EC2x-QuecOpen Aboot

Adding SPI Dot Matrix Screen Guide

LTE Standard Module Series

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Quectel Wireless Solutions Co., Ltd.
7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

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About the Document

History

Revision	Date	Author	Description
1.0	2018-07-04	Matthew MA	Initial
1.1	2019-03-14	Matthew MA	Updated and improved the document format.

Contents

1 Introduction

This document mainly introduces how to add and adapt one SPI LCD dot matrix screen to Open Linux Aboot from the user's development perspective. Here LCD driver codes take dot matrix screen for example.

This document mainly applies to global market, and supports the LTE Standard modules currently included:

- EC2x: EC20 R2.1/EC25/EC21

2 Preparation

Prepare the SDK compilation environment under Linux, and complete *lk(aboot)* compilation.

2.1. Compiling Aboot under Open Linux

Prepare compilation environment:

```
# source ql-ol-crosstool/ql-ol-crosstool-env-init
```

Compile Aboot:

```
# make aboot
```

Check Aboot image after compilation:

```
# ls target/appsboot.mbn
```

```
Makefile  ql-ol-bootloader  ql-ol-crosstool  ql-ol-extsdk  ql-ol-kernel  ql-ol-rootfs  ql-ol-usrdata  target
ol@ol-OptiPlex-7050:~/sdk/cefdlg/ql-ol-sdk$ source ql-ol-crosstool/ql-ol-crosstool-env-init
QUECTEL_PROJECT_NAME      =EC20CE_FDLG
QUECTEL_PROJECT_REV       =EC20CEFDLGR06A03M1G_OCPU
QUECTEL_FEATURE_OPENLINUX =OL
ol@ol-OptiPlex-7050:~/sdk/cefdlg/ql-ol-sdk$ make aboot
cd /home/ol/sdk/cefdlg/ql-ol-sdk/ql-ol-bootloader ; make -j 4 mdm9607  TOOLCHAIN_PREFIX=arm-oe-linux-gnueabi- SIGNED_KERNEL=1 || exit ; \
cp build-mdm9607/appsboot.mbn /home/ol/sdk/cefdlg/ql-ol-sdk/target
make[1]: Entering directory '/home/ol/sdk/cefdlg/ql-ol-sdk/ql-ol-bootloader'
make[2]: Entering directory '/home/ol/sdk/cefdlg/ql-ol-sdk/ql-ol-bootloader'
including app/aboot dev/keys dev/pmic/pm8x41 dev/vib lib/debug lib/heap lib/libc lib/libfdt lib/openssl lib/ptable
including lib/openssl/crypto lib/zlib_inflate
generating build-mdm9607/config.h
generating build-mdm9607/system-onesegment.ld
linking build-mdm9607/lk
generating image: build-mdm9607/lk.bin
generating listing: build-mdm9607/lk.debug.lst
generating symbols: build-mdm9607/lk.sym
generating listing: build-mdm9607/lk.lst
   text    data     bss     dec     hex filename
 265660  105240   77300  448200   6d6c8 build-mdm9607/lk
arm-oe-linux-gnueabi-objcopy -O binary build-mdm9607/lk build-mdm9607/lk.bin
generating size map: build-mdm9607/lk.size
generating stripped elf: build-mdm9607/lk_s.elf
cp ./build-mdm9607/lk.bin ./build-mdm9607/appsboot.raw
cp -f ./build-mdm9607/lk_s.elf ./build-mdm9607/appsboot.mbn
make[2]: Leaving directory '/home/ol/sdk/cefdlg/ql-ol-sdk/ql-ol-bootloader'
make[1]: Leaving directory '/home/ol/sdk/cefdlg/ql-ol-sdk/ql-ol-bootloader'
ol@ol-OptiPlex-7050:~/sdk/cefdlg/ql-ol-sdk$ ls
Makefile  ql-ol-bootloader  ql-ol-crosstool  ql-ol-extsdk  ql-ol-kernel  ql-ol-rootfs  ql-ol-usrdata  target
ol@ol-OptiPlex-7050:~/sdk/cefdlg/ql-ol-sdk$ ls target/
appsboot.mbn  mdm9607-perf-boot.img
ol@ol-OptiPlex-7050:~/sdk/cefdlg/ql-ol-sdk$
```

3 The Source Code for Aboot Adding Dot Matrix Screen

Dot matrix screen source code included following:

- LCD driver file: *lcd.c*
- Compilation file: *runles.mk*

3.1. Steps to Add

- Adding source code

lcd.tar.gz

Please extract provided by Quectel to *ql-ol-bootloader/dev*

- Adding LCD Compilation

Modify *target/mdm9607/rules.mk*, and add as following:

```
MODULES += \
        dev/keys \
        dev/lcd\
        dev/vib \
        lib/ptable \
        dev/pmic/pm8x41 \
        lib/libfdt
```

- LCD display during initiating Aboot

Modify *kernel/main.c*

```
        platform_init();

        // initialize the target
        dprintf(SPEW, "initializing target\n");
        target_init();

        dprintf(SPEW, "calling apps_init()\n");
/*****************************************************************************************
matthew-2018/11/28:avoid the splash screen
Refer to [Issue-Depot].[IS0000376][Submitter:matthew.ma,Date:2018-11-28]
<avoid the splash screen>
*****************************************************************************************/
        //matthew.ma 2018.9.17 press the power key at least 2s for boot
        if((pm8x41_get_is_cold_boot())&&(pm8x41_get_pon_reason()==64))
                if(0==ql_pm8x41_get_pwrkey_is_pressed())
                        shutdown_device();
/*****************************************************************************************
matthew-2018/10/12:lcd init and boot with logo
Refer to [Req-Depot].[RQ0000192][Submitter:matthew.ma,Date:2018-10-12]
<对讲机屏幕,开机logo和gui>
*****************************************************************************************/
        lcd_init();
//end matthew-2018/10/12
//end matthew 2018-11-28
        apps_init();
```

- Re-compiling Aboot in *ql-ol-sdk*

```
# make aboot
```

4 LCD Configuration

- LCD external pin configuration

Please check following definition in *lcd.c*

```
#include<pm8x41.h>


#define GPIO_RST                                1       //pin6
#define GPIO_RS                         2       //pin 139
#define GPIO_BL                         1
#define SPI_CLK                         23
#define SPI_CS                          22
#define SPI_OUT                         20
#define LCD_W                           128
#define LCD_H                           8

#define LCD_RST_L               pm8x41_gpio_set(GPIO_RST, 0)
```

In which, the RST is the reset pin, RS is the command data selection pin, BL is the backlight pin. CLK, CS and OUT are SPI pins (modification is not recommended). LCD_W and LCD_H mean width and height of the LCD, please be noted that the value here needs to be in accord with the specific model, such as 128*64 dot matrix screen, the width is 128, but the LCD_H value needs to be divided by 8, so it is 8, as one byte has 8 bits, however one byte of dot matrix screen can cover 8 dots.

- Screen display in Aboot

```
void hw_lcd_update(void)
{


        //uint8 *pLcdbuf = "12345678";
        uint8 pLcdbuf[1]={0xff};
        uint8 line,col;

        line = 0;
        while( line < LCD_H)
        {
                //if (LCD_FRESH_MAP & SET_8BIT[line])
                {
                        // set display start line
                        wr_cmd( 0);
                        // set page
                        lcd_set_page( line );

                        // set start col
                        lcd_set_column(0);

                        for( col = 0; col < LCD_W; col ++ )
                        {
                                wr_data(pLcdbuf[0]);
                                //pLcdbuf ++;
                        }
                        //LCD_FRESH_MAP &= CLR_8BIT[line];
                }
                line ++;
        }
"lcd.c" [已转换] 238L, 4350C 已写入
```

The function *hw_lcd_update* in *Lcd.c* can black a whole dot matrix screen, please take it as reference.

- LCD initialization sequence

The function *lcd_init* in *Lcd.c* has LCD initialization sequence, please set it according to specific screen sequence.

```
const uint8 LCD_INIT_CODE[] =
{
        0xac,
        0x00,
        0xa2,
        0xa0,
        0xc8,
        0x60,
        0x25,
        0x81,
        0x20,
        0x2f,
        0xf8,
        0x00,
        0xa6,
        0xaf
};
```

5 Appendix A References

Table 1: Terms and Abbreviations

Abbreviation	Description
SPI	Serial Peripheral Interface
LCD	Liquid Crystal Display
LTE	Long Term Evolution
SDK	Software Development Kit