TI-DM3730-EM User Manual

Directory

Chapter One

1. TI-DM3730-EM introduction

1.1. TI-DM3730-EM BRIEF INTRODUCTION

TI-DM3730-EM from PardazeshSabz is a Low-power, high-performance single board computer

based on SOM35x. Designed with EPIC Standard and extendable architecture . TI-DM3730-EM helps users leverage the benefits of OMAP35x processor comprising of advanced Superscalar ARM Cortex-A8 RISC core with NEON co-processing, IVA2.2 subsystem with a C64x+ digital signal processor (DSP) core and SGX subsystem for 2D and 3D graphics acceleration (PowerVR).

The TI-DM3730-EM helps users building their products around the OMAP35x enjoy the benefits of faster user interfaces, faster data access and multi-standard encode/decode. Resolution up to 1280*720, Supports multiple display output, such as VGA, LCD,

S-Video and AV composite video output. Supports multi-standard encode/decode at D4 (1280×720p/60Hz) 30 fps. Supports multiple embedded operation system, such as Android, Embedded Linux, WinCE.

TI-DM3730-EM comes with X-Loader、U-Boot、Linux Kernel（V2.6.32） and UBIFS File system for Linux. The PSP Software Release from TI includes the Code Sourcery tool chain and the required source code and utilities.It is an ideal platform for users to develop their applications.Present TI-DM3730-EM hasbeen applied to mobile Internet devices, Global Positioning System (GPS), 2D/3D GameStation, medical equipment, Image Capture Machine, HMI, etc.

1.2. TI-DM3730-EM model

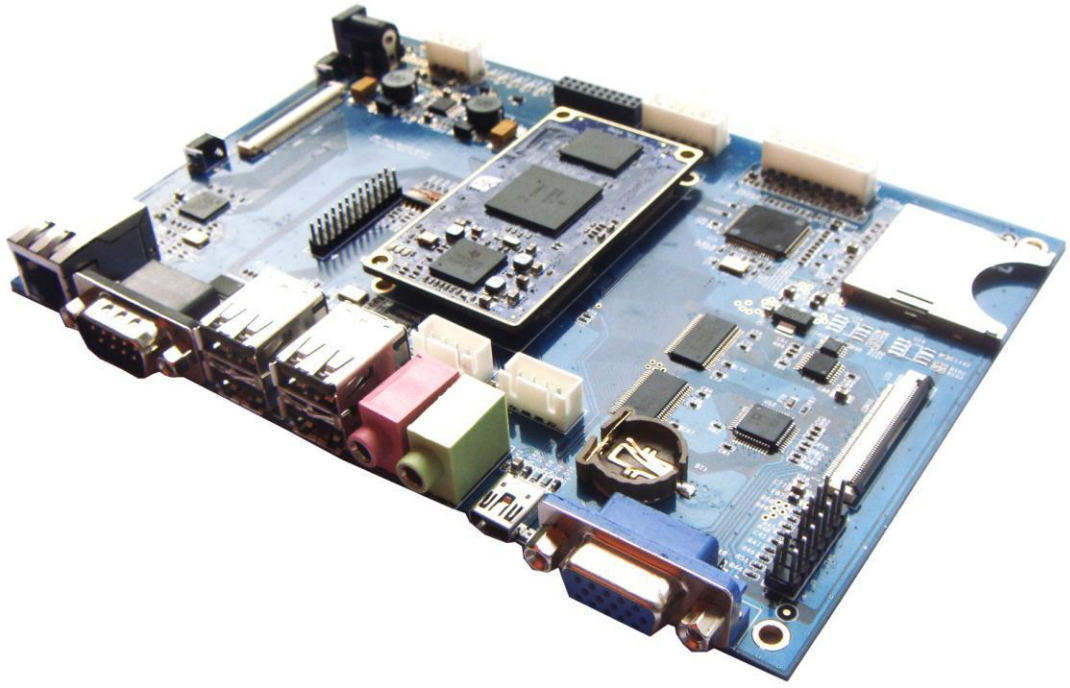


Figure 1.1 TI-DM3730-EM

Customers in batch purchase, the client can choose memory flash memory and processor according to the product demand,Conventional models are as follows:

Model Number	Processor	Speed (MHz)	SDRAM (MB)	NAND Flash (MB)	Temperture	Analog Video Input	WIFI/ BT
SBC3530 -B1-1880 -LUAC0	OMAP 3530	600	256	256	0℃-70℃	Y	N
SBC3530 -B1-1880 -LUEC0	OMAP 3530	600	256	256	0℃-70℃	Y	Y

Chapter Two

2. TI-DM3730-EM Hardware introduction

2.1 TI-DM3730-EM hardware specification

2.1.1 Block diagram

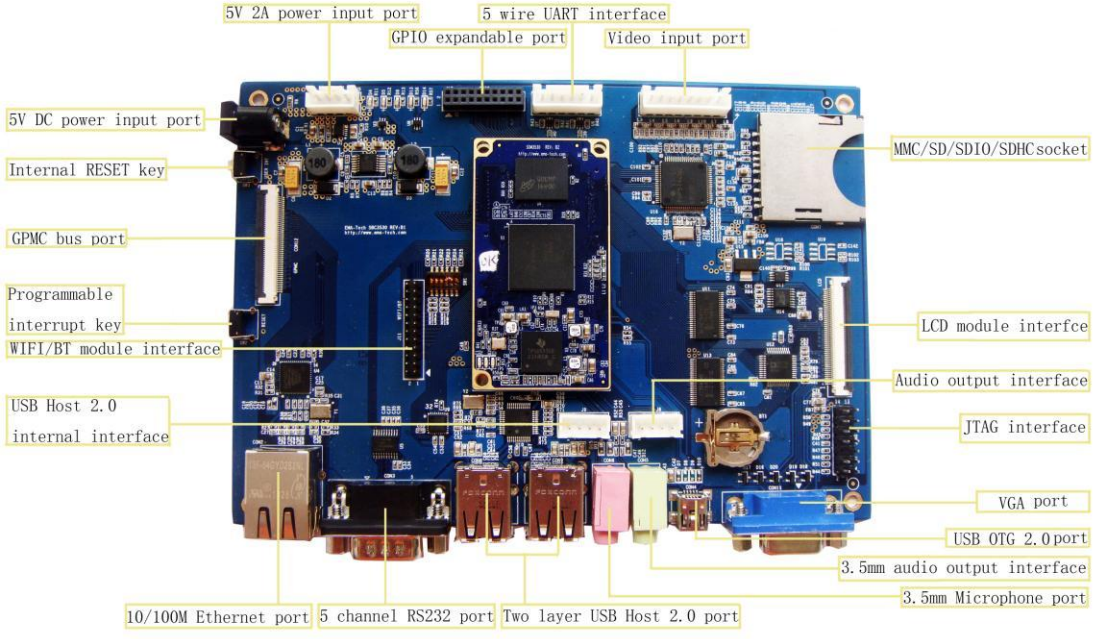


Figure 2.1 TI-DM3730-EM Block diagram

2.1.2 TI-DM3730-EM hardware parameter

SOM3530	OMAP3530	600MHz ARM Cortex™-A8 Core NEON™ SIMD coprocessor 430MHz TMS320C64x+ DSP POWERVR SG™ 2D/3D graphic accelerator
	RAM	128MByte/256MByte/512MByte DDR
	Flash	128MByte/256MByte/512MByte/1GByte Nand Flash
Ethernet port	1x 10M/100M high performance Ethernet RJ45 interface	
Serial port	1x 5 wire RS232 interface（TX,RX,CTS,RTS,GND）	
	1x 3.3V 5 wire UART（TX,RX,CTS,RTS,GND）	
USB Host	4x USB 2.0 high speed Host	
	1x Internal USB 2.0 high speed Host	
USB OTG	1x USB 2.0 high speed OTG（Can be used as Device）	
JTAG	1x 14Pin TI standard JTAG	
Audio	1x 3.5mm audio output interface	
	1x Internal audio output interface	
	1x 3.5mm Microphone input port	
VGA	Standard VGA output interface	
AV/S-Video video output	Support below standard： NTSC-J, M PAL-B, D, G, H, I PAL-M CGMS-A	
Video intput	4 channels video input Maximum support： 4 wire CVBS Or 1 wire CVBS、1 wire YPbPr Or 1 wire CVBS、1 wire RGB (internal multiple synchronize signal) Or 2 wire CVBS、1 wire S-Video Or 2 wire S-Video CVBS support NTSC/PAL/SECAM standard	
SD socket	MMC/SD/SDIO/SDHC sokect， Maximum support 32GByte capacity	
ferroelectric storage device（optional device）	64Kbit/128Kbit/256Kbit/512Kbit unlimited erase ferroelectric storage device	
Encryption device（optional device）	Internal hardware encryption mechanism	
RTC	Internal RTC， support CR1220 battery power supply	
Key	1x Programmable user interrupt key	
	1x RESET key	
LED indicator	3x power indicator	
	2x Programmable indicator	
Boot mode selection switch	1x 6 bit boot mode selection switch	
Power	1x 5V 2A DC socket	
	1x 5V 2A internal DC socket	
Extendable interface	1x 3.3V LCD module port （support touch）	
	1x 1.8V WIFI module port	
	1x 1.8V GOIO expand port	
	1x 1.8V GPMC high speed bus port	

2.1.3 TI-DM3730-EM working environment

Environment	Min value	Typical value	Max value
Power supply	5V 0.3A	5V 0.5A (Remark 2)	5V 3.5A (Remark 1)
Power consumption (working mode)	1.5W	2.5W (Remark 2)	17.5W (Remark 1)
Working temperature (commercial level)	0℃	/	70℃
Working temperature (Industrial level)	-40℃	/	80℃

Remark 1: This is the average value When 4 channel USB interface charge to external device and LCD, digital camera, WIFI module are connected.

Remark 2: This is the average value when CPU under 600Mhz full speed working status, and no external module is connected, USB port are not charging to external device.

2.1.4 TI-DM3730-EM mechanical information

Design purpose	Single board computer
PCB size	4.528 x 6.496 inch (115.00 x 165.00 mm)
Compatible standard	EPIC standard
Installation hole number	4 Nos

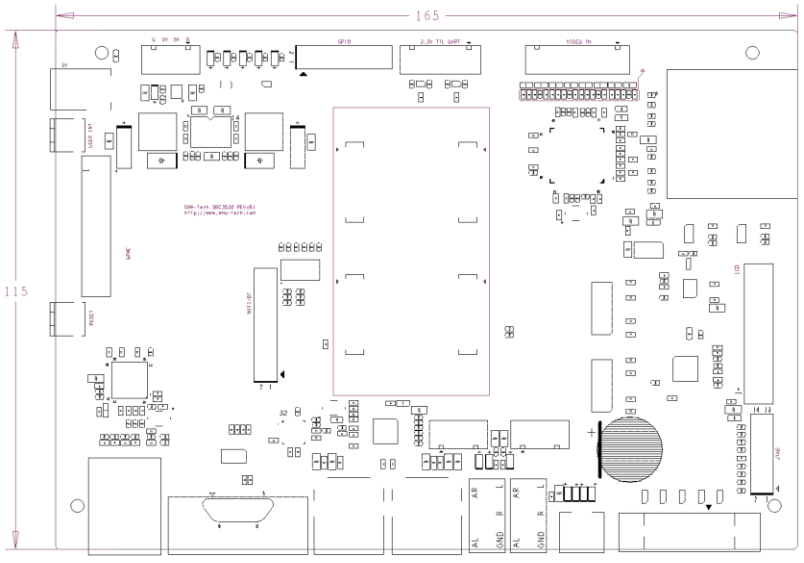


Figure 2.2 PCB machnical diagram

2.2 TI-DM3730-EM pin definition

2.2.1 Pin definition

Pin number	Pin description	Remark
CON1	5V DC power input port	DC-208 port, inside is positive and outside is negative, Max current is 4A
CON2	10/100M Ethernet port	RJ45 port
CON3	5 channel RS232 port	
CON4	USB OTG 2.0 port	
CON5	3.5mm audio output interface	
CON6	3.5mm Microphone port	
CON7	MMC/SD/SDHC/SDIO socket	3V/1.8V compatiable
CON8	Two layer USB Host 2.0 port	
CON9	Two layer USB Host 2.0 port	
CON10	LCD module interface	50Pin Pin plat cable port
CON11	VGA port	
CON12	GPMC bus port	50Pin Pin plat cable port
BT1	RTC battery socket	Use CR1220 battery
J1~J4	SOM35X interface	
J5	5V 2A Internal DC input port	
J6	5 wire UART interface	3.3V I/O
J7	14Pin TI standard JTAG	
J8	Internal audio output interface	
J9	Internal USB 2.0 high speed Host	
J10	video input port	
J11	WIFI/BT module port	
J12	GPIO expandable port	

2.2.2 Key/ Switch specification

Key index	Key description	Remark
SW1	6 bit boot selection switch	
SW2	Programmable interrupt key	GPIO18
SW3	Internal RESET key	

2.2.3 LED specification

LED Index	LED description	Remark
D4	5V power supply indicator	
D5	SOM3530 power supply indicator	
D6	3.3V power supply indicator	
D13	Programmable power management module indicator	GPIO126
D14	Programmable power management module indicator	GPIO127

2.1. Connector descrption

1) +5V DC input power port CON1

CON1 is+5V DC input power port, connector is DC-208, inside is positive, and outside is negative. The MAX current is 4A

2) Ethernet port socket CON2

This port is standard RJ45 10/100M self-adapter Ethernet port, it comes with data indicator and channel indicator

3) Digital switch SW1（Remark：1：Move the Switch upward 0：Move the switch downward）

Set the boot sequence of the TI-DM3730-EM through digital switch. Please check the normal booting sequence according to TI-DM3730-EM system connection introduction.

Booting Sequence When SYS.BOOT[5] = 0 Memory Booting Preferred Order					
sys_boot [4:0]	**First**	**Second**	**Third**	**Fourth**	**Fifth**
0b00000			Reserved(1)		
0b00001					
0b00010					
0b00011					
0b00100	OneNAND	USB			
0b00101	MMC2	USB			
0b00110	MMC1	USB			
0b00111			Reserved(1)		
0b01000					
0b01001					
0b01010					
0b01011					
0b01100					
0b01101	XIP	USB	UART3	MMC1	
0b01110	XIPwait	DOC	USB	UART3	MMC1
0b01111	NAND	USB	UART3	MMC1	
0b10000	OneNAND	USB	UART3	MMC1	
0b10001	MMC2	USB	UART3	MMC1	
0b10010	MMC1	USB	UART3		
0b10011	XIP	UART3			
0b10100	XIPwait	DOC	UART3		
0b10101	NAND	UART3			
0b10110	OneNAND	UART3			
0b10111	MMC2	UART3			
0b11000	MMC1	UART3			
0b11001	XIP	USB			
0b11010	XIPwait	DOC	USB		
0b11011	NAND	USB			
0b11100			Reserved(1)		
0b11101					
0b11110					
0b11111	Fast XIP booting.devices)Wait monitoring OFF (only for GPdevices)	USB (only on GP devices)	UART3 (only on GP		

Booting Sequence When SYS.BOOT[5] = 1 Peripheral Booting Preferred Order					
sys_boot [4:0]	**First**	**Second**	**Third**	**Fourth**	**Fifth**
0b00000			Reserved(1)		
0b00001					
0b00010					
0b00011					
0b00100	USB	OneNAND			
0b00101	USB	MMC2			
0b00110	USB	MMC1			
0b00111			Reserved(1)		
0b01000					
0b01001					
0b01010					
0b01011					
0b01100					
0b01101	USB	UART3	MMC1	XIP	
0b01110	USB	UART3	MMC1	XIPwait	DOC
0b01111	USB	UART3	MMC1	NAND	
0b10000	USB	UART3	MMC1	OneNAND	
0b10001	USB	UART3	MMC1	MMC2	
0b10010	USB	UART3	MMC1		
0b10011	UART3	XIP			
0b10100	UART3	XIPwait	DOC		
0b10101	UART3	NAND			
0b10110	UART3	OneNAND			
0b10111	UART3	MMC2			
0b11000	UART3	MMC1			
0b11001	USB	XIP			
0b11010	USB	XIPwait	DOC		
0b11011	USB	NAND			
0b11100					
0b11101			Reserved(1)		
0b11110					
0b11111	Fast XIP booting.Wait monitoring ON (only for GP devices)	SB (only on GP devices)	UART3 (only on GP devices)		

4) Earphone output port CON5

Support stereo (Dual channel) audio output, this port is connected by speaker or stereo earphone

5) Microphone input port CON6

Support Microphone input (Single channel) , please connect microphone input (Single channel) to this port.

6) Reset Switch SW3

Press this key and release it, the TI-DM3730-EM board will enter POWER ON RESET

status; the development board will be restart.

7) SD card socket CON7

This socket support standard MMC/SD/SDHC/SDIO card, and compatible with 3V/1.8V. The system can boot from the SD/SDIO card.

8) Serial communication port CON3

Serial port is 5 wire RS232 port communication signal to other device. use standard serial cable to connect to development board and other device which has standard serial cable (Such as PC)

9) VGA port CON11

Standard VGA output interface, support all the VESA standard resolution. TI-DM3730-EM development board connected with LCD monitor and CRT monitor by this port.

10) LCD connector CON10

This connector is 50 pin plat cable connector, include 24 bit true color CMOS display signal and touch screen interface, all the touch screen resolution can achieve 1920x1080.

11) AV connector（CVBS）/ SVIDEO　OUT socket J12

The AV connector support CVBS and S-VIDEO output, user can select either one as output

12) USB OTG 2.0 port CON4

The port is MINI type USB Host/Device multiplexing port, it can connect with standard USB Device product, support OTG and HOST mode (Use different type of cable).

13) USB Host 2.0 port CON8/ CON9

USB 2.0 high speed HOST (Every port will provide standard 500mA power supply)

14) SDIO port /WIFI expand module port J11

Extend port support expandable signal, when customer need these signal, they can connect to corresponding socket to get the signal.

15) GPIO expandable port J12

General input/ output GPIO, every GPIO port can set to input or output by software. Pin definition please refer to 2.7.11

16) SPI expandable port J12

Serial peripheral port SPI, Pin definition please refer to 2.7.14

17) 4 channel video output interface J10

4 channel video input max support：

4 channel CVBS or 1 channel CVBS, 1 channel YPbpr or 1 channel CVBS, 1 channel RGB (internal multiplexing synchronous signal) or 2 channel CVBS, 1 channel S-Video or 2 channels S-Video

Further more, CVBS support NTSC/ PAL / SECAM

18) D4、D5power indicator

When TI-DM3730-EM correctly input DC +5V power supply, the indicator will power on, and indicate power supply is properly. If the indicator not on, please shut down the power supply and find out the problem

2.4 TI-DM3730-EM pin definition

J1~J4 SOM35x interface
This interface is used to connect SOM35x module

J5 power management module interface
This module is used to connect power management module

Pin	Function description	Remark
1	Grand	
2	DC 5V input	
3	DC 5V input	
4	Grand	

J6 UART3 interface

This port is used to connect UART3

Pin	Function description	Remark
1	3.3V I/O reference voltage output	I/O reference voltage
2	Grand	
3	CTS	3.3V I/O
4	RTS	3.3V I/O
5	TX	3.3V I/O
6	RX	3.3V I/O

J7 TI-DM3730-EM JTAG debug interface

This port is used to debug TI-DM3730-EM and internal DSP

Pin	Function description	Remark
1	TMS	1.8V I/O
2	nTRST	1.8V I/O
3	TDI	1.8V I/O
4	Grand	
5	1.8V I/O reference voltage output	I/O reference voltage
6	/	Incorrect insertion protection Pin
7	TDO	1.8V I/O
8	Grand	
9	RTCK	1.8V I/O
10	Grand	
11	TCK	1.8V I/O
12	Grand	
13	EMU0	1.8V I/O
14	EMU1	1.8V I/O

J8 Internal audio output interface

This port is used for output to additional amplifier module.

Pin	Function description	Remark
1	Left audio channel output	25mW
2	Left Grand	
3	Right Grand	
4	Right audio channel output	25mW

J9 internal USB Host interface

This port is multiplexing with CON9 and USB4

Remark :This interface is multiplex with USB4 (CON 9)

Pin	Function description	Remark
1	5V power output	Used for USB power supply
2	DM	USB data difference (Negative)
3	DP	USB data difference (Positive)
4	Grand	

J10 Video input port

This port is used to video input

Pin	Function description	Remark
1	The 4th video input channel：CVBS/Y input	
2	Virtual signal grand	The 4th channel grand
3	The 3rd video input channel: CVBS/Pr/R/C input	
4	Virtual signal grand	The 3rd channel grand
5	The 2nd video input channel：CVBS/Y input	
6	Virtual signal grand	The second signal grand
7	The 1st video input channel：CVBS/Pb/B/C input	
8	Virtual signal grand	The first channel grand

J11 WIFI module expand interface

Pin	Function description	Remark
1	3.3V power output	
2	Grand	
3	1.8V I/O reference voltage output	I/O reference voltage
4	Grand	
5	SYS_nRESPWRON	
6	MMC2_CMD	1.8V I/O
7	MMC2_CLK	1.8V I/O
8	MMC2_DAT1	1.8V I/O
9	MMC2_DAT0	1.8V I/O
10	MMC2_DAT3	1.8V I/O
11	MMC2_DAT2	1.8V I/O
12	MMC2_DAT5/GPIO137	1.8V I/O
13	MMC2_DAT4/GPIO136	1.8V I/O
14	MMC2_DAT7/GPIO139	1.8V I/O
15	MMC2_DAT6/GPIO138	1.8V I/O
16	MCBSP3_DX/UART2_CTS	1.8V I/O
17	MCBSP3_FSX/UART2_RX	1.8V I/O
18	MCBSP3_CLKX/UART2_TX	1.8V I/O
19	MCBSP3_DR/UART2_RTS	1.8V I/O
20	MCBSP1_DR/GPIO159	1.8V I/O
21	MCBSP1_DX/GPIO158	1.8V I/O
22	MCBSP1_CLKX/GPIO162	1.8V I/O
23	MCBSP1_FSX/GPIO161	1.8V I/O
24	/	/

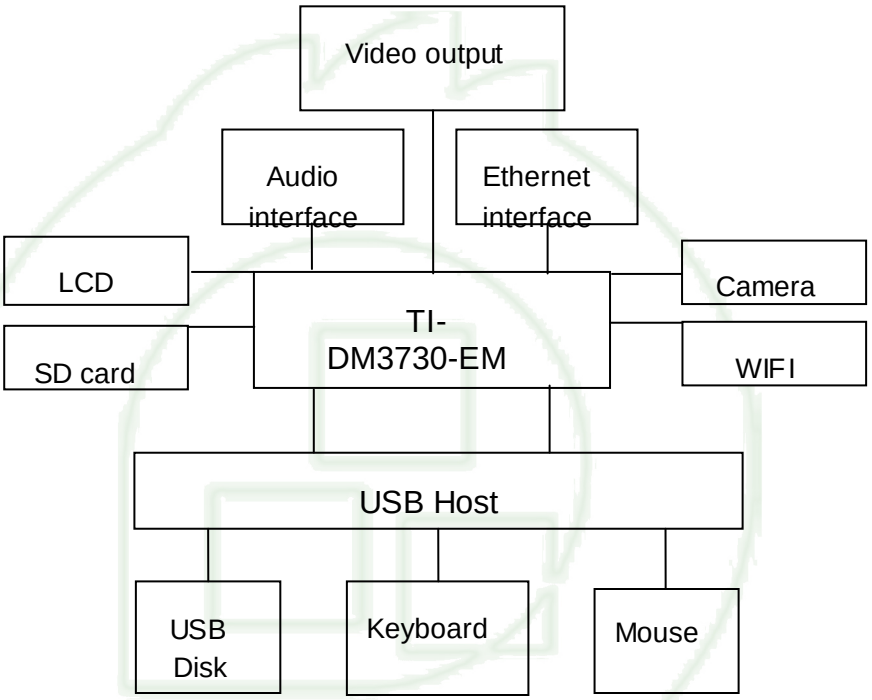
J12 GPIO expand interface

Pin	Function description	Remark
1	3.3V power output	
2	Grand	
3	1.8V I/O reference voltage output	I/O reference voltage
4	Grand	
5	SYS_CLKOUT1/GPIO10	1.8V I/O
6	SYS_nRESPWRON	1.8V I/O
7	SYS_CLKOUT2/GPIO186	1.8V I/O
8	MCBSP1_CLKR/GPIO156	1.8V I/O
9	HSUSB1_D0/MCSPI3_SIMO/GPIO14	1.8V I/O
10	MCBSP1_FSR/GPIO157	1.8V I/O
11	HSUSB1_D1/MCSPI3_SOMI/GPIO15	1.8V I/O
12	HSUSB1_CLK/GPIO13	1.8V I/O
13	HSUSB1_D2/MCSPI3_CS0/GPIO16	1.8V I/O
14	HSUSB1_STP/GPIO12	1.8V I/O
15	HSUSB1_D7/MCSPI3_CLK/GPIO17	1.8V I/O
16	Grand	
17	3V3_I2C3_SCL	3.3V I/O
18	AV/SVIDEO_Y	CVBS output /S-Video Y output
19	3V3_I2C3_SDA	3.3V I/O
20	SVIDEO_C	S-Video C output

Chapter Three

3. TI-DM3730-EM basic function

3.1. TI-DM3730-EM computer system



Standard accessories

1) DV +5V power
2) Standard cross serial cable, both side is female type
3) One DVD for software
4) Ethernet cable
5) SD card

Optional accessories

1) USB keyboard
2) USB mouse
3) Audio connector (Dual stereo)
4) 4 port USB integrator

3.2. TI-DM3730-EM connection configuration

3.2.1. External port connection

1) Power off

Before connect/disconnect each device, the power need to be off, and the static damage need to be prevented.

2) Prepare EM A TI-DM3730-EM

Check whether TI-DM3730-EM board is damaged when user get it.

3) Connect serial communication cable

Connect serial cable to TI-DM3730-EM socket CON3, the other side connect to the PC serial port (Normally is COM1 port)

4) Connect to LCD monitor

Prepare one VESA standard resolution, VGA interfaces LCD. Connect the LCD VGA port with TI-DM3730-EM CON11 port by VGA cable.

5) Connect LCD touch screen

Connect the LCD touch screen with TI-DM3730-EM CON10 interface by FPC cable. The gold finger connector of the FPC and CON10 of TI-DM3730-EM are both downwards

Notice: Please do not misconnect 3.3V LCD CON10 connector with 5VGPMC connector, it will case great damage to the board.

6) Connect keyboard and mouse

Connect the USB port keyboard and mouse to USB host

7) Insert SD card.

Insert the proper working SD card to TI-DM3730-EM CON4 socket,

8) Set digital switch J12 （Remark: 1 : Switch upward, 0: switch downward）

Sequence	First device	Second device	Third device	Fourth device
111100	NAND	USB	UART3	MMC1
111101	USB	UART3	MMC1	NAND
000111	UART3	MMC1		

Set the digital switch to (1-6): 111100, checking sequence is NANDFLASH->USB->UART3->MMC1

Set the digital switch (1-6): 111101, checking sequence will be USB->UART3->MMC1-> NANDFLASH

Set the digital switch (1-6): 000111, check sequence will be UART3→ MMC1

3.2.2 The sequence to power on the system

1) Power on peripheral power supply

Please power on the peripheral device step by step, such as LCD display, USB integrator.

2) Connect and power on the TI-DM3730-EM power

Use TI-DM3730-EM standard 5V power supply, connect it with the 220V outlet and power on. Connect the 5V output power to power socket CON1.

3) Removable storage device synchronization

If you use the USB interface, hot swappable storage device to the written documents which can then enter the Linux command line console sync command, so that the data stored in the cache to write all these devices.

3.2.3 The sequence to power off the system

1) Remove the portable storage device

2) Shut down system power

3) Shut down TI-DM3730-EM power supply system.

4) Shut down the power for peripheral

Chapter Four

4. TI-DM3730-EM Linux system configuration

4.1. System booting method and procedure

There are two common ways to start on TI-DM3730-EM :

TI-DM3730-EM normally has two booting method:

- ✧ Boot from Nand flash
- ✧ Boot from SD card

Starting from the SD card storage capacity is available to a more flexible configuration, while the flexibility to replace the system software.

Two channels are used to start the SD card. SD card launch is a complete system where all start from the SD, which started from the SD card Nandflash boot into U-Boot, by command of the four SD Kari system image files downloaded to the memory, and then programmed to Nandflash on, and then back on after power without SD, a complete system where you can start from Nandflash. Therefore, format partitions on the SD card is very important to start the system, the specific realization of the system can view the **6.2.1 start making SD card.**

4.1.1. The system boot process :

- ■ Detection Nandflsah / SD card. From Nandflash / SD card Fat32 partition start address unit X-Loader program to the memory, and begin implementation of the X-Loader.

- X-Loader do some initialization work first and then · read the U-Boot to memory from Nandflash/SD card Fat32 partition · and begin execute the U-Boot.
- U-Boot read Fat32 partition boot parameters from · and then read into the Linux kernel uImage to TI-DM3730-EM me mory · decompress and running the kernel uImage.
- Re-initialize TI-DM3730-EM after Linux kernel start · then load NandFlash file system stored on SD cards or EXT3 partition file system, file system execute
  program and start the console.

4.1.2. SD card boot process

1) Ready to start the system image file (MLO, u-boot.bin, uImage, rootfs), and put the three image files into the SD card FAT32 partition, the rootfs on SD card EXT3 partition (the CD-ROM file system archive, extract the Linux systems to SD card EXT3 partition).
2) Connect the hardware.
3) Start the Hyper Terminal on the PC.
4) Link and connect the power of TI-DM3730-EM.
   After normal boot the system, you can see the target board in HyperTerminal startup information, login as super-character display terminal, enter the user name "root", press enter to access Linux systems.

4.1.3. Nandflash boot process

1) Ready to start the system image file (MLO, u-boot.bin, uImage, ubi.img), and put four image files into SD card FAT32 partition.

2) Program the boot system image file to Nandflash.

3) Connecting hardware（without SD）.

4) Start the Hyper Terminal on the PC.

5) Link and connect the power of TI-DM3730-EM.

6) After normal boot the system, you can see the target board in HyperTerminal startup information, login as super-character display terminal, enter the user name "root", press enter to access Linux systems.

4.2. Display setting

TI-DM3730-EM supports multiple display output, DVI output is from the system default. If users want to use the LCD output, or want to change the resolution, the user needs to modify U-Boot in the corresponding parameters。

Refresh rate of resolution of the corresponding General：

Resolution	Refresh rate
480x272	60
800x480	60
800x600	60
1024x768	60
1280x720	60
1366x768	60
1280x1024	50
1440x900	50
1920x1080	30

4.2.1 VGA port display:

```
# setenv dvimode 1024x768MR-16@60
#setenv defaultdisplay dvi
```

setenv dvimode 1024x768MR-16@60 mean the display mode is VGA、1024x768 resolution、16bit and fresh rate 60

4.2.2 4.3 inch touch screen display

```
# setenv dvimode
# setenv defaultdisplay lcd043
```

The meaning of parameters is not set to DVI display mode of resolution, color bit, and refresh rate, then modify the default display mode into 4.3-inch touch screen.

4.2.3 7 inch touch screen display

```
# setenv dvimode
# setenv defaultdisplay lcd070
```

The meaning of parameters is not set to DVI display mode of resolution, color bit, and refresh rate, then modify the default display mode into 7-inch touch screen.

4.3. DEMO software demonstration

- Copy CDROM Demo folder to /home/ema/ directory, (this directory is under /mnt/ hgfs/share directory)

```
#cd /mnt/hgfs/share
#sudo cp –a Demo /home/ema/
```

- Copy the mirror of the demo and system to the SD card which already been formatted.

```
#cd /home/ema/ Demo
#sudo cp MLO /media/boot
#sync
#sudo cp u-boot.bin    /media/boot
#sudo cp uImage    /media/boot
#sudo tar jxvf    evm_fs.tar.bz2    –C /media/rootfs
#umount /media/boot
#umount /media/rootfs
```

- Disconnect the USB connection, remove SD card from development board,, power on and start the development board.

4.3.1 3D Demo

- Enter U-BOOT setting parameter

```
OMAP3 Stalker # setenv vram 12M omapfb.vram=0:12M

OMAP3 Stalker # saveenv
Saving Environment to NAND...
Erasing Nand...
Erasing at 0x260000 -- 100% complete.
Writing to Nand... done

OMAP3 Stalker # boot
Starting Connection Manager
.-------.
|       |                    .-.
|   |   |-----.-----.-----.| |   .----..-----.-----.
|       |     | __  |   ---'| '--.|  .-'|     |     |
|   |   |  |  |     |---  ||  --'|  |  |  '  | | | |
'---'---'--'--'--.  |-----''----''--'  '-----'-'-'-'
                 -'  |
                 '---'
The Angstrom Distribution stalker ttyS2
Angstrom 2009.X-stable stalker ttyS2

stalker login: root
```

- User ID ：root ， password is empty, press “Enter” directly to sign in

```
root@beagleboard:~# cd /opt/gfxsdkdemos/ogles

root@beagleboard:/opt/gfxsdkdemos/ogles# ls
Balloon_fixed.pod           OGLESOptimizeMesh          SphereOpt_fixed.pod
Balloon_float.pod           OGLESParticles             SphereOpt_float.pod
ChameleonScene.pod          OGLESPhantomMask           Sphere_fixed.pod
ChameleonScene_Fixed.pod    OGLESPolyBump              Sphere_float.pod
Mesh_fixed.pod              OGLESShadowTechniques      balloon.pvr
Mesh_float.pod              OGLESSkybox                o_model_fixed.pod
OGLESChameleonMan           OGLESTrilinear             o_model_float.pod
OGLESCoverflow              OGLESUserClipPlanes        skybox1.pvr
OGLESEvilSkull              OGLESVase                  skybox2.pvr
OGLESFiveSpheres            PhantomMask_fixed.pod      skybox3.pvr
OGLESFur                    PhantomMask_float.pod      skybox4.pvr
OGLESLighting               Scene_fixed.pod            skybox5.pvr
OGLESMouse                  Scene_float.pod            skybox6.pvr
```

4.3.2 Quake3

- Enter U-BOOT setting parameter

```
OMAP3 Stalker # setenv vram 12M omapfb.vram=0:12M

OMAP3 Stalker # saveenv
Saving Environment to NAND...
Erasing Nand...
Erasing at 0x260000 -- 100% complete.
Writing to Nand... done

OMAP3 Stalker # boot
Starting Connection Manager
.-------.
|       |                          .-.
|   |   |-----.-----.-----.| |     .----..-----.-----.
|       |     | __  |   ---'| '--.|  .-'|     |     |
|   |   |  |  |     |---  ||  --'|  |  |  '  | | | |
'---'---'--'--'--.  |-----''----''--'  '-----'-'-'-'
                 -'  |
                 '---'
The Angstrom Distribution stalker ttyS2
Angstrom 2009.X-stable stalker ttyS2

stalker login: root
```

- User ID : root , password is empty, press “Enter” directly to sign in

```
root@stalker:~# cd /usr/lib/quake3/
root@stalker:/usr/lib/quake3# ./run.sh
```

- Execute the script and user can see the game interface from the VGA monitor, Select “ SINGLE PLAYER “ to enter the game map, then select CHOOSE “ LEVEL FIGHT “ ->DIFFICULTY FIGHT to play the game. Press “ ESC ” on the keyboard which is connecting to the development board. Then select EXIT GAME ->YES, because the console has been screened, so we can control through the serial port terminal. We can also finish the game by press “ CTRL + C “ on the keyboard of the PC.

4.3.3 DVSDK

- Enter U-BOOT setting parameter

```
OMAP3 Stalker # setenv mmcargs 'setenv bootargs console=${console} vram=${vram}
omapfb.mode=dvi:${dvimode} omapdss.def_disp=${defaultdisplay} root=${mmcroot}
init=/init mpurate=${mpurate} rootfstype=${mmcrootfstype} boardmodel=${boardmodel}
mem=99M@0x80000000 mem=128M@0x88000000'

OMAP3 Stalker # saveenv
Saving Environment to NAND...
Erasing Nand...
Erasing at 0x260000 -- 100% complete.
Writing to Nand... done

OMAP3 Stalker # boot
Starting Connection Manager
.-------.
|       |                    .-.
|   |   |-----.-----.-----.| |   .----..-----.-----.
|       |     | __  |   ---'| '--.|  .-'|     |     |
|   |   |  |  |     |---  ||  --'|  |  |  '  | | | |
'---'---'--'--'--.  |-----''----''--'  '-----'-'-'-'
                -'  |
                '---'
The Angstrom Distribution stalker ttyS2
Angstrom 2009.X-stable stalker ttyS2

stalker login: root
```

- User ID ：root ， password is empty, press “Enter” directly to sign in

```
root@beagleboard:/opt/dvsdk/omap3530# ./loadmodules.sh
root@beagleboard:/opt/dvsdk/omap3530# ./decode
-v ./data/videos/davincieffect_ntsc_1.264
```

4.3.4 Video input demonstration

Video input demo is play DVDS CDS, Through the TI-DM3730-EM development board VGA display interface。The DVD player need us take CVBS signal and Grounding signall connect to TI-DM3730-EM J8 interface foot 7 and foot 8， The program channel default selection is 0, The other program channel number of Corresponding simulation channel and Video mode choice, Please refer to The form below：

Analog Channel and Video Mode Selection

Mode	Input(s) Selected	Program channe l number	Cvbs	Cvbs GND	S-video Y	S-video C	S-video GND
CVBS	VI_1_A(default)	0	PIN7	PIN8	/	/	/
	VI_2_A	1	PIN5	PIN6	/	/	/
	VI_3_A	2	PIN3	PIN4	/	/	/
	VI_4_A	3	PIN1	PIN2	/	/	/
S-video	VI_2_A(Y), VI_1_A(C)	4	/	/	PIN5	PIN7	PIN8
	VI_2_A(Y), VI_3_A(C)	5	/	/	PIN5	PIN3	PIN4
	VI_4_A(Y), VI_1_A(C)	6	/	/	PIN1	PIN7	PIN8
	VI_4_A(Y), VI_3_A(C)	7	/	/	PIN1	PIN3	PIN2

Video Input DEMO Compiler Steps :

a) Copy analog_vi_demo.tar.bz2 to /home/ema/ directory (Compressed files are in share directory)

```
ema@ema3530:~$ cd /mnt/hgfs/share
ema@ema3530:/mnt/hgfs/share$ cp analog_vi_demo.tar.bz   /home/ema/
```

b) Unzip analog_vi_demo.tar.bz2 into present Folder

```
ema@ema3530:~ $ cd /home/ema/Source
ema@ema3530:~ $ sudo tar analog_vi_demo.tar.bz
ema@ema3530:~ cd analog_vi_demo/video
```

c) make clean command clean up earlier Compilation files

```
ema@ema3530:~/analog_vi_demo/video$ make clean
Cleaning binaries...
```

d) then. Configuration and compiled .modify Cross-compilation tool chain libraries path in Makefile

LDFLAGS = -L/usr/local/arm/arm-2009q1/arm-none-linux-gnueabi/libc/lib/

Modify its kernel code paths and Cross-compilation tool chain libraries path in Rules.make file

KERNEL_DIR = /home/ema/linux-03.00.01.06

CROSS_COMPILE = /usr/local/arm/arm-2009q1/bin/arm-none-linux-gnueabi-

```
ema@ema3530:~/analog_vi_demo/video $ make
```

After the completion of the compiler, It will Generate many Executable file in Bin directory, put saMmapLoopback in Development board systems and running on.

```
ema@ema3530:~ /analog_vi_demo/video /bin$ cp saMmapLoopback /mnt/hgfs/share
```

saMmapLoopback.c program adopted by default program channel “0”, If want to modify the program channel, modify“capt_input = 0”corresponding program channel numbe In the main () function, Save and exit。Recompile again.

Development board operation procedures：

- power on and Start development board，Enter your user name and password to enter a file system.

```
Starting Connection Manager
.-------.
|       |                    .-.
|   |   |-----.-----.-----.||   .----..-----.-----.
|       |     |__   |   ---'| '--.|   .-'|     |     |
|   |   |   |   |     |---   ||   --'|   |   |   '   ||||
'---'---'--'--'--.   |-----''----''--'   '-----'-'-'-'
                  -'   |
                  '---'
The Angstrom Distribution stalker ttyS2
Angstrom 2009.X-stable stalker ttyS2

stalker login: root
```

- user name：root，password is empty，Press enter can login。

- execute “saMmapLoopback”.

```
root@beagleboard:~# ./saMmapLoopback
[    44.942169] tvp514x 2-005d: tvp5146m2 found at 0xba (OMAP I2C adapter)

Capture: Opened Channel
Capture: Current Input: COMPOSITE
Capture: Input changed to: COMPOSITE
Capture: Current standard: NTSC
Capture: Capable of streaming
Capture: Number of buffers request = 2
Capture: Number of requested buffers = 2
Capture: Init done successfully
```

```
Display: Opened Channel
Display: Capable of streaming
Display: Number of buffers request = 2
Display: Number of requested buffers = 3
Display: Init done successfully

Display: Stream on...
Capture: Stream on...
```

4.3.5 USB camera demonstration

USB camera demonstration, It need to make a new SD card system, then.take MLO,u-boot.bin,uImage of Camera_FS Folder.into SD card FAT32 partition, camera_fs.tar.bz2 unzip to Sd card EXT3 partition（**See user manual 6.2. Linux System mirroring update**）

- Power on and Start development board，Enter your user name and password to enter a file system。

```
Starting Connection Manager
.-------.
|       |                    .-.
|   |   |-----.-----.-----.| |   .----..-----.-----.
|       |     | __  |  ---'| '--.|  .-'|     |     |
|   |   |  |  |     |---  ||  --'|  |  |  '  | | | |
'---'---'--'--'--.  |-----''----''--'  '-----'-'-'-'
                 -'  |
                 '---'
The Angstrom Distribution stalker ttyS2
Angstrom 2009.X-stable stalker ttyS2

stalker login: root
```

- user name：root ，The password is empty，Press enter can login。
- Enter dev/video files and Check video equipment files，Then insert USB cameras，Check the video Additional equipment files（Note the device name，when we modify Script,we will use it）。

```
root@beagleboard:~# cd /dev
```

- Enter mjpg-streamer-r63 directory, modify mjpg-streamer.sh of equipment filename · The default is/dev/dev/video0 and/video2 。(modify the device name, according to the above additional the video equipment filename)

```
root@beagleboard:~# cd mjpg-streamer-r63
root@beagleboard:~/mjpg-streamer-r63# vi mjpg-streamer-r63.sh
```

```
./mjpg_streamer -o "output_http.so -w `pwd`/www -p 8080" -i "input_uvc.so -d /dev/video0 -r 640x480 -f 30" &

./mjpg_streamer -o "output_http.so -w `pwd`/www -p 8081" -i "input_uvc.so -d /dev/video2 -r 640x480 -f 5" &
```

8080 and 8081 is port Number · / dev/dev/video0 and/video2 is corresponding to the USB camera equipment filename · 640x480 is resolution 。This script is also testing two cameras 。If testing one · One can shield 。

- Executive mjpg-streamer.sh scripts

```
root@beagleboard:~/mjpg-streamer-r63#./ mjpg-streamer-r63.sh
root@beagleboard:~/mjpg-streamer-r63# MJPG Streamer Version.: 2.0
i: Using V4L2 device.: /dev/video2
 i: Desired Resolution: 640 x 480
 i: Frames Per Second.: 5
 i: Format............: MJPEG
 o: www-folder-path...: /home/root/mjpg-streamer-r63/www/
 o: HTTP TCP port.....: 8081
 o: username:password.: disabled
 o: commands.........: enabled
```

- Connect NetworkCable and Check development board IP 。

```
root@beagleboard:~/mjpg-streamer-r63#ifconfig
eth0      Link encap:Ethernet  HWaddr 02:00:39:BC:00:04
          inet addr:192.168.1.180  Bcast:255.255.255.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:3219 errors:0 dropped:0 overruns:0 frame:0
          TX packets:57 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:357335 (348.9 KiB)  TX bytes:8662 (8.4 KiB)
          Interrupt:179
```

- Open the PC browser(Recommended for use Firefox), Input development board IP and port number，like http://192.168.1.180:8081/ ，choose"Stream"->"here"or"Javascript"->"here" in the web,Now You can see the camera image acquisition。

4.3.6 Play video demonstration

- Power on and start Development board ,Enter your user name and password to enter a file system。

```
Starting Connection Manager
.-------.
|       |                        .-.
|   |   |-----.-----.-----.| |    .----..-----.-----.
|       |     | __  |   ---'| '--.|  .-'|     |     |
|   |   |  |  |     |---  ||  --'|  |  |  '  | | | |
'---'---'--'--'--.  |-----''----''--'  '-----'-'-'-'
                 -'  |
                 '---'
The Angstrom Distribution stalker ttyS2
Angstrom 2009.X-stable stalker ttyS2

stalker login: root
```

- user name：root ，The password is empty，Press enter can login。

- we can see"720x480Hotplace.avi" in current directory，use mplayer broadcast。

```
root@beagleboard:~# mplayer 720x480Hotplace.avi -ao alsa
```

Chapter Five

5. Construct Embedded Linux software development environment

5.1 Linux software development environment description

Before using the development board, user need to build the software development environment for TI-DM3730-EM.

As Linux is open source, user can download the software for TI-DM3730-EM board from internet free. And after some necessary modification and set the configuration, that software can run on TI-DM3730-EM board. Our CD-ROM already include those contents,

TI-DM3730-EM development board provides a complete software development environment, after the installation according to the system instruction, users no need to install unnecessary content and software and start the development immediately. The development environment is normally a PC with Windows XP operating system

User can visit our website: http://code.google.com/p/ema3530/ to get updated software package and information

5.2 Build the software development environment

5.2.1 Install the VMare-workstation-6.5.0

1、Double click VMare-workstation-6.5.0-118166.exe to enter below installation interface.

Figure 5.1

2、Clicks next, enter the interface as picture 4.2, and select Typical install.

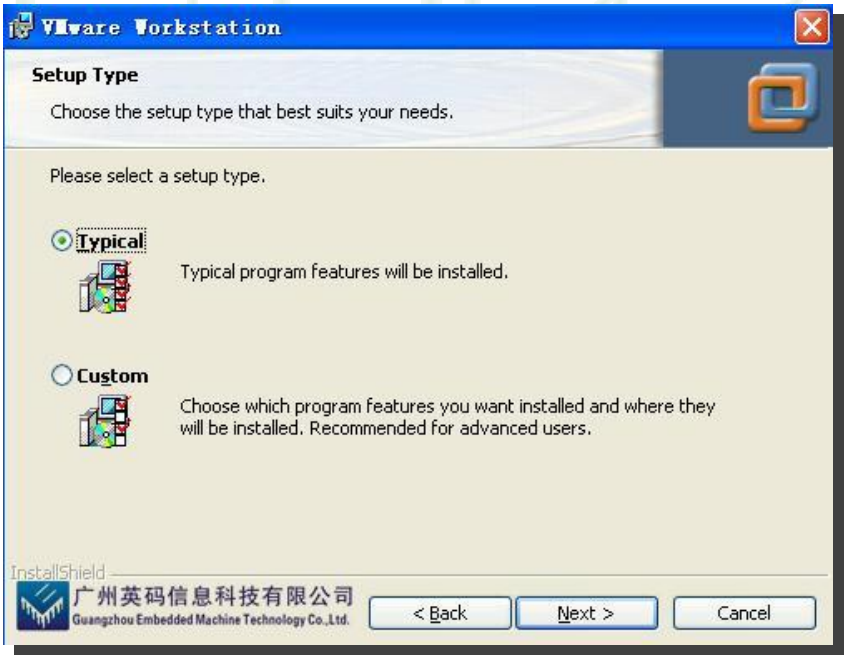


Figure 5.2

3、Click “Next” button, and click “change” button, select the installation path and click “next” button as picture 4.3 show.

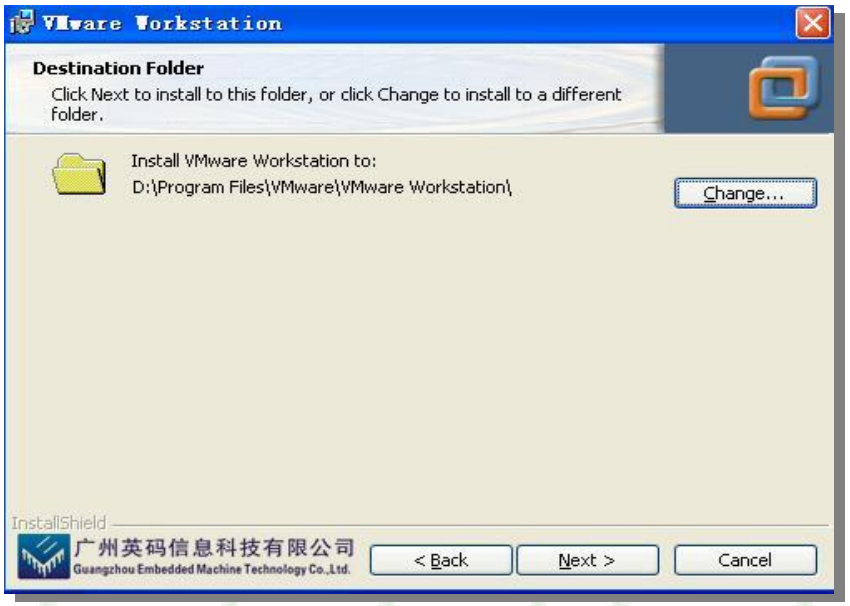


Figure 5.3

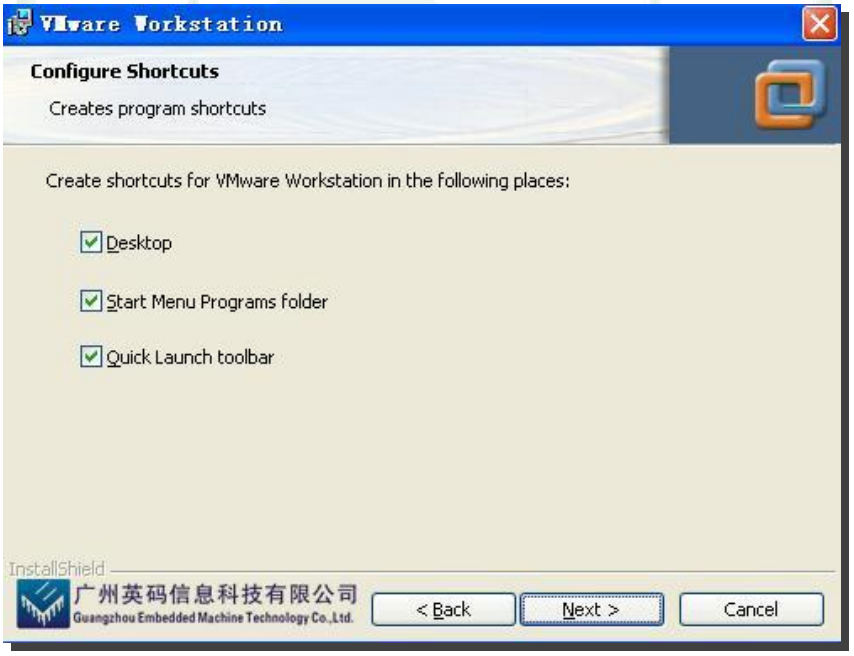


Figure 5.4

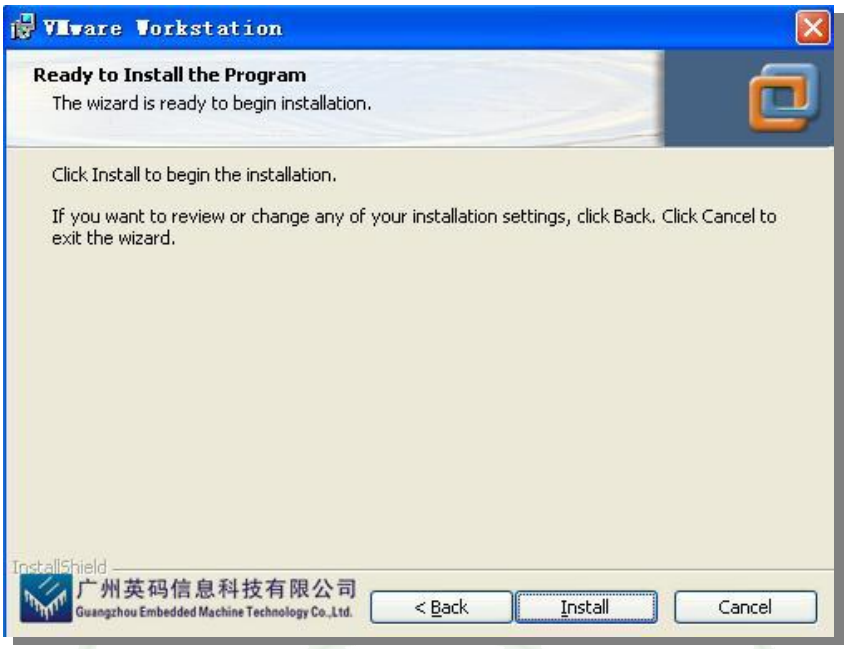


Figure 5.5

4、Click “install” and start the installation as picture 4.6 show.

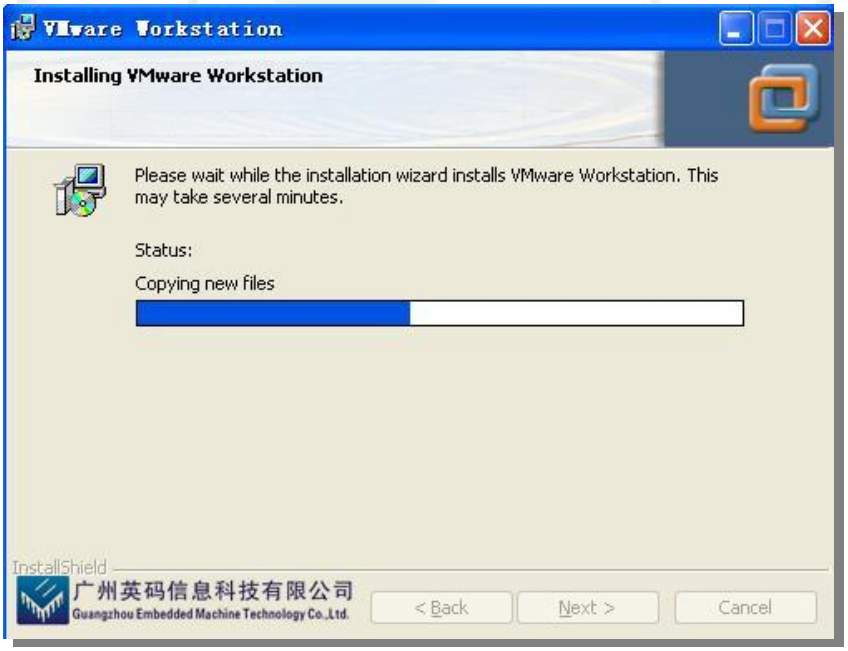


Figure 5.6

5、After installation there will be a pop-up message as 4.7 show, please “YES” and restart the computer

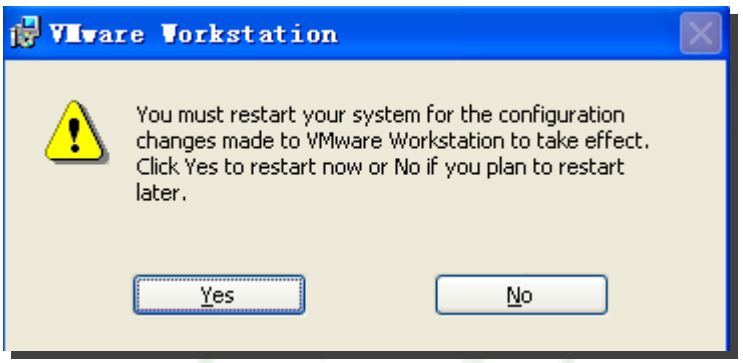


Figure 5.7

6、Finally the VMware-workstation icon be generated on the desktop.

Figure 5.8

5.2.2 Ubuntu installation

We provide a Ubuntu system in the CD. User only needs to copy it to the PC. The installation step as below:

1) Open the CD-ROM, copy and decompress the vm.7z file as picture 4.9 show.

Figure 5.9

2) Open VMware-workstation icon (As picture 4.10 show)

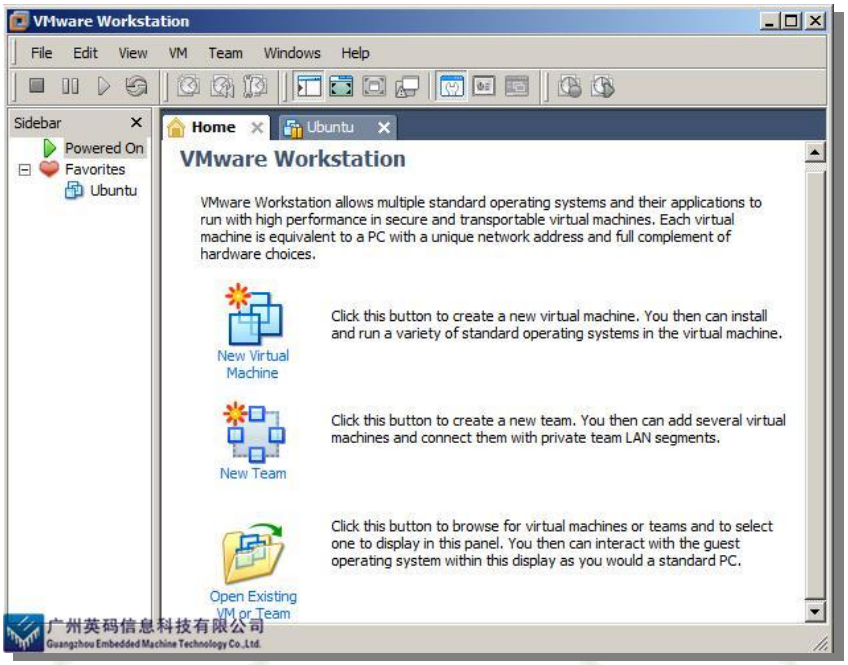


Figure 5.10

3) Open File as picture 4.11 show

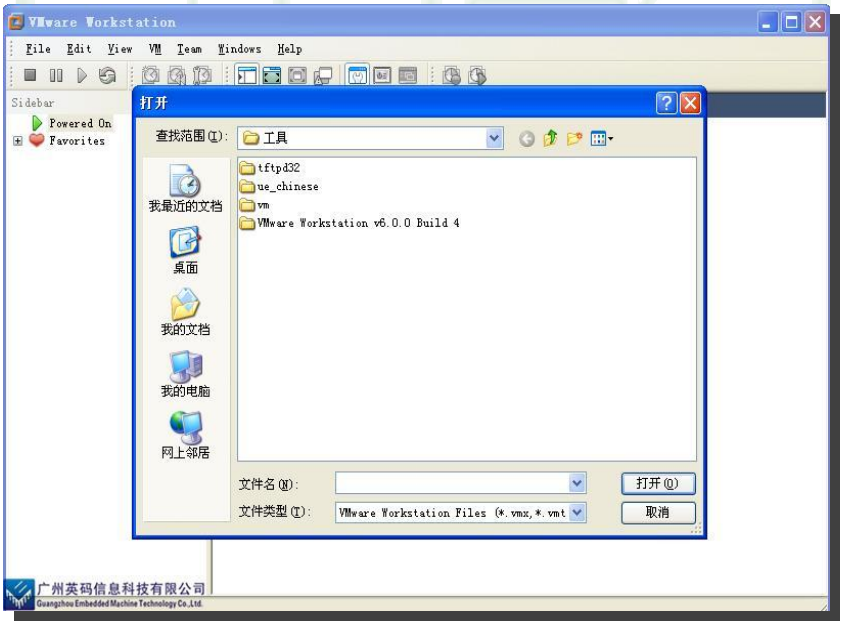


Figure 5.11

4) Select the vm.7z file as picture 4.12 show

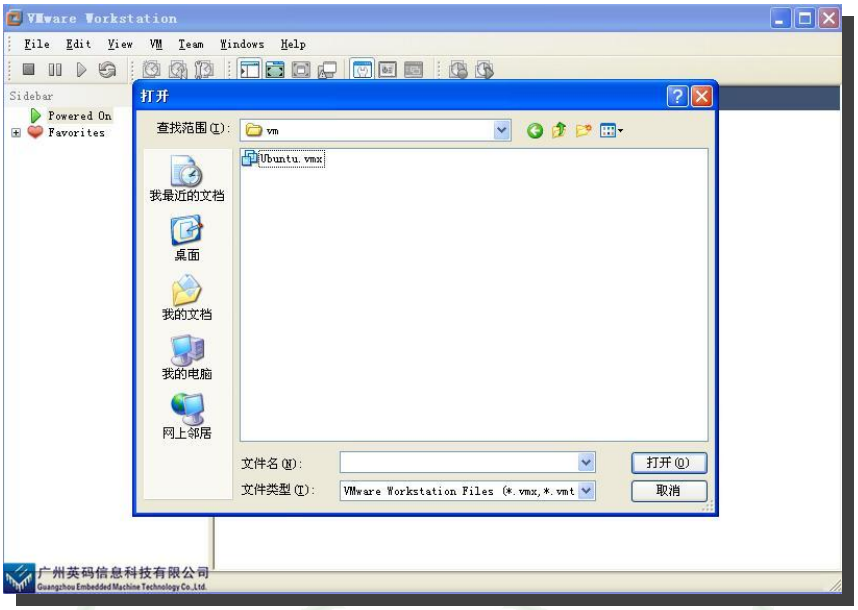


Figure 5.12

5) Select the Green triangle on the up-left side, and start Ubuntu as picture 4.13 show.

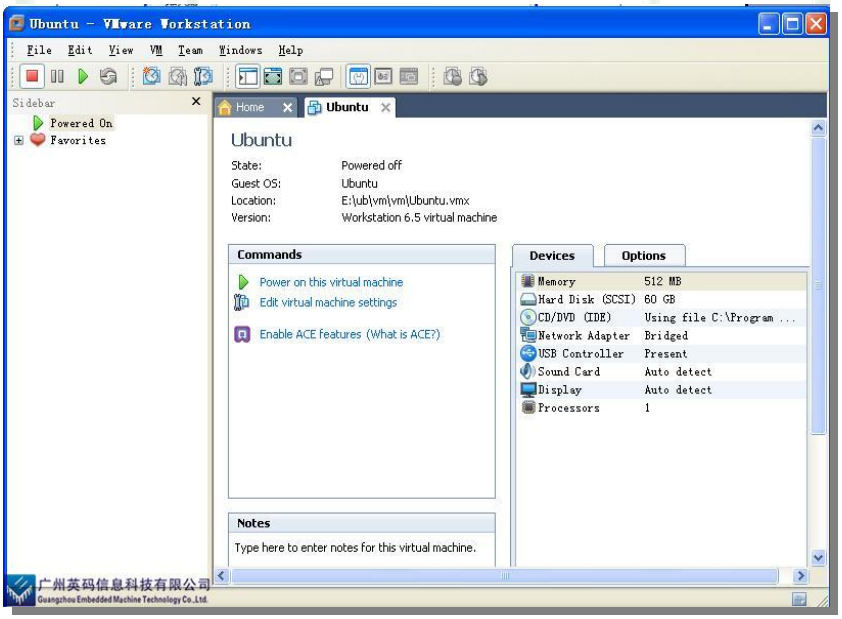


Figure 5.13

6) Log in Ubuntu as picture 4.14 show :

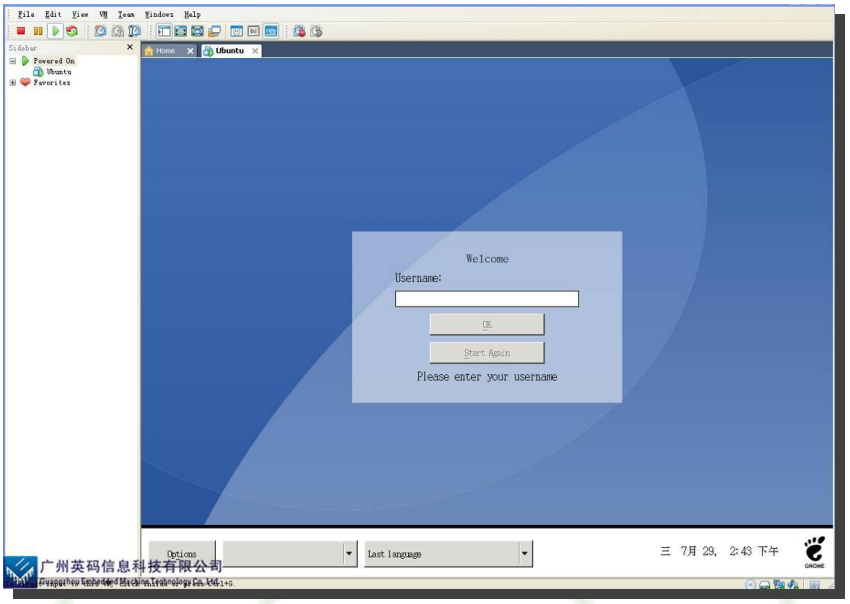


Figure 5.14

Input the user name: ema password: ema

7) Log in success as picture 4.15 show.

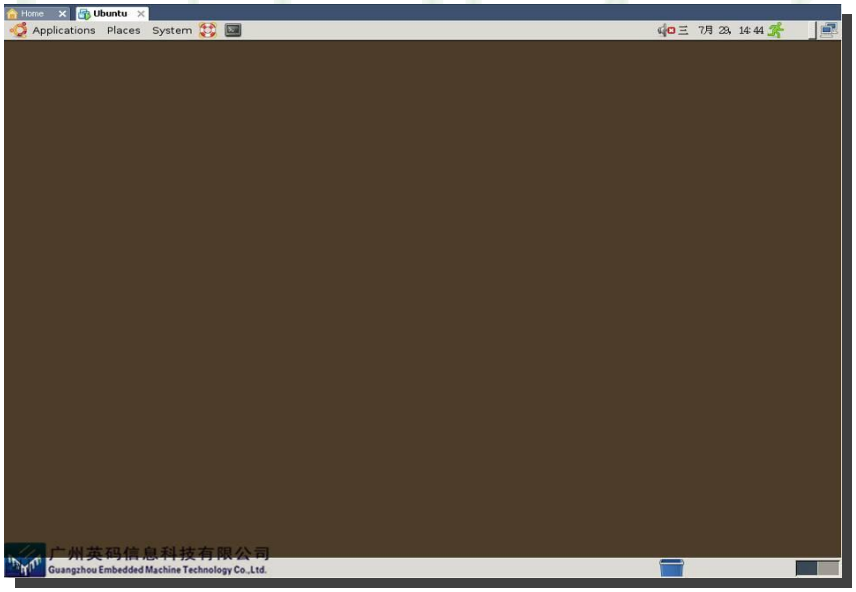


Figure 5.15

5.2.3 Set the file share configuration for Virtual machine and the host.

1) Set the virtual machine. Select VM/Settings or Ctrl+D as below

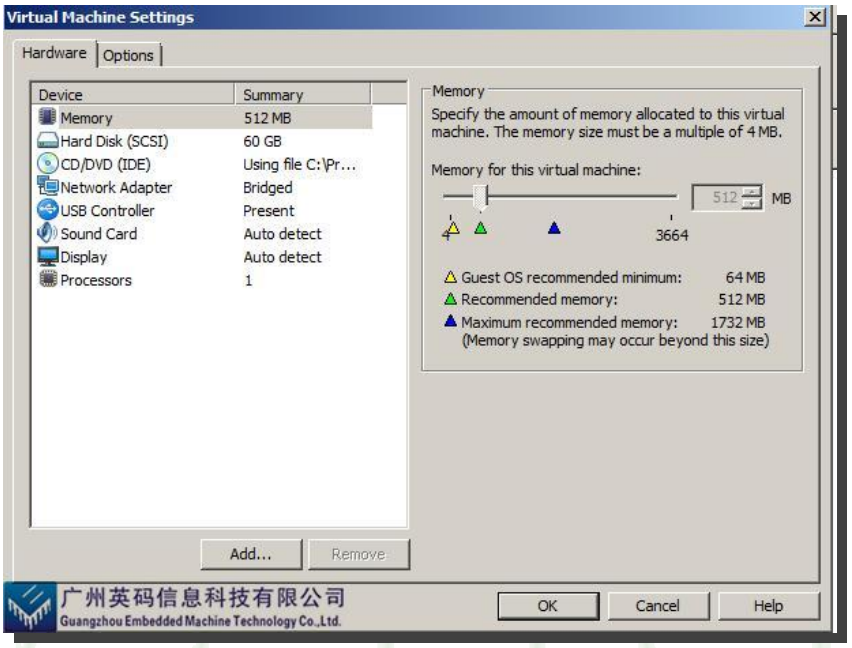


Figure 5.16

2) Select the “Shared Folders” under “Options”, as picture 4.17 show

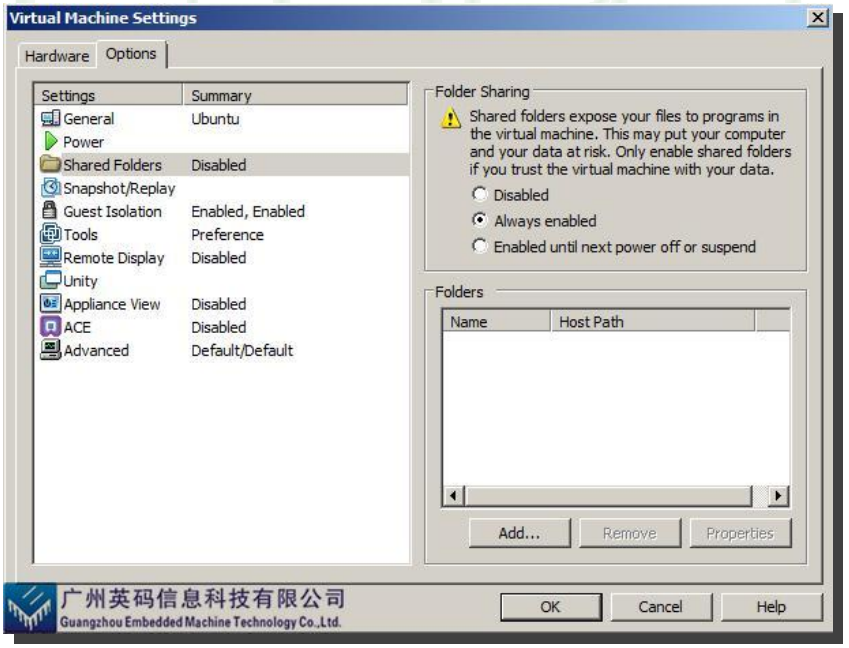


Figure 5.17

3) The Linux system of the Virtual Machine can access shared folder. The path of those file which will be access by Linux is “/mnt/hgfs”, set the shared folder’s path and name at the pop-up windows.

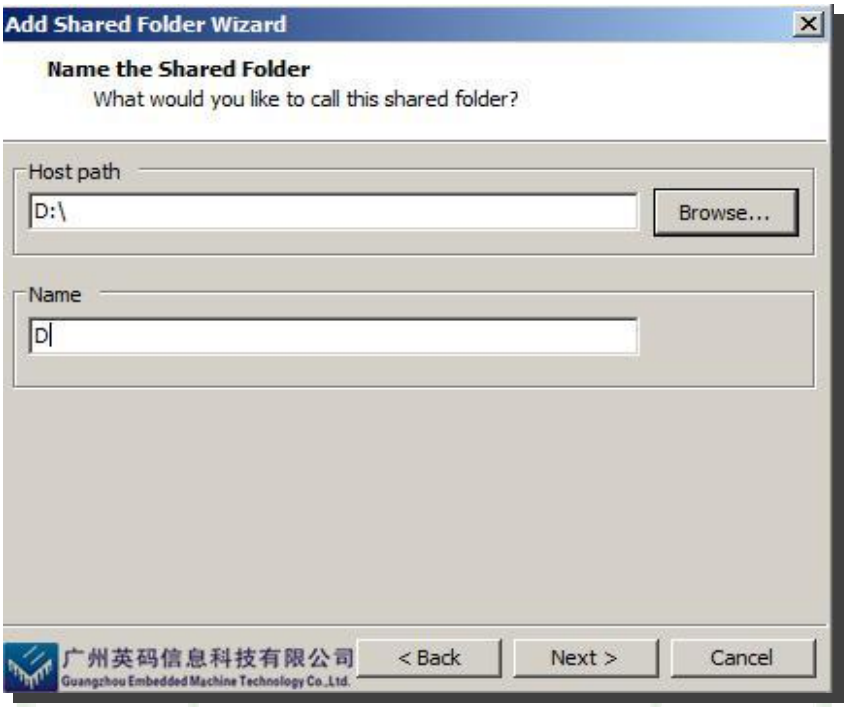


Figure 5.18

4) After set the configuration, add the path of the shared folder automatically as below:

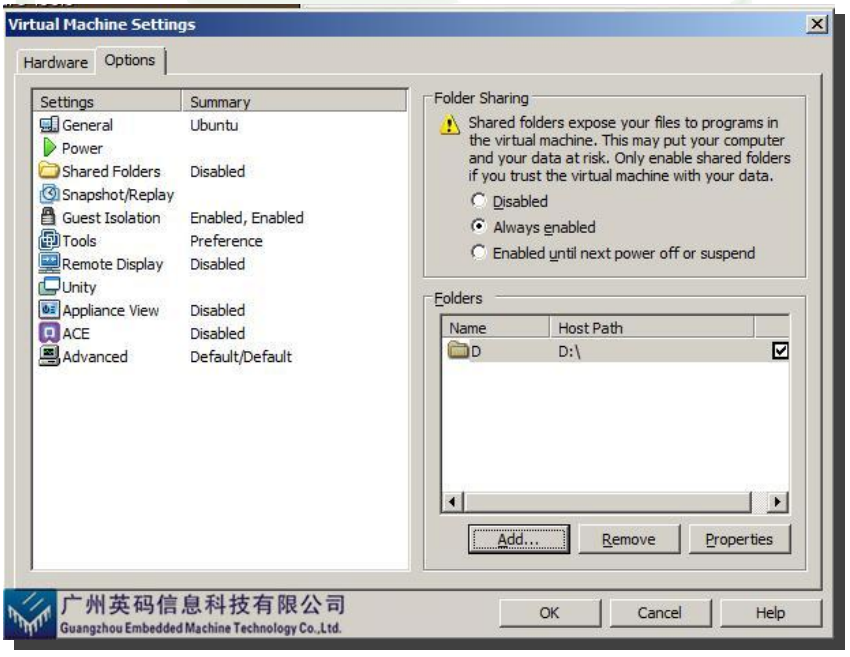


Figure 5.19

5) After the installation finished, under /mnt/ directory there will be a new hgfs folder, the folder is used to communication between the Virtual machine and Host.

Command is :

```
#cd  /mnt/hgfs
#ls
```

This command will help user to check the shared folder.

5.2.4 Build cross compiler

1) Create folder arm under /usr/local/

Command is :

```
#su
#ema
#mkdir  /usr/local/arm
```

2) Copy arm-2009q1-126-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2 to /home/ema/tool
(arm-2009q1-126-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2 already been move to /mnt/hgfs/share)

Command is :

```
#cd /mnt/hgfs/share
#cp  arm-2009q1-203-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2
/home/ema/tool
```

3) Decompress to the /usr/local/arm folder

Command is :

```
#cd /home/ema/tool
#tar jxvf arm-2009q1-203-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2 –C /usr/local/arm
```

4) Set the environment variable

Command is：

```
#export PATH= /usr/local/arm/arm-2009q1/bin:$PATH
```

5) Check the environment variable

Command is：

```
#echo $PATH
```

5.3 Serial terminal software use

- the Windows XP desktop, select the menu: Start -> All Programs -> Accessories -> Communications -> HyperTerminal
- In the "Connection Description" window, enter the name: ema, select "OK"
- In the "Connect to" window to confirm the "Connect using" item as "COM1", select "confirm"
- In the "COM1 Properties" window set: second digit = 115200, data bits = 8, parity = none, stop bits = 1 Flow control = None, select "OK"
- the desktop will automatically open "ema-Super Terminal" window
- In the "ema-Super Terminal" window, select the menu: File -> Exit, when asked whether the stored connections to answer "yes"
- Expand the WindowXP desktop and right click the individual: Start -> All Programs -> Accessories -> Communications -> HyperTerminal -> ema, select "Send to desktop shortcut" back to the desktop to the newly created connection renamed bit " Connect ema "Start HyperTerminal

- In Window XP desktop double-click the "Connect ema" icon to start the HyperTerminal

It is recommended that you use the ZOC Terminal, software on the CD in the Linux\Tools\ZOC folder, there are configuration instructions.

5.4 Mount the network file system NFS

NFS service is to host a directory can be mounted through the network to other computers, and other computer as a directory. In embedded development, through the NFS can be easily modified files will be transferred to the target board via NFS.

Ubuntu default is no NFS service, so needs its own installation

1、Install the version of NFS Services

```
ema@ema3530:~$ sudo apt-get install nfs-kernel-server
```

2、Modify the NFS configuration files，vim /etc/exports

```
ema@ema3530:~$ vim /etc/exports
```

Add the NFS in the file directory format is as follows, and save the file exit.

```
/home/ema/nfs_share *(rw,sync,no_root_squash)
```

3、Established in the root directory of the shared directory, and create a test file in directory

```
ema@ema3530:~$ mkdir /home/ema/nfs_share
ema@ema3530:~$ touch /home/ema/nfs_share/test
```

4、Restart NFS

```
ema@ema3530:~$ sudo /etc/init.d/nfs-kernel-server restart
```

5、look over the host IP

```
ema@ema3530:~$ ifconfig
```

6、Mount a local directory, test NFS

```
ema@ema3530:/$ sudo mount 192.168.1.162:/home/ema/nfs_share/ /tmp/
[sudo] password for ema:
ema@ema3530:/$ ls /tmp/
aaa
ema@ema3530:/$ sudo umount /tmp/
ema@ema3530:/$ ls /tmp/
gconfd-ema      keyring-QhwEr7      orbit-ema      ssh-oHsGDk5300      VMwareDnD
vmware-root
```

7、Target boards need to install nfs-utils-client

```
root@beagleboard:~# opkg install nfs-utils-client
Installing nfs-utils-client (1.1.2-2.1) to root...
Downloading
http://www.angstrom-distribution.org/feeds/2008/ipk/glibc/armv7a/base/nfs-utils-client_1.1
.2-2.1_armv7a.ipk
Configuring nfs-utils-client
```

8、Target board through the NFS mount the host directory

```
root@beagleboard:~# mount 192.168.1.162:/home/ema/nfs_share /tmp/
Can't set permissions on mtab: Operation not permitted
root@beagleboard:~# ls /tmp/
test
```

Chapter Six

6. Build the software development environment

6.1 System compile

6.1.1 First stage code x-loader compile

First set up environment variables, command is :

```
ema@ema3530:~$ export PATH= /usr/local/arm/arm-2009q1/bin:$PATH
```

e) Copy x-loader.tar.bz2 to /home/ema/ source directory (the files are in the share disk directory)

```
ema@ema3530:~$ cd /mnt/hgfs/share
ema@ema3530:/mnt/hgfs/share$ cp x-loader.tar.bz2 /home/ema/Source
```

f) Decompress x-loader.tar.bz2 to the current folder

```
ema@ema3530:~ $ cd /home/ema/Source
ema@ema3530:~/Source$ sudo tar jxvf x-loader.tar.bz2
ema@ema3530:~/Source$ cd xloader
```

g) make distclean :clear the previous build dependency files generated

```
ema@ema3530:~/source/xloader$ make CROSS_COMPILE=arm-none-linux-gnueabi-
ARCH=arm distclean
find . -type f \
```

```
        \( -name 'core' -o -name '*.bak' -o -name '*~' \
        -o -name '*.o'    -o -name '*.a'    \) -print \
        | xargs rm -f
find . -type f \
        \( -name .depend -o -name '*.srec' -o -name '*.bin' \) \
        -print \
        | xargs rm -f
rm -f    *.bak tags TAGS
rm -fr *.*~
rm -f x-load x-load.map
rm -f include/asm/proc include/asm/arch
rm -f include/config.h include/config.mk
```

h) Then configure and compile

```
ema@ema3530:~/source/xloader$ make   CROSS_COMPILE=arm-none-linux-gnueabi-
ARCH=arm sbc3530_config
rm -f include/config.h include/config.mk
Configuring for omap3530beagle board...
ema@ema3530:~/source/xloader$   make   CROSS_COMPILE=arm-none-linux-gnueabi-
ARCH=arm
```

Compilation is completed, xloader directory will generate a new x-load.bin.

```
ema@ema3530:~/source/xloader$ ls
arm_config.mk   config.mk   drivers   lib          README    System.map   x-load.map
board           cpu         fs        Makefile     scripts   x-load
common          disk        include   mkconfig     signGP    x-load.bin
```

i) into SD card startup procedures：MLO

```
ema@ema3530:~/source/xloader$ ./ signGP
ema@ema3530:~/source/xloader$ ls
```

```
arm_config.mk   cpu        include    README        x-load
board           disk       lib        scripts       x-load.bin
common          drivers    Makefile   signGP        x-load.bin.ift
config.mk       fs         mkconfig   System.map    x-load.map
ema@ema3530:~/source/xloader$ cp x-load.bin.ift MLO
```

6.1.2 Second code u-boot compile

First set up environment variables, command is :

```
ema@ema3530:~ $ export PATH= /usr/local/arm/arm-2009q1/bin:$PATH
```

a) Copy u-boot-release.tar.bz2 to /home/ema/ source directory (the files are in the share disk directory)

```
ema@ema3530:~$ cd /mnt/hgfs/share
ema@ema3530:/mnt/hgfs/share$ cp u-boot-release.tar.bz2 /home/ema/Source
```

b) decompress u-boot-release.tar.bz2 to the current folder

```
ema@ema3530:~$ cd /home/ema/Source
ema@ema3530:~/Source$ sudo tar jxvf u-boot-release.tar.bz2
ema@ema3530:~/Source$ cd u-boot-release
```

c) configure and compile

```
ema@ema3530:~/Source/u-boot-release$ make sbc3530_rev_a_config
ema@ema3530:~/Source/u-boot-release$ make
```

Compilation is completed, you can see generated u-boot.bin in the current directory

d) Copy mkimage to / usr / bin, which is generated to compile the kernel uImage

```
ema@ema3530:~/Source/u-boot-release$ cd  tools/
ema@ema3530:~/Source/u-boot-release/tools$ cp mkimage /usr/bin
```

6.1.3 Kernel compile

First set up environment variables, command is :

```
ema@ema3530:~ $ export PATH= /usr/local/arm/arm-2009q1/bin:$PATH
```

a) Copy linux-03.00.01.06.tar.bz2 to / home / ema / source directory (the files are in / share disk directory)

```
ema@ema3530:~$ cd /mnt/hgfs/share
ema@ema3530:/mnt/hgfs/share$ cp linux-03.00.01.06.tar.bz2 /home/ema/Source
```

b) decompress linux-03.00.01.06.tar.bz2 to the current folder

```
ema@ema3530:/mnt/hgfs/share$ cd /home/ema/Source
ema@ema3530:~/Source$ sudo tar jxvf linux-03.00.01.06.tar.bz2
ema@ema3530:~/Source$ cd linux-03.00.01.06
```

c) configure and compile

```
ema@ema3530:~/Source/linux-03.00.01.06$ make
CROSS_COMPILE=arm-none-linux-gnueabi- ARCH=arm omap3_stalker_defconfig
ema@ema3530:~/Source/linux-03.00.01.06$ make
CROSS_COMPILE=arm-none-linux-gnueabi- ARCH=arm
ema@ema3530:~/Source/linux-03.00.01.06$ make
CROSS_COMPILE=arm-none-linux-gnueabi- ARCH=arm uImage
```

Compilation is completed, you can see generated uImage in the arch/arm/boot directory

6.1.4 Make the file system image

a) Copy UBIFS_tools folder to / home / ema / directory (folder in / mnt / hgfs / share shared directory)

```
ema@ema3530:~ $ cd /mnt/hgfs/share
ema@ema3530:~ $ sudo cp –a UBIFS_tools  /home/ema/
```

b) copy mkfs.ubifs and ubinize to / usr / bin directory.

```
ema@ema3530:~ $ cd /home/ema/UBIFS_tools
ema@ema3530:~/UBIFS_tools $ cp mkfs.ubifs ubinize /usr/bin
```

c) decompress the file system to the new rootfs directory。

```
ema@ema3530:~/UBIFS_tools $ cd /home/ema/
ema@ema3530:~ $ mkdir rootfs
ema@ema3530:~$ sudo tar jxvf
Angstrom-console-image-glibc-  -2009.X-stable-beagleboard.rootfs.tar.bz2 –C rootfs/
```

d) Generates a file system image file source by mkfs.ubifs and ubinize tool

```
ema@ema3530:~ $ sudo mkfs.ubifs -r rootfs -m 2048 -e 129024 -c 812 -o ubifs.img
ema@ema3530:~ $ sudo ubinize -o ubi.img -m 2048 -p 128KiB -s 512
/home/ema/UBIFS_tools/ubinize.cfg
```

6.2 Programming Linux system image

6.2.1 Make SD card to boot

In order to achieve the next steps need to prepare for a blank SD card (the following are the steps involved in this card), and the need to build on it Fat32 partition and Ext3 partitions. If you are using the SD Card we offer, then the SD card may already have two partitions, partition and format eliminating the need for some action, you can just delete the existing file.

- The following commands are executed in the root privileges, first download and install bc.（note：make sure connecting）

```
root@ema3530:/home/ema# apt-get install bc
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
Reading state information... 完成
下列【新】软件包将被安装：
```

```
  bc
共升级了 0 个软件包，新安装了 1 个软件包，要卸载 0 个软件包，有 5 个软件未被升
级。
需要下载 73.1kB 的软件包。
After this operation, 201kB of additional disk space will be used.
获取：1 http://cn.archive.ubuntu.com hardy/main bc 1.06.94-3ubuntu1 [73.1kB]
下载 73.1kB，耗时 55s (1310B/s)
选中了曾被取消选择的软件包 bc。
(正在读取数据库 ... 系统当前总共安装有 53291 个文件和目录。)
正在解压缩 bc (从 .../bc_1.06.94-3ubuntu1_i386.deb) ...
正在设置 bc (1.06.94-3ubuntu1) ...
```

```
root@ema3530:/home/ema# ./mkcard.sh /dev/sdb
1024+0 records in
1024+0 records out
1048576 bytes (1.0 MB) copied, 0.652779 s, 1.6 MB/s
Disk /dev/sdb doesn't contain a valid partition table
DISK SIZE - 1995440128 bytes
CYLINDERS - 242
Checking that no-one is using this disk right now ...
OK
Disk /dev/sdb: 242 cylinders, 255 heads, 63 sectors/track
sfdisk: ERROR: sector 0 does not have an msdos signature
 /dev/sdb: unrecognized partition table type
Old situation:
No partitions found
```

```
New situation:
Units = cylinders of 8225280 bytes, blocks of 1024 bytes, counting from 0
   Device Boot Start       End     #cyls     #blocks   Id  System
/dev/sdb1   *        0+       8         9-      72261    c  W95 FAT32 (LBA)
/dev/sdb2            9      241       233    1871572+  83  Linux
/dev/sdb3            0        -         0          0    0  Empty
/dev/sdb4            0        -         0          0    0  Empty
Successfully wrote the new partition table
Re-reading the partition table ...
If you created or changed a DOS partition, /dev/foo7, say, then use dd(1)
to zero the first 512 bytes:  dd if=/dev/zero of=/dev/foo7 bs=512 count=1
(See fdisk(8).)
mkfs.vfat 2.11 (12 Mar 2005)
mke2fs 1.40.8 (13-Mar-2008)
Filesystem label=rootfs
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
117120 inodes, 467893 blocks
23394 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=482344960
15 block groups
32768 blocks per group, 32768 fragments per group
7808 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912
Writing inode tables: done
Creating journal (8192 blocks): done
```

```
Writing superblocks and filesystem accounting information: done
This filesystem will be automatically checked every 35 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

- Disconnect the SD card then connected again, input "df" command to see the two partitions have been divided into.

```
root@ema3530:/home/ema# df
Filesystem           1K-blocks      Used Available Use% Mounted on
/dev/sda1             60924160   7115212  50738528  13% /
varrun                  257720        88    257632   1% /var/run
varlock                 257720         0    257720   0% /var/lock
udev                    257720        56    257664   1% /dev
devshm                  257720         0    257720   0% /dev/shm
.host:/               62468720  62430096     38624 100% /mnt/hgfs
/dev/sdb1                71133         1     71133   1% /media/boot
/dev/sdb2              1856764     35568   1727620   3% /media/rootfs
```

6.2.2 SD Card system image updates

- Copy boot system files（Concrete steps to view the 4.3 Demo）

```
# sudo cp MLO /media/boot
# sync
# sudo cp u-boot.bin /media/boot
# sudo uImage /media/boot
# sudo cp –a rootfs/* /media/rootfs
```

- unmount SD card and wait for the "boot" and "rootfs" icon disappears and the lights no longer flash card reader

6.2.3 NAND Flash system image update

- **NAND FLASH partition：**

* 0x00000000-0x00080000 : "X-Loader"

* 0x00080000-0x00260000 : "U-Boot"

* 0x00260000-0x00280000 : "U-Boot environment data"

* 0x00280000-0x00680000 : "Kernel"

- **For 128MB core：**

* 0x00680000-0x08000000 : "File System"

- **For 256MB core：**

* 0x00680000-0x10000000 : "File System"

- **The following guide is a guide to using the SD card image written to the NAND FLASH**

prepare：

（1）Prepare a bootable SD card.

（2）Make sure the following files in the FAT32 partition of the SD card inside：

MLO (X-Loader)

u-boot.bin (U-Boot)

uImage (Linux kernel image)

ubi.img (UBIFS file system image)

you can download the files from the following web

http://code.google.com/p/ema3530/downloads/list

- X-Loader is first stage of boot loader，using the following command to program X-Loader NAND FLASH：

```
OM AP3 Stalker # mmc init
OM AP3 Stalker # fatload mmc 0:1 80000000 MLO
OM AP3 Stalker # nandecc hw
OM AP3 Stalker # nand erase 0 80000
OM AP3 Stalker # nand write.i 80000000 0 80000
```

- U-Boot is second stage ، using the following command to program U-Boot to NAND FLASH :

```
OM AP3 Stalker # mmc init
OM AP3 Stalker # fatload mmc 0:1 80000000 u-boot.bin
OM AP3 Stalker # nandecc sw
OM AP3 Stalker # nand erase 80000 160000
OM AP3 Stalker # nand write.i 80000000 80000 160000
```

- Use the following command programmed kernel image to NAND FLASH :

```
OM AP3 Stalker # mmc init
OM AP3 Stalker # fatload mmc 0:1 80000000 uImage
OM AP3 Stalker # nandecc sw
OM AP3 Stalker # nand erase 280000 400000
OM AP3 Stalker # nand write.i 80000000 280000 400000
```

- We use the file system UBIFS. Use the following command to load the file system image to RAM. Here is an example of the file system image name is : ubi.img

```
OM AP3 Stalker # mmc init
OM AP3 Stalker # fatload mmc 0:1 84000000 ubi.img
OM AP3 Stalker # nandecc sw
```

- For 128MB core，Use the following command erases the file system partition：

```
OM AP3 Stalker # nand erase 680000 8000000
```

- For 256MB core，Use the following command erases the file system partition：

```
OM AP3 Stalker # nand erase 680000 10000000
```

- the programming file system image to the NAND FLASH. For example, here's the file system image size is 0xD40000 (Bytes), the specific size can be adjusted according to actual image size:

```
OM AP3 Stalker # nand write.i 84000000 680000 D40000
```

When all the above work can be turned off after the completion of the power, pull out the SD card, set up DIP switch (111 100), re-start the development of power on board, where the U-BOOT set up the parameters can be passed to the kernel from NAND FLASH start.

6.3 Linux Application Development

6.3.1 Set boot auto-run programs

- Add the shell of a script in /etc/init.d/rcS ,it will execute the boot script, such as set_fb。

```
#!/bin/sh
#
# rcS               Call all S??* scripts in /etc/rcS.d in
#                   numerical/alphabetical order.
#
# Version:      @(#)/etc/init.d/rcS  2.76  19-Apr-1999  miquels@cistron.nl
#
```

```
PATH=/sbin:/bin:/usr/sbin:/usr/bin

runlevel=S

prevlevel=N

umask 022

export PATH runlevel prevlevel
```

/etc/init.d/set_fb &

```
◆

#!/bin/sh

sleep 5

echo "fbset success"

VYRES="$(cat /sys/devices/platform/omapfb/graphics/fb0/virtual_size |awk -F,

'{print$2*3}')"

echo $VYRES

fbset -vyres $VYRES

/etc/init.d/rc.pvr start

cd /opt/gfxsdkdemos/ogles

./OGLESVase
```

6.3.2 Shield displays the login screen

Login screen displays the service

```
root@beagleboard:~# cd /etc/rc5.d/

root@beagleboard:/etc/rc5.d# ls

S10dropbear S20syslog S30ntpdate S99rmnologin

S20apmd S21avahi-daemon S50usb-gadget

S20dbus-1 S22connman S99gpe-dm

root@beagleboard:/etc/rc5.d# mv S99gpe-dm bakS99gpe-dm
```

6.3.3 Download and install software

- Enter the "route" command to see the default gateway。

```
root@beagleboard:~# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     *               255.255.255.0   U     0      0        0 eth0
default         192.168.1.1     0.0.0.0         UG    0      0        0 eth0
```

- If not set, use the following command to set .

```
root@beagleboard:~# udhcpc
```

- Download and install the software, for example to install gdb.

```
root@beagleboard:~# opkg update
root@beagleboard:~# opkg install mplayer
```

6.3.4 ALSA Sound settings

ALSA play sound, command：alsamixer。

Function keys：Tab 、 space、left and right 、up and down、m set whether mute（mute show MM）

use “TAB”，VIEW items in internal selection：PLAYBACK，CAPTURE，ALL（ALL item，in fact, PLAYBACK and CAPTURE is the comprehensive）

1. Audio output settings

use “TAB”，VIEW items in internal selection：PLAYBACK

Enable the following options（press “m”， show “00” says that the option is enabled “MM” is that mute）。

- DAC2 Analog（up and down to adjust the voice）
- DAC2 Digital coarse（up and down to adjust the voice）
- DAC2 Digital Fine（up and down to adjust the voice）
- PreDriv
- PredriveL Mixer AudioL2
- PredriveR Mixer AudioL2

2. Audio Input settings（increase the options in the audio output setting , the test is passed after recording with the microphone headset output）

1) use “TAB”，VIEW items in internal selection：CAPTURE

Used space to select a particular whether the increase CAPTURE，show the A red L and R, that is added, here select Analog Right Sub Mic on it.

2) use “TAB”，VIEW items in internal selection：PLAYBACK

Enable the following options（press “m”， show “00” says that the option is enabled “MM” is that mute）。

- DAC Voice Analog Downlink （up and down to adjust the voice）
- PredriveL Mixer Voice
- PredriveR Mixer Voice
- Voice Analog Loopback

6.3.5 General Linux application development process

1) Write the procedure of Hello.c

```
#include<stdio.h>
    main()
    {
        printf("Helloworld!\n");
    }
```

2) cross-compiler

```
# arm-none-linux-gnueabi-gcc Hello.c –o Hello
```

3) download and run

Executable file can be EXT3 partition on the SD card file system；

Executable file can be set directly on the U disc；

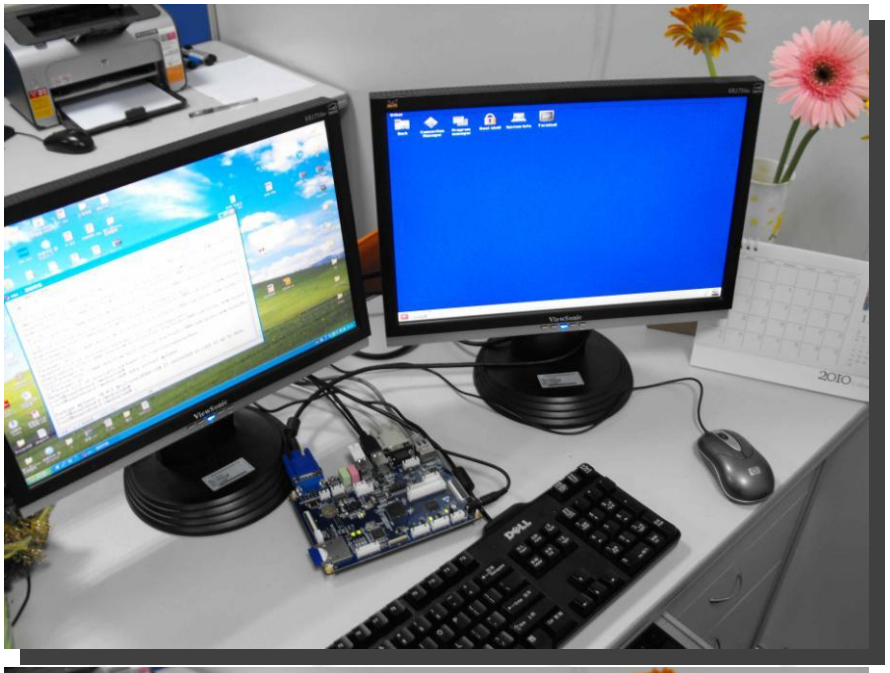
Executable file can be downloaded to the development board through the network, **Please see 5.4 Network File System NFS mount**；

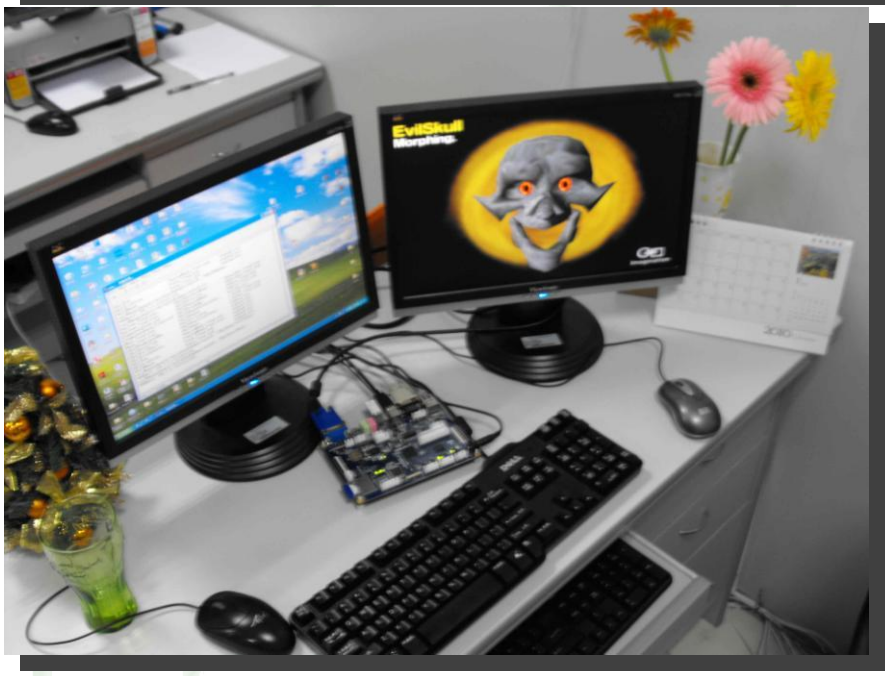
Executable file can be downloaded through the software to the development board, such as SSH, WinSCP3。

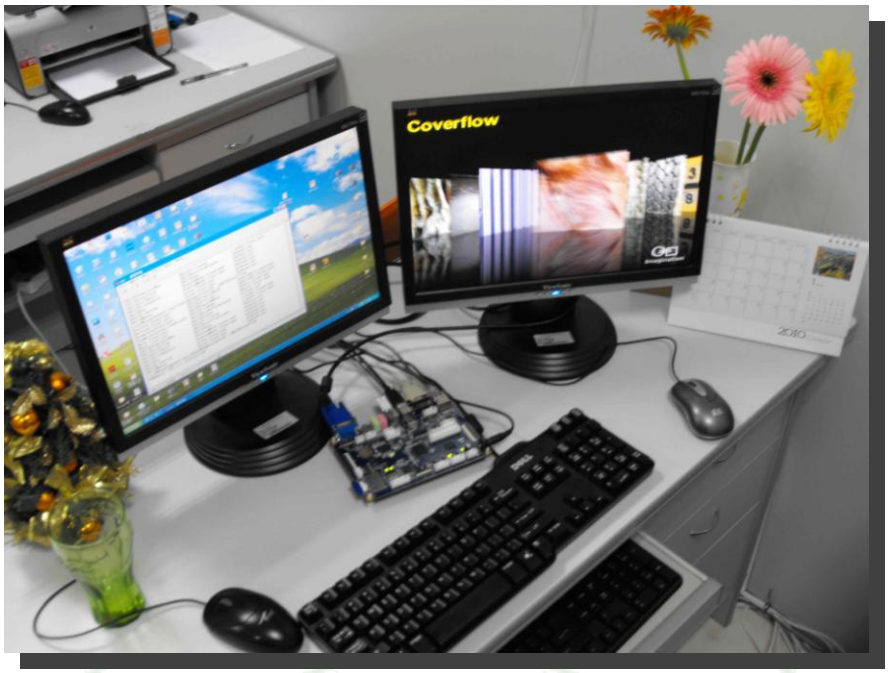
```
# ./Hello
```

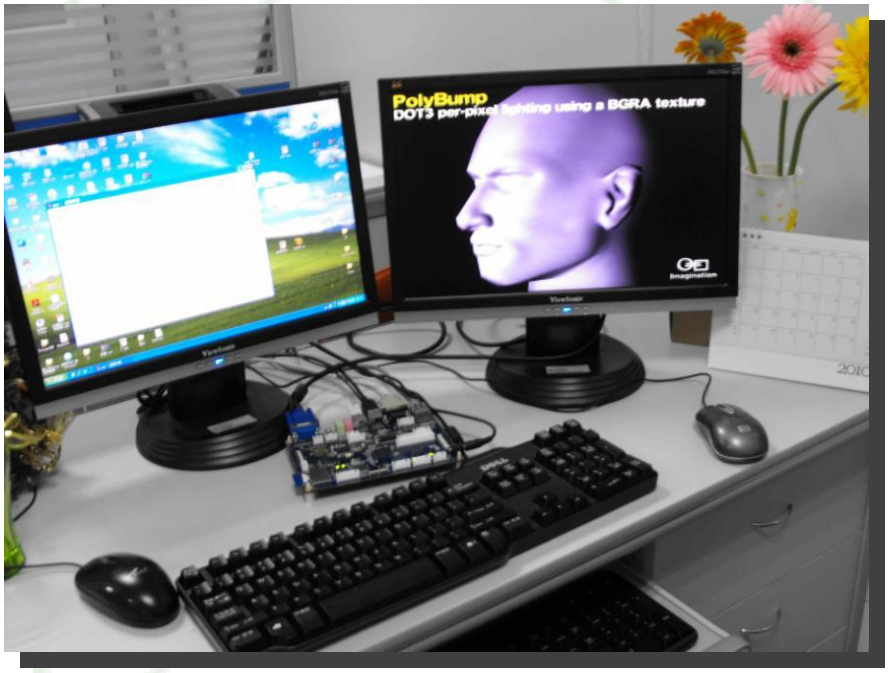
6.4 Demo system running performance

The system provide Demo program based on Angstrom Linux desktop system, through VGA signal output interface (resolution can arrive 1080P). Use the software from Angstrom system include file editor, web browser, audio player and photo editor, and user can use USB mouse to operate this system.


DELL
2010


EvilSkull
Morphing


Coverflow


PolyBump
DOT3 per-pixel lighting using a BGRA texture

Chapter Seven

7. appendix

7.1 Schematic and CPU board pin definition

- Please refer to TI-DM3730-EM board DVDROM
- TI-DM3730-EM schematic.pdf。