

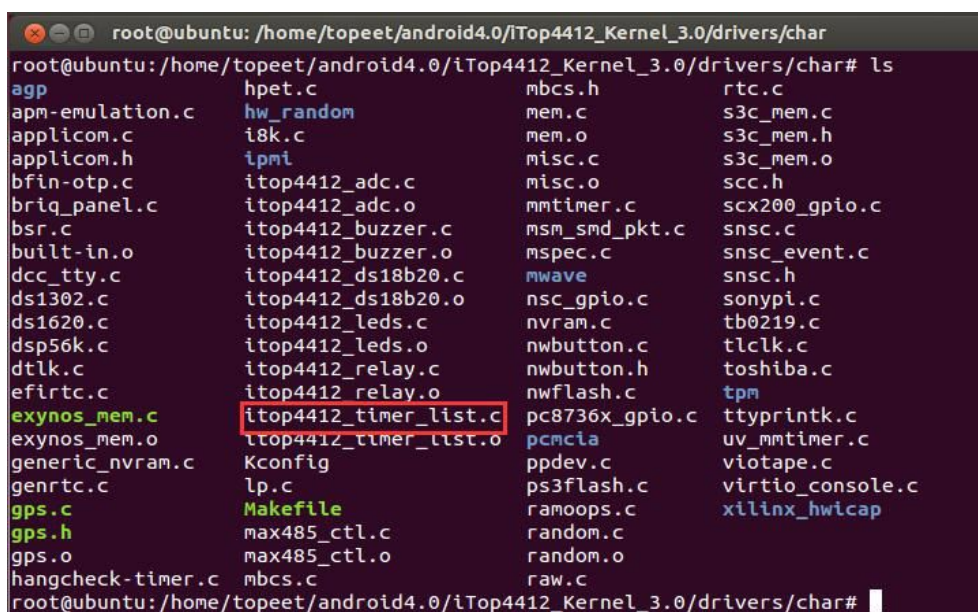
# iTOP-4412 实现 timer\_list 定时器驱动例程

大家好，今天我们来学习下 linux 定时程序驱动的编写，本节我们实现的功能是通过定时实现灯的亮和灭。

## 驱动程序

驱动程序的名字是：“itop4412\_timer\_list.c”。

要想把这个驱动注册到内核,先把这个驱动程序放到内核的“driver/char”目录下，如下图所示：



```
root@ubuntu: /home/topeet/android4.0/iTop4412_Kernel_3.0/drivers/char# ls
agp                hpet.c            mbc.c             rtc.c
apm-emulation.c   hw_random         mem.c             s3c_mem.c
applicom.c         i8k.c            mem.o             s3c_mem.h
applicom.h         ipmi              misc.c            s3c_mem.o
bfin-otp.c         itop4412_adc.c    misc.o            scc.h
briq_panel.c       itop4412_adc.o    mmtimer.c         scx200_gpio.c
bsr.c              itop4412_buzzer.c  msm_smd_pkt.c     snsc.c
built-in.o         itop4412_buzzer.o  mspec.c           snsc_event.c
dcc_tty.c          itop4412_ds18b20.c  mwave             snsc.h
ds1302.c           itop4412_ds18b20.o  nsc_gpio.c        sonypi.c
ds1620.c           itop4412_leds.c    nvram.c           tb0219.c
dsp56k.c           itop4412_leds.o    nwbutton.c        tclclk.c
dtlk.c             itop4412_relay.c   nwbutton.h        toshiba.c
efirtc.c           itop4412_relay.o   nwflash.c         tpm
exynos_mem.c       itop4412_timer_list.c  pc8736x_gpio.c    ttyprintk.c
exynos_mem.o       itop4412_timer_list.o  pcmcia            uv_mmtimer.c
generic_nvram.c    Kconfig           ppdev.c           viotape.c
genrtc.c           lp.c              ps3flash.c        virtio_console.c
gps.c              Makefile          ramoops.c         xilinx_hwicap
gps.h              max485_ctl.c       random.c
gps.o              max485_ctl.o       random.o
hangcheck-timer.c  mbc.c             raw.c
root@ubuntu: /home/topeet/android4.0/iTop4412_Kernel_3.0/drivers/char#
```

## Makefile

然后打开“drive/char”目录下面的 Makefile，添加

```
obj-$(CONFIG_TIMER_LIST_CTL) += itop4412_timer_list.o
```

如下图所示：

```
root@ubuntu: /home/topeet/android4.0/ITop4412_Kernel_3.0/drivers/char

obj-$(CONFIG_HANGCHECK_TIMER) += hangcheck-timer.o
obj-$(CONFIG_TCG_TPM) += tpm/

obj-$(CONFIG_DCC_TTY) += dcc_tty.o
obj-$(CONFIG_PS3_FLASH) += ps3flash.o
obj-$(CONFIG_RAMOOPS) += ramoops.o

obj-$(CONFIG_JS_RTC) += js-rtc.o
js-rtc-y = rtc.o

obj-$(CONFIG_S3C_MEM) += s3c_mem.o
obj-y += gps.o

obj-$(CONFIG_MAX485_CTL) += max485_ctl.o
obj-$(CONFIG_LEDS_CTL) += itop4412_leds.o
obj-$(CONFIG_DS18B20_CTL) += itop4412_ds18b20.o
obj-$(CONFIG_TIMER_LIST_CTL) += itop4412_timer_list.o
obj-$(CONFIG_BUZZER_CTL) += itop4412_buzzer.o
obj-$(CONFIG_ADC_CTL) += itop4412_adc.o
obj-$(CONFIG_RELAY_CTL) += itop4412_relay.o

obj-$(CONFIG_EXYNOS_MEM) += exynos_mem.o

79,1 Bot
```

添加完成后保存退出。

## Kconfig

然后打开 “drive/char” 目录下面的 Kconfig , 搜索 “LEDS\_CTL” ,找到之后在下面添加 “TIMER\_LIST\_CTL” ,仿照着 “LEDS\_CTL” 写就可以了 , 添加内容如下 :

```
config TIMER_LIST_CTL
    bool "Enable TIMER_LIST config"
    default y
    help
        Enable TIMER_LIST config
```

添加完成后如下图所示 :

```
root@ubuntu: /home/topeet/android4.0/ITop4412_Kernel_3.0/drivers/char

config DS18B20_CTL
    tristate "Enable DS18B20 config"
    default y
    help
        Enable DS18B20 config

config TIMER_LIST_CTL
    bool "Enable TIMER_LIST config"
    default y
    help
        Enable TIMER_LIST config

config LEDS_CTL
    bool "Enable LEDS config"
    default y
    help
        Enable LEDS config

config BUZZER_CTL
    bool "Enable BUZZER config"
    default n
    help
```

修改完成后保存退出。

## 添加设备到平台文件

最后使用命令 “vim arch/arm/mach-exynos/mach-itop4412.c” ，打开平台文件。添加设备，参考 led 的驱动，添加内容一如下：

```
#ifdef CONFIG_TIMER_LIST_CTL
struct platform_device s3c_device_timer_list_ctl = {
    .name    = "timer_list",
    .id      = -1,
};
#endif
```

添加完成后如下图所示：

```
root@ubuntu: /home/topeet/android4.0/ITop4412_Kernel_3.0/arch/arm/mach-exynos
struct platform_device s3c_device_ds18b20_ctl = {
    .name = "ds18b20",
    .id = -1,
};
#endif

#ifdef CONFIG_TIMER_LIST_CTL
struct platform_device s3c_device_timer_list_ctl = {
    .name = "timer_list",
    .id = -1,
};
#endif

#ifdef CONFIG_LEDS_CTL
struct platform_device s3c_device_leds_ctl = {
    .name = "leds",
    .id = -1,
};
#endif

#ifdef CONFIG_BUZZER_CTL
struct platform_device s3c_device_buzzer_ctl = {
    .name = "buzzer_ctl",
};
#endif
```

2678,31 53%

添加内容二如下：

```
#ifdef CONFIG_TIMER_LIST_CTL
    &s3c_device_timer_list_ctl,
#endif
```

添加完成后如下图所示：

```
root@ubuntu: /home/topeet/android4.0/ITop4412_Kernel_3.0/arch/arm/mach-exynos
//&smm6260_modem,

#ifdef CONFIG_MAX485_CTL
    &s3c_device_max485_ctl,
#endif

#ifdef CONFIG_DS18B20_CTL
    &s3c_device_ds18b20_ctl,
#endif

#ifdef CONFIG_TIMER_LIST_CTL
    &s3c_device_timer_list_ctl,
#endif

#ifdef CONFIG_LEDS_CTL
    &s3c_device_leds_ctl,
#endif

#ifdef CONFIG_BUZZER_CTL
    &s3c_device_buzzer_ctl,
#endif

#ifdef CONFIG_ADC_CTL
```

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修改完成后保存退出。

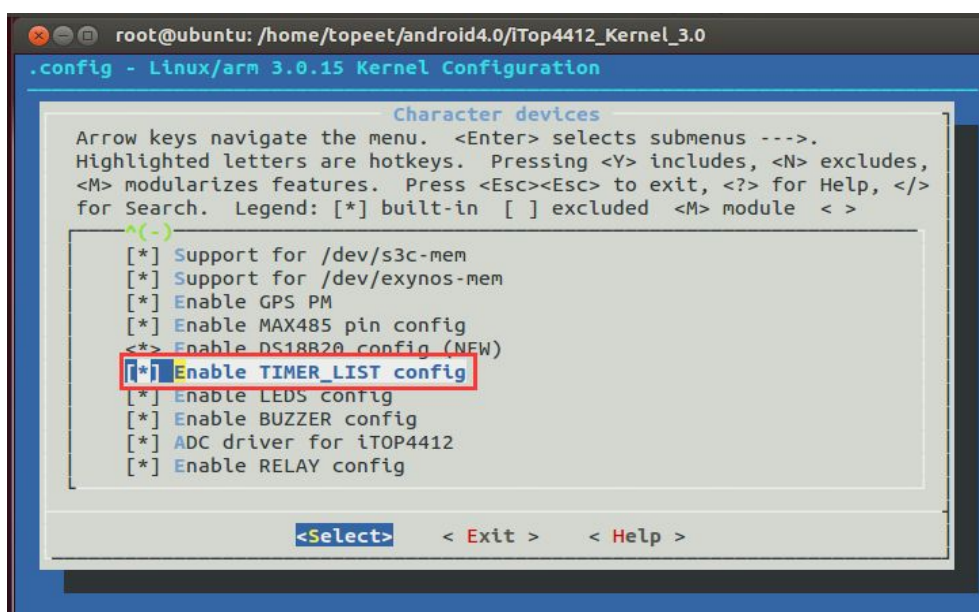
## 内核的编译

内核在编译之前应该先对其进行参数配置。具体讲解可以参考 itop-4412 开发板精英使用手册 5.3.2，这里以 SCP 2G 核心板为例编译 zImage 内核镜像,那么配置文件为

“config\_for\_linux\_scp\_elite” 使用命令 “cp cconfig\_for\_linux\_scp\_elite .config” 配置，

```
root@ubuntu: /home/topeet/android4.0/iTop4412_Kernel_3.0
root@ubuntu: /home/topeet/android4.0/iTop4412_Kernel_3.0# cp config_for_
config_for_android_2M_pop          config_for_linux_pop_supper
config_for_android_2M_scp          config_for_linux_scp_elite
config_for_android_pop2G_elite     config_for_linux_scp_supper
config_for_android_pop2G_super     config_for_ubuntu_hdmi_pop
config_for_android_pop_elite       config_for_ubuntu_hdmi_pop_sd
config_for_android_pop_supper      config_for_ubuntu_hdmi_scp
config_for_android_scp_elite       config_for_ubuntu_hdmi_scp_sd
config_for_android_scp_supper      config_for_ubuntu_pop
config_for_linux_pop2G_elite        config_for_ubuntu_pop_sd
config_for_linux_pop2G_supper       config_for_ubuntu_scp
config_for_linux_pop_elite          config_for_ubuntu_scp_sd
root@ubuntu: /home/topeet/android4.0/iTop4412_Kernel_3.0# cp config_for_linux_scp
_elite .config
root@ubuntu: /home/topeet/android4.0/iTop4412_Kernel_3.0#
```

在内核目录下使用 make menuconfig 命令打开内核配置界面，进入 “Device Drivers --->” → “Character devices --->” → “Enable TIMER\_LIST config”，如下图所示，配置上宏 定义 “TIMER\_LIST\_CTL”。



配置完成后保存退出，以免出错可以再查看一遍，然后使用编译命令 “make zImage” 编译内核。编译完成后在目录

“/home/topeet/android4.0/iTop4412\_Kernel\_3.0/arch/arm/boot” 下找到新生成的 zImage 编译到开发板，启动开发板。开发板启动之后，使用命令 “ls /sys/devices/platform/” 可以查看到新注册的 timer\_list 设备，如下图所示。



```

[root@iTOP-4412]# ls /sys/devices/platform/
adc_ctl          s3c-pl1330.1      s5pv210-uart.3
alarm            s3c-pl1330.2      samsung-audio
android_pmem.0   s3c-sdhci.2       samsung-audio-idma
android_pmem.1   s3c-sdhci.3       samsung-i2s.0
arm-pmu.0        s3c-usb gadget     samsung-i2s.4
bt-sysfs         s3c2410-wdt       samsung-keypad
buzzer_ctl       s3c2440-i2c.1     samsung-kmsg
ds18b20          s3c2440-i2c.3     samsung-pd.0
dw_mmc           s3c2440-i2c.4     samsung-pd.1
exynos-busfreq   s3c2440-i2c.5     samsung-pd.2
exynos-usb-switch s3c2440-i2c.7     samsung-pd.5
exynos4412-adc   s3c24xx-pwm.1     samsung-pd.6
gpio-keys        s3c64xx-rtc       samsung-pd.7
i2c-gpio.0       s3c64xx-spi.2     samsung-rp
ion-exynos       s5p-ehci          serial8250
leds             s5p-fimg2d        si_gps
max485_ctl       s5p-pmic          snd-soc-dummy
mt3326-gps       s5p-sysmmu.15     soc-audio
power            s5p-tvout-cec     switch-gpio.0
power.0          s5p-tvout-hpd     tc4-regulator-consumer
reg-dummy        s5pv210-uart.0    timer_list
regulatory.0     s5pv210-uart.1    uevent
relay_ctl        s5pv210-uart.2    wlan_ar6000_pm_dev.1
[root@iTOP-4412]#

```

如下图所示，加载之后使用命令“ls /dev”，可以看到新生成了设备节点“timer\_list”。

```

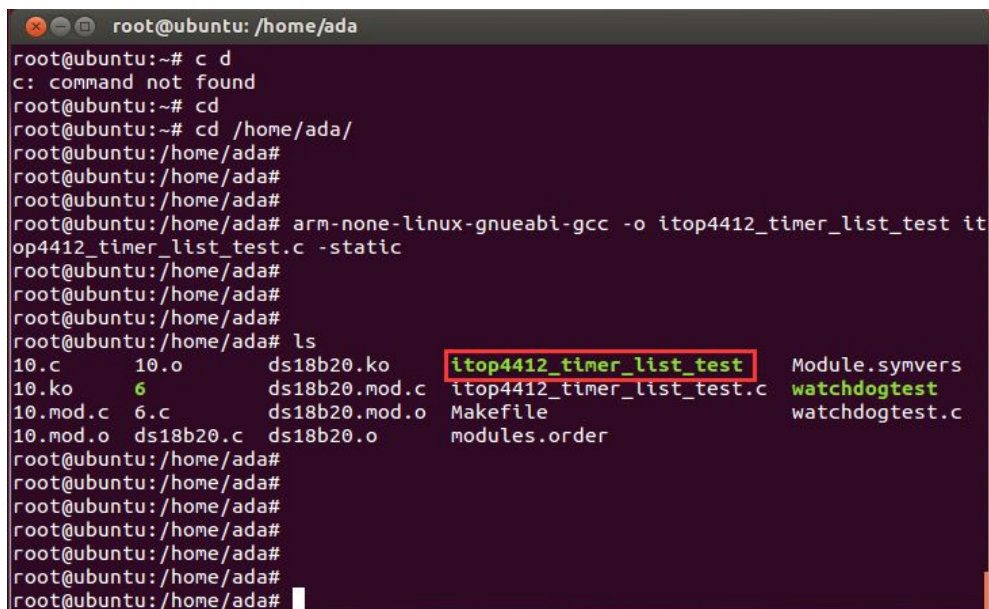
[root@iTOP-4412]# ls /dev
AGPS          ion            ram11          tty3
HPD           keychord       ram12          tty4
adc           kmem           ram13          ttyGS0
alarm         kmsg           ram14          ttyGS1
android_adb   leds           ram15          ttyGS2
ashmem        log            ram2           ttyGS3
bus           loop0          ram3           ttyS0
buzzer_ctl    loop1          ram4           ttyS1
console       loop2          ram5           ttyS2
cpu_dma_latency loop3          ram6           ttyS3
ds18b20       loop4          ram7           ttySAC0
exynos-mem    loop5          ram8           ttySAC1
fb0           loop6          ram9           ttySAC2
fb1           loop7          random         ttySAC3
fb10          mali           rtc0           uinput
fb11          mapper         rtc1           ump
fb2           max485_ctl_pin root            urandom
fb3           mem            s3c-mem        usb_accessory
fb4           mmcblk0        s3c-mfc        usbdev1.1
fb5           mmcblk0p1      sda            usbdev1.2
fb6           mmcblk0p2      sda1           usbdev1.3
fb7           mmcblk0p3      sda2           usbdev1.4
fb8           mmcblk0p4      sda3           video0
fb9           mtp_usb        sda4           video11
fimg2d        network_latency sda5           video12
full          network_throughput sg0            video16
fuse          null           shm            video2
gps           pmem           snd            video20
i2c-0         pmem_gpu1     srp            video3
i2c-1         ppp           srp_ctrl       watchdog
i2c-3         ptmx          timer_list     xt_qtaguid
i2c-4         pts           tty            zero
i2c-5         ram0          tty1
i2c-7         ram1          tty2
input         ram10
[root@iTOP-4412]#

```

## 测试程序

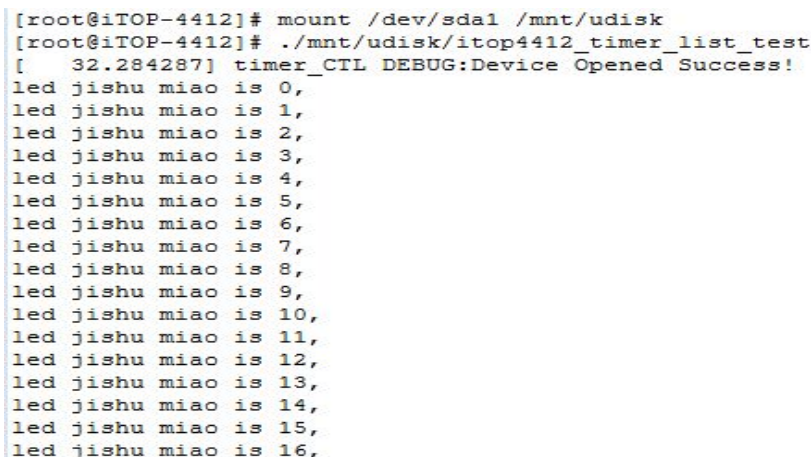
名字：“itop4412\_timer\_list\_test.c”

在 Ubuntu 系统下新建 ada 文件夹，将写好的 “itop4412\_timer\_list\_test.c” 拷贝到文件夹下，使用 “arm-none-linux-gnueabi-gcc -o itop4412\_timer\_list\_test itop4412\_timer\_list\_test.c -static” 命令编译应用。如下图所示。



```
root@ubuntu: /home/ada
root@ubuntu:~# c d
c: command not found
root@ubuntu:~# cd
root@ubuntu:~# cd /home/ada/
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada# arm-none-linux-gnueabi-gcc -o itop4412_timer_list_test itop4412_timer_list_test.c -static
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada# ls
10.c      10.o      ds18b20.ko  itop4412_timer_list_test  Module.symvers
10.ko     6         ds18b20.mod.c  itop4412_timer_list_test.c  watchdogtest
10.mod.c  6.c      ds18b20.mod.o  Makefile                  watchdogtest.c
10.mod.o  ds18b20.c ds18b20.o     modules.order
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
root@ubuntu:/home/ada#
```

将上图中的文件 “itop4412\_timer\_list\_test” 拷贝到 U 盘。启动开发板，将 U 盘插入开发板，使用命令 “mount /dev/sda1 /mnt/udisk/” 加载 U 盘符，使用命令 “./mnt/udisk/itop4412\_timer\_list\_test” 运行小应用 “itop4412\_timer\_list\_test”，如下图所示。



```
[root@iTOP-4412]# mount /dev/sda1 /mnt/udisk
[root@iTOP-4412]# ./mnt/udisk/itop4412_timer_list_test
[ 32.284287] timer_CTL DEBUG:Device Opened Success!
led jishu miao is 0,
led jishu miao is 1,
led jishu miao is 2,
led jishu miao is 3,
led jishu miao is 4,
led jishu miao is 5,
led jishu miao is 6,
led jishu miao is 7,
led jishu miao is 8,
led jishu miao is 9,
led jishu miao is 10,
led jishu miao is 11,
led jishu miao is 12,
led jishu miao is 13,
led jishu miao is 14,
led jishu miao is 15,
led jishu miao is 16,
```

LED2 每隔 60s 亮一次，灭一次，依次循环。



