LeMaker Guitar User Manual

( The first edition )
## Revision History

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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>
<thead>
<tr>
<th>Table 1.1: Accessories table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Micro SD card</strong></td>
</tr>
<tr>
<td><strong>Display and connectivity cables</strong></td>
</tr>
<tr>
<td><strong>Keyboard and mouse</strong></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
</tr>
<tr>
<td><strong>Internet connection</strong></td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td><strong>USB3.0/2.0 cable</strong></td>
</tr>
</tbody>
</table>

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

![Diagram of LeMaker Guitar accessories](image)

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


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
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
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](http://mirror.lemaker.org/Win32DiskImage_v0.9.5_install.zip)

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 command 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:

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

RedHat / Fedora / CentOS Linux:

```bash
yum -y install ddrescue
```

**Step 4:** Write OS image into MicroSD card

```bash
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_Windows_V2.01.03.zip](http://mirror.lemaker.org/IH_FW_Burning_Tool_For_Windows_V2.01.03.zip)

![Figure 2.4: IH FW Burning Tool](image)
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).

![Detect USB Device](image)

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.
2.4 Write OS firmware into EMMC on Linux

**Step 1:** Download the firmware burning tool such as FW Burning Tool from [http://mirror.lemaker.org/FW_Burning_Tool_For_Linux_V1.0_01.tar.gz](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 FW Burning 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
...
```

---

Figure 2.5: Writing the OS image
Step 4: Write the firmware .fw file into EMMC

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

### 2.5 OS image partitions description

Table 2.1: Linux OS image partitions table

<table>
<thead>
<tr>
<th>Name</th>
<th>Start</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbr</td>
<td>0</td>
<td>The first bootable partition of MicroSD card</td>
</tr>
<tr>
<td>Gpt</td>
<td>0x200</td>
<td>gtb partition table</td>
</tr>
<tr>
<td>Environment</td>
<td>0x5000</td>
<td>Saving uboot environment variables</td>
</tr>
<tr>
<td>Bootloader</td>
<td>0x200200</td>
<td>The first stage bootstraps (bootloader.bin)</td>
</tr>
<tr>
<td>Uboot</td>
<td>0x300000</td>
<td>uboot bootloader (u-boot-dtb.img)</td>
</tr>
<tr>
<td>Misc</td>
<td>0x800000</td>
<td>fat partitions, including kernel, initramfs, kernel configure files, uEnv.txt etc...(misc.img)</td>
</tr>
<tr>
<td>Rootfs</td>
<td>0x3800000</td>
<td>filesystem(rootfs.img)</td>
</tr>
</tbody>
</table>

### 2.6 See Also

1. [7za(1)] - Linux man page: [http://linux.die.net/man/1/7za](http://linux.die.net/man/1/7za)
2. [7-Zip](http://www.7-zip.org/) - a file archiver with a high compression ratio:
3. [SDFormatter](http://www.sdcard.org/downloads/formatter_4/) - a tool for writing images to USB sticks or SD/CF cards:
4. [Win32 Disk Imager](http://sourceforge.net/projects/win32diskimager/) - a tool for writing images to USB sticks or SD/CF cards:
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:

![Picture 3.1: HDMI-to-DVI cable](image1)

![Figure 3.2: HDMI-to-VGA cable](image2)

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

<table>
<thead>
<tr>
<th>HDMI Resolution Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>VID</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>17</td>
</tr>
</tbody>
</table>
View HDMI output resolution

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

Set HDMI output resolution, for example 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](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](image)

**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.

```c
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 */
}
```

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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>;
		psynchronization_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.

```dts
lcd0: lcd0@b02a0000 {
    pinctrl-names = "default";
    pinctrl-0 = <&lvds_state_default>;
    lcd_power_gpio = <&gpio 36>;  /*GPIOB4*/
    lcd_reset_gpio = <&gpio 49>;  /*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>;  

Step 3: Recompile LeMaker Guitar BSP

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

```bash
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:

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

```bash
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.

```bash
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

```bash
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:
Figure 3.4: Open wap gui

Figure 3.5: Scan WI-FI AP
The configure Parameters will be saved in /etc/wpa_supplicant/wpa_supplicant.conf.

```bash
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
```

Figure 3.6: Input SSID and PSK
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.

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

#Examples
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
```
Step 6: Reboot and start DHCP and hostap

```bash
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

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

Step 2: Install related software

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

Step 3: Download and install rtl8723bs_bt

```bash
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

```bash
sudo chmod +x start_bt.sh
```
Step 5: View and use Bluetooth

```
sudo ./start_bt.sh
```

```
hcitool dev

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

hciconfig -a

hci0:  Type: BR/EDR  Bus: UART
       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.

```
hctool scan
Scanning ...
   88:C9:D0:0A:B6:8B   *****
```

**Step 6: Install Bluetooth GUI and connect Bluetooth devices**

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

![Figure 3.8: Open Bluetooth Manager](image)
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.

**Step 1: Load camera drivers**

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

Step 2: View camera drivers

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 driver ov5640 has been loaded correctly, we can find the “/dev/video0” device 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:

(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:

Figure 3.14: 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 to 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

<table>
<thead>
<tr>
<th>Micro B Plug</th>
<th>Wire</th>
<th>USB3.0 Standard A Receptacle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Number</td>
<td>Wire Number</td>
<td>Pin Number</td>
</tr>
<tr>
<td>1</td>
<td>VBus</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>ID</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>SSTX-</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>SSTX+</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>SSRX-</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>SSRX+</td>
<td>9</td>
</tr>
</tbody>
</table>
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

```
isblk
```

3.7 ADC

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

\[
\text{AnalogVol} = \frac{3.0}{1024} \times (\text{ADC0\_DATA})
\]

**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):

\[
\text{alogVol} = \frac{\text{SVCC}}{1024} \times (\text{REM\_CON\_DATA})
\]

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

### 3.8 See also


[4] MPlayer - a movie player which runs on many systems: [http://www.mplayerhq.hu/design7/info.html](http://www.mplayerhq.hu/design7/info.html)


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:

<table>
<thead>
<tr>
<th>Number</th>
<th>Start</th>
<th>End</th>
<th>Size</th>
<th>File system</th>
<th>Name</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8389kB</td>
<td>58.7MB</td>
<td>50.3MB</td>
<td>fat16</td>
<td>primary</td>
<td>msftdata</td>
</tr>
<tr>
<td>2</td>
<td>58.7MB</td>
<td>3670MB</td>
<td>3611MB</td>
<td>ext4</td>
<td>primary</td>
<td>msftdata</td>
</tr>
</tbody>
</table>
```
(parted) resizepart  #Resize partition
Partition number? 2  #Select partition 2
End? [3670MB]?: -1  #Resize to the end
(parted) print  #List partitions

Model: SD SL08G (sd/mmc)

Disk /dev/mmcblk0: 7948MB

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

Partition Table: gpt

Disk Flags:

<table>
<thead>
<tr>
<th>Number</th>
<th>Start</th>
<th>End</th>
<th>Size</th>
<th>File system</th>
<th>Name</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8389kB</td>
<td>58.7MB</td>
<td>50.3MB</td>
<td>fat16</td>
<td>primary</td>
<td>msftdata</td>
</tr>
<tr>
<td>2</td>
<td>58.7MB</td>
<td>7947MB</td>
<td>7888MB</td>
<td>ext4</td>
<td>primary</td>
<td>msftdata</td>
</tr>
</tbody>
</table>

(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.

**userspace:** 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 and scaling_max_freq.

Type the command below to lock CPU frequency:

```bash
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.
```
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**

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

**Use `lm-sensors` to read temperature**

**Step 1: Install `lm-sensors`**

```bash
sudo apt-get update
sudo apt-get install lm-sensors
```

**Step 2: Detect hardware monitoring chips**

```bash
sudo sensors-detect
```

**Step 3: Read the CPU temperature**

```bash
sudo sensors
battery-virtual-0
Adapter: Virtual device
temp1: +0.0°C
```
owl-thermal-virtual-0
Adapter: Virtual device
templ: +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


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.

```bash
ifconfig
```

Step 3: Select “SSH” option, and set Host Name be your LeMaker Guitar ip address.
Step 4: Click “Open” button to remotely login your LeMaker 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

```
sudo 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’s IP address

```
ifconfig
```

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

![Figure 6.3: Configure VNC Viewer](image)

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

![Picture 6.4: Input password](image)
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.

**Step 1:** 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".

![Figure 6-5: Run command window](image)

**Step 3:** Type the IP address of the Lemuntu system, then click the "connect"
Figure 6-6: Remote desktop connection

**Step 4:** Type your account for the Lemuntu

![Remote Desktop Connection](image)

Figure 6-7: Login to xrdp

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

![Login to xrdp](image)
6.4 See also


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

[3] SecureCRT - The rock-solid Telnet and SSH client for Windows:
https://www.vandyke.com/products/securecrt/


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_20151.tar.gz
sudo tar -zxvf GPU_For_LeMaker_Guitar_20151.tar.gz
```

**Step 2:** Install the software installation package

```
cd GPU_For_LeMaker_Guitar_20151
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 driver 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 libglu1.10 libgl1-mesa-dev
libgl1-mesa-dev

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sudo apt-get install libpng-dev
sudo apt-get install libx11-dev
sudo apt-get install pkg-config

**Step 2: compile and install glmark2**

```bash
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
sudo ./waf install
```

**Step 3: Replace some libraries**

```bash
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`
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

```bash
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

```bash
cd /home/owlplayer
make
```

**Step 3:** Test examples

```bash
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


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.
To access a GPIO pin such as GPIOB19 (32+19 = 51), you first 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 input
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 output, 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:

```c
#include <wiringPi.h>

int main (void)
{
    wiringPiSetupPhys ();
    pinMode (7, OUTPUT);
    for (;;) {
        digitalWrite (0, HIGH); delay (500);
        digitalWrite (0, LOW); delay (500);
    }
}
For more information, please visit [http://wiki.lemaker.org/WiringLMK](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 download 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:

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

import LMK.GPIO as GPIO

import time

#LED Mode BOARD

PIN_NUM = 7

GPIO.setmode(GPIO.BOARD)

GPIO.setup(PIN_NUM, GPIO.OUT)

while True:
    GPIO.output(PIN_NUM, GPIO.HIGH)
    time.sleep(1)
    GPIO.output(PIN_NUM, GPIO.LOW)
    time.sleep(1)
```

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.

![Figure 9.1: Set Win32DiskImager](image1)

![Figure 9.2: Backup the OS image](image2)

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/mmcbklkx of=backup.img bs=1M
sync
sudo umount /media/lemaker/udiskname
```

**Note:** `/dev/mmcbklkx` represents `/dev/mmcbklk0` or `/dev/mmcbklk1`. When the OS boot from EMMC NAND Flash, `/dev/mmcbklk0` is the device node of EMMC NAND Flash. If you insert a MicroSD card into MicroSD card slot, you will find `/dev/mmcbklk1` become the device node of MicroSD card. But when the OS boot from the MicroSD card, `/dev/mmcbklk0` is the device node of MicroSD card, and `/dev/mmcbklk1` 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/mmcbklkx 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.

![Android home desktop](image)

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.

![Android main menu](image)

Figure 10.2: Android main menu

10.2 Basic Setting

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