Embedded System Assignment 103 on Raspberry Pi
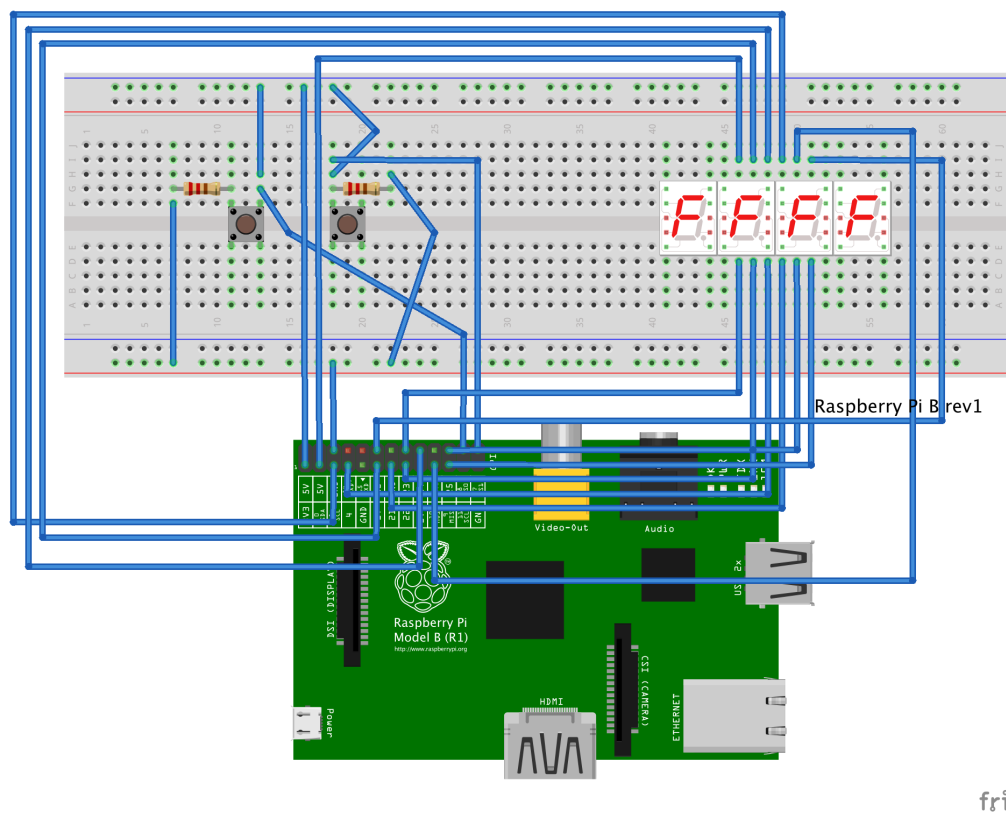
3130000020 董可扬

一、实验器材

- 树莓派
- 面包板
- 4位LED七段数码管
- 按钮 * 2
- 小电阻 * 2
- 杜邦线若干
- 手机电源线
- WRTnode（作为路由器！）
- EDUP 树莓派无线网卡
- Macbook Pro

二、接线方法

用Fritzing画出如下的接线示意图（其实和Lab 6是一样一样的）：

Raspberry Pi B rev1

fritzing

//另外树莓派的TxD、RxD和一个GND的Pin针连接TTL-to-USB串口线，通过串口进行通讯控制。

不再需要这么麻烦啦！将EDUP无线网卡插到树莓派的USB口上，开启WRTnode，

三、实验步骤

因为共阳七段数码管的引脚配置在实验六中已经有了，且GPIO控制库wiringPi已经安装，只要拿来用即可，因此略过这两个准备步骤。

1. 安装ntpdate并配置

首先从Mac终端iTerm 2使用ssh登录树莓派（都连接到了WRTnode的信号源），然后使用 `sudo apt-get install ntpdate` 从官方源安装：


```
pi@raspberrypi ~ $ sudo apt-get install ntpdate
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  ntpdate
0 upgraded, 1 newly installed, 0 to remove and 80 not upgraded.
Need to get 0 B/78.8 kB of archives.
After this operation, 135 kB of additional disk space will be use
perl: warning: Setting locale failed.
perl: warning: Please check that your locale settings:
        LANGUAGE = (unset),
        LC_ALL = (unset),
        LC_CTYPE = "zh_CN.UTF-8",
        LANG = "en_GB.UTF-8"
    are supported and installed on your system.
perl: warning: Falling back to the standard locale ("C").
locale: Cannot set LC_CTYPE to default locale: No such file or di
locale: Cannot set LC_ALL to default locale: No such file or dire
Selecting previously unselected package ntpdate.
```

使用 `tzselect` 命令修改时区，按照导引依次选择 亚洲->中国->北京时间：


```
pi@raspberrypi ~ $ tzselect
Please identify a location so that time zone rules can be set correctly.
Please select a continent or ocean.
 1) Africa
 2) Americas
 3) Antarctica
 4) Arctic Ocean
 5) Asia
 6) Atlantic Ocean
 7) Australia
 8) Europe
 9) Indian Ocean
10) Pacific Ocean
11) none - I want to specify the time zone using the Posix TZ format.
#? 5
Please select a country.
```

```
Please select a country.
 1) Afghanistan        18) Israel            35) Palestine
 2) Armenia            19) Japan             36) Philippines
 3) Azerbaijan         20) Jordan            37) Qatar
 4) Bahrain            21) Kazakhstan        38) Russia
 5) Bangladesh         22) Korea (North)     39) Saudi Arabia
 6) Bhutan             23) Korea (South)     40) Singapore
 7) Brunei             24) Kuwait            41) Sri Lanka
 8) Cambodia           25) Kyrgyzstan        42) Syria
 9) China              26) Laos              43) Taiwan
10) Cyprus             27) Lebanon           44) Tajikistan
11) East Timor         28) Macau             45) Thailand
12) Georgia            29) Malaysia          46) Turkmenistan
13) Hong Kong          30) Mongolia          47) United Arab Emirates
14) India              31) Myanmar (Burma)   48) Uzbekistan
15) Indonesia          32) Nepal             49) Vietnam
16) Iran               33) Oman              50) Yemen
17) Iraq               34) Pakistan
#? 9
Please select one of the following time zone regions.
1) Beijing Time
2) Xinjiang Time
#? 1


The following information has been given:

        China
        Beijing Time

Therefore TZ='Asia/Shanghai' will be used.
Local time is now:       Mon Jun 15 12:31:14 CST 2015.
Universal Time is now:  Mon Jun 15 04:31:14 UTC 2015.
Is the above information OK?
1) Yes
2) No
#?
```

修改完成后，将上海的时区信息拷贝到 `/etc/localtime` ，设置自动同步时间：

`ntpdate cn.pool.ntp.org`

```
You can make this change permanent for yourself by appending the line
        TZ='Asia/Shanghai'; export TZ
to the file '.profile' in your home directory; then log out and log in again.

Here is that TZ value again, this time on standard output so that you
can use the /usr/bin/tzselect command in shell scripts:
Asia/Shanghai
pi@raspberrypi ~ $ sudo cp /usr/share/zoneinfo/Asia/Shanghai /etc/localtime
pi@raspberrypi ~ $ sudo ntpdate cn.pool.ntp.org
15 Jun 12:33:45 ntpdate[2683]: the NTP socket is in use, exiting
pi@raspberrypi ~ $
```
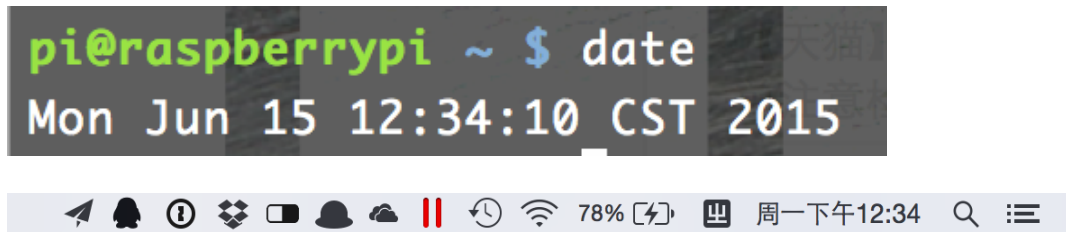
配置完成。

2. 编写代码并测试

输入 `date` 查看rpi同步的当前时间，可以看到和Mac显示的是一样的：

代码编写使得按一个按钮可以在七段数码管上显示当前时间，另一个显示当前日期：

```c
include <wiringPi.h>
include <stdio.h>
include <stdlib.h>
include <unistd.h>
include <time.h>

define DIGIT0 8
define DIGIT1 9
define DIGIT2 12
define DIGIT3 13

define BTN0 10
define BTN1 11

define TRUE 1
define FALSE 0

char digit[10][8] =  // definition of each digit
{
{0,0,0,0,0,0,1,1}, //0
{1,0,0,1,1,1,1,1}, //1
{0,0,1,0,0,1,0,1}, //2
{0,0,0,0,1,1,0,1}, //3
{1,0,0,1,1,0,0,1}, //4
{0,1,0,0,1,0,0,1}, //5
{0,1,0,0,0,0,0,1}, //6
{0,0,0,1,1,1,1,1}, //7
{0,0,0,0,0,0,0,1}, //8
{0,0,0,0,1,0,0,1}  //9
};

time_t now;
struct tm *tm_now;

void showDigit(int dispNo, int num, int showDot) {


```

```c
digitalWrite(DIGIT0, LOW);
digitalWrite(DIGIT1, LOW);
digitalWrite(DIGIT2, LOW);
digitalWrite(DIGIT3, LOW);

int pin = 0;
for (pin = 0; pin < 8; pin++) {
digitalWrite(pin, digit[num][pin]);
}

if (showDot == 1) { // whether or not show the dot
digitalWrite(7, LOW);
} else {
digitalWrite(7, HIGH);
}

switch(dispNo){
case 0:
digitalWrite(DIGIT0, HIGH);
break;
case 1:
digitalWrite(DIGIT1, HIGH);
break;
case 2:
digitalWrite(DIGIT2, HIGH);
break;
case 3:
digitalWrite(DIGIT3, HIGH);
break;
default:
break;
}
}

int main(void) {

int pin;
int dispTime = 0;
unsigned int time0 = 0, time1 = 0;
int dispFigure[4];

if (wiringPiSetup () == -1) {
exit (1) ;
}

for (pin = 0 ; pin < 8 ; ++pin) {
pinMode (pin, OUTPUT) ;
digitalWrite(pin, HIGH);
}

pinMode(DIGIT0, OUTPUT);
```

```c
pinMode(DIGIT1, OUTPUT);
pinMode(DIGIT2, OUTPUT);
pinMode(DIGIT3, OUTPUT);

pinMode(BTN0, INPUT); //display time button
pinMode(BTN1, INPUT); //display date button

while (1) {

time1 = millis();
time(&now);
tm_now = localtime(&now);
if (digitalRead(BTN0) && dispTime == 0) {
printf("Now is %d%d:%d%d.\n", tm_now->tm_hour / 10, tm_now->tm_hour % 10
, tm_now->tm_min / 10, tm_now->tm_min % 10);
dispTime = 1;
time0 = millis();
} else if (digitalRead(BTN1) && dispTime == 1) {
printf("Today is %d/%d.\n", tm_now->tm_mon + 1, tm_now->tm_mday);
dispTime = 0;
}

if (time1 - time0 >= 50 && dispTime == 1) {
time0 = time1;
}

if (dispTime) {
delay(5);
showDigit(0, tm_now->tm_min % 10, FALSE);
delay(5);
showDigit(1, tm_now->tm_min / 10, FALSE);
delay(5);
showDigit(2, tm_now->tm_hour % 10, TRUE);
delay(5);
showDigit(3, tm_now->tm_hour / 10, FALSE);
} else {
delay(5);
showDigit(0, (tm_now->tm_mday) % 10, FALSE);
delay(5);
showDigit(1, (tm_now->tm_mday) / 10, FALSE);
delay(5);
showDigit(2, (tm_now->tm_mon + 1 ) % 10, TRUE);
delay(5);
showDigit(3, (tm_now->tm_mon + 1 ) / 10, FALSE);
}

}
return 0;
}
```

四、实验结果


```
pi@raspberrypi ~/Dong $ mv clock.c task103.c
pi@raspberrypi ~/Dong $ gcc -o task103 task103.c -lwiringPi
pi@raspberrypi ~/Dong $ sudo ./task103
Now is 12:39.
Today is 6/15.
Now is 12:39.
Today is 6/15.
Now is 12:39.
Today is 6/15.
Now is 12:39.
Today is 6/15.
```