LCD1602 Display Experiment

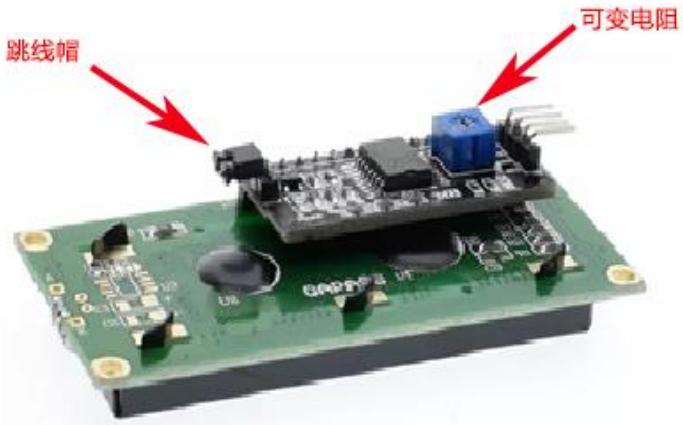
Introduction

LCD1602 is a character LCD module specially designed for displaying letters, Numbers and symbols. It is extensively used in industry, such as electronic clocks, temperature displays. The character LCD on the market is mostly according to the HD44780 character LCD chip, the control principle is exactly the same. "1602" means 2 lines and 16 characters per line. The LCD1602 display with the adapter board use the IIC interface, which saves a lot of I/O ports. The 1602Liquid Crystal Display (hereinafter referred to as the 1602 LCD) is a common character LIQUID Crystal Display, so named because it may be able to display 16*2 characters. Usually the 1602LCD we use is integrated with the word library chip, through the API provided by LiquidCrystal class, we may be able to easily use the 1602LCD to display English letters and some symbols. Before using the 1602 LCD, we need to connect it to Raspberry Pi.

In the kit, we may be able to make the use of LCD1602 easier by using IIC LCD1602 module to integrate the IIC I/O extension chip PCA8574. Raspberry Pi may be used to control LCD 1602 display via two-wire IIC bus (serial clock line SCL, serial data line SDA). It not only simplifies the circuit, but also saves I/O port, enabling Raspberry Pi to achieve more functions. The contrast of the LCD display may be able to also be adjusted via the potentiometer on the module. You may be able to also set the address: 0x20-0x27 by setting the jumper, which enables Raspberry Pi to control multiple LCD 1602.

A blue potentiometer may be seen on the back of the module. It may be rotated to adjust the contrast of the 1602 LCD. GND, VCC, SDA and SCL (DATA line and clock line of IIC communication for SDA and SCL respectively) are the physical diagram of LCD1602:

Note: If the LCD light is too dim, you may be able to adjust the blue variable resistor on the back of the LCD (note: connect the wire jumper on the back)



Experimental Principle

Connect the **Raspberry Pi** main control board with the serial **LCD1602** screen and use **I2C** communication to control the **LCD1602** display characters.

Experimental Purpose

The **LCD1602** display is controlled by the **Raspberry Pi** master board.

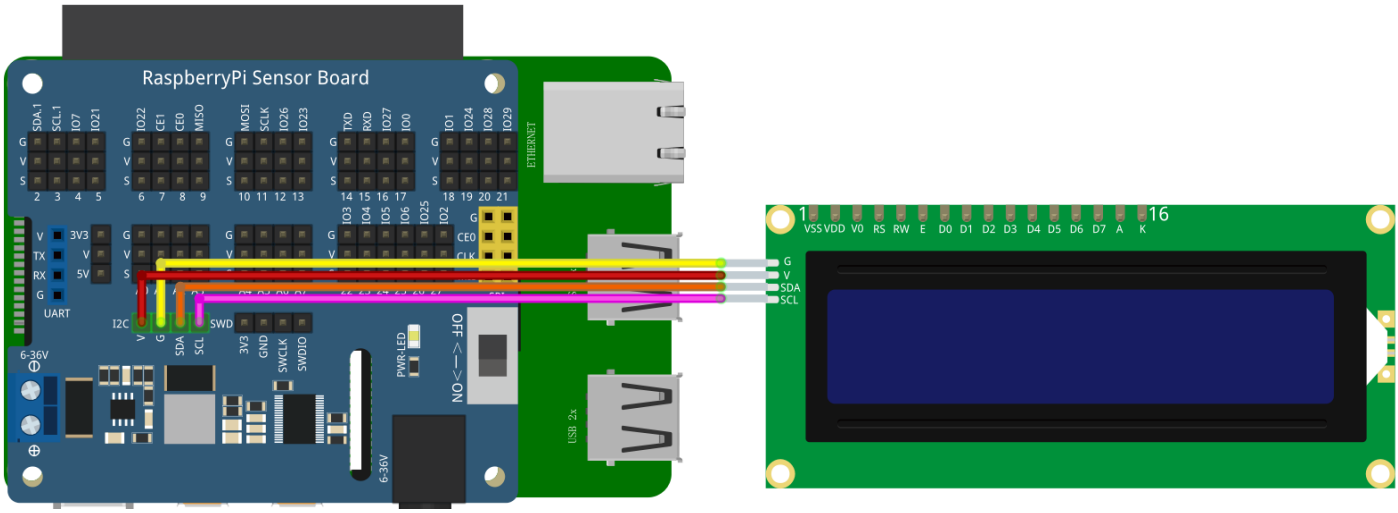
Component List

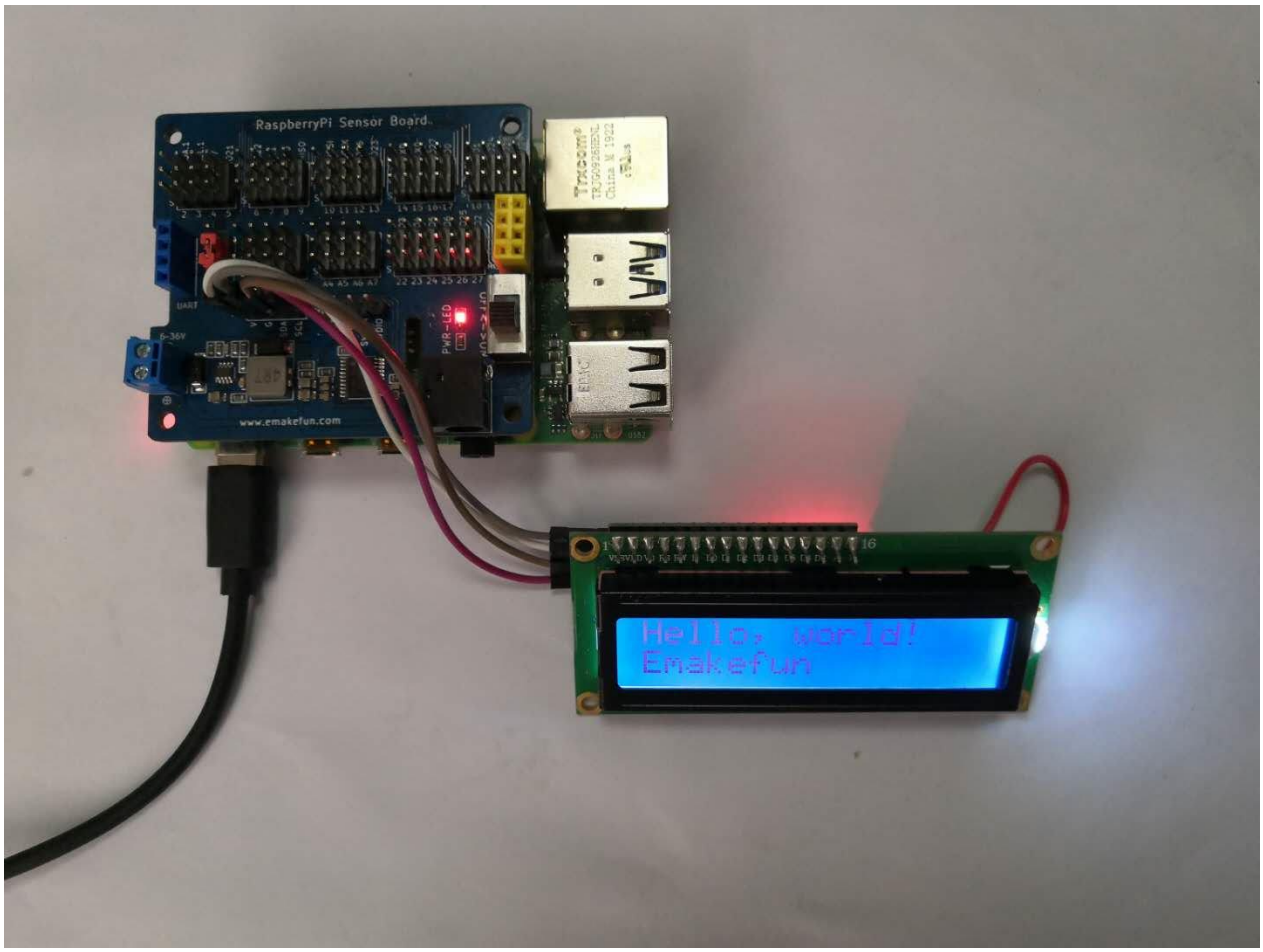
- Raspberry Pi main board
- Raspberry Pi expansion board
- Breadboard
- Cable
- LCD1602 display with adapter board
- Several jumper wires

Wiring

First of, we need to solder the adapter board on the LCD display screen.

LCD1602 Module	Raspberry Pi
GND	GND
VCC	VCC
SDA	SDA
SCL	SCL


RaspberryPi Sensor Board
ETHERNET
USB 2x
UART
I2C
SWD
PWR-LED
OFF <—> ON
6-36V
VSS VDD V0 RS RW E D0 D1 D2 D3 D4 D5 D6 D7 A K
G
V
SDA
SCL


RaspberryPi Sensor Board
www.emakefun.com
Hello, world!
Emakefun

C++ program

```
#include <stdio.h>
#include <wiringPi.h>
#include <wiringPiI2C.h>
#include <string.h>
#include <stdlib.h>
#include "LiquidCrystal_I2C.h"

int main()
{
    init();
    delay(100);
    wiringPiSetup();
    while(1)
    {
        write(0, 0,"Hello, world!");
        write(0, 1,"Emakefun");
    }
}
```

Python partial program

```
import time
import smbus
import logx
import logging
BUS = smbus.SMBus(1)
LCD_ADDR = 0x27
BLEN = 1 #turn on/off background light

def turn_light(key):
    global BLEN
    BLEN = key
    if key ==1 :
        BUS.write_byte(LCD_ADDR, 0x08)
        logging.info('LCD executed turn on BLight')
    else:
        BUS.write_byte(LCD_ADDR, 0x00)
        logging.info('LCD executed turn off BLight')

def write_word(addr, data):
```

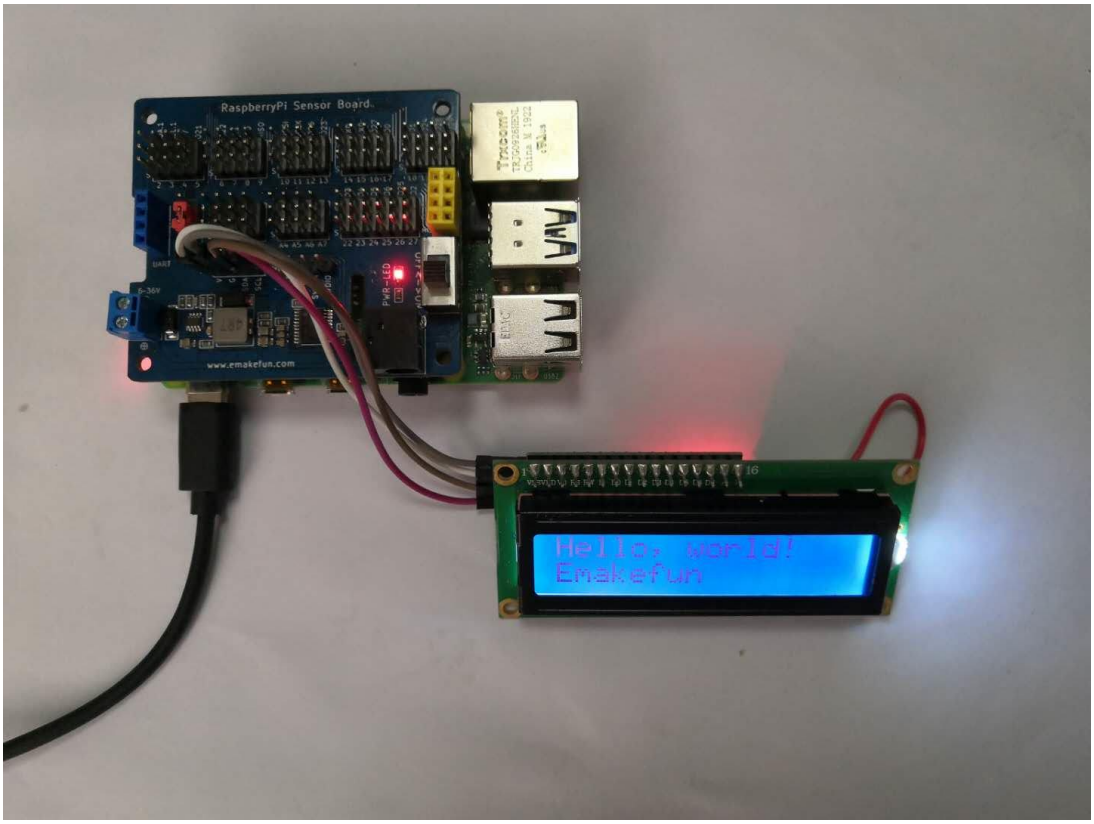
```
    global BLEN
    temp = data
    if BLEN == 1:
        temp |= 0x08
    else:
        temp &= 0xF7
    BUS.write_byte(addr, temp)

def send_command(comm):
    # Send bit7-4 firstly
    buf = comm & 0xF0
    buf |= 0x04             # RS = 0, RW = 0, EN = 1
    write_word(LCD_ADDR, buf)
    time.sleep(0.002)
    buf &= 0xFB             # Make EN = 0
    write_word(LCD_ADDR, buf)

    # Send bit3-0 secondly
    buf = (comm & 0x0F) << 4
    buf |= 0x04             # RS = 0, RW = 0, EN = 1
    write_word(LCD_ADDR, buf)
    time.sleep(0.002)
    buf &= 0xFB             # Make EN = 0
    write_word(LCD_ADDR, buf)

def send_data(data):
    # Send bit7-4 firstly
    buf = data & 0xF0
    buf |= 0x05             # RS = 1, RW = 0, EN = 1
    write_word(LCD_ADDR, buf)
    time.sleep(0.002)
    buf &= 0xFB             # Make EN = 0
    write_word(LCD_ADDR, buf)

    # Send bit3-0 secondly
    buf = (data & 0x0F) << 4
    buf |= 0x05             # RS = 1, RW = 0, EN = 1
    write_word(LCD_ADDR, buf)
    time.sleep(0.002)
    buf &= 0xFB             # Make EN = 0
    write_word(LCD_ADDR, buf)
```

```
def init_lcd():
    try:
        send_command(0x33) # Must initialize to 8-line mode at first
        time.sleep(0.005)
        send_command(0x32) # Then initialize to 4-line mode
        time.sleep(0.005)
        send_command(0x28) # 2 Lines & 5*7 dots
        time.sleep(0.005)
        send_command(0x0C) # Enable display without cursor
        time.sleep(0.005)
        send_command(0x01) # Clear Screen
        logging.info('LCD init over')
        BUS.write_byte(LCD_ADDR, 0x08)
        logging.info('LCD turning on BLight')
    except:
        return False
    else:
        return True

def clear_lcd():
    send_command(0x01) # Clear Screen

def print_lcd(x, y, str):
    if x < 0:
        x = 0
    if x > 15:
        x = 15
    if y <0:
        y = 0
    if y > 1:
        y = 1
    # Move cursor
    addr = 0x80 + 0x40 * y + x
    send_command(addr)

    for chr in str:
        send_data(ord(chr))

if __name__ == '__main__':
    init_lcd()
    print_lcd(0, 0, 'Hello, world!')
    print_lcd(0, 1, 'Emakefun')
```

Java program

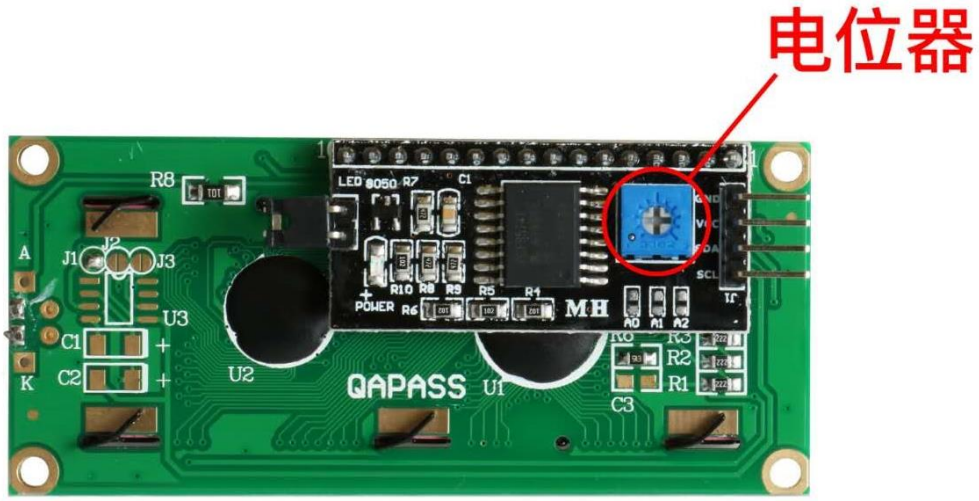
```
/*
 * To change this license header, choose License Headers in Project Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */

import com.pi4j.io.i2c.I2CBus;
import com.pi4j.io.i2c.I2CDevice;
import com.pi4j.io.i2c.I2CFactory;
/**
 *
 * @author user
 */
public class LCD1602 {

    /**
     * @param args the command line arguments
     */
    public static void main(String[] args) {
        I2CDevice _device = null;
        I2CLCD _lcd = null;

        try {
            I2CBus bus = I2CFactory.getInstance(I2CBus.BUS_1);
            _device = bus.getDevice(0x27);
            _lcd = new I2CLCD(_device);
            _lcd.init();
            _lcd.backlight(true);
            _lcd.display_string_pos("Hello, world!", 1, 2);
        } catch (Exception ex) {
            System.out.println(ex.toString());
        }
    }

}
```

Experimental Effect



LCD1602 shows common problems and solutions

1) If the backlight is on after uploading the program while the characters are not displayed, try to adjust the potentiometer behind the adapter board to adjust the brightness and display.



2) If the backlight lights up after uploading the program while only part of the characters are displayed, this is caused by the different versions of the chips used. Some chips are **PCF8574** chips, while others are **PCF8574AT** chips, so the interface address is different. The default address of **PCF8574** is **0x27**.