Calculator using Arduino,LCD & Push Buttons

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1 Objective

To make a simple calculator using Arduino where input is given through 4x4 keypad made of push buttons and display the whole operation on a 16x2 LCD display.

2 Components Required

1. Resistor-220Ohm
2. Arduino Uno board
3. 16x2 LCD display
4. 16 Push buttons
5. Jumper wires

3 Introduction

3.1 Arduino UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.

3.2 4x4 Keypad

A keypad is a set of buttons arranged in a block or pad which bear digits, symbols or alphabetical letters.The 4*4 matrix keypad usually is used as input in a project. It has 16 keys in total, which means the same input values.

3.3 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.

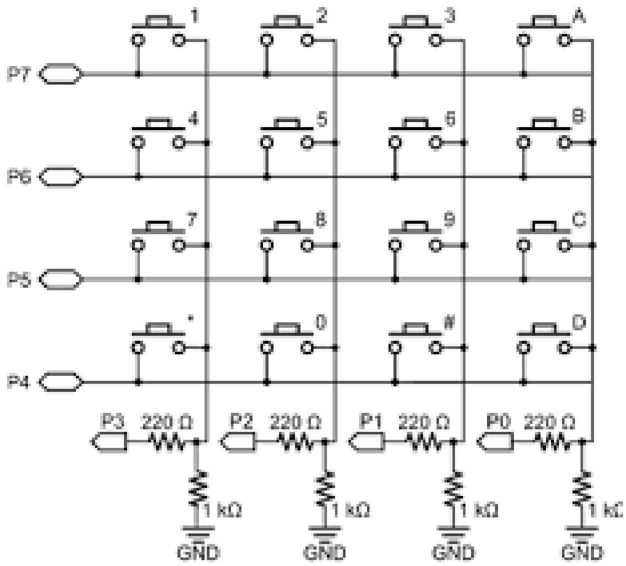


Figure 1: 4x4 keypad matrix using push buttons

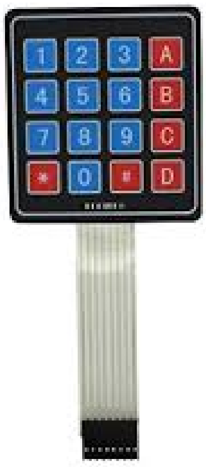


Figure 2: 4x4 Keypad

4 Hardware Setup

4.1 Push buttons to Arduino connections

1. Connect the 16 push buttons on the bread board in a 4x4 matrix type and assume a value for each push button.

2. Using connecting wires/jumpers connect the 16 push buttons as shown in the Figure 1.

3. Connect the column wires to D0,D1,D6,D7 pins of aurdino and the row wires to D8,D9,D10,D13 of the arduino.

4. Note:In this calculator the push buttons are given following values/characters:

’0’ ’1’ ’2’ ’3’

’4’ ’5’ ’6’ ’7’

’8’ ’9’ ’=’ ’.’

’+’ ’-’ ’*’ ’/’

4.2 LCD to Arduino connections

1. Connect the 5V pin of the Arduino to an extreme pin of the Breadboard shown in Fig. 1. Let this pin be Vcc.

2. Connect the GND pin of the Arduino to the opposite extreme pin of the Breadboard.

3. Connect the arduino to the computer so that it is powered.

4. Plug the LCD in Figure 3 to the bread-board.

5. Connect the 220Ω resistance from Vcc to pin 15 (Led+) of the LCD.

6. Connect the Arduino pins to LCD pins as per Figure 4.

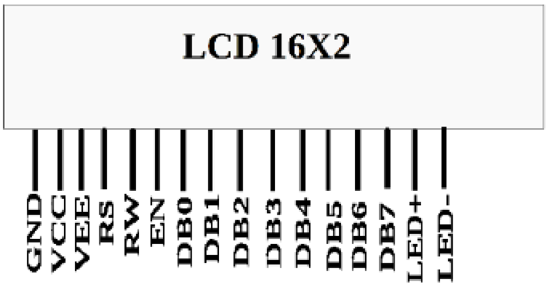
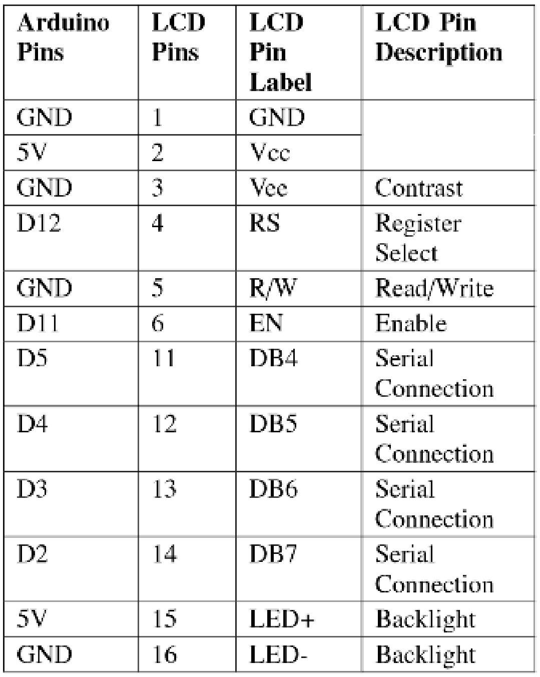


Figure 3: LCD pin out



Arduino Pins	LCD Pins	LCD Pin Label	LCD Pin Description
GND	1	GND	
5V	2	Vcc	
GND	3	Vcc	Contrast
D12	4	RS	Register Select
GND	5	R/W	Read/Write
D11	6	EN	Enable
D5	11	DB4	Serial Connection
D4	12	DB5	Serial Connection
D3	13	DB6	Serial Connection
D2	14	DB7	Serial Connection
5V	15	LED+	Backlight
GND	16	LED-	Backlight

Figure 4: Arduino to LCD Pin Connection

5 Programming of Arduino

Using the arduino IDE write the code for the calculator.The code for the calculator is attached in the appendix H.
The necessary libraries such as Keypad.h and LiquidCrystal.h have to be added to the libraries of the arduino.

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 an arduino and push buttons.All 14 digital pins of arduino are used for this purpose.
Using C programming we can write code for the calculator by importing certain libraries.

H Appendix

The arduino code for calculator:

```
#include <Keypad.h>
#include <LiquidCrystal.h>
#include <stdlib.h>

LiquidCrystal lcd(0,1,5,4,3,2);
float result(char [],int );

int i=0,count=0;
char arr[20],data,key,sign[10];
float ans;
const byte ROWS = 4; /* four rows */
const byte COLS = 4; /* four columns */
/* define the symbols on the buttons of the keypads */
char hexaKeys[ROWS][COLS] = {
  {’0’,’1’,’2’,’3’},
  {’4’,’5’,’6’,’7’},
  {’8’,’9’,’=’,’.’},
  {’+’,’-’,’*’,’/’}
};
byte rowPins[ROWS] = {10, 11, 12, 13}; /* connect to the row pinouts of the keyp
byte colPins[COLS] = {6, 7, 8, 9}; /* connect to the column pinouts of the keypa

Keypad customKeypad = Keypad( makeKeymap(hexaKeys), rowPins, colPins, ROWS, COLS

void setup(){
  lcd.begin (16,2) ;
  lcd.setCursor (5,0) ;
  lcd.print (”Simple”) ;
  lcd.setCursor (3,1) ;
  lcd.print (”Calculator”) ;
  delay(1000);
  lcd.clear();
}

void loop(){

char key = customKeypad.getKey();

  if (key != NO_KEY && (key==’1’||key==’2’||key==’3’||key==’4’||key==’5’||key==
  {
    arr[i]=key;
    lcd.setCursor (i,0);
    lcd.print(arr[i]);
    i=i+1;
  }
  if(key==’=’){
    arr[i]=’=’;
    lcd.setCursor (i,0);
    lcd.print(arr[i]);
    ans=result(arr,i+1);
    lcd.setCursor (0,1);
    lcd.print("Result:");
    lcd.print(ans);
    delay(2000);
    i=0;
    lcd.clear();
  }

}


float result(char a[],int len)
{
int i,count,op[10],j=0,k=0,n=0;
float res,h[10];
char num[10][10],sign[10],nw[100],an[100];
count=len;
for(i=0;i<count;i++)
{
  lcd.setCursor (i,0);
   lcd.print(arr[i]);
}
for(i=0;i<count+1;i++)
{
  if(a[i]=='+'||a[i]=='-'||a[i]=='*'||a[i]=='/'||a[i]=='=')
  {
    op[j]=i;
    sign[j]=a[i];
    j=j+1;
  }
}
for(n=0;n<j;n++)
{
  if(n==0)
  {
    for(k=0;k<op[n];k++)
    {
    nw[k]=a[k];
    nw[k+1]='\0';
      h[n]=atof(nw);
    }
  }
  else
  {
    for(k=0;k<op[n]-op[n-1]-1;k++)
    {
    nw[k]=a[op[n-1]+1+k];
    nw[k+1]='\0';
      h[n]=atof(nw);
    }
  }}

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;
  }
return res;
}
```