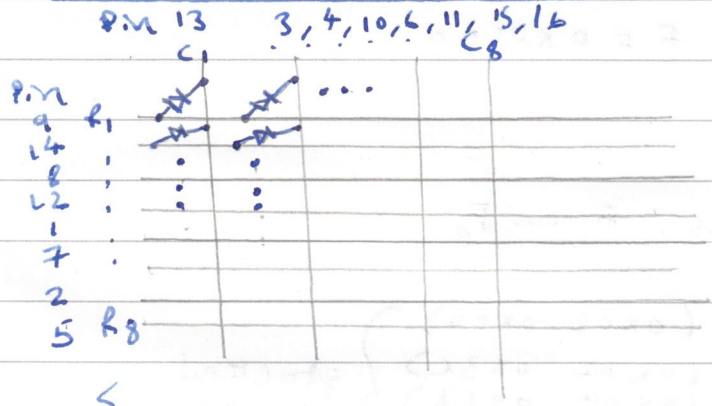
LED matrix with PIC + SIPO

8x8 LED matrix schematic



will need current limiting resitors on either set C or R.

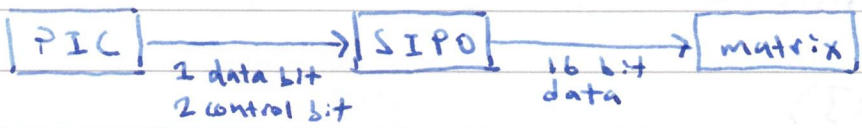
for all off,
C = (1 ... 1) and R = (0 ... 0)

use this pin map to connect to the parallel output of the 16 bit ~~SIST~~ SIPO regester.
Let P be the 16 bit parallet output,

$$P = [RC] = [R_1 \cdots R_8 C_1 \cdots C_8]$$

Goal : Drive a 8x8 LED matrix display using a small PIC μC enhanced by SIPO regesters.

Block Diagram



Shift Algorithm

Let F be the frame (16 bit) to be displayed,
ser be the serial input,
SRClk be the shift clock, RClk be the latch

```
for i = 0 → 16
    ser = (F >> i) & 0x0001
    rising edge on SRClk
    latch RClk
```

Frames

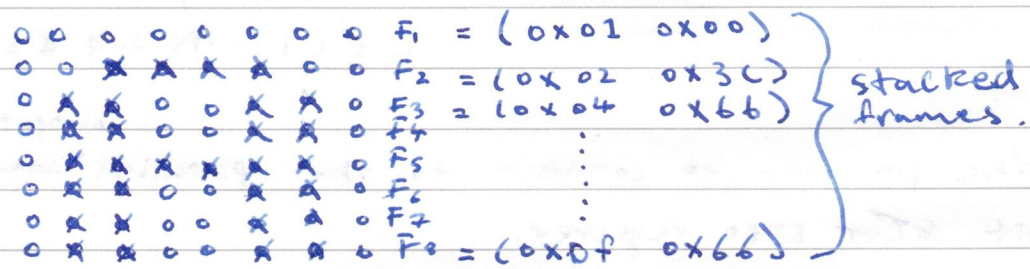
all off : $F = 0x00ff$ all on : $F = 0xff00$

Letters?

=> Break the image in to 8 pieces. $F_1 \cdots F_8$

i.e.

A:




```
uint8_t A[8] = {f1, ..., f8}
```

This will need 8 cycles (8 complet shifs) to complet the image but will need to be looped to maintain a ~~pre~~ persistense of vision.

depends on cycle period and pause period

```
for i=0 -> 5   //persistence
    for k=0 -> 7
        shift( A[k] )
```

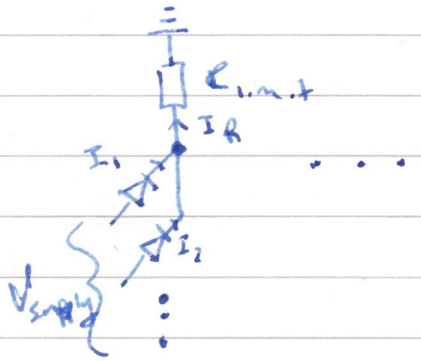
when running on battery, the current limit means that pixel's brightness depends on the # of on pixels on each image.

The chosen battery must be able to source enough current for a fully lit matrix, for evenly lit images. Also the current limit resistor can be ajusted to make this possible) ? inherent issue?

$$I_{max} = \left(\frac{V_{supply} - V_f}{R_{limit}}\right) \times 8$$

~~Limit~~ is shared!

R_{limit} shared. so the voltage drop on R_{limit} is still $(V_{supply} - V_f)$



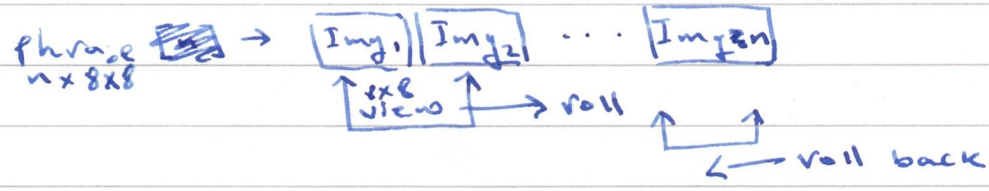
KCL: $I_R = I_1 + I_2 + \ldots + I_8$

I_R is constant ~~and is therefore~~ and is evenly distributed to all "on" LEDs evenly.

Therefore the brightness of LED depends on the # of LEDs turned on on it's column.

Animation

Rolling text animation:



using the bitwise operator >> and << , move the 8x8 view.

Limitations

⇒ memory: To support all the 52 alphabets (lower + upper)

need $52 \times 8 \times 8 \times 8 = 26,624$ bits $= 3,328$ bytes

(8 frame, 8 image)

Too large.

for small µCs like PIC 12F615 which has only 1kb flash.
use bigger µc or external memory IC

⇒ more 8x8 displays: Though adding more displays is trival as the shift register can be easily chained, the impact this will have on the cycle period maybe too great:

use faster µC.