Calculator using RaspberryPi & LCD

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1 Objective

To make a simple calculator using Raspberry Pi where input is given through keyboard and display the whole operation on a 16x2 LCD display.

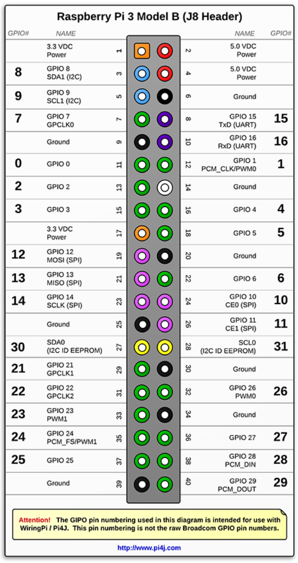
2 Components Required

1. Resistor-220Ohm
2. Raspberry Pi
3. 16x2 LCD display
4. Jumper wires

3 Introduction

3.1 Raspberry Pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard, mouse, power supply and a micro SD card with installed Linux Distribution. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.



Raspberry Pi 3 Model B (J8 Header)

GPIO#	NAME			NAME	GPIO#
	3.3 VDC Power	1	2	5.0 VDC Power	
8	GPIO 8 SDA1 (I2C)	3	4	5.0 VDC Power	
9	GPIO 9 SCL1 (I2C)	5	6	Ground	
7	GPIO 7 GPCLK0	7	8	GPIO 15 TxD (UART)	15
	Ground	9	10	GPIO 16 RxD (UART)	16
0	GPIO 0	11	12	GPIO 1 PCM_CLK/PWM0	1
2	GPIO 2	13	14	Ground	
3	GPIO 3	15	16	GPIO 4	4
	3.3 VDC Power	17	18	GPIO 5	5
12	GPIO 12 MOSI (SPI)	19	20	Ground	
13	GPIO 13 MISO (SPI)	21	22	GPIO 6	6
14	GPIO 14 SCLK (SPI)	23	24	GPIO 10 CE0 (SPI)	10
	Ground	25	26	GPIO 11 CE1 (SPI)	11
30	SDA0 (I2C ID EEPROM)	27	28	SCL0 (I2C ID EEPROM)	31
21	GPIO 21 GPCLK1	29	30	Ground	
22	GPIO 22 GPCLK2	31	32	GPIO 26 PWM0	26
23	GPIO 23 PWM1	33	34	Ground	
24	GPIO 24 PCM_FS/PWM1	35	36	GPIO 27	27
25	GPIO 25	37	38	GPIO 28 PCM_DIN	28
	Ground	39	40	GPIO 29 PCM_DOUT	29

Attention! The GIPO pin numbering used in this diagram is intended for use with WiringPi / Pi4J. This pin numbering is not the raw Broadcom GPIO pin numbers.

http://www.pi4j.com

Figure 1: RPi 3B pin diagram

3.2 16x2 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix.

4 Hardware Setup

4.1 LCD to Raspberry Pi connections

1. Connect the 5V pin i.e., pin 2 of the Raspberrry Pi to an extreme pin of the Breadboard. Let this pin be Vcc.
2. Connect the GND pin i.e., pin 6 of the Pi to the opposite extreme pin of the Breadboard.
3. Plug the LCD in Figure 1 to the bread-board.
4. Connect the 220Ω resistance from Vcc to pin 15 (Led+) of the LCD.
5. Connect the raspberry pi pins to the LCD display as shown in the table below.

LCD pins	Raspberry Pi pins
GND	Ground
Vcc	5V
Vss	Ground
RS	GPIO 25
R/W	Ground
EN	GPIO 24
DB4	GPIO 23
DB5	GPIO 22
DB6	GPIO 21
DB7	GPIO 14
LED+	5V
LED-	Ground

Table 1: Raspberry Pi to LCD connections

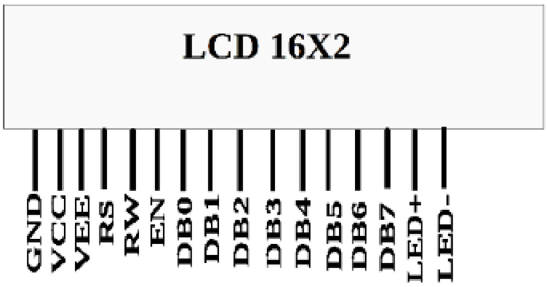


Figure 2: LCD pin out

5 Programming of Raspberry Pi

The code is written in C language by importing the wiring Pi library.
WiringPi is a PIN based GPIO access library written in C for the BCM2835, BCM2836 and BCM2837 SoC devices used in all Raspberry Pi.
Using the libraries lcd.h and wiringPi.h we can write the code for Pi.The code for the calculator is attached in the appendix H.

6 Specifications of Calculator

1. Any number of inputs can be given to the calculator with any operations between the operands.
2. The input can be a decimal number also and can be a n digit number.

3. If more than two inputs is given,it performs calculation of first two operands and the obtained result is used for next calculation with third operand and so on.
   For example if 2+3*4 is given it first adds 2+3=5 and this 5 is multiplied to 4 and the final result will be shown as 20.
4. The result of the given input calculation along with the calculation entered is displayed on the LCD display for 4s.After 4s we can enter new calculation.

7 Conclusions

A simple calculator with basic operations is made using a Raspberry Pi.GPIO pins of the Pi are used in making the hardware interface with the LCD.
Using C programming and wiring Pi,we can write code for the calculator by importing certain libraries.

H Appendix

The C code for calculator:

```
#include <stdio.h>
#include <wiringPi.h>
#include <lcd.h>

#define LCD_RS  25                //Register select pin
#define LCD_E   24                //Enable Pin
#define LCD_D4  23                //Data pin 4
#define LCD_D5  22                //Data pin 5
#define LCD_D6  21                //Data pin 6
#define LCD_D7  14                //Data pin 7
int main(){
        int i,count,op[100],j=0,k,sign[100],l,m=0,n=0;
        float h[100],res;
        char arr[100],num[100][100];
        int lcd;
    wiringPiSetup();
    lcd = lcdInit (2, 16, 4, LCD_RS, LCD_E, LCD_D4, LCD_D5, LCD_D6, LCD_D7, 0, 0
    while()
    {
    lcdPosition(lcd, 5, 0);
    lcdPuts(lcd, ”Simple”);
        lcdPosition(lcd, 3, 1);
        lcdPuts(lcd, ”Calculator”);
        printf(”Enter the Calculation\n”);
        for(i=0;i<100;i++)
        {
                scanf(”%c”,&arr[i]);
                if(arr[i]==’=’)
                {
                        count=i;
                    break;
                }
        }
        lcdClear(lcd);
        for(i=0;i<count;i++)
        {
                lcdPosition(lcd, i, 0);
                if(arr[i]==’+’||arr[i]==’−’||arr[i]==’∗’||arr[i]==’/’||arr[i]==’
                {
                        lcdPrint(lcd, ”%c”,arr[i]);
                }
                else
                {
                        lcdPrint(lcd,”%c”,arr[i]);
                }
        }

    for(i=0;i<count+1;i++)
        {
                if(arr[i]==’+’||arr[i]==’−’||arr[i]==’∗’||arr[i]==’/’||arr[i]==’
                {
                        op[j]=i;
                        sign[j]=arr[i];
                        j=j+1;
                }
        }
        for(n=0;n<j;n++)
        {
                if(n==0)
                {
                        for(k=0;k<op[n];k++)
                        {
                                num[n][k]=arr[k];
                        }
                }
                else
                {
                        for(k=0;k<op[n]−op[n−1]−1;k++)
                        {
                                num[n][k]=arr[op[n−1]+1+k];
                        }
                }

        }

        for(i=0;i<j;i++)
        {
                if(i==0)
                {
                        sscanf(num[i], ”%g”, &h[i]);
                }
                else
                {
                        sscanf(num[i], ”%g”, &h[i]);
                }
        }
        k=0;
        for(i=0;i<j-1;i++)
        {
                switch(sign[k])
                {
                case '+':
                        res=h[i]+h[i+1];
                        break;
                case '-':
                        res=h[i]-h[i+1];
                        break;
                case '*':
                        res=h[i]*h[i+1];
                        break;
                case '/':
                        res=h[i]/h[i+1];
                        break;
                }
                h[i+1]=res;
                k=k+1;
        }
        printf("result=%g\n",res);
        lcdPosition(lcd, 0, 1);
    lcdPrint(lcd, "Result:%0.6g",result);
    sleep(4);
        lcdClear(lcd);


        }
        return 0;
}
```