# Interfacing the 4x4 Keypad matrix and 7-Segment display to 8051 microcontroller

Name: Nirvan Tamhane

Aim: To interface and program the 8051-microcontroller for taking inputs from 4*4 matrix keyboard and display on 7-segment display using Keil µvision 5 software.
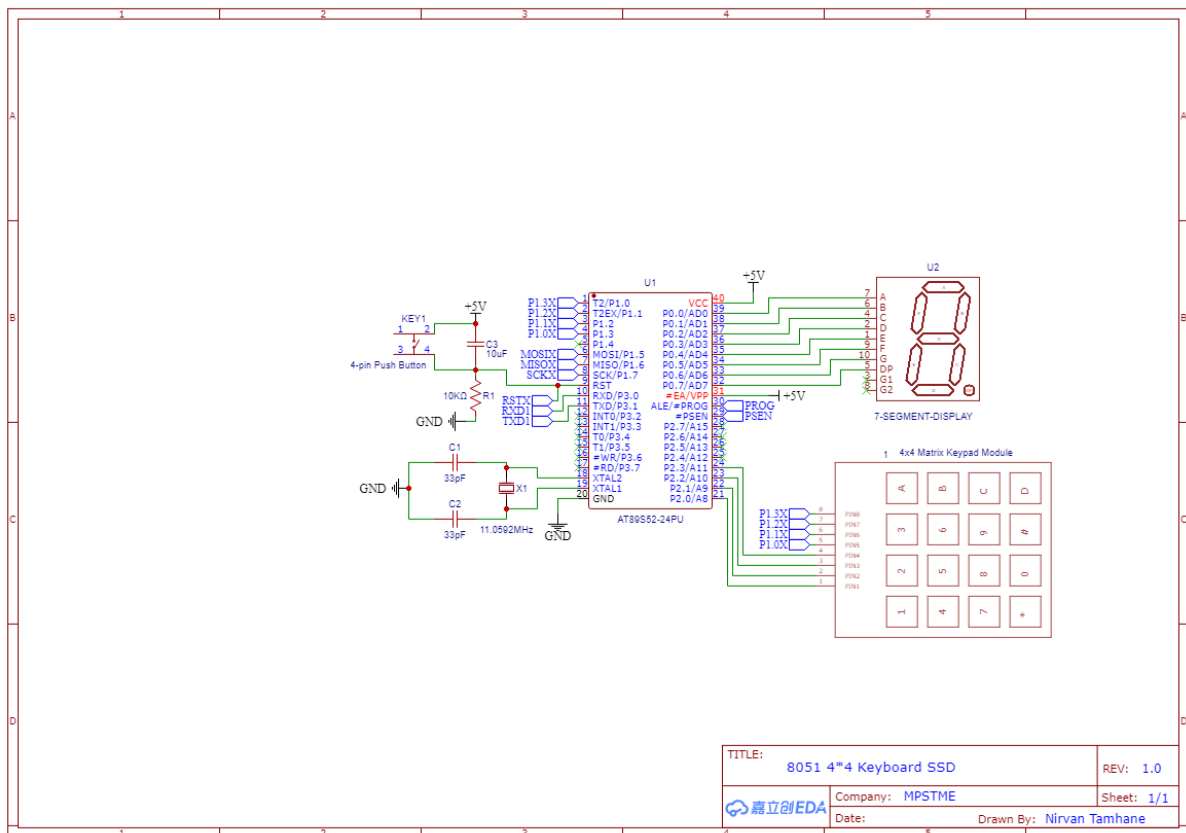
Theory of 4 x 4 matrix keypad:

The predominant interface between humans and hardware is the keyboard. The matrix keypad allows a designer to implement a large number of inputs with a small number of port pins. For examples 16 keys arranged as a 4 x 4 matrix can be implemented with only eight port pins. These keypads were evolved originally for telephonic applications involving touch—tone signalling.
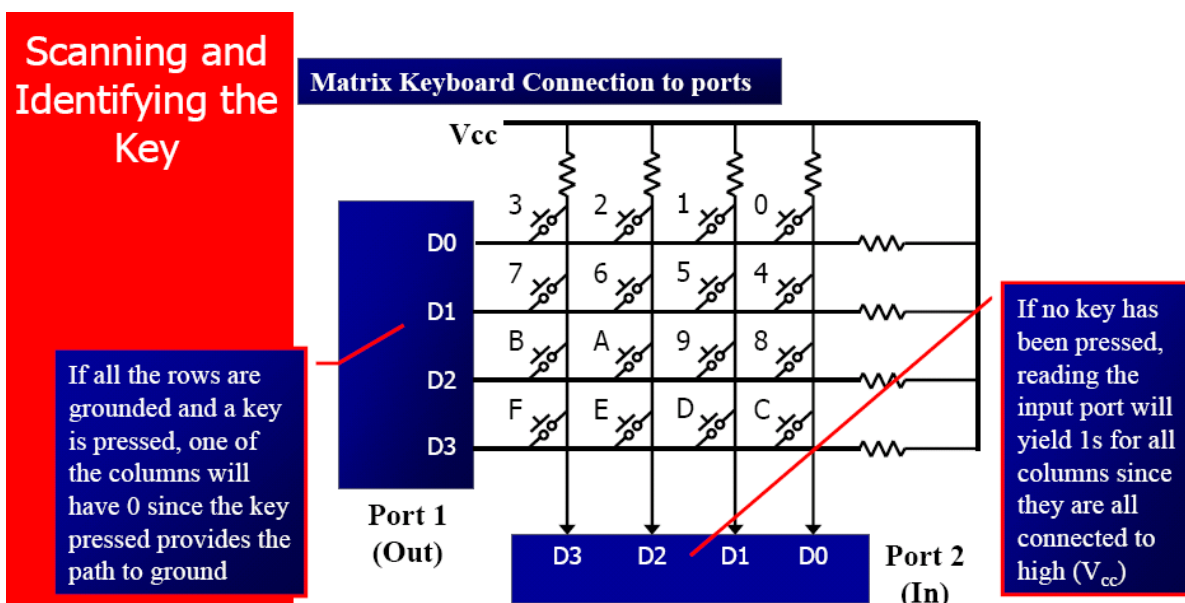
Keypad Interface:

4*4 matrix Pins	Description
(P2.0)	ROW0
(P2.1)	ROW1
(P2.2)	ROW2
(P2.3)	ROW3
(P1.0)	COL0
(P1.1)	COL1
(P1.2)	COL2
(P1.3)	COL3

Interfacing/Schematic:

Program flowchart:

FLOW CHART

Assembly Program:

```
ORG     0000H                              ;START OF MAIN PROGRAM FROM
MAIN

AJMP    MAIN


MAIN: MOV    P0,       #0FFH                ;CONFIGURE PORT-0 AS INPUT
PORT

MOV    P1,       #0FFH                ;BLANK THE SSD'S common anode

NEXT: MOV    A,       P0                    ;READ THE KEY
BOARD

CJNE A, #77H, CHECKKEY1

ACALL   KEYDEBOUNCE

MOV    P1,       #0FEH                      ;ENABLE SSD-0


 MOV    P2,       #0C0H               ;DISPLAY-0

 ACALL   NEXT                        ;CHECK FOR NEXT KEY PRESS
```

```
CHECKKEY1:      CJNE A, #7BH, CHECKKEY2        ;READAGAIN
ACALL    KEYDEBOUNCE
MOV    P1,      #0FDH                 ;ENABLE SSD-1
MOV    P2,      #0F9H                 ;DISPLAY-1
ACALL   NEXT                         ;CHECK FOR NEXT KEY PRESS


CHECKKEY2:      CJNE A, #7DH, CHECKKEY3        ;READAGAIN
ACALL    KEYDEBOUNCE
MOV    P1,      #0FBH                 ;ENABLE SSD-2
MOV    P2,      #0A4H                 ;DISPLAY-2
ACALL   NEXT                         ;CHECK FOR NEXT KEY PRESS


CHECKKEY3:      CJNE A,#7EH, NEXT        ;READAGAIN
ACALL    KEYDEBOUNCE
MOV    P1,      #0F7H                 ;ENABLE SSD-3
MOV    P2,      #0B0H                 ;DISPLAY-3
ACALL   NEXT                         ;CHECK FOR NEXT KEY PRESS



;DeBOUNCE subroutine for 100 msec

KEYDEBOUNCE:      MOV    TMOD,  #10H              ;TIMER-1, MODE-1
MOV    R0,      #14H             ; COUNT FOR 20D
REPEAT: MOV      TL1,      #3CH             ; LOWER BYTE OF COUNT
MOV    TH1,      0B0H             ; HIGHER BYTE OF COUNT
MOV    TCON,   #40H             ;START TIMER-1
WAIT: JNB        TCON.7, WAIT              ;WAIT FOR OVERFLOW
MOV    TCON,   #00H             ; STOP THE TIMER-1
DJNZ    R0,       REPEAT             ; 20 D TIMES COUNTING
RET
```

END

Conclusion – I learned the interfacing of the 4*4 matrix keyboard and the 7-segment display with the 8051-microcontroller using Keil µvision 5 software. I also learnt about the key debounce function which helps to avoid false key acceptance.