

MICROPROCESSOR BASED SYSTEM DESIGN LAB

LAB 5



Spring 2021

CSE307L MBSD Lab

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“On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work.”

Student Signature: _____

Submitted to:

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Thursday, July 8, 2021

Department of Computer Systems Engineering
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Task:

Interface Calculator Keypad with 8051 Microcontroller and perform basic operations of addition, subtraction and multiplication.

Code:

```
#include <reg51.h>
#include <stdio.h>

//Function declarations
void cct_init(void);
void delay(int);
void lcdinit(void);
void writecmd(int);
void writedata(char);
void Return(void);
char READ_SWITCHES(void);
char get_key(void);

//*****
//Pin description
/*
P2 is data bus
P3.7 is RS
P3.6 is E
P1.0 to P1.3 are keypad row outputs
P1.4 to P1.6 are keypad column inputs
*/
//*****
// Define Pins
//*****
sbit RowA = P1^0; //RowA
sbit RowB = P1^1; //RowB
sbit RowC = P1^2; //RowC
sbit RowD = P1^3; //RowD

sbit C1 = P1^4; //Column1
sbit C2 = P1^5; //Column2
sbit C3 = P1^6; //Column3
sbit C4 = P1^7; //Column4

sbit E = P3^6; //E pin for LCD
sbit RS = P3^7; //RS pin for LCD

unsigned int key_count = 0, result_int;
```

```

char array[3], result_char;
// *****
// Main program
//
int main(void)
{
    char key;          // key char for keeping record of pressed key

    cct_init();        // Make input and output pins as required
    lcdinit();         // Initilize LCD

    writecmd(0x95);
        writedata('T');          //write
        writedata('i');          //write
        writedata('m');          //write
        writedata('e');          //write
        writedata(' ');          //write
        writedata('2');          //write
        writedata('3');          //write
        writedata(':');          //write
        writedata('5');
        writedata('9');
        writedata(':');
        writedata('2');
        writedata('7');
    writecmd(0xd5);
        writedata('D');          //write
        writedata('a');          //write
        writedata('t');          //write
        writedata('e');          //write
        writedata(' ');          //write
        writedata('3');          //write
        writedata('1');          //write
        writedata('/');          //write
        writedata('1');
        writedata('2');
        writedata('/');
        writedata('2');
        writedata('0');
        writedata('2');
    writedata('1');              //write

    writecmd(0x80);
    while(1)
    {
        key = get_key();        // Get pressed key

```

```

    if (key == 'C')
    {
        writcmd(0x01);    // Clear screen
        array[0]= array[1]= array[2]='n';
        result_int = 0; key_count = 0;
    }
    else if(key == '=')
    {
        writedata(key);    // Echo the key pressed to LCD
        if(array[1] == 'x')
            result_int = (array[0] - '0') * (array[2] - '0');
        else if(array[1] == '/')
            result_int = (array[0] - '0') / (array[2] - '0');
        else if(array[1] == '+')
            result_int = (array[0] - '0') + (array[2] - '0');
        else if(array[1] == '-')
            result_int = (array[0] - '0') - (array[2] - '0');
        if(result_int > 9)    //if the result is greater than 9 then we need to store
each digit in an array
        {
            int result[2];    //Delare an array
            result[0] = result_int/10; //Store the digit at ten's place at index 0
            result[1] = result_int%10; //Store the digit at unit's place at index 1
            result_char = (char)result[0] + '0';//Convert the integer at index 0 to
character

            writedata(result_char );    // Echo the key pressed to LCD
            result_char = (char)result[1] + '0';//Convert the integer at index 1 to
character

            writedata(result_char );    // Echo the key pressed to LCD
        }
        else
        {
            result_char = (char)result_int + '0';
            writedata(result_char );    // Echo the key pressed to LCD
        }
    }
    else
        writedata(key);    // Echo the key pressed to LCD
}
}

void cct_init(void)
{
    P0 = 0x00; //not used
    P1 = 0xf0; //used for generating outputs and taking inputs from Keypad

```

```

        P2 = 0x00; //used as data port for LCD
        P3 = 0x00; //used for RS and E
    }

void delay(int a)
{
    int i;
    for(i=0;i<a;i++); //null statement
}

void writedata(char t)
{
    RS = 1;          // This is data
    P2 = t;          //Data transfer
    E = 1;           // => E = 1
    delay(150);
    E = 0;           // => E = 0
    delay(150);
}

void writecmd(int z)
{
    RS = 0;          // This is command
    P2 = z;          //Data transfer
    E = 1;           // => E = 1
    delay(150);
    E = 0;           // => E = 0
    delay(150);
}

void lcdinit(void)
{
    //////////// Reset process from datasheet ////////////
    delay(15000);
    writecmd(0x30);
    delay(4500);
    writecmd(0x30);
    delay(300);
    writecmd(0x30);
    delay(650);
    //////////////////////////////////////
    writecmd(0x38); //function set
    writecmd(0x0c); //display on,cursor off,blink off
    writecmd(0x01); //clear display
    writecmd(0x06); //entry mode, set increment

```

```

}

void Return(void) //Return to 0 location on LCD
{
    writecmd(0x02);
    delay(1500);
}

char READ_SWITCHES(void)
{
    RowA = 0; RowB = 1; RowC = 1; RowD = 1; //Test Row A

    if (C1 == 0) { delay(10000); while (C1==0); return '7'; }
    if (C2 == 0){ delay(10000); while (C2==0); return '8'; }
    if (C3 == 0) { delay(10000); while (C3==0); return '9'; }
    if (C4 == 0) { delay(10000); while (C4==0); return '/'; }

    RowA = 1; RowB = 0; RowC = 1; RowD = 1; //Test Row B

    if (C1 == 0) { delay(10000); while (C1==0); return '4'; }
    if (C2 == 0) { delay(10000); while (C2==0); return '5'; }
    if (C3 == 0) { delay(10000); while (C3==0); return '6'; }
    if (C4 == 0) { delay(10000); while (C4==0); return 'x'; }

    RowA = 1; RowB = 1; RowC = 0; RowD = 1; //Test Row C

    if (C1 == 0) { delay(10000); while (C1==0); return '1'; }
    if (C2 == 0) { delay(10000); while (C2==0); return '2'; }
    if (C3 == 0) { delay(10000); while (C3==0); return '3'; }
    if (C4 == 0) { delay(10000); while (C4==0); return '-'; }

    RowA = 1; RowB = 1; RowC = 1; RowD = 0; //Test Row D

    if (C1 == 0) { delay(10000); while (C1==0); return 'C'; }
    if (C2 == 0) { delay(10000); while (C2==0); return 'O'; }
    if (C3 == 0) { delay(10000); while (C3==0); return '='; }
    if (C4 == 0) { delay(10000); while (C4==0); return '+'; }
    return 'n'; // Means no key has been pressed
}

char get_key(void) //get key from user
{
    char key = 'n'; //assume no key pressed

    while(key=='n') //wait untill a key is pressed
        key = READ_SWITCHES(); //scan the keys again and again
}

```

```

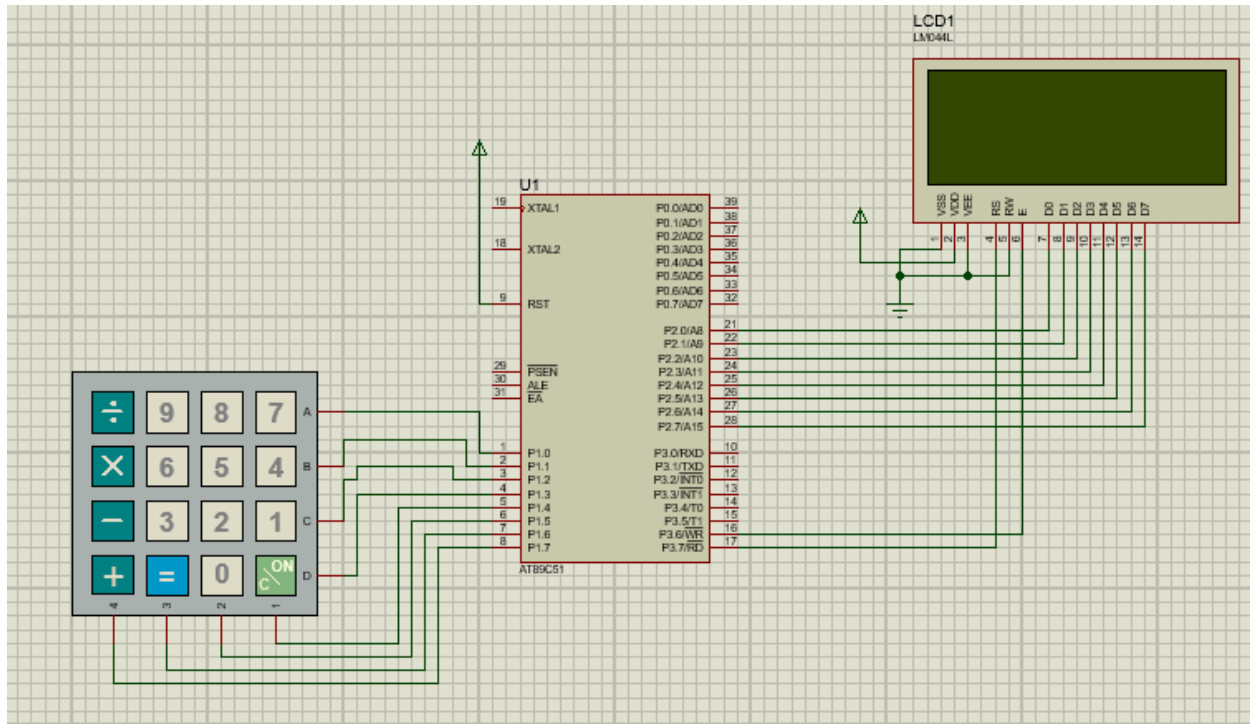
array[key_count++]= key;

return key;           //when key pressed then return its value
}

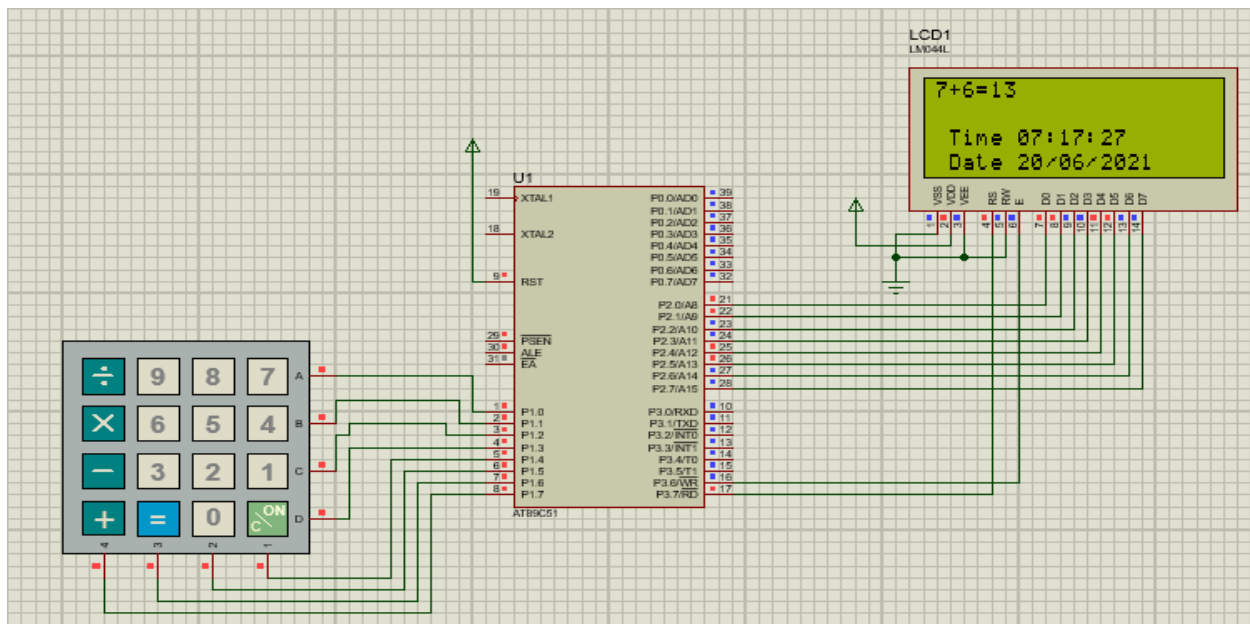
```

Output / Graphs / Plots / Results:

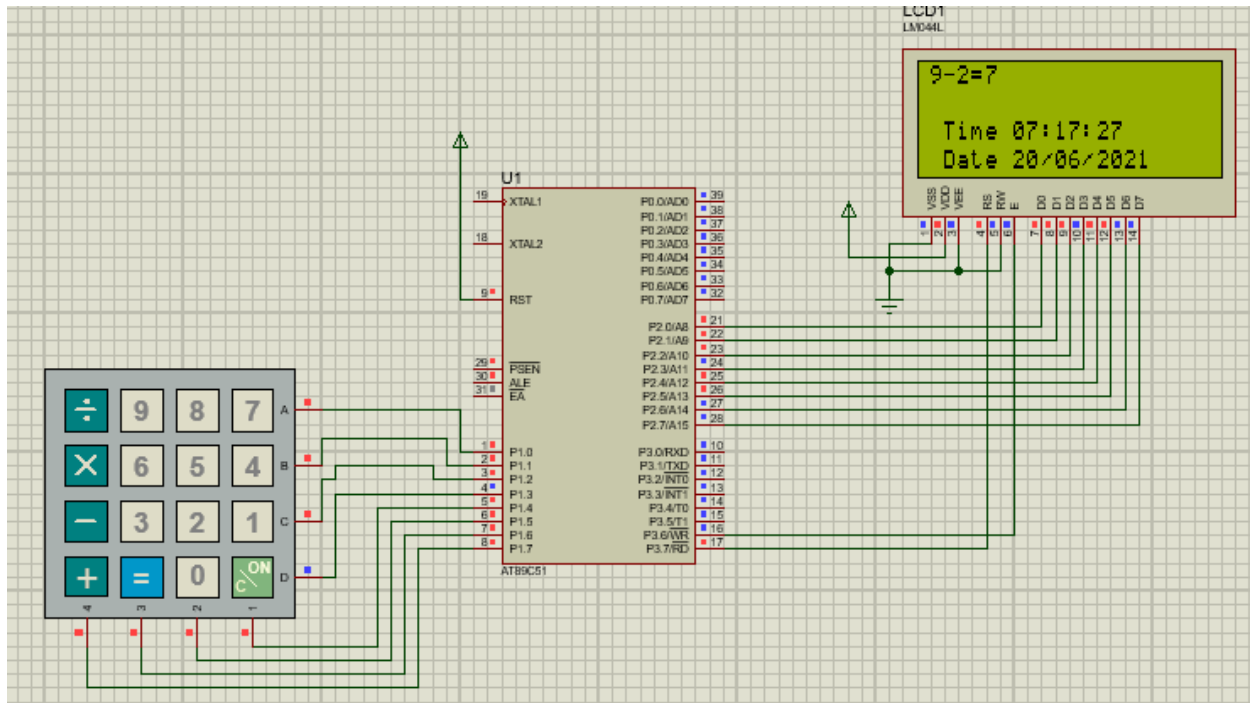
Schematic:



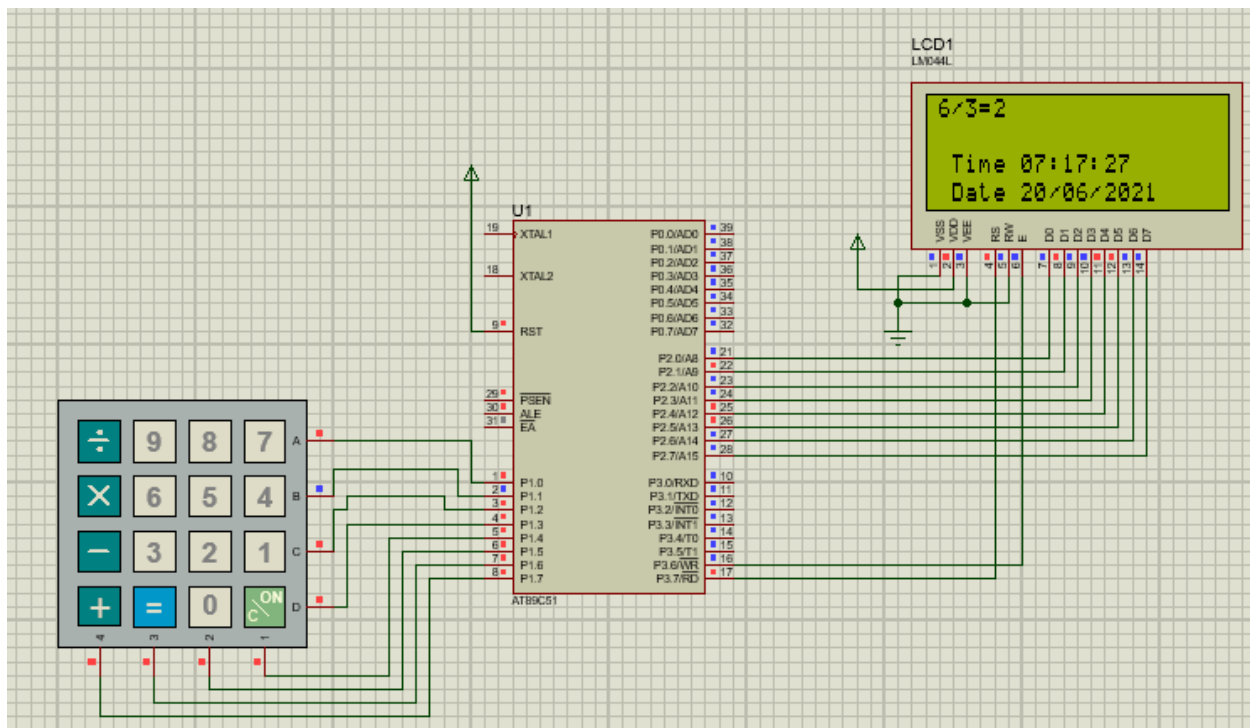
Addition:



Subtraction:



Division:



Multiplication:

