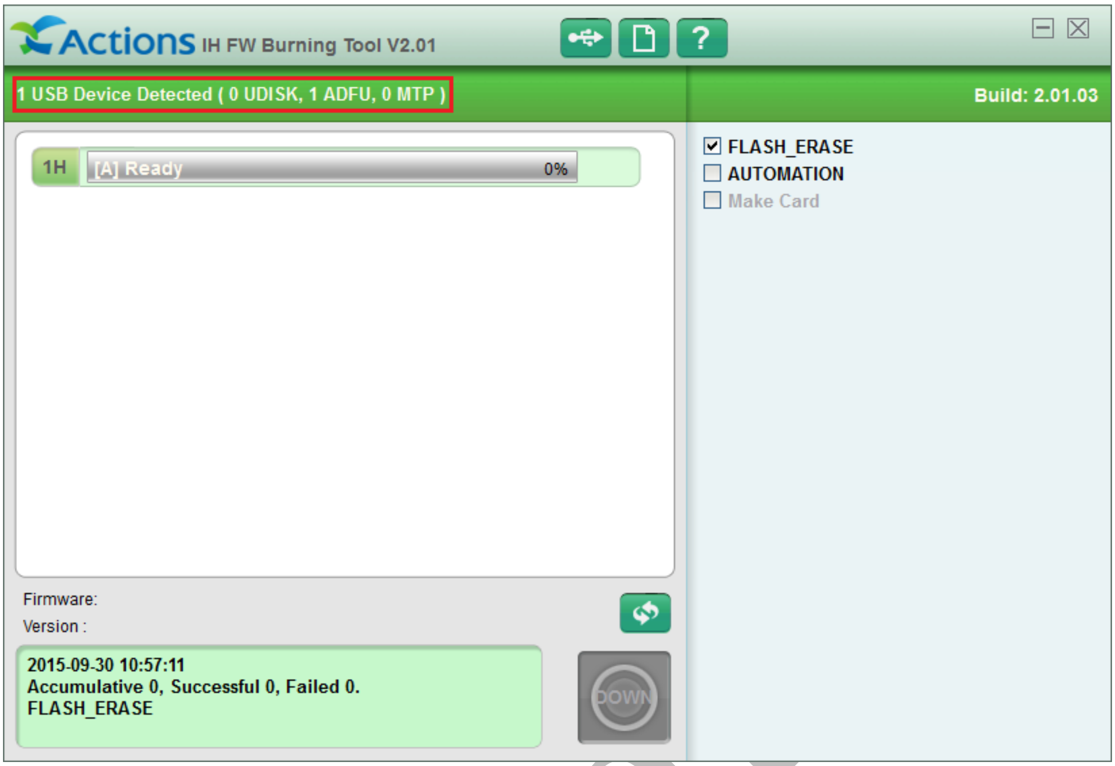
☑ FLASH_ERASE
□ AUTOMATION
□ Make Card

Firmware:
Version :

2015-09-30 10:57:11
Accumulative 0, Successful 0, Failed 0.
FLASH_ERASE

Figure 2.5: Detect USB Device

Step 3: Open the firmware **.fw** file, and then click the "DOWN" button to write the firmware file to EMMC. Wait patiently to successfully complete the writing.



1 USB Device Detected (0 UDISK, 1 ADFU, 0 MTP)

[A] Ready 0%

☑ FLASH_ERASE
□ AUTOMATION
□ Make Card

Firmware:
Version :

2015-09-30 10:57:11
Accumulative 0, Successful 0, Failed 0.
FLASH_ERASE

Figure 2.5: Writing the OS image

2.4 Write OS firmware into EMMC on Linux

Step 1: Download the firmware burning tool such as FWBurning Tool from

http://mirror.lemaker.org/FW_Burning_Tool_For_Linux_V1.0_01.tar.gz

```
wget http://mirror.lemaker.org/FW_Burning_Tool_For_Linux_V1.0_01.tar.gz
```

Step 2: In the command terminal, extract the archive file and install FWBurning Tool.

```
sudo tar -zxvf FWBurning_Tool_For_Linux_V1.0_01.tar.gz

cd FWBurning_Tool_For_Linux_V1.0_01

sudo ./FWBurningTool-1.0.run
```

Step 3: Press and hold “ADFU” button, Connect to LeMaker Guitar via USB3.0/USB2.0 cable. Release “ADFU” button when LeMaker Guitar is powered on and enters the ADFU mode. You can use the command “**lsusb**” to list the USB devices.

```
sudo lsusb

…
```

```
Bus 001 Device 002: ID 10d6:10d6 Actions Semiconductor Co., Ltd

…
```

Step 4: Write the firmware .fw file into EMMC

```
sudo python ./ActionsFWU.py  --fw=firmware_name.fw
```

2.5 OS image partitions description

Table 2.1: Linux OS image partitions table

MicroSD Card Layout		
Name	Start	Usage
Mbr	0	The first bootable partition of MicroSD card
Gpt	0x200	gtb partition table
Environment	0x5000	Saving uboot environment variables
Bootloader	0x200200	The first stage boottraps (**bootloader.bin**)
Uboot	0x300000	uboot bootloader (**u-boot-dtb.img**)
Misc	0x800000	fat parttions, including kernel, initramfs, kernel configure files, uEnv.txt etc…(**misc.img**)
Rootfs	0x3800000	filesystem(**rootfs.img**)

2.6 See Also

[1] 7za(1) - Linux man page: http://linux.die.net/man/1/7za

[2] 7-Zip - a file archiver with a high compression ratio: http://www.7-zip.org/

[3] SDFormatter: http://www.sdcard.org/downloads/formatter_4/

[4] Win32 Disk Imager - a tool for writing images to USB sticks or SD/CF cards:

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

[5] How to make OS image:

http://wiki.lemaker.org/LeMaker_Guitar:How_to_make_LeMaker_Guitar_OS_image

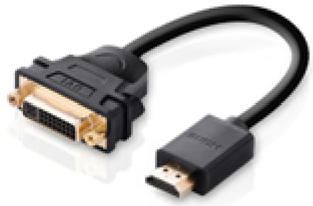
3 Basic Usage

3.1 Display

3.1.1 HDMI

HDMI (High-Definition Multimedia Interface) is a proprietary audio/video interface for transferring uncompressed video data and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as a display controller, to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for analog video standards.

There has a HDMI interface on LeMaker Guitar, you can connect the display to LeMaker Guitar via the HDMI cable. But if the display use DVI or VGA as input interface, we need a HDMI-to-DVI cable or HDMI-to-VGA cable in the photo below:



Pictrue 3.1: HDMI-to-DVI cable

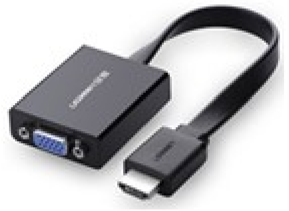


Figure 3.2: HDMI-to-VGA cable

LeMaker Guitar supports a variety of resolutions for HDMI outputting, you can configure the HDMI outputting resolution according to the display you use.

Table 3.1: HDMI resolution table

HDMI Resolution Table	
VID	Resolution
1	VID640x480P_60
4	VID1280x720P_60
16	VID1920x1080P_60
17	VID720x576P_50

19	VID1280x720P_50
31	VID1920x1080P_50
126	VID1280x720P_60_DVI

View HDMI output resolution

```
cat /sys/devices/b02c0000.hdmi/vid
16      #Resolution is 1920x1080
```

Set HDMI output resolution, for exmaple VID1280x720P_50

Step 1: Edit the dts file: *linux-actions-bsp/linux-actions/arch/arm/boot/dts/lemaker_guitar_bbb.dts* Set default_resolution = “720P50HZ”.

Step 2: Edit the dts file: *linux-actions-bsp/u-boot-actions/arch/arm/dts/lemaker_guitar.dts*. Set default_resolution = “720P50HZ”.

Step 3: Recompile LeMaker Guitar BSP

You can refer to http://wiki.lemaker.org/LeMaker_Guitar:How_to_use_LeMaker_Guitar_BSP to download LeMaker Guitar BSP that includes the above two files.

```
cd linux-actions-bsp/
make
```

Step 4: Replace kernel.dtb and u-boot-dtb.img

Copy *linux-actions-bsp/build/s500/misc/kernel.dtb* and *linux-actions-bsp/build/s500/u-boot/u-boot-dtb.img* to */tmp* directory of LeMaker Guitar. And then:

```
cd /tmp/
sudo cp kernel.dtb /media/lemaker/misc     #or sudo cp kernel.dtb /media/misc
sudo dd if=u-boot-dtb.img of=/dev/mmcblk0 bs=512 seek=6144
sync
sudo reboot
```

3.1.2 LVDS

LVDS (Low-voltage differential signaling), also known as TIA/EIA-644, is a technical standard that specifies electrical characteristics of a differential, serial communications protocol. LVDS operates at low power and can run at very high speeds using inexpensive twisted-pair copper cables. LeMaker Guitar supports 7.0 inch LCD module by default. If you want to use other size LCD module, you should configure the resolution of LCD like configuring HDMI, for example 1024*600_60.

Figure 3.3: LCD module

Step 1: Edit the dts file: *linux-actions-bsp/linux-actions/arch/arm/boot/dts/lemaker_guitar_bbb.dts*, and set refresh = 60, xres = 1024, yres = 600.

```
        lcd0: lcd0@b02a0000 {


                pinctrl-names = "default";

                pinctrl-0 = <&lvds_state_default>;

                lcd_power_gpios = <&gpio 36 0>;     /*GPIOB4*/

                lcd_reset_gpios = <&gpio 49 0>;     /*GPIOB17*/

                port_type = "lvds";

                data_width = <0>;             /* 0:24bit ,1:18bit */
                videomode-0 = <&lcd_mode0>;
                vsync_inversion = <0>;
                hsync_inversion = <0>;

                dclk_inversion = <0>;
                lde_inversion = <0>;
                lvds_ctl = <0x000a9523>;        /* last two bit: 3:8bit ,1:6bit */
                lvds_alg_ctl0 = <0xc141a030>;
                lightness = <128>;
                saturation = <7>;
                contrast = <5>;


                lcd_mode0:mode@1024x600p60 {
                        refresh = <60>;             /* refresh frequency*/
                        xres = <1024>;              /* width */
                        yres = <600>;               /* height*/
                        /*in pico second, 0.000 000 000 001s*/
                        pixclock = <20000>;
                        left_margin = <56>;
                        right_margin = <60>;
                        upper_margin = <13>;
                        lower_margin = <18>;
                        hsync_len = <4>;
                        vsync_len = <4>;
                        /*0: FB_VMODE_NONINTERLACED, 1:FB_VMODE_INTERLACED*/
                        vmode = <0>;
                };

        };
```

Step 2: Edit the dts file: *linux-actions-bsp/u-boot-actions/arch/arm/dts/lemaker_guitar.dts*, and set refresh = 60, xres = 1024, yres = 600.

```
        lcd0: lcd0@b02a0000 {
                pinctrl-names = "default";
                pinctrl-0 = <&lvds_state_default>;
                lcd_power_gpios = <&gpio 36 0>;    /*GPIOB4*/
                lcd_reset_gpios = <&gpio 49 0>; /*GPIOB17*/
                port_type = "lvds";
                data_width = <0>;              /* 0:24bit ,1:18bit */
                videomode-0 = <&lcd_mode0>;
                vsync_inversion = <0>;
                hsync_inversion = <0>;

                dclk_inversion = <0>;
                lde_inversion = <0>;
                lvds_ctl = <0x000a9523>;        /* last two bit: 3:8bit ,1:6bit */
                lvds_alg_ctl0 = <0xc141a030>;
                lightness = <128>;
                saturation = <7>;
                contrast = <5>;

                lcd_mode0:mode@1024x600p60 {
                        refresh = <60>;
                        xres = <1024>;
                        yres = <600>;
                        /*in pico second, 0.000 000 000 001s*/
                        pixclock = <20000>;
                        left_margin = <56>;
                        right_margin = <60>;
                        upper_margin = <13>;
                        lower_margin = <18>;
                        hsync_len = <4>;
                        vsync_len = <4>;
                        /*0: FB_VMODE_NONINTERLACED, 1:FB_VMODE_INTERLACED*/
                        vmode = <0>;
                };
        };
```

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```
cd /tmp/
sudo cp kernel.dtb /media/lemaker/misc     #or sudo cp kernel.dtb /media/misc
sudo dd if=u-boot-dtb.img of=/dev/mmcblk0 bs=512 seek=6144
sync
sudo reboot
```

3.2 Audio

Audio is played through speakers or headphones using a standard 3.5mm jack by default. No separate audio lead is necessary if you are going to use an HDMI cable to connect to a monitor with speakers, as audio can be played directly through the display; but you should firstly install e pulseaudio tool in Lemuntu and edit */etc/pulse/default.pa*

```
sudo apt-get install pulseaudio
sudo nano /etc/pulse/default.pa
...
### use module-udev-detect -- see below -- for doing this automatically)
#load-module module-alsa-sink device=hw:0,0     # 3.5mm Jack output
load-module module-alsa-source device=hw:1,0  # HDMI output
...
```

3.3 WI-FI

LeMaker Guitar use Realtek RTL8723BS as WI-FI module on board, which integrates WI-FI+BT function blocks。RTL8723BS is a small size and low profile of WI-FI+BT combo module with LGA (Land-Grid Array) footprint, board size is 14mm*14mm with module height of 2mm. It can be easily manufactured on SMT process and highly suitable for tablet PC, ultra book, mobile device and consumer products. It provides GSPI/SDIO interface for WI-FI to connect with host processor and high speed UART interface for BT. It also has a PCM interface for audio data transmission with direct link to external audio codec via BT controller. The WI-FI throughput can go up to 150Mbps in theory by using 1x1 802.11n b/g/n MIMO technology and Bluetooth can support BT2.1+EDR/BT3.0 and BT4.0.

3.3.1 Use WI-FI as the station mode

Usually, we use the WI-FI on board to connect WI-FI AP. It is a station mode.

Step 1: Load the WI-FI driver

The operating system will auto load wlan_8723bs WI-FI driver by default. You can type the command as below to list all drivers

```
lsmod
Module                  Size  Used by
…
wlan_8723bs          1327715  0
…
```

But If you can't find the wlan_8723bs WI-FI driver, you should type the command below to load the WI-FI driver.

```
sudo modprobe wlan_8723bs
```

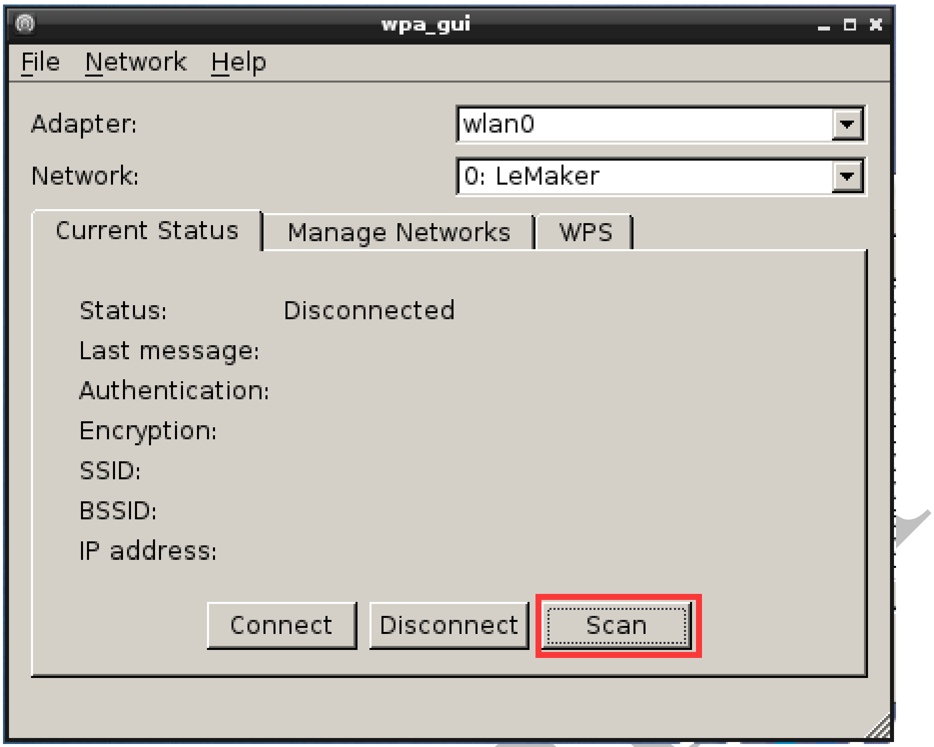
If you want to auto load the WI-FI driver when booting the operating system, you should add "wlan_8723bs" into the */etc/modules* file

```
sudo nano /etc/modules
wlan_8723bs
```

Step 2: Configure WI-FI

Configure WI-FI on Lumuntu

For Lemuntu, you can connect to the WI-FI AP by using the wap_gui as follow:

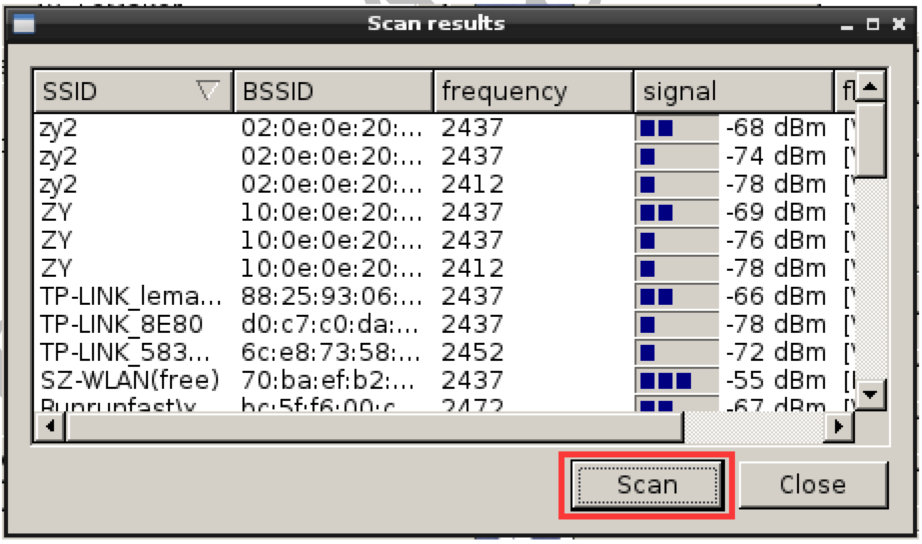


Adapter: wlan0

Network: 0: LeMaker

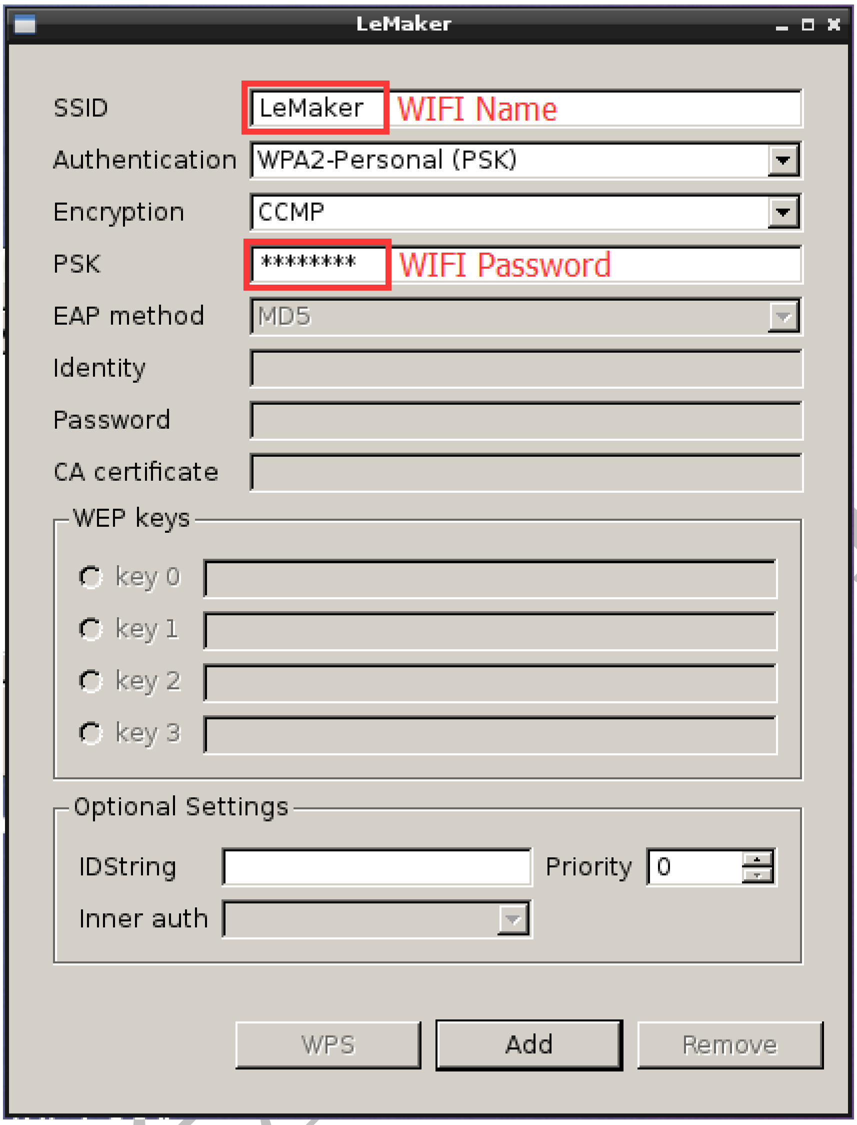
Status: Disconnected
Last message:
Authentication:
Encryption:
SSID:
BSSID:
IP address:

Figure 3.4: Open wap_gui



SSID	BSSID	frequency	signal	fl
zy2	02:0e:0e:20:...	2437	■■ -68 dBm	['
zy2	02:0e:0e:20:...	2437	■ -74 dBm	['
zy2	02:0e:0e:20:...	2412	■ -78 dBm	['
ZY	10:0e:0e:20:...	2437	■■ -69 dBm	['
ZY	10:0e:0e:20:...	2437	■ -76 dBm	['
ZY	10:0e:0e:20:...	2412	■ -78 dBm	['
TP-LINK_lema...	88:25:93:06:...	2437	■■ -66 dBm	['
TP-LINK_8E80	d0:c7:c0:da:...	2437	■ -78 dBm	['
TP-LINK_583...	6c:e8:73:58:...	2452	■ -72 dBm	['
SZ-WLAN(free)	70:ba:ef:b2:...	2437	■■■ -55 dBm	[I
Runrunfastly	bc:5f:f6:00:c	2472	■■ -67 dBm	['

Figure 3.5: Scan WI-FI AP



SSID: LeMaker

Authentication: WPA2-Personal (PSK)

Encryption: CCMP

PSK: ********

EAP method: MD5

Priority: 0

Figure 3.6: Input SSID and PSK

The configure Parameters will be saved in */etc/wpa_supplicant/wpa_supplicant.conf*.

```
cat /etc/wpa_supplicant/wpa_supplicant.conf

ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev

update_config=1


network={

        ssid="LeMaker"           #WI-FI Name

        psk="****** "            #WI-FI password

        proto=RSN
        key_mgmt=WPA-PSK

        pairwise=CCMP

        auth_alg=OPEN

}
```

Configure Wi-Fi on Ubuntu Mate

You can connect to the WI-FI AP by clicking the button which is at the right-up corner of the desktop.

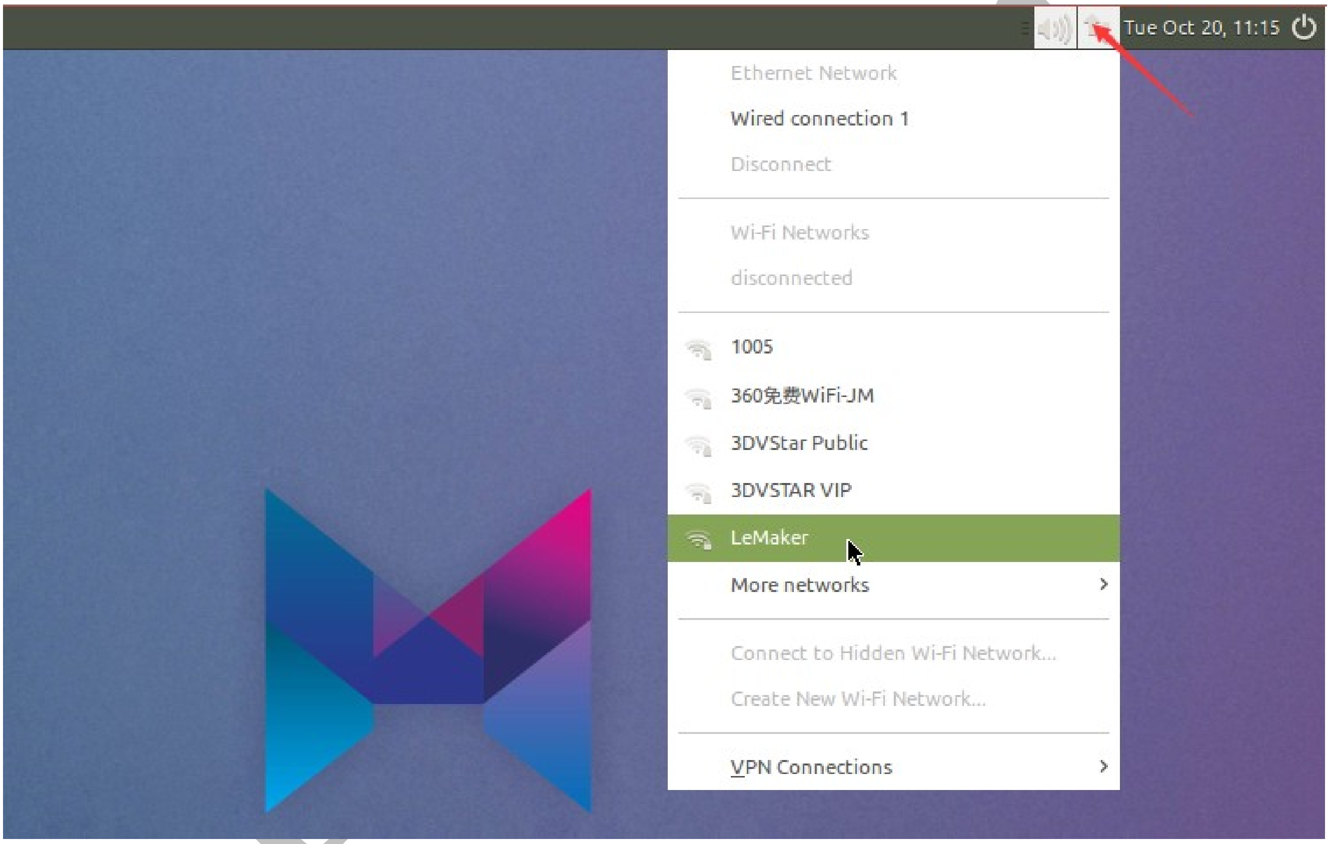


Figure 3.7: Connect WI-FI on Ubuntu Mate

Configure WI-FI on Linux without desktop

If you use the Linux-like system without desktop, we recommend you to use wpa_supplicant tool to connect WI-FI AP.

Step 1: Install wpa_supplicant

```
sudo apt-get install wpasupplicant
```

Step 2: Edit the wpa_supplicant.conf

Add the content below into the wpa_supplicant.conf. If the wpa_supplicant.conf is not exist, you need create one. ssid is the name of WI-FI AP, psk is the password of WI-FI AP.

```
sudo nano /etc/wpa_supplicant/wpa_supplicant.conf


ap_scan=1 # use the wpa_supplicant to scan and choose the AP

network={

              ssid=”your_Wi-Fi_name”

              psk=”your_Wi-Fi_password”

}
```

Step 3: Edit /etc/network/interfaces

Add the content below into /etc/network/interfaces.

```
sudo nano /etc/network/interfaces

auto wlanx

iface wlanx inet dhcp

pre-up wpa_supplicant -B -i wlanx -c/etc/wpa_supplicant

/wpa_supplicant.conf

pre-down killall -q wpa_supplicant
```

Note: wlanx represents wlan0, wlan1 ..., you can type the command **ifconfig** to view which the wlanx should be.

3.3.2 Use WI-FI as the ap mode

If you want to let LeMaker Guitar become a WI-FI AP, you can refer to the below instructions to configure the WI-FI mode.

Step 1: Check and load WI-FI driver

```
sudo modprobe wlan_8723bs
```

Step 2: Install hostapd tool

```
sudo apt-get install git #install git if not installed
```

```
git clone git://github.com/tgraf/libnl-1.1-stable.git #install libnl
cd libnl-1.1-stable/
./configure
make
sudo make install

sudo apt-get install libnl-3-dev
sudo apt-get install openssl
sudo apt-get install libssl-dev

git clone git://w1.fi/srv/git/hostap.git  #install hostap
cd hostap/hostapd/
cp defconfig .config
make
sudo make install
```

Step 3: Create and edit the hostapd.conf

```
sudo mkdir -p /etc/hostapd
sudo nano /etc/hostapd/hostapd.conf
interface=wlanx
driver=nl80211
ssid=LeMaker_1020
channel=6
hw_mode=g
macaddr_acl=0
auth_algs=1
ignore_broadcast_ssid=0
```

```
wpa=2

wpa_passphrase=12345678

wpa_key_mgmt=WPA-PSK

wpa_pairwise=TKIP

rsn_pairwise=CCMP
```

Step 4: Edit /etc/network/interfaces

```
sudo nano /etc/network/interfaces

auto lo

iface lo inet loopback

iface eth0 inet dhcp

allow-hotplug wlanx

iface wlanx inet static

address 192.168.100.1

netmask 255.255.255.0
```

Step 5: Install the DHCP server

```
sudo apt-get install udhcpd

sudo nano /etc/udhcpd.conf

# The start and end of the IP lease block

start         192.168.100.20  #default: 192.168.0.20

end           192.168.100.254 #default: 192.168.0.254

# The interface that udhcpd will use

interface      wlanx          #default: eth0

#Examles

option  subnet  255.255.255.0

opt     router  192.168.100.1

opt     wins    192.168.100.1

option  dns     192.168.100.1   # appended to above DNS servers for a total of 3
option  domain  local
option  lease   864000          # 10 days of seconds
```

Step 6: Reboot and start DHCP and hostap

```
sudo reboot
udhcp /etc/udhcpd.conf
hostapd -B /etc/hostapd/hostapd.conf
```

And then, you can type the command **iwconfig** to check the result.

(**Note:** wlanx represents wlan0, wlan1 ..., you can type the command **ifconfig** to view which the wlanx should be.)

Now you can connect to LeMaker Guitar WI-FI AP, but you can’t connect to the Ethernet, you should create a net bridge between ethx and wlanx。

3.4 Bluetooth

LeMaker Guitar use Realtek RTL8723BS as Bluetooth module on board, which integrates WI-FI+BT function blocks。

Step 1: Load Bluetooth driver

```
sudo modprobe rfkill-actions_8723bs.ko
```

Step 2: Install related software

```
sudo apt-get install bluetooth bluez-cups python-bluez gnome-phone-manager
```

Step 3: Download and install rtl8723bs_bt

```
sudo wget http://mirror.lemaker.org/rtl8723bs_bt.tar.gz
tar -zxvf rtl8723bs_bt.tar.gz
cd rtl8723bs_bt
make
make install
```

Step 4: Start Bluetooth

```
sudo chmod +x start_bt.sh
sudo ./start_bt.sh
```

Step 5: View and use Bluetooth

```
hcitool dev

Devices:

       hci0    8D:18:D9:F3:79:5D



hciconfig  -a

hci0:   Type: BR/EDR  Bus: UART

       BD Address: 8D:18:D9:F3:79:5D  ACL MTU: 1021:8  SCO MTU: 255:16

       UP RUNNING PSCAN ISCAN

       RX bytes:1179 acl:0 sco:0 events:36 errors:0

       TX bytes:2052 acl:0 sco:0 commands:36 errors:0

       Features: 0xff 0xff 0xff 0xfe 0xdb 0xff 0x7b 0x87

       Packet type: DM1 DM3 DM5 DH1 DH3 DH5 HV1 HV2 HV3

       Link policy: RSWITCH HOLD SNIFF PARK

       Link mode: SLAVE ACCEPT

       Name: '*******'

       Class: 0x000000

       Service Classes: Unspecified

       Device Class: Miscellaneous,

       HCI Version: 4.0 (0x6)  Revision: 0x1e3e

       LMP Version: 4.0 (0x6)  Subversion: 0xe40e

       Manufacturer: Realtek Semiconductor Corporation (93)



hciconfig hci0 up
```

You can type the command below to scan other Bluetooth devices. Maybe you will find some Bluetooth devices, but you also can use the other bluetooth device to find LeMaker Guitar via

Bluetooth.

```
hcitool scan

Scanning ...

        88:C9:D0:0A:B6:8B       ******

        28:E3:47:94:09:4A       ******
```

Step 6: Install Bluetooth GUI and connect Bluetooth devices

```
apt-get install blueman gnome-bluetooth
```

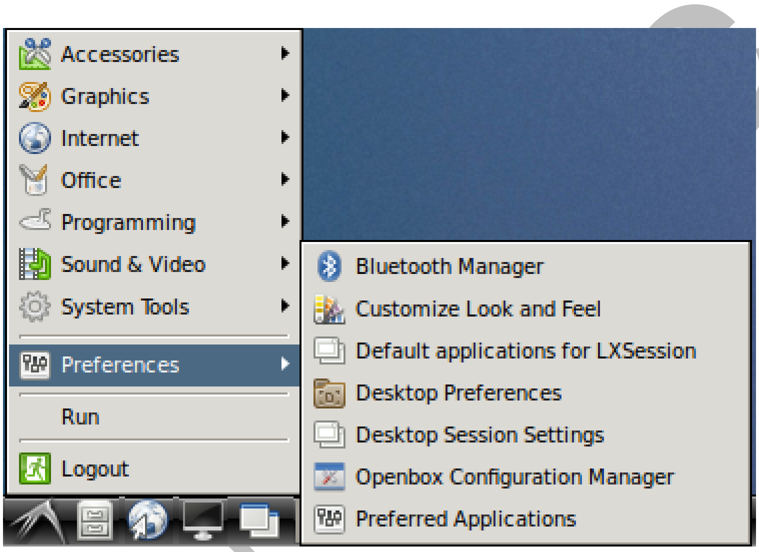


Figure 3.8: Open Bluetooth Manager

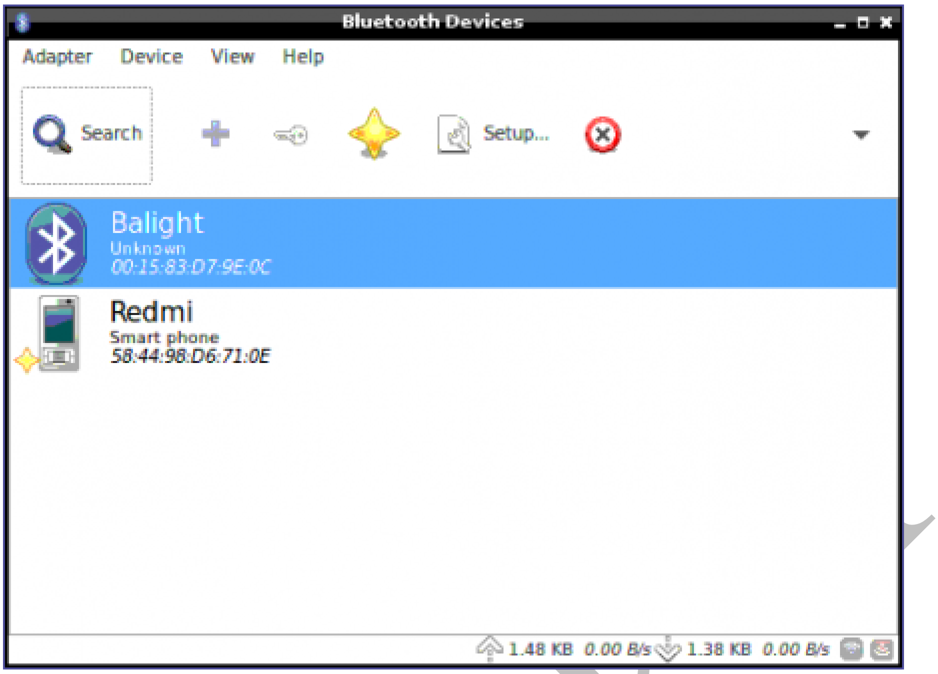


Figure 3.9: Search Bluetooth devices

3.5 Camera

LeMaker Guitar's camera interface is compatible with Banana Pi/Pro, so we can use the Banana Pi Camera module on LeMaker Guitar. The Banana Pi Camera module is a high definition camera using Omnivision 5640 CMOS image sensor. The camera module connects to the CSI connector on LeMaker Guitar base board via FPC cable. It provides high sensitivity, low crosstalk and low noise image capture in a small and lightweight design.

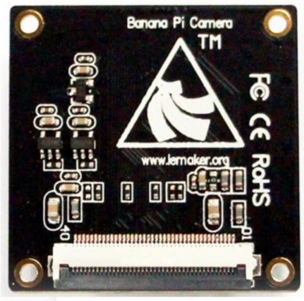


Figure 3.10: Banana Pi Camera Module

Figure 3.11: 40pin FPC Cable

Step 1: Load camera dirvers

```
sudo modprobe owl_camera
sudo modprobe ov5640 rear=1
```

Step 2: View camera dirvers

We can list driver modules that have been loaded to make sure that ov5640 has been loaded.

```
lsmod

Module                     Size  Used by

...

ov5640                    34118  1

…
```

If the camera dirver ov5640 has been loaded correctly, we can find the "/dev/video0" deviece file.

```
ls /dev/video0

/dev/video0
```

Step 3: Install mplayer

MPlayer is a movie player which runs on many systems. It plays most MPEG/VOB, AVI, Ogg/OGM, VIVO, ASF/WMA/WMV, QT/MOV/MP4, RealMedia, Matroska, NUT, NuppelVideo, FLI, YUV4MPEG, FILM, RoQ, PVA files, supported by many native, XAnim, and Win32 DLL codecs. You can watch VideoCD, SVCD, DVD, 3ivx, DivX 3/4/5, WMV and even H.264 movies. You also can use guvcview to open the camera. guvcview is A simple v4l2 full-featured video grabber.

```
sudo apt-get install mplayer
```

Step 4: Use mplayer to test the camera

Type the command below on LeMaker Guitar's command terminal to show the camera video.

```
mplayer tv:// -fs
```

You also can use a UVC camera to show the camera video by the above steps. But not all UVC cameras can work properly. USB 2.0 on LeMaker Guitar supports the UVC camera that there have 3 transactions per microframe or the last transaction is short in the microframe. But USB 2.0 do not supports the UVC camera there has one transaction or 2 transactions per microframe.

3.6 Storage

3.6.1 USB

On LeMaker Guitar base board Rev.B, there is a USB 3.0 Micro-B Receptacle, which can work as USB device mode and host mode.

(1) Device mode

When you want to write the OS image firmware into the LeMaker Guitar EMMC NAND Flash, you need connect the Guitar to PC. Or when you want to debug the Android APP on Guitar, you also need connect the Guitar to the PC. At that time, the LeMaker Guitar is act as a device of PC, so the USB 3.0 will work as device mode. But at currently the development of USB3.0 device mode low level driver is not finished, so when you use it as device mode, it will switch to USB2.0 device function automatically.

You can use a "USB 2.0 Micro-B Plug to USB 2.0 Standard-A Plug" cable like this to connect LeMaker Guitar to PC:

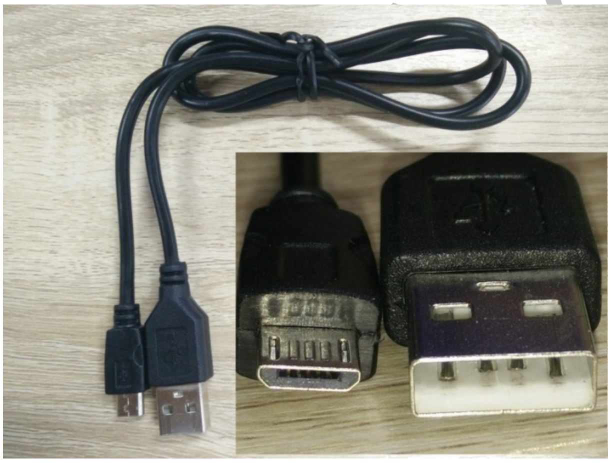


Figure 3.12: USB2.0 Micro-B to Standard-A Plug Cable

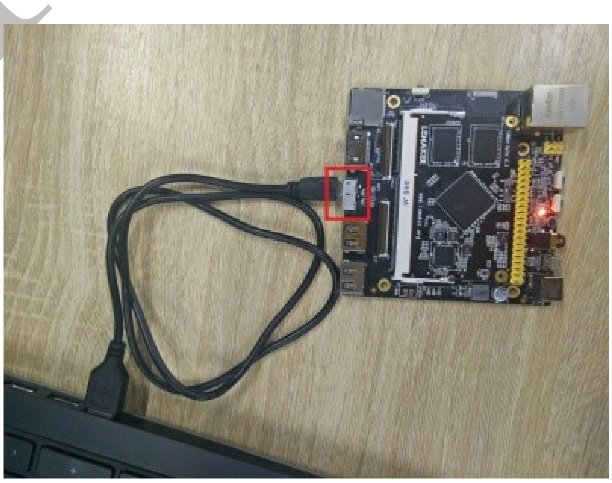


Figure 3.13: Guitar USB2.0 device mode

(2) Host Mode

The host mode may be more useful than device mode, because most of you will use the USB3.0 to connect the hard disk or 1000Mbps Ethernet adapter. When you want to use the USB 3.0 Micro-B Receptacle as the host mode, you need a USB 3.0 Micro-B OTG cable (USB 3.0 Micro-B Plug to

USB 3.0 Standard-A Receptacle) like below:

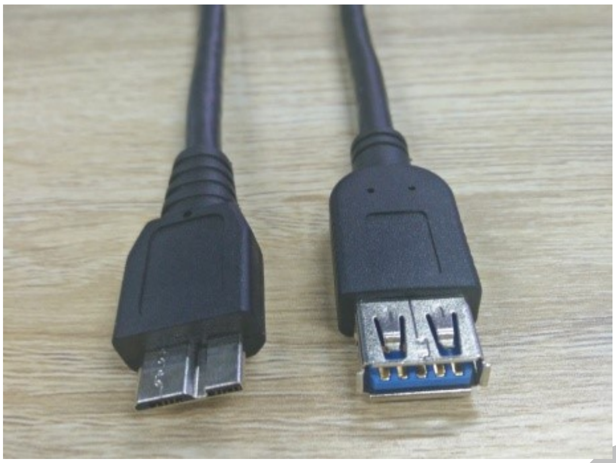


Figure3.14: USB3.0 Micro-B to Standard-A Receptacle

Because there are two different USB 3.0 Micro-B OTG cable with different pin definition, you need be careful to buy a right one from the market. You can refer to the diagram below to select the right OTG cable.

Table 3.1: USB3.0 pins definition

Micro B Plug		Wire	USB3.0 Standard A Receptacle	
Pin Number		Wire Number	Pin Number	
1	VBus	1	1	VBUS
2	D-	2	2	D-
3	D+	3	3	D+
4	ID			
5	GND	4	4	GND
6	SSTX-	5	8	SSTX-
7	SSTX+	6	9	SSTX+
8	GND	7	7	GND
9	SSRX-	8	5	SSRX-
10	SSRX+	9	6	SSRX+

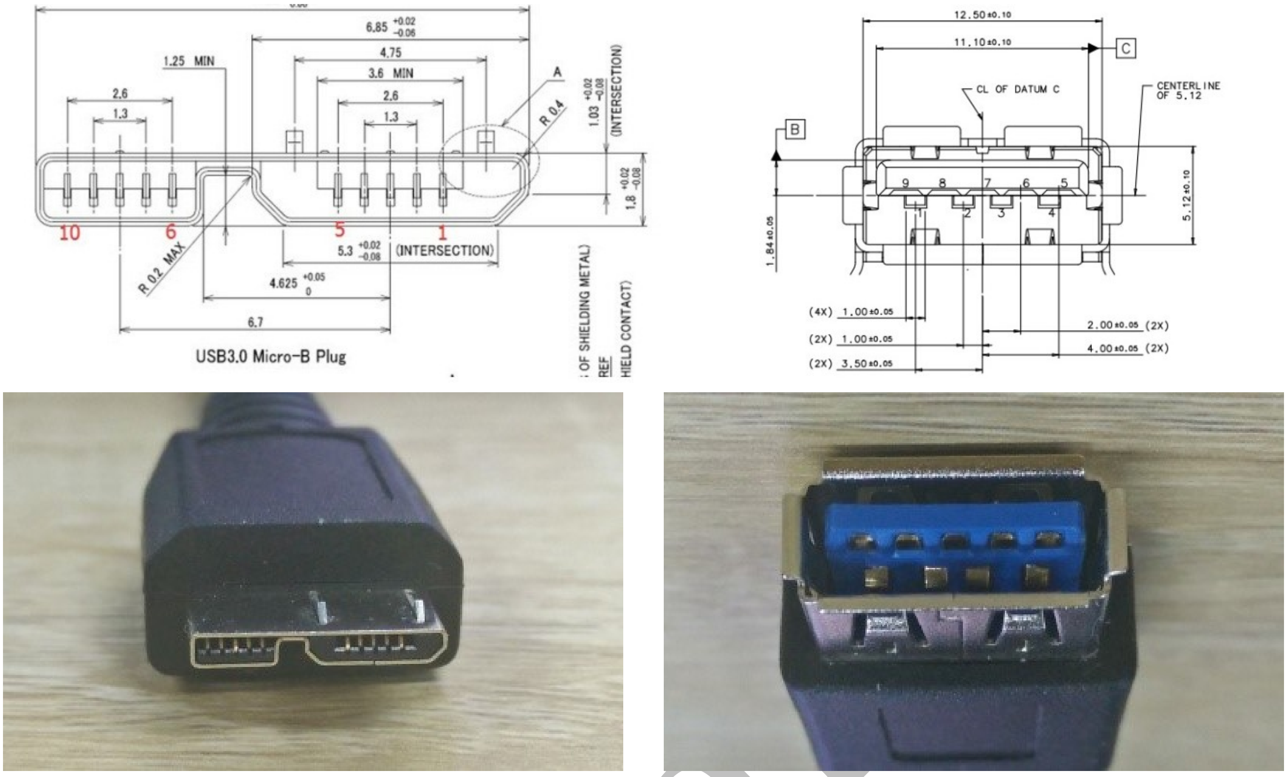


Figure 3.15: USB 3.0 plugs

3.6.2 Micro SD card and EMMC NAND Flash

When the OS boot from EMMC NAND Flash, /dev/mmcblk0 is the device node of EMMC NAND Flash. If you insert a MicroSD card into MicroSD card slot, you will find /dev/mmcblk1 become the device node of MicroSD card. But when the OS boot from the MicroSD card, /dev/mmcblk0 is the device node of MicroSD card, and /dev/mmcblk1 is the device node of EMMC NAND Flash.

Type the command below to list the partitions of storage device

```
sudo fdisk -l
```

or

```
lsblk
```

3.7 ADC

There are two ADC channels on LeMaker Guitar base board Rev.B: ADC0 and ADC_COM.

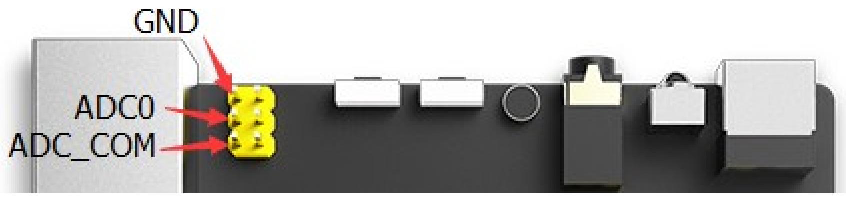


Figure 3.16: ADC on board

Type the command below to view the value of ADC:

ADC0:

```
cat /sys/class/hwmon/hwmon0/device/aux0

185 /1024
```

Then using the following formula to calculate the voltage value of ADC0 (AnalogVol):

AnalogVol = 3.0/1024*(ADC0_DATA)

ADC_COM:

```
cat /sys/class/hwmon/hwmon0/device/remote_control

99 /1024
```

Then using the following formula to calculate the voltage value of ADC_COM (AnalogVol):

alogVol = SVCC/1024*(REM_CON_DATA)

The SVCC voltage value is set to 3.1V by default.

3.8 See also

[1] hostapd - http://w1.fi/hostapd/

[2] wpa_supplicant - a WPA Supplicant for Linux: http://w1.fi/wpa_supplicant/

[3] Netlink Protocol Library Suite: http://www.infradead.org/~tgr/libnl/

[4] MPlayer - a movie player which runs on many systems:

http://www.mplayerhq.hu/design7/info.html

[5] guvcview - a simple v4l2 full-featured video grabber: http://sourceforge.net/projects/guvcview/

[6] The OV5640: http://www.ovt.com/products/sensor.php?id=177

4 Resize root filesystem partition

The Linux OS image file (an .img or .fw file) provided by LeMaker has a size about 3.0GB, after you use the image burning tool to write it into a MicroSD card or EMMC NAND Flash on board, you'll find that the partition which contains the root directory "/" has a space of about 3.0GB, and it is a trouble because the partition space will be used up soon, e.g. Installing emacs related packages will use more than 200 MB space.

So, we need to resize the root directory partition that uses almost the whole MicroSD card or EMMC NAND Flash space. For example, I have an 8GB MicroSD card or an 8GB EMMC NAND Flash, and then I want the left space to be the root directory partition.

parted is a disk partitioning and partition resizing program. It allows you to create, destroy, resize, move and copy ext2, linux-swap, FAT, FAT32, and reiserfs partitions. It can create, resize, and move Macintosh HFS partitions, as well as detect jfs, ntfs, ufs, and xfs partitions. It is useful for creating space for new operating systems, reorganising disk usage, and copying data to new hard disks.

```
parted /dev/mmcblk0                          #mmcblkx represents MicroSD card or EMMC

GNU Parted 3.2

Using /dev/mmcblk0

Welcome to GNU Parted! Type 'help' to view a list of commands.

(parted) print                              #List partitions

Model: SD SL08G (sd/mmc)

Disk /dev/mmcblk0: 7948MB

Sector size (logical/physical): 512B/512B

Partition Table: gpt

Disk Flags:


Number  Start   End     Size    File system  Name     Flags

  1      8389kB  58.7MB  50.3MB  fat16        primary  msftdata

  2      58.7MB  3670MB  3611MB  ext4         primary  msftdata
```

```
(parted) resizepart                     #Resize partition
Partition number? 2                     #Select partition 2
End?  [3670MB]? -1                      #Resize to the end
(parted) print                          #List partitons
Model: SD SL08G (sd/mmc)
Disk /dev/mmcblk0: 7948MB
Sector size (logical/physical): 512B/512B
Partition Table: gpt
Disk Flags:

Number  Start   End     Size    File system  Name     Flags
 1      8389kB  58.7MB  50.3MB  fat16        primary  msftdata
 2      58.7MB  7947MB  7888MB  ext4         primary  msftdata

(parted)  q
Information: You may need to update /etc/fstab.
```

And then:

```
sudo reboot
sudo resize2fs /dev/mmcblk0p2
```

(**Notice: parted 2.3 is not support dynamic partitioning**.)

5 CPU

5.1 Scale CPU frequency

According to your different demands, it is very important for LeMaker Guitar to be able to operate both performant as well as energy efficient. CPU frequency scaling plays an important role. The lower the clock speed, the slower the device and the less energy it consumes (and vice versa). Even the voltage available to the ARM core(s) will be adjusted depending on the clock speed, there existed a mapping called dvfs_table between clock speeds and voltage. Now in mainline kernel this is done inside the kernel by defining similar operating-points (the higher the CPU is clocked the more voltage it needs to still operate reliable). It's not enough to define a set of CPU frequency/voltage mappings and upper/lower limits but also strategies to switch between them are needed. These so called cpufreq governors are responsible for that. LeMaker Guitar Linux kernel supports cpu frequency scaling, you can list available governors, frequencies and current frequency as below:

```
cat /sys/devices/system/cpu/cpu0/cpufreq/scaling_available_frequencies

408000 720000 900000 1104000 1308000

cat /sys/devices/system/cpu/cpu0/cpufreq/scaling_cur_freq

900000

cat /sys/devices/system/cpu/cpu0/cpufreq/scaling_available_governors

conservative ondemand userspace powersave interactive performance
```

ondemand: The CPUfreq governor "ondemand" sets the CPU depending on the current usage. To do this the CPU must have the capability to switch the frequency very quickly.

conservative: The CPUfreq governor "conservative", much like the "ondemand" governor, sets the CPU depending on the current usage. It differs in behaviour in that it gracefully increases and decreases the CPU speed rather than jumping to max speed the moment there is any load on the CPU. This behaviour more suitable in a battery powered environment.

userspce: The CPUfreq governor "userspace" allows the user, or any userspace program running with UID "root", to set the CPU to a specific frequency by making a sysfs file "scaling_setspeed" available in the CPU-device directory.

powersave: The CPUfreq governor "powersave" sets the CPU statically to the lowest frequency within the borders of scaling_min_freq and scaling_max_freq.

performance: The CPUfreq governor "performance" sets the CPU statically to the highest frequency within the borders of scaling_min_freq andscaling_max_freq.

Type the command below to lock CPU frequency:

```
echo ondemand > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor
echo 900000 > /sys/devices/system/cpu/cpu0/cpufreq/scaling_min_freq
echo 900000 > /sys/devices/system/cpu/cpu0/cpufreq/scaling_max_freq
echo 35 > /sys/devices/system/cpu/cpufreq/ondemand/up_threshold
echo 10 > /sys/devices/system/cpu/cpufreq/ondemand/sampling_down_factor
echo 1 > /sys/devices/system/cpu/cpufreq/ondemand/io_is_busy
```

The default configuration of CPU frequency scaling is saved in */ec/rc.local*

```
cat /etc/rc.local
#!/bin/sh -e
#
# rc.local
#
# This script is executed at the end of each multiuser runlevel.
# Make sure that the script will "exit 0" on success or any other
# value on error.
#
# In order to enable or disable this script just change the execution
# bits.
#
# By default this script does nothing.
```

```
echo ondemand > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor


echo 45 > /sys/devices/system/cpu/cpufreq/ondemand/up_threshold

echo 15 > /sys/devices/system/cpu/cpufreq/ondemand/sampling_down_factor

echo 1 > /sys/devices/system/cpu/cpufreq/ondemand/io_is_busy


exit 0
```

5.2 Read the CPU&PMU temperature

There have two ways to read the CPU temperature. One way is reading the file */sys/class/thermal/thermal_zone1/temp* directly, the other way is using lm-sensors tool.

Read CPU temperature directly

```
cat /sys/class/thermal/thermal_zone1/temp
```

Use lm-sensors to read temperature

Step 1: Install lm-sensors

```
sudo apt-get update

sudo apt-get install lm-sensors
```

Step 2: Detect hardware monitoring chips

```
sudo sensors-detect
```

Step 3: Read the CPU temperature

```
sudo sensors

battery-virtual-0

Adapter: Virtual device

temp1:        +0.0°C
```

```
owl-thermal-virtual-0

Adapter: Virtual device

temp1:        +51.0°C  (crit = +105.0°C)
```

Read PMU temperature

```
cat /sys/devices/b0170000.i2c/i2c-0/0-0065/atc2603c-hwmon.0/ic_temperature
```

5.3 See also

[1] PU frequency and voltage scaling code in the Linux(TM) kernel:

https://www.kernel.org/doc/Documentation/cpu-freq/governors.txt

[2] PowerVR: https://en.wikipedia.org/wiki/PowerVR#Series_5_.28SGX.29

[3] lm-sensors: http://www.lm-sensors.org/

6 Remote login

6.1 Use ssh to login

Secure Shell, or SSH, is a cryptographic (encrypted) network protocol for initiating text-based shell sessions on remote machines in a secure way.

This allows a user to run commands on a machine's command prompt without them being physically present near the machine. It also allows a user to establish a secure channel over an insecure network in a client-server architecture, connecting an SSH client application with an SSH server. Common applications include remote command-line login and remote command execution, but any network service can be secured with SSH. The protocol specification distinguishes between two major versions, referred to as SSH-1 and SSH-2.

SSH was designed as a replacement for Telnet and other insecure remote shell protocols such as the Berkeley rsh and rexec protocols, which send information, notably passwords, in plaintext, rendering them susceptible to interception and disclosure using packet analysis. The encryption used by SSH is intended to provide confidentiality and integrity of data over an unsecured network, such as the Internet, although files leaked by Edward Snowden indicate that the National Security Agency can sometimes decrypt SSH.

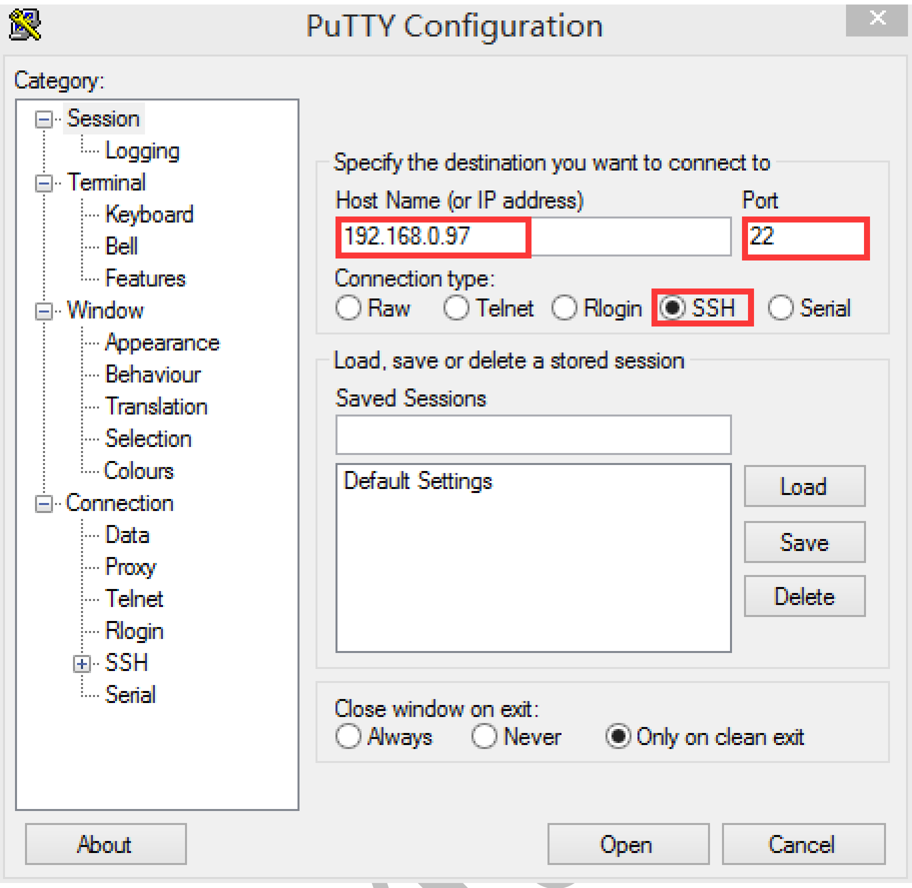
6.1.1 Remote login on Windows

Step 1: Install Putty or SecureCRT on windows

Step 2: List the IP address on your LeMaker Guitar via the serial terminal, for example 10.3.217.133. Make sure that your desktop PC and LeMaker Guitar on the same LAN.

```
ifconfig
```

Step 3: Select “SSH” option, and set Host Name be your LeMaker Guitar ip address.



Specify the destination you want to connect to

Host Name (or IP address): 192.168.0.97

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Load, save or delete a stored session

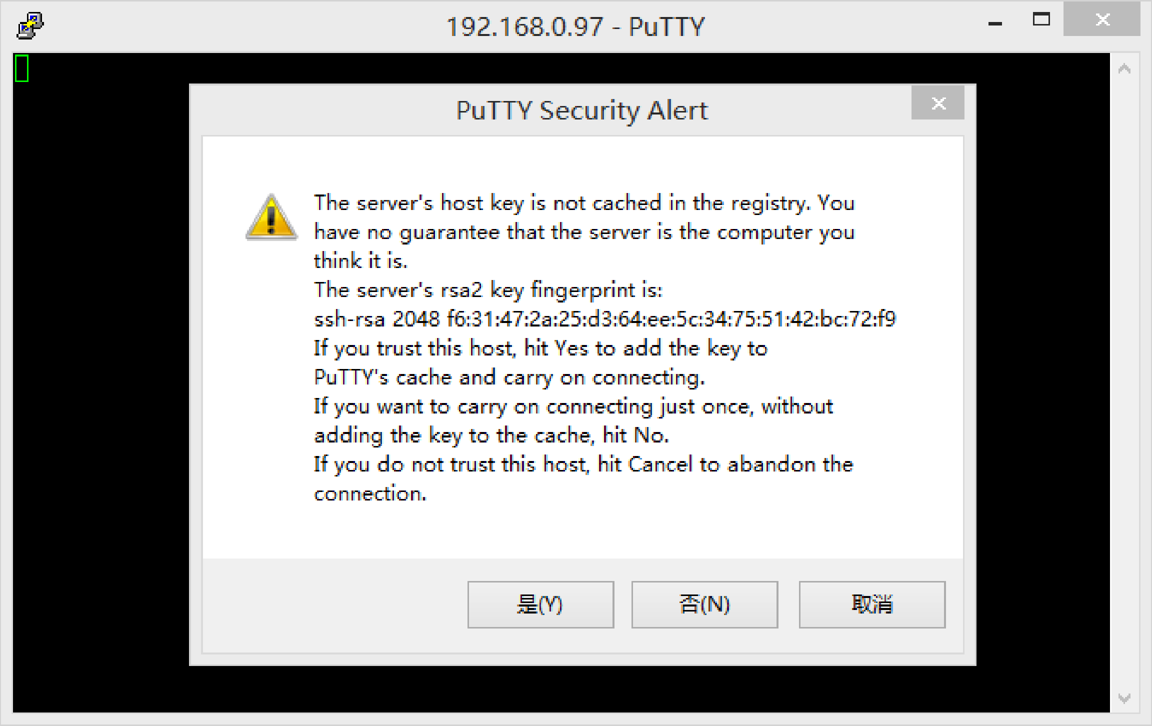
Saved Sessions

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

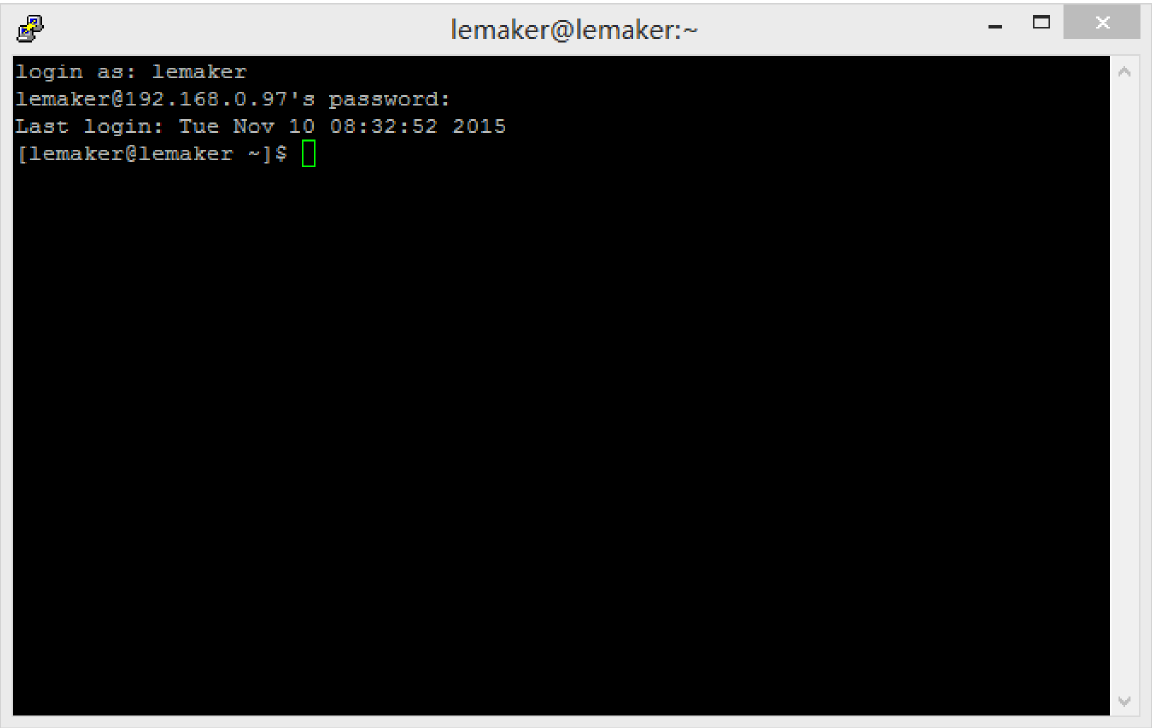
Figure 6.1: Configure Putty

Step 4: Click “Open” button to remotely login your LeMaker Guitar.



The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.
The server's rsa2 key fingerprint is:
ssh-rsa 2048 f6:31:47:2a:25:d3:64:ee:5c:34:75:51:42:bc:72:f9
If you trust this host, hit Yes to add the key to PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the connection.

Figure 6.3: Remote connect Guitar



```
login as: lemaker
lemaker@192.168.0.97's password:
Last login: Tue Nov 10 08:32:52 2015
[lemaker@lemaker ~]$
```

Figure 6.4: Remote login Guitar

6.1.2 Remote login on Linux

You also can login LeMaker Guitar on Linux PC.

Step 1: Install SSH for Desktop PC(ubuntu 12.04)

```
sudo apt-get install openssh
```

openssh-client, openssh-server and ssh-import-id will be installed.

Step 2: Login your LeMaker Guitar by SSH

```
suod ssh -l [username] [ipaddress]
```

username is user name(lemaker), **ipaddress** is IP address on your LeMaker Guitar.

6.2 Use vnc to login

VNC stands for Virtual Network Computing. It is remote control software which allows you to view and interact with one computer (the "server") using a simple program (the "viewer") on another computer anywhere on the Internet. The two computers don't even have to be the same type, so for example you can use VNC to view an office Linux machine on your Windows PC at home. VNC is freely and publicly available and is in widespread active use by millions throughout industry, academia and privately. Interact with a remote computer in a much easier fashion.

TightVNC is a free remote control software package. With TightVNC, you can see the desktop of a remote machine and control it with your local mouse and keyboard, just like you would do it sitting in the front of that computer.

Step 1: Install tightvncserver

```
sudo apt-get update
sudo apt-get install tightvncserver
```

Step 2: Start vncserver

```
vncserver :1
```

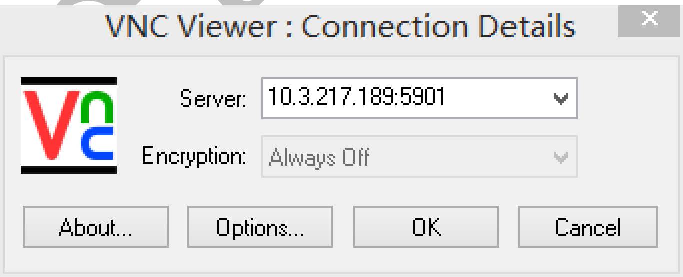
If you want to stop vncserver, you can type the command below:

```
vncserver -kill :1
```

Step 3: Type the command below to get LeMaker Guitar’ ip address

```
ifconfig
```

Step 4: Use vncview to remote control your LeMaker Guitar on your desktop PC.

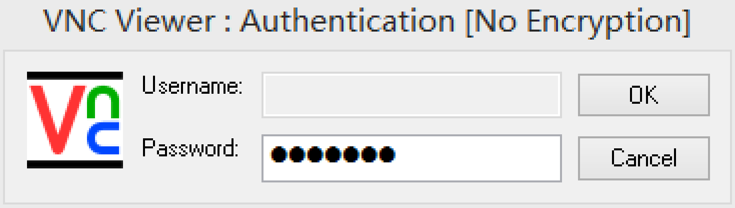

VNC Viewer : Connection Details

Server: 10.3.217.189:5901

Encryption: Always Off

Figure6.3: Configure VNC Viewer

10.3.217.189 is the IP address of your SBC. **5901** is the default port of tightvncserver.


VNC Viewer : Authentication [No Encryption]

Username:

Password: ●●●●●●●

Pictrue 6.4: Input password

Input the password, you will see the desktop.

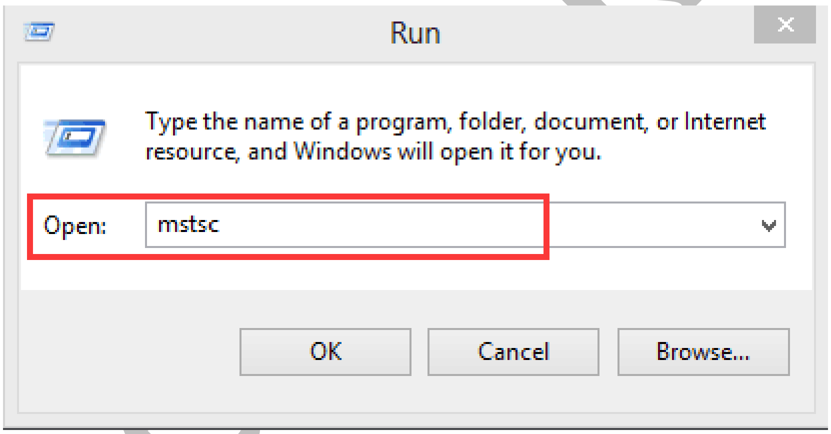
6.3 Use RDP to login

RDP provides quality-controlled, aligned and annotated Bacterial and Archaeal 16S rRNA sequences, and Fungal 28S rRNA sequences, and a suite of analysis tools to the scientific community.

Step1: Install RDP Server on Lemuntu

```
sudo apt-get install xrdp

sudo apt-get install tightvncserver

sudo systemctl enable xrdp

sudo reboot
```

Step 2: Open the run command window on windows, and then type "mstsc".

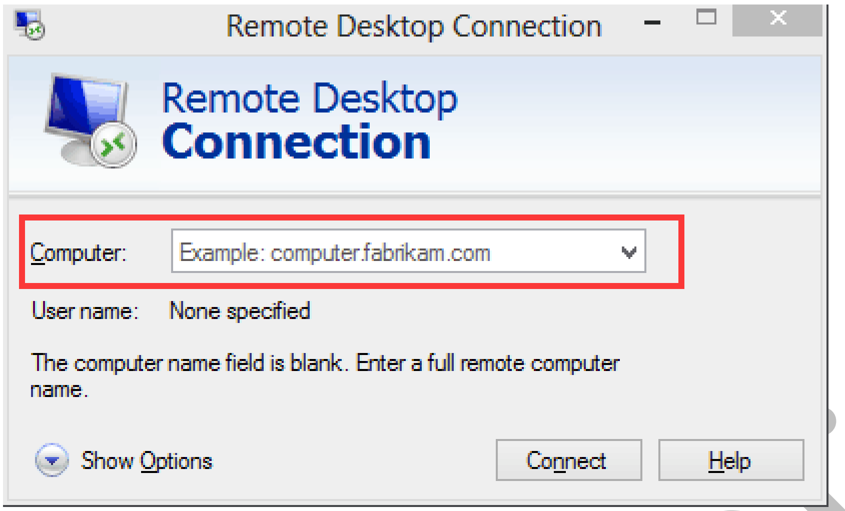


Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.

Open: mstsc

Figure 6-5: Run command window

Step 3: Type the IP address of the Lemuntu system, then click the "connect"



Remote Desktop Connection

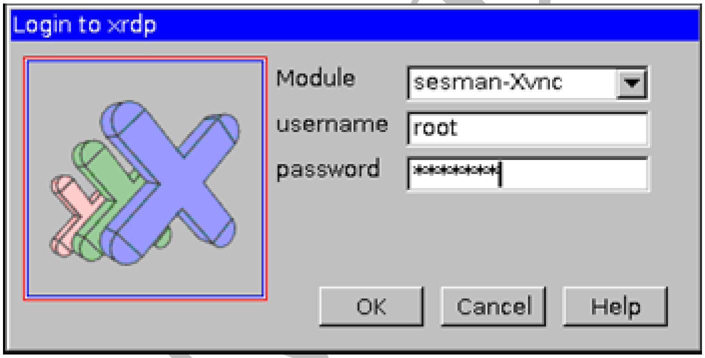
Computer: Example: computer.fabrikam.com

User name: None specified

The computer name field is blank. Enter a full remote computer name.

Figure 6-6: Remote desktop connection

Step 4: Type your acount for the Lemuntu



Login to xrdp

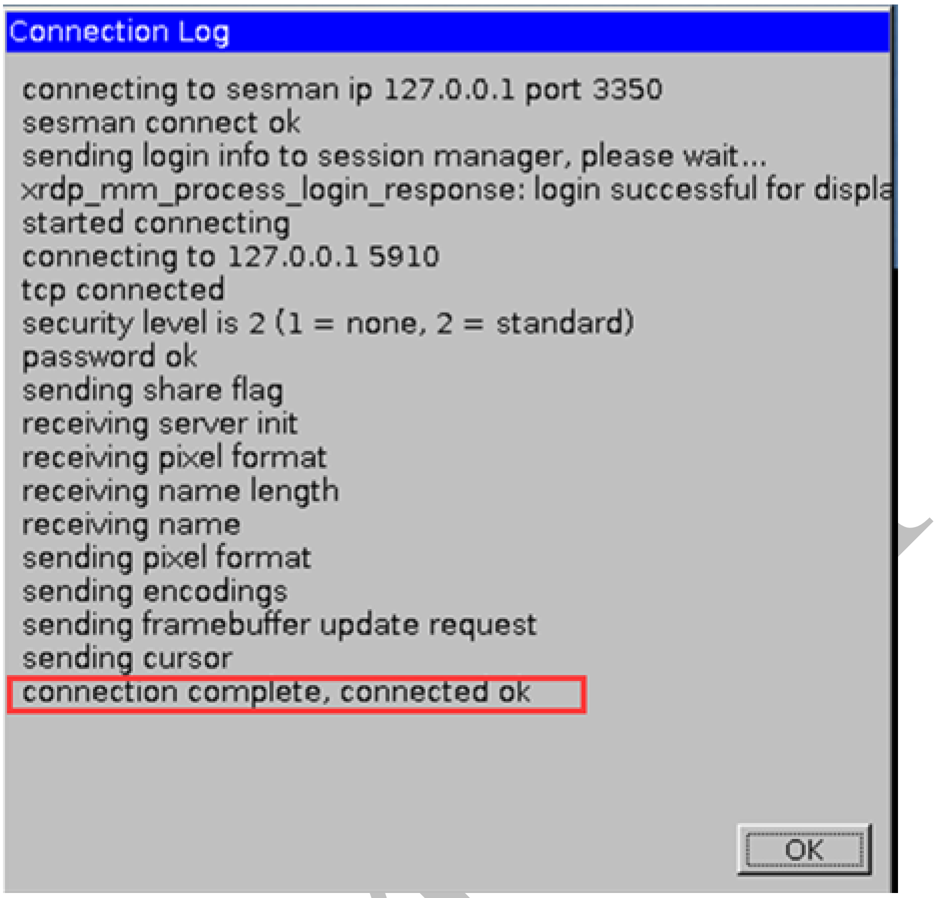
Module sesman-Xvnc

username root

password ********

Figure 6-7: Login to xrdp

Step 5: Click "OK", and you will view the remote connection successfully.



```
connecting to sesman ip 127.0.0.1 port 3350
sesman connect ok
sending login info to session manager, please wait...
xrdp_mm_process_login_response: login successful for displa
started connecting
connecting to 127.0.0.1 5910
tcp connected
security level is 2 (1 = none, 2 = standard)
password ok
sending share flag
receiving server init
receiving pixel format
receiving name length
receiving name
sending pixel format
sending encodings
sending framebuffer update request
sending cursor
connection complete, connected ok
```

Figure 6-9: Xrdp connection log

6.4 See also

[1] PuTTY Download Page: http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

[2] SSH - a cryptographic network protocol to allow remote login:

https://en.wikipedia.org/wiki/Secure_Shell

[3] SecureCRT - The rock-solid Telnet and SSH client for Windows:

https://www.vandyke.com/products/securecrt/

[4] Http File Server: http://www.rejetto.com/hfs/

[5] tightvnc: http://www.tightvnc.com/

7 Video

7.1 GPU hardware acceleration

PowerVR is a division of Imagination Technologies (formerly VideoLogic) that develops hardware and software for 2D and 3D rendering, and for video encoding, decoding, associated image processing and OpenGL ES, OpenVG, and OpenCL acceleration.

The PowerVR product line was originally introduced to compete in the desktop PC market for 3D hardware accelerators with a product with a better price/performance ratio than existing products like those from 3dfx Interactive. Rapid changes in that market, notably with the introduction of OpenGL and Direct3D, led to rapid consolidation. PowerVR introduced new versions with low-power electronics that were aimed at the laptop computer market. Over time, this developed into a series of designs that could be incorporated into system-on-a-chip architectures suitable for handheld device use. PowerVR accelerators are not manufactured by PowerVR, but instead their integrated circuit designs and patents are licensed to other companies, such as Texas Instruments, Intel, NEC, BlackBerry, Renesas, Samsung, STMicroelectronics, Freescale, Apple, NXP Semiconductors (formerly Philips Semiconductors), and many others.

7.1.1 Install GPU hardware acceleration libraries

Step 1: Download and unzip the archive file

```
wget http://mirror.lemaker.org/GPU_For_LeMaker_Guitar_201511.tar.gz

sudo tar -zxvf GPU_For_LeMaker_Guitar_201511.tar.gz
```

Step 2: Install the software installation package

```
cd GPU_For_LeMaker_Guitar_201511

sudo chown -R root:root ./*

sudo ./install.sh
```

Step 3: Replace X, Xorg

```
cd /usr/bin
```

```
sudo mv X X.original

sudo mv Xorg Xorg.original

sudo ln -sf /usr/local/XSGX/bin/X X

sudo ln -sf /usr/local/XSGX/bin/Xorg Xorg

sudo cp /usr/local/XSGX/etc/xorg.conf  /etc/
```

Step 4: Check the modules dependency

```
sudo depmod
```

Step 5: Add library path

```
sudo nano /etc/ld.so.conf

include /etc/ld.so.conf.d/*.conf

/usr/local/XSGX/lib

/usr/lib



sudo ldconfig
```

Step 6: Check whether the GPU started

```
lsmod
Module                   Size  Used by
...
pvrsrvkm               336156  6
drm                   225379   6 pvrsrvkm
...
```

If you can find pvrsrvkm and drm dirver modules, and the Used of the modules are not 0, and the graphical user interface runs normally, the GPU hardware acceleration works normally!

7.1.2 Use glmark2 tool to test GPU

Step 1: Install some necessary libraries

```
sudo apt-get install libgegl-0.2-0 libgfortran3 libgimp2.0 libgl1-mesa-dev

libgles2-mesa-dev libglew-dev libglew1.10 libglib2.0-bin libglib2.0-data

libglib2.0-dev libglu1-mesa-dev
```

```
sudo apt-get install libpng-dev

sudo apt-get install libx11-dev

sudo apt-get install pkg-config
```

Step 2: compile and install glmark2

```
wget http://mirror.lemaker.org/glmark2_2011.09.orig.tar.gz

tar -zxvf glmark2_2011.09.orig.tar.gz

cd glmark2-2011.09/

./waf configure --enable-glesv2

./waf

sduo ./waf install
```

Step 3: Replace some libraries

```
sudo cp /usr/lib/libEGL.so* /usr/lib/arm-linux-gnueabihf/ -a

sudo cp /usr/lib/libGLES*  /usr/lib/arm-linux-gnueabihf/ -a
```

Step 4: Run glmark2-es2 on **Lemuntu command terminal**

```
glmark2-es2
```

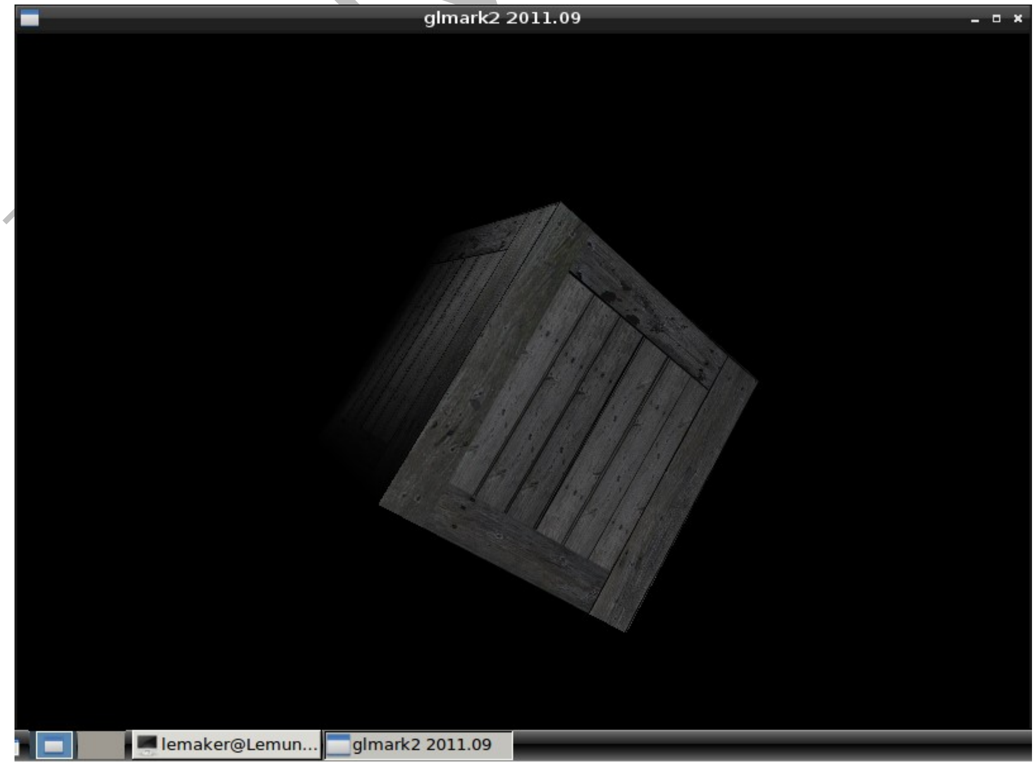


Figure 7.1: glmark test

7.2 Video decoder engine

LeMaker Guitar VDE (Video Decoder Engine) is a decoder component based on OpenMAX. OpenMAX (Open Media Acceleration), often shortened as "OMX", is a non-proprietary and royalty-free cross-platform set of C-language programming interfaces that provides abstractions for routines especially useful for audio, video, and still images processing. It is intended for low power and embedded system devices (including smartphones, game consoles, digital media players, and set-top boxes) that need to efficiently process large amounts of multimedia data in predictable ways, such as video codecs, graphics libraries, and other functions for video, image, audio, voice and speech. OpenMAX provides three layers of interfaces: application layer (AL), integration layer (IL) and development layer (DL).

OMX_VDE has two ports: port1 acts as the video stream input port, port2 acts as the video stream output port. OMX_VDE supports many video formats, such as AVC(H264), H263, MJPEG, MPEG2, MPEG4, WMV3 etc…

Step 1: Download and install omx lib

```
sudo wget http://mirror.lemaker.org/omx.tar.gz

sudo tar -zxvf omx.tar.gz

sudo ./install.sh
```

omx head files will be installed in */usr/include/omx-include*, omx video decoder libraries will be installed in */usr/lib*, examples source code will be installed in */home/owlplayer*

Step 2: Compile examples

```
cd /home/owlplayer

make
```

Step 3: Test examples

```
cd /home/owlplayer

./owlplayer [videoname]
```

When executed “./owlplayer [videoname]”, you will find a file "NV12_wxxx_hxxx" in /home. The file "NV12_wxxx_hxxx" records 50 frames of the video "videoname". The "NV12" means the pix format is NV12. the "xxx" means width or height. You can play the file "NV12_wxxx_hxxx" with YUVPlayer.exe on Windows PC.

7.3 See also

[1] OpenMAX: https://en.wikipedia.org/wiki/OpenMAX

[2] UV Player - a full-featured tool for playback of uncompressed planar YUV video files: http://www.yuvplayer.com/

8 IO controlling

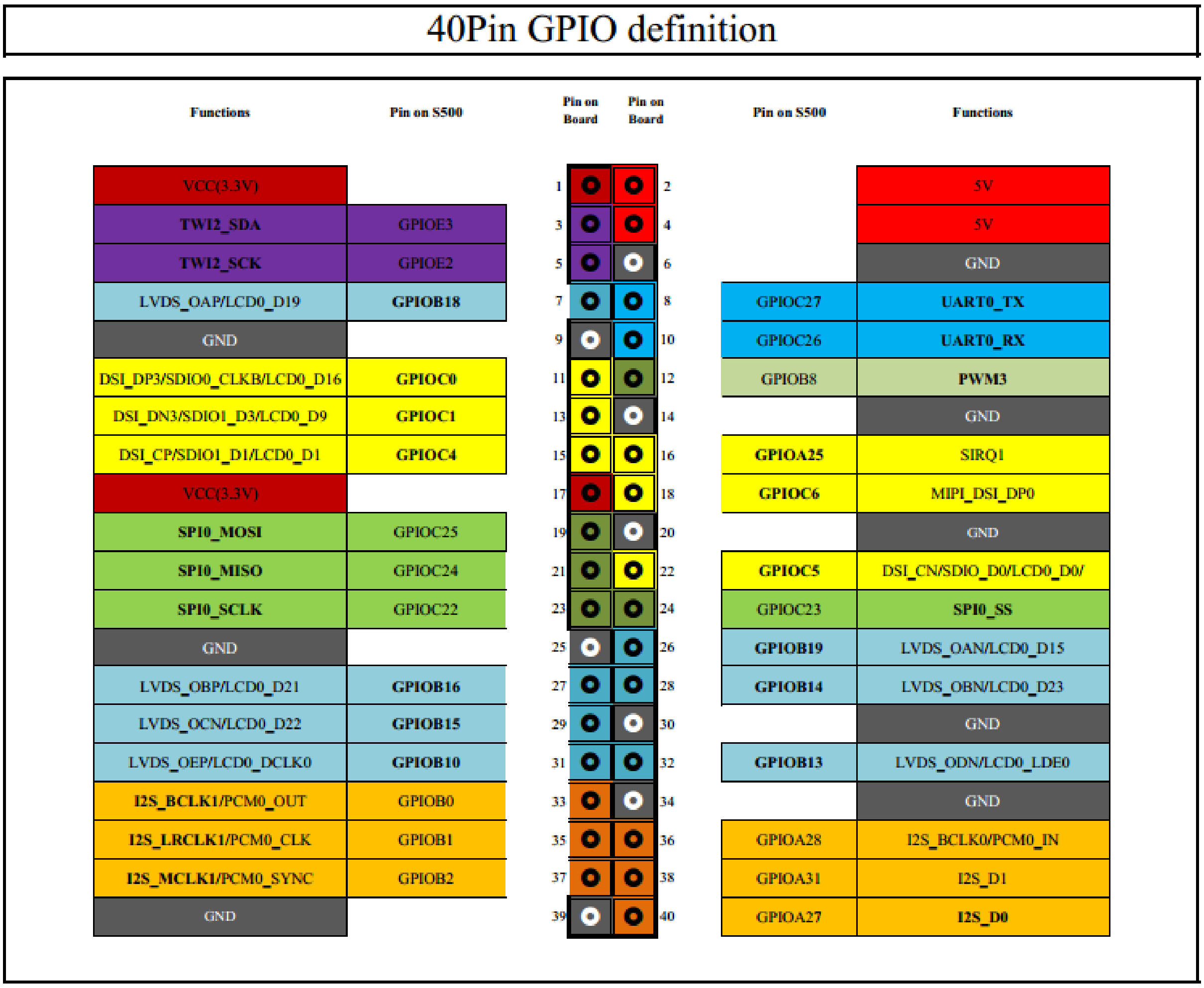
There has a 40pin GPIO ports on LeMaker Guitar Base Board Rev.B, including TWI, PWM, SPI, I2C, UART, etc…. Via the basic way, we can control the digital IO ports input or output from the sys user space. But if we want to use more complex interface such as SPI or I2C, it is not that easy to achieve. Thus there have two GPIO libraries WiringLMK and LMK.GPIO which offer various API to easily control the IO on LeMaker Guitar. Currently, both the WiringLMK C library and the LMK.GPIO Python library support Banana Pro and LeMaker Guitar. In the following, we will introduce you how to use these libraries with the physical numbering scheme.

8.1 Use sysfs control gpio

The GPIO pins can be accessed from user space using sysfs. By default, the mapping gpio_operation from the physical GPIO to the sys file system is enabled in the kernels. Before exporting or unexporting, you have to obtain the correct numbering index from the pin name, the calculation is as below for LeMaker Guitar Base Board Rev.B:

```
GPIO A: GPIOA*NUMBER* = 0 + *NUMBER*, for example, GPIOA27 = 0+27 = 27

GPIO B: GPIOB*NUMBER* = 32 + *NUMBER*, for example, GPIOB32 = 16+32 = 48

GPIO C: GPIOC*NUMBER* = 64 + *NUMBER*, for example, GPIOC0 = 64+0 = 64

GPIO D: GPIOD*NUMBER* = 96 + *NUMBER*, for example, GPIOD3 = 96+3 = 99

GPIO E: GPIOE*NUMBER* = 128 + *NUMBER*, for example, GPIOE22 = 128+22 = 150
```

You can simply check “40Pin GPIO definition” below to obtain the correct sys pin number.



40Pin GPIO definition

Functions	Pin on S500	Pin on Board	Pin on Board	Pin on S500	Functions
VCC(3.3V)		1	2		5V
TWI2_SDA	GPIOE3	3	4		5V
TWI2_SCK	GPIOE2	5	6		GND
LVDS_OAP/LCD0_D19	GPIOB18	7	8	GPIOC27	UART0_TX
GND		9	10	GPIOC26	UART0_RX
DSI_DP3/SDIO0_CLKB/LCD0_D16	GPIOC0	11	12	GPIOB8	PWM3
DSI_DN3/SDIO1_D3/LCD0_D9	GPIOC1	13	14		GND
DSI_CP/SDIO1_D1/LCD0_D1	GPIOC4	15	16	GPIOA25	SIRQ1
VCC(3.3V)		17	18	GPIOC6	MIPI_DSI_DP0
SPI0_MOSI	GPIOC25	19	20		GND
SPI0_MISO	GPIOC24	21	22	GPIOC5	DSI_CN/SDIO_D0/LCD0_D0/
SPI0_SCLK	GPIOC22	23	24	GPIOC23	SPI0_SS
GND		25	26	GPIOB19	LVDS_OAN/LCD0_D15
LVDS_OBP/LCD0_D21	GPIOB16	27	28	GPIOB14	LVDS_OBN/LCD0_D23
LVDS_OCN/LCD0_D22	GPIOB15	29	30		GND
LVDS_OEP/LCD0_DCLK0	GPIOB10	31	32	GPIOB13	LVDS_ODN/LCD0_LDE0
I2S_BCLK1/PCM0_OUT	GPIOB0	33	34		GND
I2S_LRCLK1/PCM0_CLK	GPIOB1	35	36	GPIOA28	I2S_BCLK0/PCM0_IN
I2S_MCLK1/PCM0_SYNC	GPIOB2	37	38	GPIOA31	I2S_D1
GND		39	40	GPIOA27	I2S_D0

Figure 8.1 40pin GPIO defінetion

To access a GPIO pin such as GPIOB19 (32+19 = 51), you firstly need to type the command below to export it.

```
sudo echo 51 > /sys/class/gpio/export
```

If succeed, you will find the sys file system node

```
ls /sys/class/gpio/gpio51

active_low  direction  edge  power  subsystem  uevent  value
```

Type the command below to set a GPIO pin as output

```
echo out > /sys/class/gpio/gpio51/direction
```

Type the command below to set a GPIO pin as intput

```
echo in > /sys/class/gpio/gpio51/direction
```

Type the command below to read the value of GPIO pin

```
cat /sys/class/gpio/gpio51/value
```

When the direction is set to ouput, you can write 1 or 0 into a GPIO pin

```
echo 1 /sys/class/gpio/gpio51/value
```

8.2 WiringLMK

WiringLMK is a GPIO access library written in C language for LeMaker Guitar Base Board Rev.B. It is modified on the base of the original WiringPi for the BCM2835 used in the Raspberry Pi created by Drogon. The modification done by LeMaker keeps the WiringLMK API usage the same as the original wiringPi.

You can download and install the WiringLMK by typing the commands below:

```
git clone https://github.com/LeMaker/WiringLMK.git

cd WiringLMK

chmod +x ./build

sudo ./build
```

There has a simple "Hello World" example to show how to make an LED blinks:

```
#include <wiringPi.h>

int main (void)

{

  wiringPiSetupPhys () ;

  pinMode (7, OUTPUT) ;

  for (;;)

  {

    digitalWrite (0, HIGH) ; delay (500) ;

    digitalWrite (0,  LOW) ; delay (500) ;

  }
  return 0 ;
}
```

For more information, please visit http://wiki.lemaker.org/WiringLMK

8.3 LMK.GPIO

LMK.GPIO provides a class to control the GPIO on LeMaker Guitar Base Board Rev.B written in Python language. It is modified on the base of the original RPi.GPIO for the BCM2835 used in the Raspberry Pi [1]. Note that the current release does not support SPI, I2C, hardware PWM or serial functionality on the LMK.GPIO yet. The modification done by LeMaker keeps the LMK.GPIO API usage the same as the original RPi.GPIO.

You can donwload and install the LMK.GPIO by typing the commands below:

```
sudo apt-get install python-dev
git clone https://github.com/LeMaker/LMK.GPIO.git
cd LMK.GPIO
python setup.py install
sudo python setup.py install
```

There has a simple "Hello World" example to show how to make an LED blinks:

```
#!/usr/bin/env python

import LMK.GPIO as GPIO
import time

#LED Mode BOARD
PIN_NUM = 7
GPIO.setmode(GPIO.BOARD)

while True:
        try:
                GPIO.setup(PIN_NUM, GPIO.OUT)
        except:
                print("Failed to setup GPIO %d", PIN_NUM)

        GPIO.output(PIN_NUM, True)
        time.sleep(0.5)
        GPIO.output(PIN_NUM, False)
       time.sleep(0.5)
```

For more information, please visit http://wiki.lemaker.org/LMK.GPIO

8.4 LeScratch

Scratch is designed with learning and education in mind. It can run in cooperation with LeScratch, which is the Scratch message handler that runs in the background on LeMaker Guitar to let Scratch to communicate with hardware peripherals. For education purpose, people at any age can earn an easy access to the principles of microcomputers and sensors with LeScratch, which is implemented in Python to extend the functionalities that sending and receiving commands among all the peripherals.

For more information, please visit http://wiki.lemaker.org/LeScratch_User_Guide

8.5 See also

[1] LeScratch: https://github.com/LeMaker/LeScratch

[2] Scratch - a free programming language and online community: https://scratch.mit.edu/

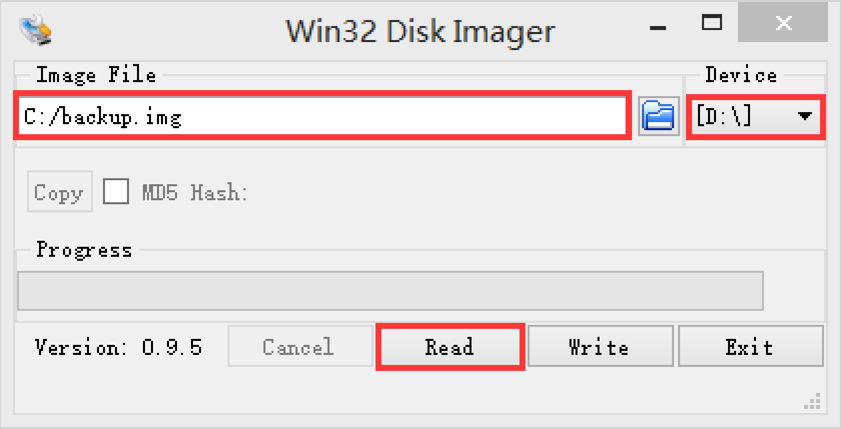
9 Back up OS image

9.1 Use Win32Diskimager to back up

You must remember that we can use Win32Diskimager tool to write the OS image into a MicroSD card. We also can use Win32Diskimager tool to read data from the MicroSD card for backup the OS image.

Step 1: Insert the MicroSD card into your computer or card reader.

Step 2: Open Win32DiskImager tool, set image file name and select the MicroSD card device, and then click “read” button to start backup the OS image.



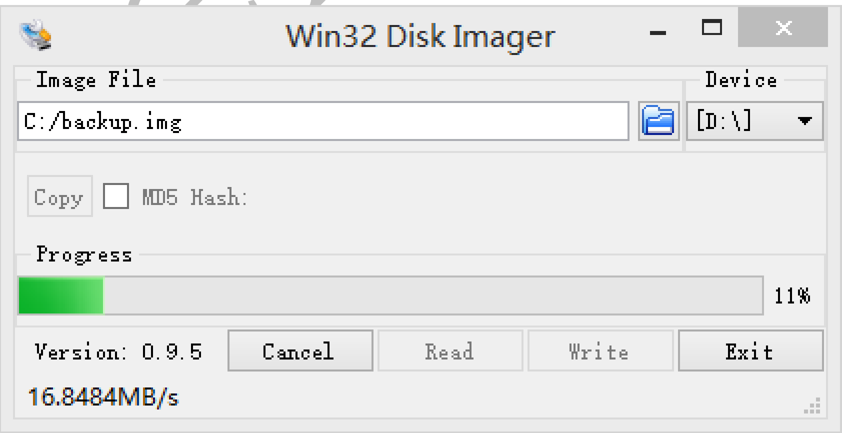
Win32 Disk Imager

Image File: C:/backup.img

Device: [D:\]

Version: 0.9.5

Figure 9.1: Set Win32DiskImager



Win32 Disk Imager

Image File: C:/backup.img

Device: [D:\]

Progress: 11%

Version: 0.9.5

16.8484MB/s

Figure 9.2: Backup the OS image

9.2 Use dd command to back up

You can back up the OS image with Win32Diskimager tool, But there has a another way to backup the OS image. We can back up the OS image by using the command **dd** on Linux.

Step 1: Insert a U disk into LeMaker Guitar for saving the backup of OS image. The U disk will be mounted in /media/lemaker/. Type the command below to view where the u disk was mounted

```
lsblk
```

Step 2: Type the command below to backup the OS image.

```
cd /media/lemaker/udiskname

sudo dd if=/dev/mmcblkx of=backup.img bs=1M

sync

sudo umount /media/lemaker/udiskname
```

Note: /dev/mmcblkx represents **/dev/mmcbkl0** or **/dev/mmcblk1**. When the OS boot from EMMC NAND Flash, /dev/mmcblk0 is the device node of EMMC NAND Flash. If you insert a MicroSD card into MicroSD card slot, you will find /dev/mmcblk1 become the device node of MicroSD card. But when the OS boot from the MicroSD card, /dev/mmcblk0 is the device node of MicroSD card, and /dev/mmcblk1 is the device node of EMMC NAND Flash. So you can backup the OS image of MicroSD card or EMMC NAND Flash according to which mmc block device you choose. If you want to restore the OS image, type the command below:

```
dd if=backup.img of=/dev/mmcblkx bs=1M

sync
```

9.3 See also

[1] Win32 Disk Imager - a tool for writing images to USB sticks or SD/CF cards:

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

10 Android

Android is a mobile operating system based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touchscreen mobile devices such as smartphones and tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear). The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touchscreen input, it has also been used in game consoles, digital cameras, regular PCs, and other electronics.

10.1 Basic desktop

Home desktop

Slide the Screen, you can switch to another home screens (support 5 home screens in total), Click the “HOME” button on status bar to switch to the default home screen.

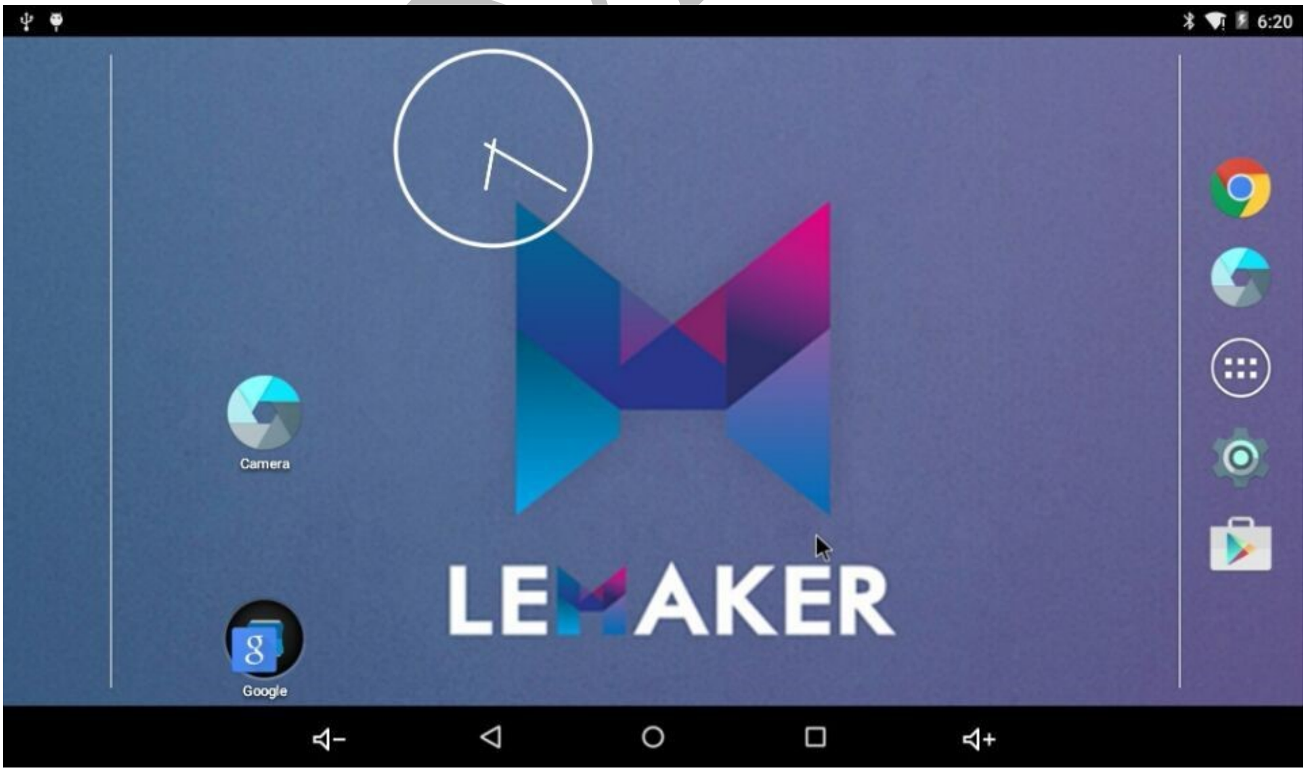


Figure 10.1: Android home desktop

Main menu

Click icon on the right side of the home screen to enter the main menu. All applications will be listed on main menu, you can drag the screen to scroll through the context.

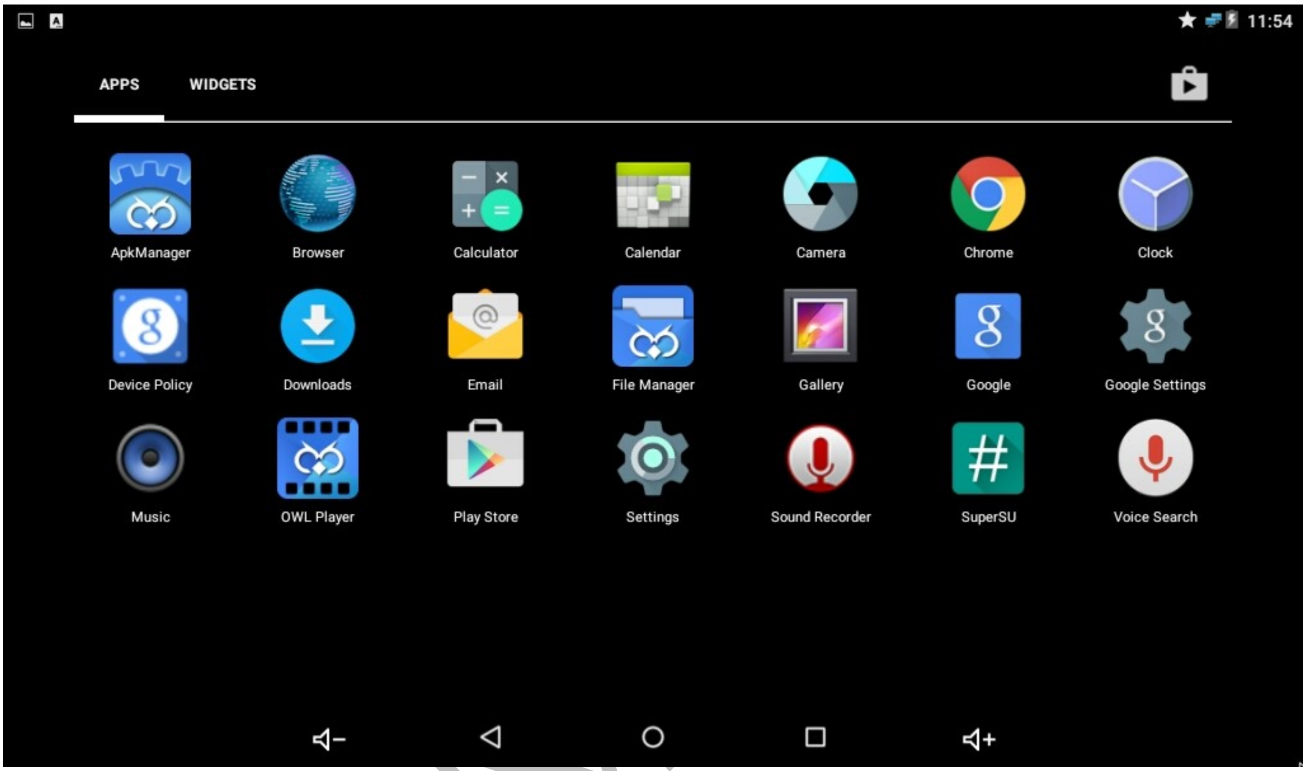
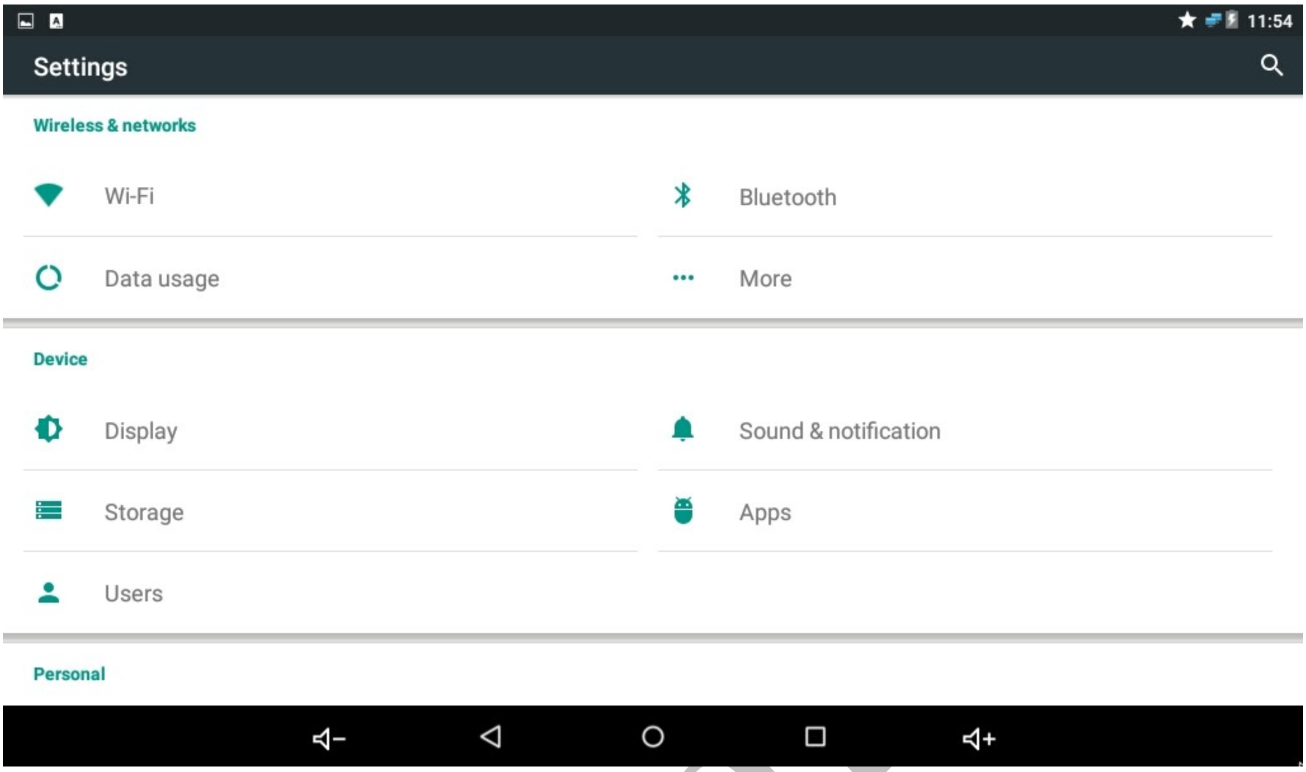


Figure 10.2: Android main menu

10.2 Basic Setting

Click icon to enter basic setting, including “Wireless & network”, “Device”, “Personal” and “System”



11:54

Settings

Wireless & networks

Wi-Fi

Bluetooth

Data usage

More

Device

Display

Sound & notification

Storage

Apps

Users

Personal

Figure 10.3: Android basic setting

For more info and help:

LeMaker Website:	http://www.lemaker.org/
LeMaker Forum:	http://forum.lemaker.org/
LeMaker Wiki:	http://wiki.lemaker.org/
LeMaker Support Email:	support@lemaker.org
LeMaker Github:	https://github.com/LeMaker
LeMaker Blog:	http://www.lemaker.org//blog
Lenovator:	http://www.lenovator.com/