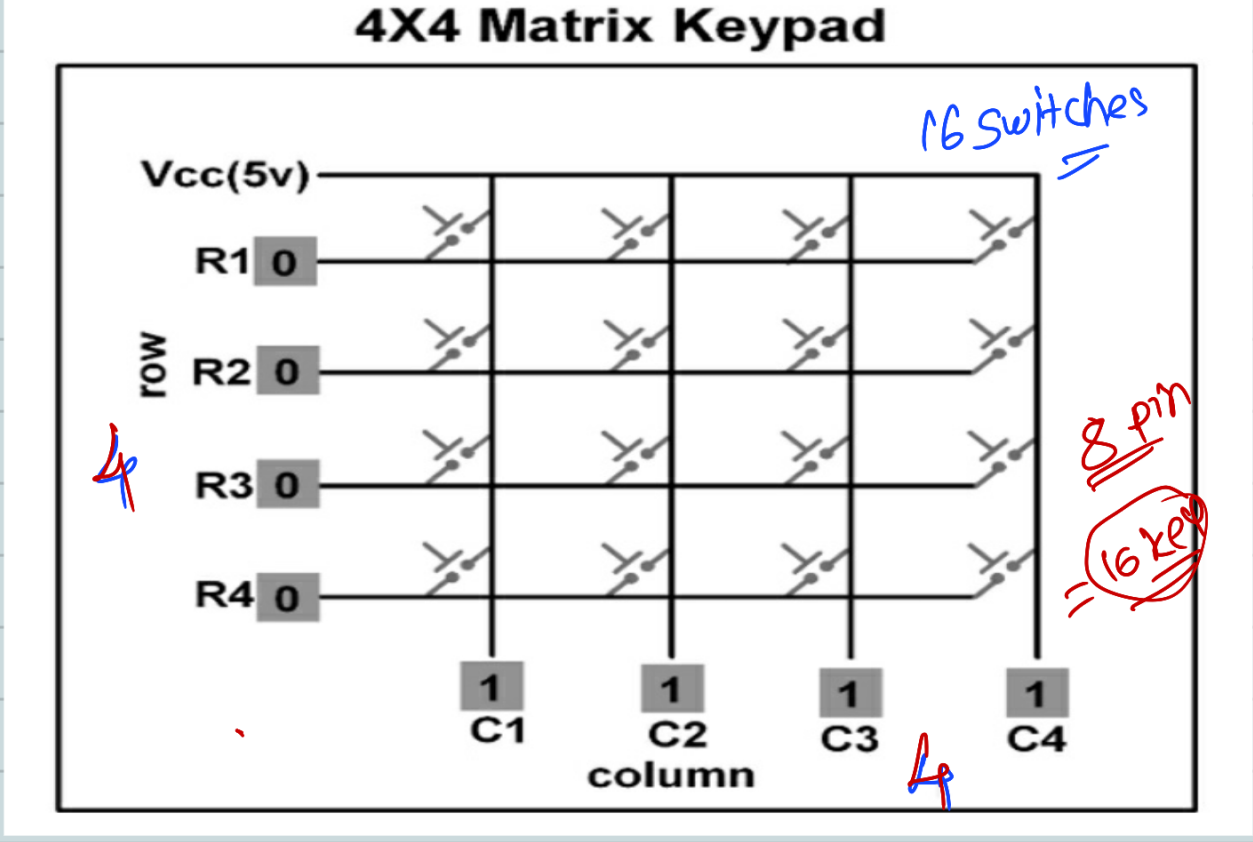
Objective: To interface an 4x4 matrix keyboard to blink an LED's using TM4C123GH6PM TIVA C series Launchpad board

Tools & softwares :
i) TIVA Launch pad ✓
ii) 4X4 matrix keyboard ✓
iii) Jumper wires ✓
iv) USB Cable ✓

Introduction:



GPIO pool.
1 - 1 switch

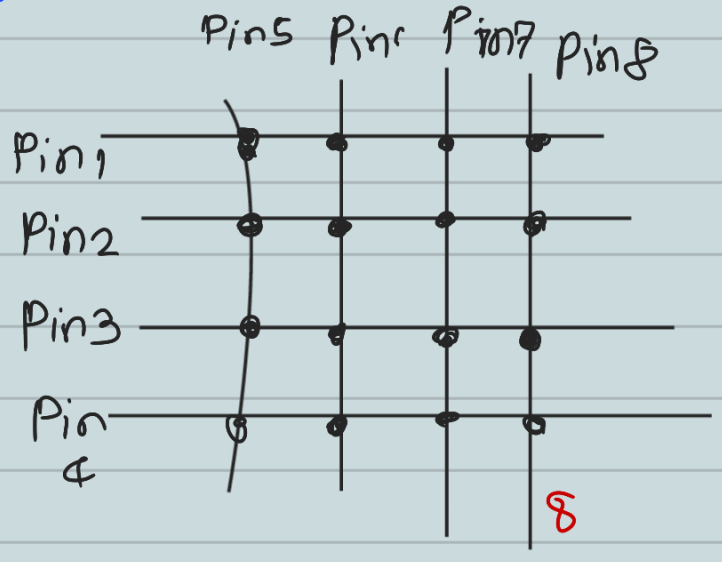
⊙ Why matrix key pad ??

→ To use a single pin of GPIO for each switch function is a completely wastage of Pins

→ For n-switches or for n inputs you will require n pins

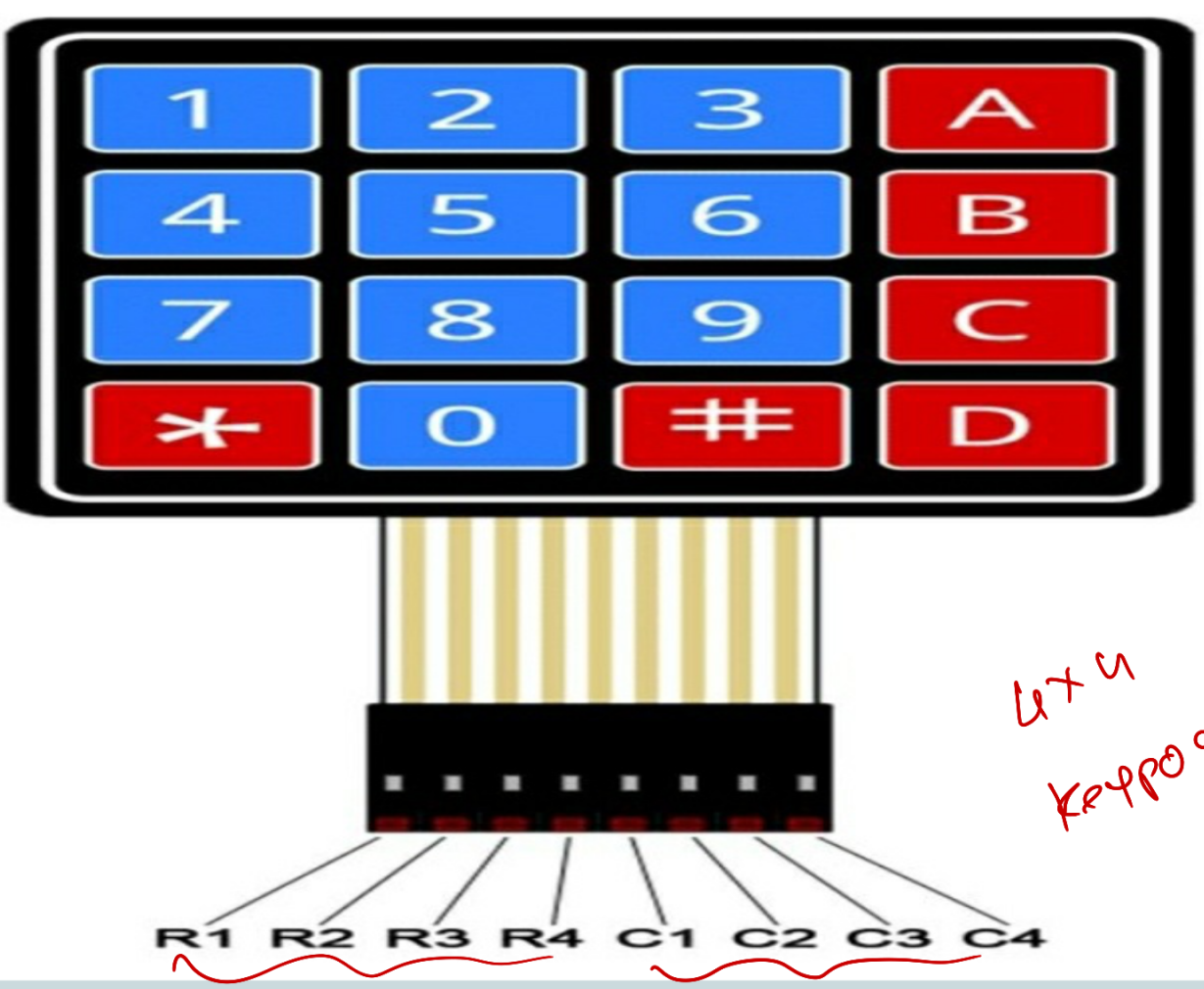
→ Hence this will occupy the large amount of pin of your micro-controller

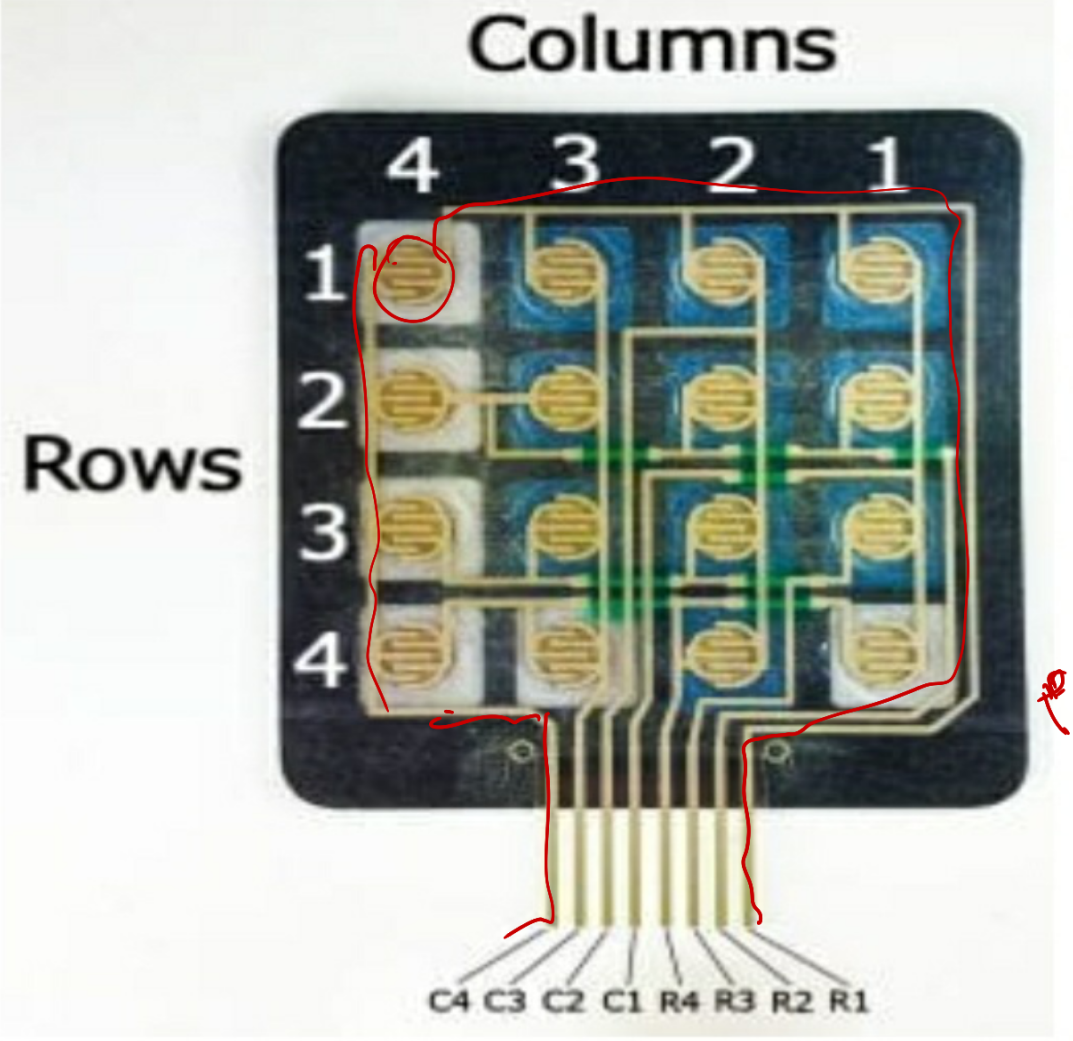
→ So, to save micro controller pins key pads are arranged in matrix of rows and columns.



4×4 ⇒ matrix
only 8 Pins
8×8 = 64 keys
using 16 pins

→





→ When particular push button is pressed a particular row and coloumn could make contact

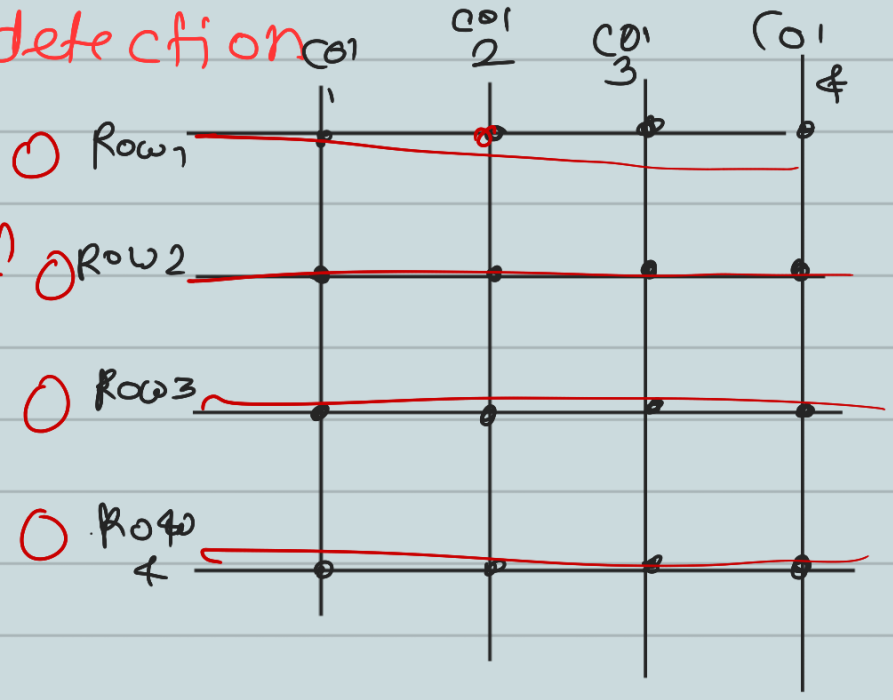
→ Allows current to flow between particular row and column

→ This will detect ouo key.

(i) key press detection

weak PU

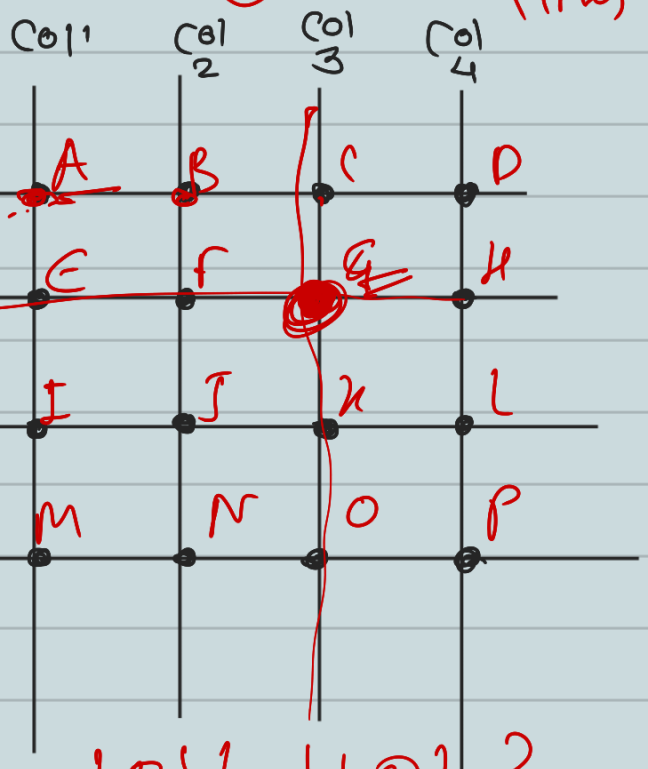
0000 ⇒ Rows high



0 1 1 1

(ii) key identification

Returns lines



0111 Row 1 → Row 1

1111 Row 2

Row 3

Row 4

Scanning lines

1011 Row 2

2 Col 1 = 1111

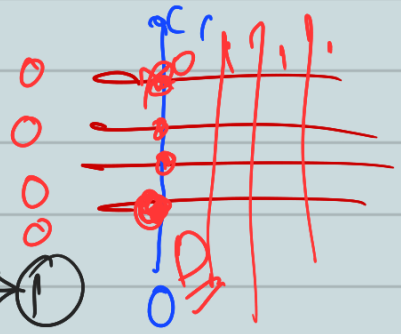
Col 2

Col 3 = 1101

1011 1101 ⇒ Process

9

Flowchart : for key press detection & identification



Start

Key pressed

Ground all row

Rows = 0000

Read all column

$C_1 C_2 C_3 C_4$

1110

1011

All key off

yes

no

A

Ground next row

1110

1101

1011

0111

Read all column

0111

Key pressed in row

no

yes

0111 0111

Which

find which key Pressed

Get scan code

Return

Connections :-

No.	Controller Pin	to Keypad
1	PD0	C1 ✓
2	PD1	C2 ✓
3	PD2	C3 ✓
4	PD3	C4 ✓
5	PC4	R1 ✓
6	PC5	R2 ✓
7	PC6	R3 ✓
8	PC7	R4 ✓

⊙ if interfacing LCD : LCD 4bit mode

1	VSS ✓	Gnd	
2	VDD ✓	+5V (VBUS)	
3	Vo ✓	P2 (Potentiometer)	
4	RS ✓	PA5	
5	R/W	PA6	A → 8bit
6	E	PA7	
7	D0	—	1 cycle
8	D1	—	8bit
9	D2	—	1c4
10	D3	—	
11	D4	PB4	2 cycle
12	D5	PB5	4bit
13	D6	PB6	
14	D7	PB7	
15	A	+V	

(D4–D7: 4bit)

16 k -Gnd

Methods :-

i) Include all necessary libraries
ii) set clock
iii) Give crock to ports
- Port F
- Port C
- Port D

} keypad LCD PB PA

iv) Which one is input Port
which one is output Port
- Port C = Output // row
- Port D = input // column
- Port F = output LCD

v) Pull up/ pull down configured

vi) Row = 0000 Active keypad A
Column = 0x0F LCD

vii) Read Coloumn

viii) Get Codes

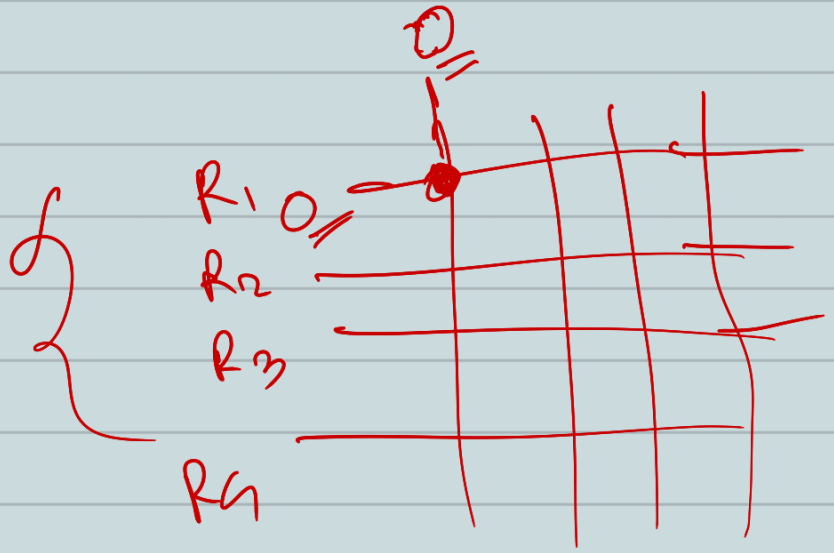
viii) when particular key pressed to task for that code

{ LCD = pri }

* What are scan lines ??

what are return lines ??

what is scan codes ??



$R_1\ R_2\ R_3\ R_4\ C_1\ C_2\ C_3\ C_4$ $C_1\ C_2\ C_3\ C_4$

0 1 1 1 0 1 1 1 ⇒

⊙ LCD in 4 bit mode :-