

Lab Manual for Embedded System Design

Lab No. 4

Keypad Interfacing and Applications

Objectives

In this lab students are introduced to the interfacing of Arduino with Keypad. Some application circuits like keypad security lock and calculator has also been worked out using this Hardware Device.

LAB # 4

Keypad Interfacing and Applications

Introduction

Matrix Keypad:

A keypad is a set of buttons arranged in a block or "pad" which usually bear digits, symbols and usually a complete set of alphabetical letters. If it mostly contains numbers then it can also be called a numeric keypad. Keypads are found on many alphanumeric keyboards and on other devices such as calculators, push-button telephones, combination locks, and digital door locks, which require mainly numeric input. A computer keyboard usually has a small numeric keypad on the side, in addition to the other number keys on the top, but with a calculator-style arrangement of buttons that allow more efficient entry of numerical data. This number pad (commonly abbreviated to "numpad") is usually positioned on the right side of the keyboard because most people are right-handed. As a general rule, the keys on calculator-style keypads are arranged such that 123 is on the bottom row, whereas in a telephone keypad, there will be the 123-keys at the top. A phone key-pad also has the special buttons labelled * (star) and # (octothorpe, number sign, "pound", "hex" or "hash") on either side of the zero key as shown in Fig. 1. Most of the keys on a telephone also bear letters which have had several auxiliary uses, such as remembering area codes or whole telephone numbers. The pin configuration is as shown below.



Fig. 4.1: Matrix Keypad

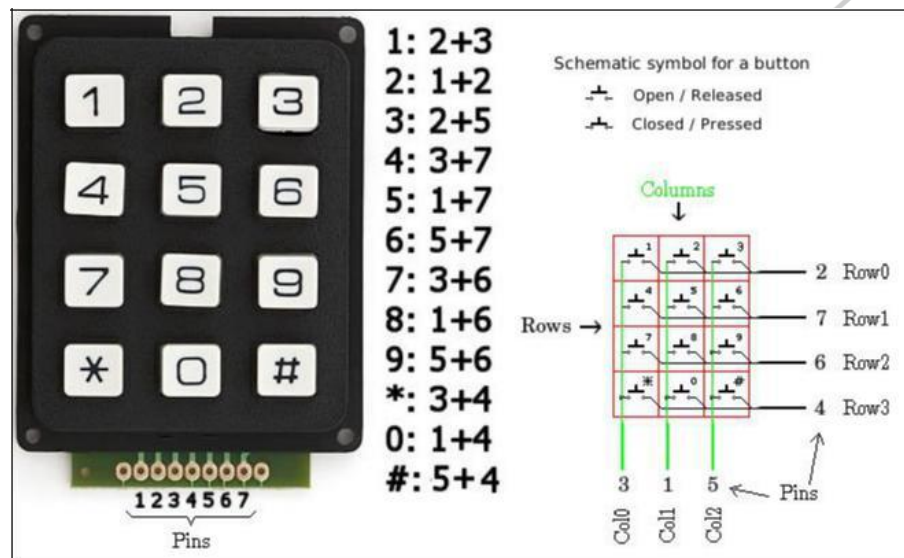


Fig. 4.2: 3 x 4 Matrix Keypad Pinout

Time Boxing

Activity Name	Activity Time	Total Time
Login Systems + Setting up Proteus & Arduino Environment	3 mints + 5 mints	8 mints
Walk through Theory & Tasks	60 mints	60 mints
Implement Tasks	80 mints	80 mints
Evaluation Time	30 mints	30 mints
Total Duration		178 mints

Objectives

The aim of this lab is to minimize the circuit using Map Method or K-Map

Lab Tasks/Practical Work

1. Write a sketch to interface Arduino with a 3 x 4 Matrix Keypad. The display of the pressed key should be displayed on the LCD.

Connections:

Matrix Keypad

// C1, C2 and C3 to Arduino Pin # 8, 7, 6.

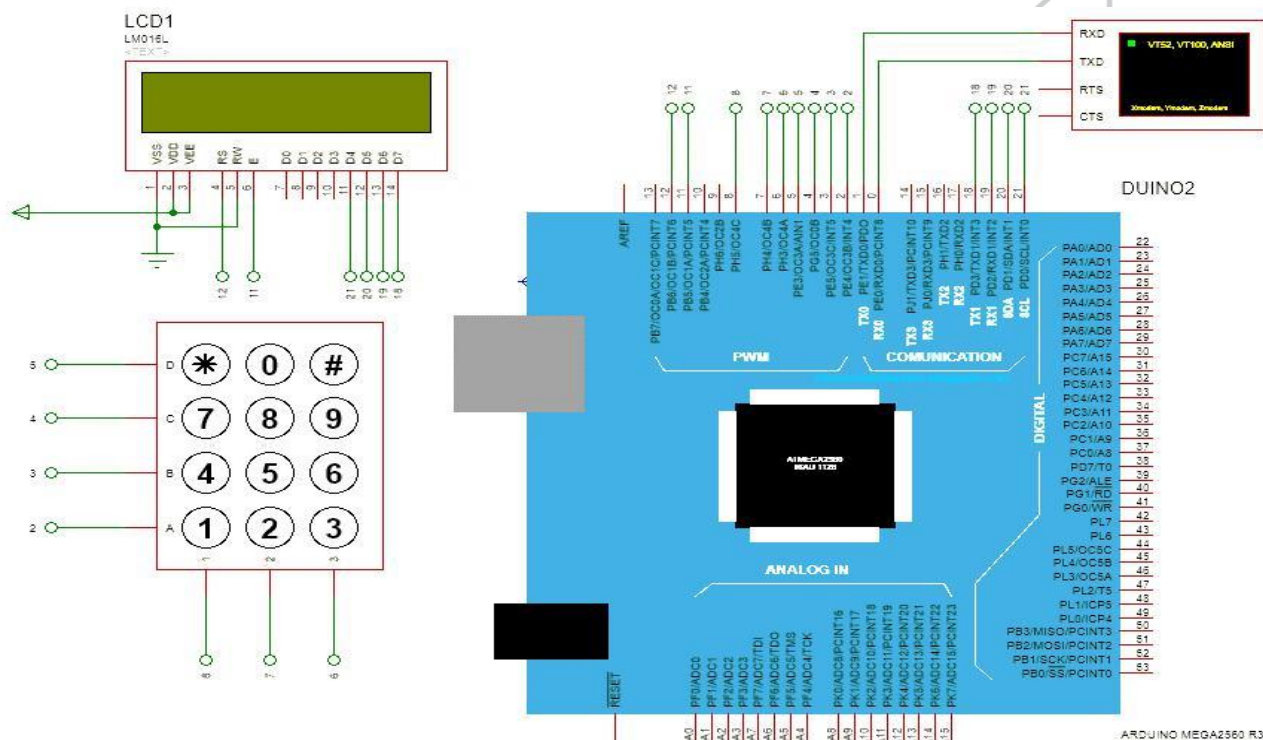
// R1, R2, R3 and R4 to Arduino Pin # 2, 3, 4, 5.

LCD Display

// Data Pins D4, D5, D6 and D7 to Arduino Pin # 21, 20, 19 & 18.

// Enable Pin to Arduino Pin # 11 and RS Pin to Arduino Pin # 12.

// VSS, RW to Ground and VDD and VEE to Power.



Code:

```

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

LiquidCrystal lcd(12, 11, 21, 20, 19, 18);

const byte ROWS = 4;           // Four Rows of Keypad.
const byte COLS = 3;           // Three Columns of Keypad
char keys[ROWS][COLS] =
{
    {'1','2','3'},
    {'4','5','6'},
    {'7','8','9'},
    {'*','0','#'}
};

byte rowPins[ROWS] = {2,3,4,5}; // Connect to the Row Pinouts of the Keypad.
byte colPins[COLS] = {8, 7, 6};  // Connect to the Column pinouts of the Keypad

Keypad keypad = Keypad(
makeKeymap(keys), rowPins,
colPins, ROWS, COLS );

void setup()
{
    Serial.begin(9600);
    lcd.begin(16, 2);
}

void loop()
{
    char key =
    keypad.getKey();

    if (key)
    {
        Serial.println(key);
        lcd.print(key);
    }
}

```



- Write a sketch that works as security keypad lock. Set any password. If the input password matches with the set password, Green LED should glow, otherwise Red LED will glow.

Connections

Matrix Keypad

- C₁, C₂ and C₃ to Arduino Pin # 3, 1, 5.
- R₁, R₂, R₃ and R₄ to Arduino Pin # 2, 7, 6, 4.

LED Connections

- Green LED to Arduino Pin # 9 and
- Red LED to Arduino Pin # 12.

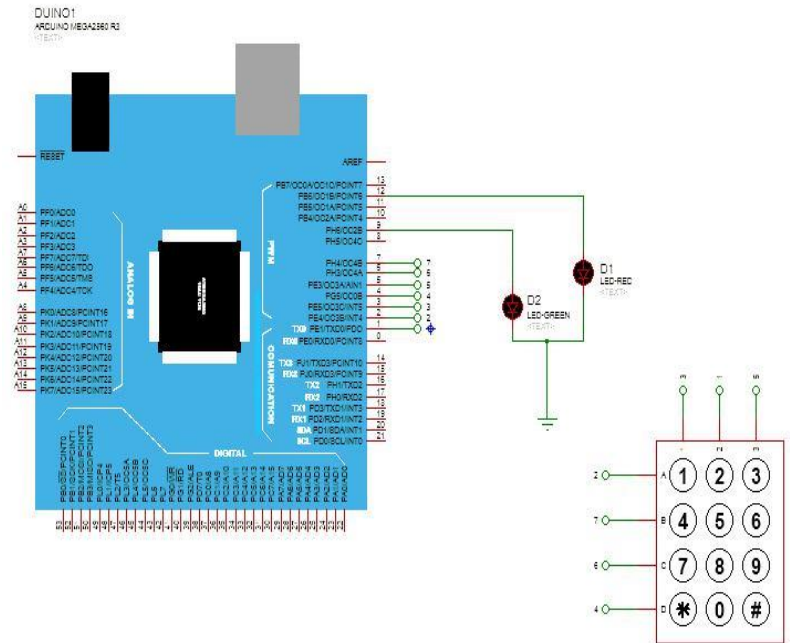


Fig. 4.4

Code:

```
#include <Keypad.h>
char* secretCode = "1234";
int position = 0;
const byte rows = 4;
const byte cols = 3;
char keys[rows][cols] =
{
    {'1','2','3'},
    {'4','5','6'},
    {'7','8','9'},
    {'*','0','#'}
};
byte rowPins[rows] = {2, 7, 6, 4};
byte colPins[cols] = {3, 1, 5};
Keypad keypad = Keypad(makeKeymap(keys), rowPins, colPins, rows, cols);
int redPin = 12;
int greenPin = 9;
void setup()
{
    pinMode(redPin, OUTPUT);
    pinMode(greenPin, OUTPUT);
    setLocked(true);
}
void loop()
{
    char key = keypad.getKey();
```

```

if (key == '*' || key == '#')           // Reset Buttons.
{
    position = 0;
    setLocked(true);
}
if (key == secretCode[position])
{
    position ++;
}
if (position == 4)
{
    setLocked(false);
}
delay(100);
}
void setLocked(int locked)
{
    if (locked)
    {
        digitalWrite(redPin, HIGH);
        digitalWrite(greenPin, LOW);
    }
    else
    {
        digitalWrite(redPin, LOW);
        digitalWrite(greenPin, HIGH);
    }
}
}

```

3. Write a sketch to control the LEDs based on their Labelled Number. (Take input from Keypad and there are 10 LED's in all labelled from 0 to 9)

