3.Display_usage_and_CPU_temperature

After CPU Info LCD screen is correctly inserted into the Raspberry Pi, you need to compile and run the program to display it normally. This experiment is used to display the current CPU usage and CPU temperature of the Raspberry Pi.

1. Install the wringPi library

CPU Info LCD screen is used for data communication through the GPIO port of the Raspberry Pi, so we must install the wiringPi library file.

Enter the following command to install the wringPi library. Users who have already installed the wiringPi library can ignore this step.

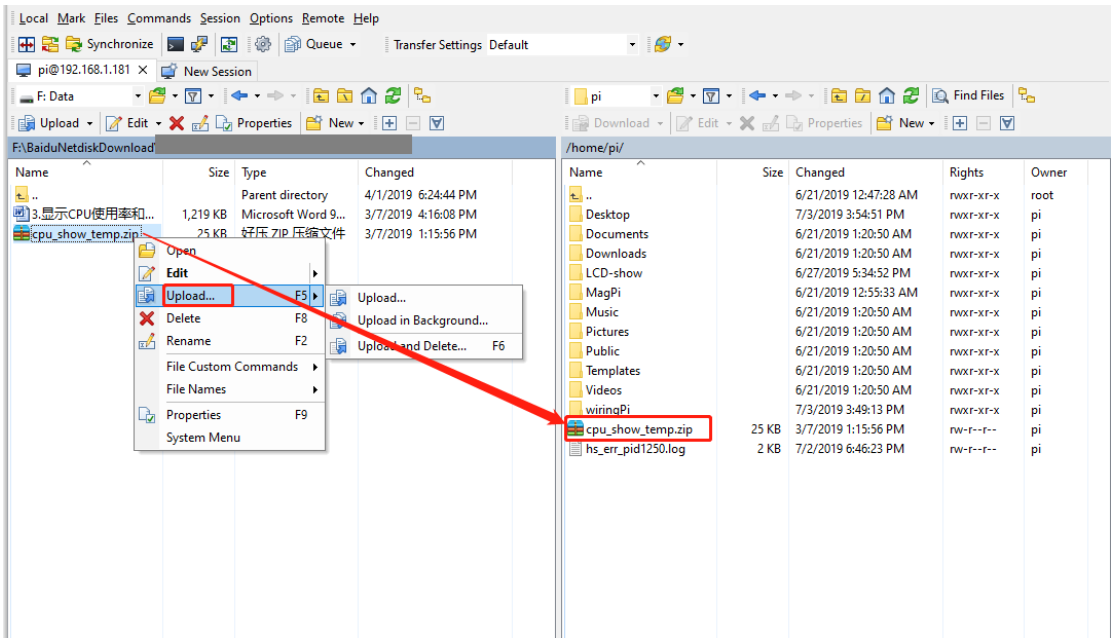
```
cd ~
git clone git://git.drogon.net/wiringPi
cd wiringPi
./build
```

2.Install Drive

2.1 Transfer the driver file to the Raspberry Pi

You need to install the WinSCP tool on your computer. After connecting to the Raspberry Pi, transfer the **cpu_show_temp.zip** package from this folder to the pi directory of the Raspberry Pi.

As shown blew, drag and drop **cpu_show_temp.zip** directly into the Raspberry Pi system.



2.2 Extract file

Open the Raspberry Pi terminal and find the **cpu_show_temp.zip** file.

Enter command:

ls

```
pi@raspberrypi:~ $ ls
cpu_show_temp.zip    Documents          Music          Templates
cpu_show_uptime.zip  Downloads          pcd8544        thinclient_drives
cpu_show_v3          LCD-show           Pictures       Videos
cpu_show_v3.zip      MagPi              Public
Desktop              matchbox-keyboard  python_games
pi@raspberrypi:~ $
```

Enter command:

unzip cpu_show_temp.zip

```
pi@raspberrypi:~ $ unzip cpu_show_temp.zip
Archive:  cpu_show_temp.zip
   creating: cpu_show_temp/
  inflating: cpu_show_temp/PCD8544.h
  inflating: cpu_show_temp/cpushow_temp
  inflating: cpu_show_temp/README.txt
   creating: cpu_show_temp/BL/
  inflating: cpu_show_temp/BL/bl
  inflating: cpu_show_temp/BL/test.c
  inflating: cpu_show_temp/pcd8544_rpi.c
  inflating: cpu_show_temp/PCD8544.c
   creating: cpu_show_temp/cputemp/
  inflating: cpu_show_temp/cputemp/cputemp.c
  inflating: cpu_show_temp/cputemp/temp
pi@raspberrypi:~ $
```

2.3 Enter the program folder

Enter command:

cd ~/cpu_show_temp

ls

```
pi@raspberrypi:~/cpu_show_temp $ ls
BL  cpushow_temp  cputemp  PCD8544.c  PCD8544.h  pcd8544_rpi.c  README.txt
pi@raspberrypi:~/cpu_show_temp $
```

2.4 Compiler file

Enter command:

cc -o cpushow_temp pcd8544_rpi.c PCD8544.c -L/usr/local/lib -lwiringPi

```
pi@raspberrypi:~/cpu_show_temp $ cc -o cpushow_temp pcd8544_rpi.c PCD8544.c  -L/
usr/local/lib -lwiringPi
pcd8544_rpi.c: In function 'main':
pcd8544_rpi.c:71:2: warning: implicit declaration of function 'getifaddrs' [-Wim
plicit-function-declaration]
  getifaddrs(&ifAddrStruct);
  ^~~~~~~~~~
pcd8544_rpi.c:131:6: warning: implicit declaration of function 'read' [-Wimplici
t-function-declaration]
  if (read(fd, buf, MAX_SIZE) < 0)
      ^~~~
pcd8544_rpi.c:145:2: warning: implicit declaration of function 'close' [-Wimplic
it-function-declaration]
  close(fd);
  ^~~~~
pi@raspberrypi:~/cpu_show_temp $
```

cc is the compile command, -o is the compile parameter, cpushow_temp is the generated program name, pcd8544_rpi.c and PCD8544.c are the source files in the current directory, -L/usr/local/lib and -lwiringPi are referenced libraries file.

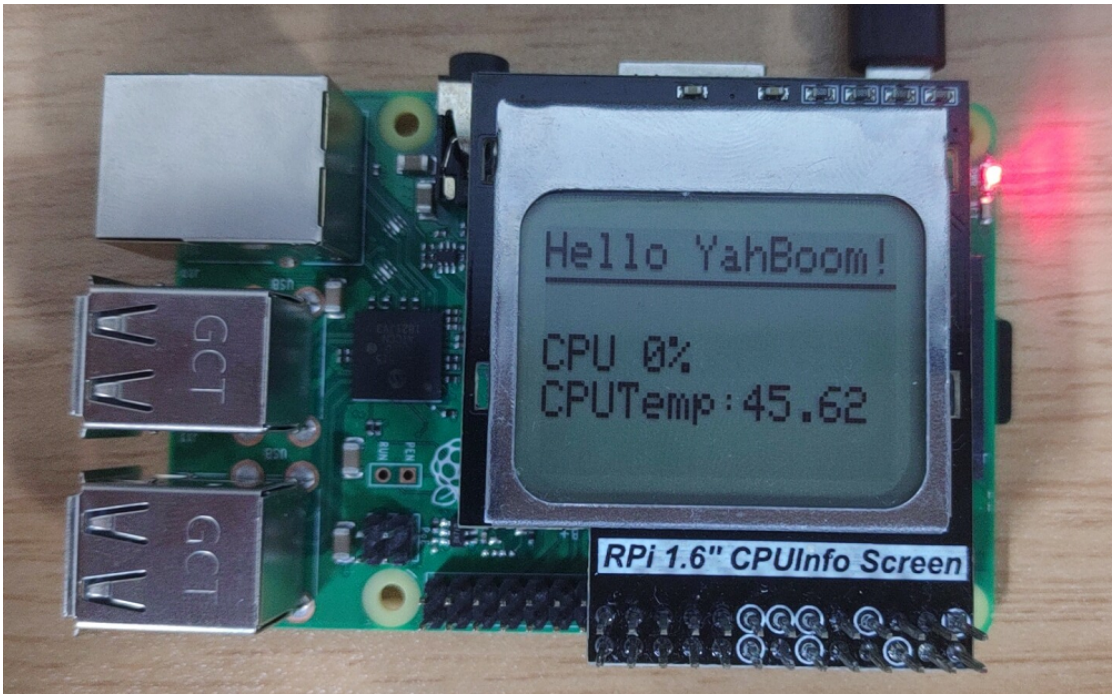
2.5 Running procedure

Enter command:

./cpushow_temp

```
pi@raspberrypi:~/cpu_show_temp $ ./cpushow_temp
Raspberry Pi PCD8544 sysinfo display
========================================

temp: 44.30
temp: 43.82
temp: 44.30
temp: 44.30
temp: 43.82
temp: 44.30
temp: 44.79
```

The system will print the current CPU temperature value and display the following on the CPU Info screen.



3. Code analysis

Enter command:

nano pcd8544_rpi.c

This command is to open pcd8544_rpi.c

1. The following sections are pin settings. The corresponding relationship of the GPIO ports has been indicated on the back of the LCD.

```
// pin setup
int _din = 1;
int _sclk = 0;
int _dc = 2;
int _rst = 4;
int _cs = 3;
```

2.Main function

```
int main (void)
{
        struct ifaddrs * ifAddrStruct=NULL;
        void * tmpAddrPtr=NULL;

        getifaddrs(&ifAddrStruct);


  // print infos
  printf("Raspberry Pi PCD8544 sysinfo display\n");
  printf("=====================================\n");

  // check wiringPi setup
  if (wiringPiSetup() == -1)
  {
        printf("wiringPi-Error\n");
    exit(1);
  }

  // init and clear lcd
  LCDInit(_sclk, _din, _dc, _cs, _rst, contrast);
  LCDclear();
```

3.The front part is the initialize program and the prompt information; the latter part is a for loop, which is display CPU usage.

```
for (;;)
{
        // clear lcd
        LCDclear();

        // get system usage / info
        struct sysinfo sys_info;
        if(sysinfo(&sys_info) != 0)
        {
              printf("sysinfo-Error\n");
        }

        // cpu info
        char cpuInfo[10];
        unsigned long avgCpuLoad = sys_info.loads[0] / 1000;
        sprintf(cpuInfo, "CPU %ld%%", avgCpuLoad);
```

Get information about the Raspberry Pi, prompt the user if an error occurs

Get the current usage of the Raspberry Pi CPU, set its format and store it in the cpuInfo array

sprintf (cpuInfo, "CPU %ld%%", avgCpuLoad) is a splicing function, replace the value of avgCpuLoad to the %ld position, and then save it to cpuInfo. If the value of avgCpuLoad is 2, the result of output cpuInfo is CPU 2%.

4.Get CPU temperature

```
char CPUTemp[15];
{
        int i;

        for(i=0;i<15;i++)
        {
                CPUTemp[i]=0;
        }
}


int fd;
double temp = 0;
char buf[MAX_SIZE];

fd = open(TEMP_PATH, O_RDONLY);
if (fd < 0)
{
        printf("failed to open thermal_zone0/temp\n");
}

// □□d□□□□
if (read(fd, buf, MAX_SIZE) < 0)
{
        printf("failed to read temp\n");
}

                                                ï□□□□□□□□□

temp = atoi(buf) / 1000.0;
printf("temp: %.2f\n", temp);


sprintf(CPUTemp,"CPUTemp:%.2f",temp);
```

Define an array of strings to hold temperature data

Get CPU temperature, and save it to CPUTemp array

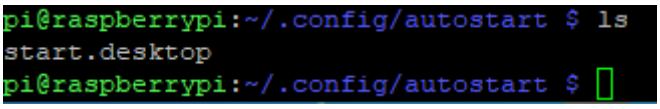
5.LCD display

```
// build screen

LCDdrawstring(0, 1, "Hello YahBoom!");
LCDdrawline(0, 10, 83, 10, BLACK);
LCDdrawstring(0, 21, cpuInfo);
LCDdrawstring(0, 30, CPUTemp);


LCDdisplay();

delay(1000);
```

LCDdrawstring(0, 1, "Hello YahBoom!") meaning is first row, second line display ‘Hello YahBoom!’. First parameter is 0,which meaning is starting from the first column on the left. Second parameter is 1, which meaning is starting

from the second column count from above. Third parameter is "hello YahBoom!", which meaning is data we need to display.

Note: If you have added a boot-up user, first move the xx.desktop file displayed on the 1.6-inch screen in the /home/pi/.config/autostart folder to the pi directory.
If you do not close a program that has already been run, the screen will always change due to conflicts after the program runs.
For example, there is a file driver.desktop that drives a 1.6-inch screen in the /home/pi/.config/autostart folder.



We need to move **start.desktop** to the pi directory:

Enter command:
mv /home/pi/.config/autostart/start.desktop /home/pi

Then we can enter command:

sudo reboot

This command is to restart the Raspberry Pi.