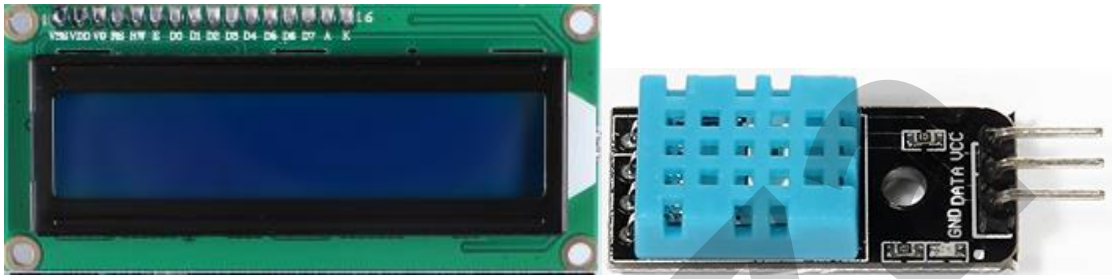
# Temperature and humidity monitoring experiment

## Overview




This is a more complex experiment, it can realize the monitoring of indoor temperature and humidity, and in the LCD above display value.

## Specification

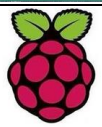
Please view LCD1602-datasheet.pdf、DHT11-datasheet.pdf and PCF8574.pdf.
Path: \Public_materials\Datasheet

## Pin definition

| RPI | | DHT11 |
|---|---|---|
| GND | -> | GND/'-' |
| GPIO4 | -> | DATA/'out' |
| 5V0 | -> | VCC/'+' |

| RPI | | LCD1602 |
|---|---|---|
| GND | -> | GND |
| 5V0 | -> | VCC |
| SDA1 | -> | SDA |
| SCL1 | -> | SCL |

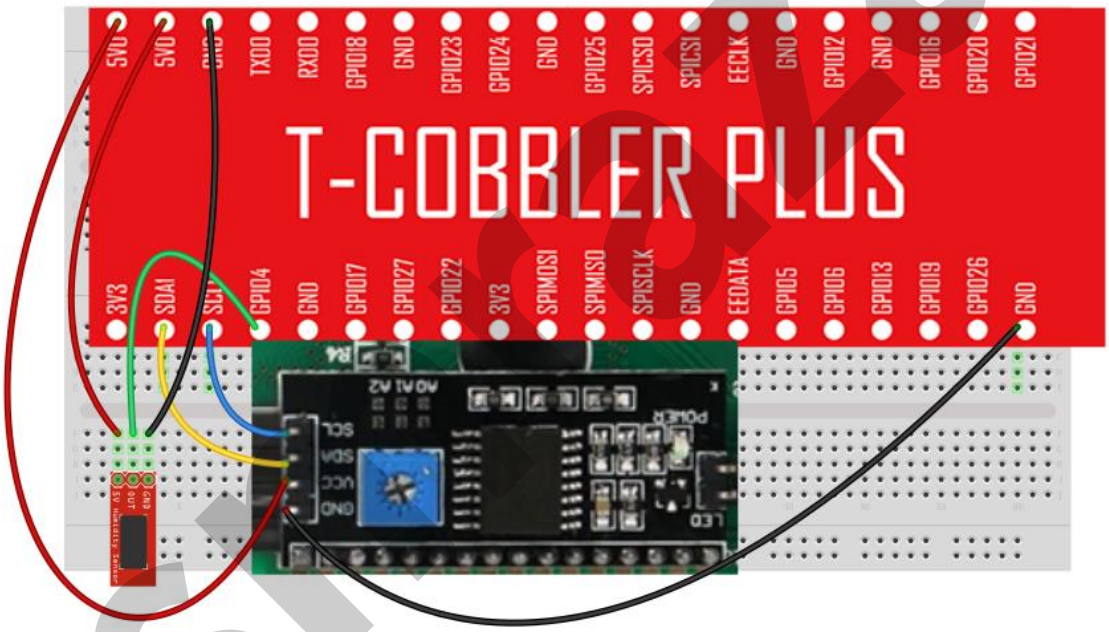
## Hardware required

| Material diagram | Material name | Number |
|---|---|---|
|  | DHT11 Module | 1 |
|  | LCD1602 with IIC | 1 |
|  | Raspberry Pi Board | 1 |

---Designed by Smraza Keen

| | | |
|---|---|---|
|  | T-Cobbler Plus | 1 |
|  | 40P GPIO Cable | 1 |
|  | Breadboard | 1 |
|  | Jumper wires | Several |

## Connection diagram




**Connection**

| | | |
|---|---|---|
| RPI | | DHT11 |
| GND | -> | GND/'-' |
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| | | |
|---|---|---|
| RPI | | LCD1602 |
| GND | -> | GND |
| 5V0 | -> | VCC |
| SDA1 | -> | SDA |
| SCL1 | -> | SCL |

## Sample code

**Note**: sample code under the **Sample code** folder.

---Designed by Smraza Keen

```
#include <wiringPi.h>
#include <pcf8574.h>
#include <lcd.h>
#include <stdio.h>
#include <stdlib.h>
#include <stdint.h>

#define MAXTIMINGS    85
#define DHTPIN          7

//PCF8574 Start I/O address
// PCF8754 64+8
#define AF_BASE 64
#define AF_RS (AF_BASE + 0)
#define AF_RW (AF_BASE + 1)
#define AF_E (AF_BASE + 2)
#define AF_LED (AF_BASE + 3)
#define AF_DB4 (AF_BASE + 4)
#define AF_DB5 (AF_BASE + 5)
#define AF_DB6 (AF_BASE + 6)
#define AF_DB7 (AF_BASE + 7)
// Global lcd handle:
static int lcdHandle;

int dht11_dat[5] = { 0, 0, 0, 0, 0 };

void read_dht11_dat();
int main(void)
{
int i;
wiringPiSetup();            //Initialise WiringPi
printf( "Welcome to Smraza\n");
printf( "Temperature and humidity monitoring experiment\n" );
printf( "Press Ctrl+C to exit\n" );
pcf8574Setup(AF_BASE,0x3F);
lcdHandle = lcdInit (2, 16, 4, AF_RS, AF_E, AF_DB4,AF_DB5,AF_DB6,AF_DB7, 0,0,0,0) ;
if (lcdHandle < 0)
{
fprintf (stderr, "lcdInit failed\n") ;
exit (EXIT_FAILURE) ;
}
for(i=0;i<8;i++)
pinMode(AF_BASE+i,OUTPUT);   //Will expand the IO port as the output mode
digitalWrite(AF_LED,1);        //Open back light
```

```
digitalWrite(AF_RW,0);                //Set the R/Wall to a low level, LCD for the write state
lcdClear(lcdHandle);            //Clear display
while ( 1 )
    {
        read_dht11_dat();
        delay(1000);
    }
}

void read_dht11_dat()
{
    uint8_t laststate     = HIGH;
    uint8_t counter         = 0;
    uint8_t j             = 0, i;

    dht11_dat[0] = dht11_dat[1] = dht11_dat[2] = dht11_dat[3] = dht11_dat[4] = 0;

    /* pull pin down for 18 milliseconds */
    pinMode( DHTPIN, OUTPUT );
    digitalWrite( DHTPIN, LOW );
    delay( 18 );
    /* then pull it up for 40 microseconds */
    digitalWrite( DHTPIN, HIGH );
    delayMicroseconds( 40 );
    /* prepare to read the pin */
    pinMode( DHTPIN, INPUT );

    /* detect change and read data */
    for ( i = 0; i < MAXTIMINGS; i++ )
    {
        counter = 0;
        while ( digitalRead( DHTPIN ) == laststate )
        {
            counter++;
            delayMicroseconds( 1 );
            if ( counter == 255 )
            {
                break;
            }
        }
        laststate = digitalRead( DHTPIN );

        if ( counter == 255 )
            break;
```

```
            /* ignore first 3 transitions */
            if ( (i >= 4) && (i % 2 == 0) )
            {
                /* shove each bit into the storage bytes */
                dht11_dat[j / 8] <<= 1;
                if ( counter > 16 )
                    dht11_dat[j / 8] |= 1;
                j++;
            }
        }
        /*
         * check we read 40 bits (8bit x 5 ) + verify checksum in the last byte
         * print it out if data is good
         */
        if ( (j >= 40) &&(dht11_dat[4] == ( (dht11_dat[0] + dht11_dat[1] + dht11_dat[2] +
dht11_dat[3]) & 0xFF) ) )
        {
            lcdPosition (lcdHandle, 0, 0);
            lcdPrintf(lcdHandle,"Hum=%d.%d%%",dht11_dat[0], dht11_dat[1]);
            lcdPosition (lcdHandle, 0, 1);
            lcdPrintf(lcdHandle,"Tem=%d.%d%%",dht11_dat[2], dht11_dat[3]);
            lcdPosition (lcdHandle, 10, 1);
            lcdPuts(lcdHandle, "Smraza");
        }
}
```

**Compiling:** gcc -Wall -o LCD1602_DHT11 LCD1602_DHT11.c -lwiringPi -lwiringPiDev

**Run:** sudo ./LCD1602_DHT11

**Tips:** Press “Ctrl+C” to exit

### Application effect

When you are running program, you will see the value of temperature and humidity on the LCD.