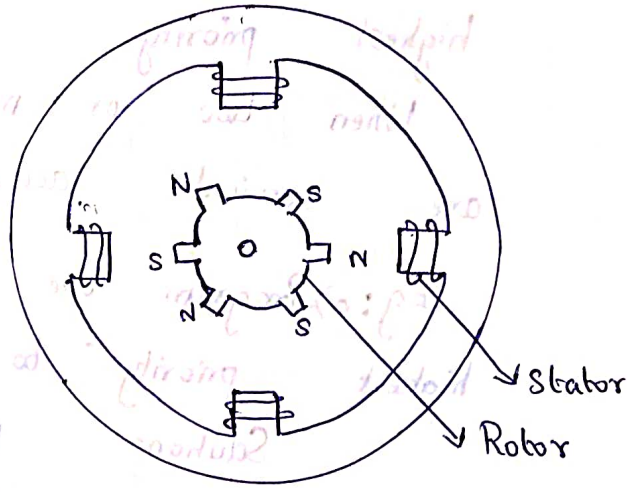
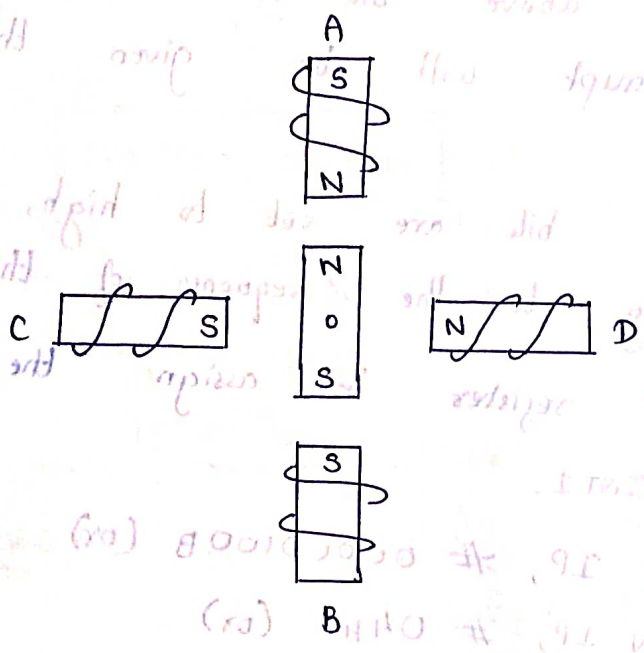


STEPPER MOTOR INTERFACING

* Stepper Motor is a widely used device that translates electrical pulses into mechanical movement.

* Stepper Motor is used in applications such as disk drives, dot matrix printers, robotics etc. for position control.

* Stepper motor has a permanent magnet rotor surrounded by a stator.



* Most motors have 4 stator windings referred as a 4-phase stepper motor.

* When a sequence of power is applied to stator, rotor will rotate.

Normal 4-step sequence:

Step #	Winding A	B	C	D
1	1	0	0	1
2	1	1	0	0
3	0	1	1	0
4	0	0	1	1

↓ Clockwise
 ↑ Counter-clockwise

The Step Angle: It is defined as the minimum degree of rotation associated with a single step.

Steps per Revolution: It is the total no. of steps needed to rotate one complete rotation or 360 degrees.

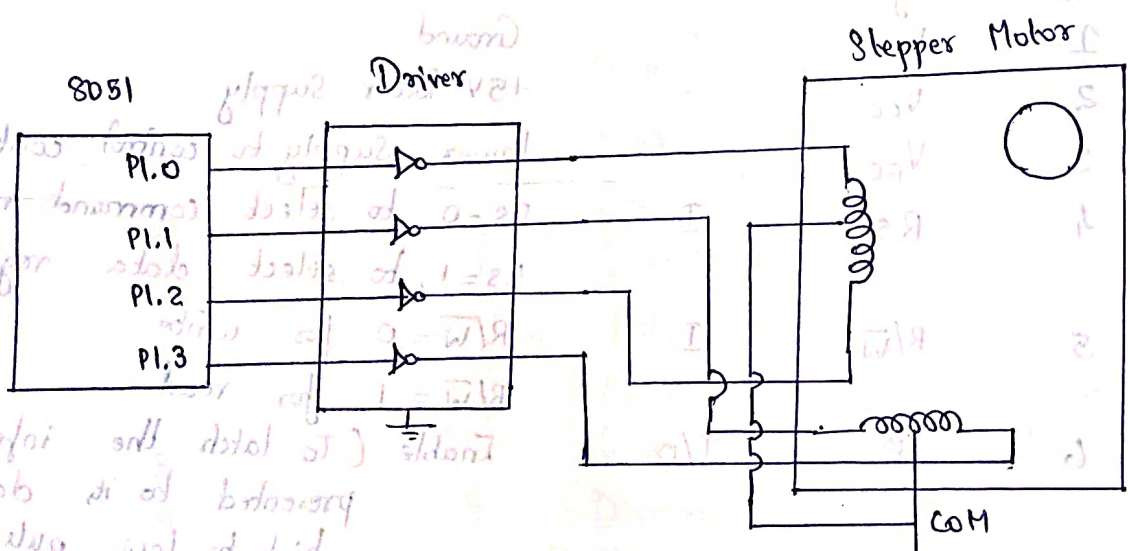
$$\text{No. of steps per revolution} = \frac{360^\circ}{\text{step angle}}$$

Eg: If Step angle = 2° ,
Steps Per Revolution = 180

$$\text{Steps Per Second} = \frac{\text{RPM} \times \text{steps per revolution}}{60}$$

Where RPM is revolutions per minute.

8051 interfacing with stepper motor:



Program to rotate stepper motor continuously:

```

START: MOV R0, #04
      MOV DPTR, #TABLE
NEXT:  MOVX A, @DPTR
      MOV P1, A
      ACALL DELAY
      INC DPTR
      DJNZ R0, NEXT
      SJMP START
  
```

TABLE: DB 09 0C 06 03

DELAY: MOV R2, # 6AH

L1: MOV R3, # FFH

L2: DJNZ R3, L2

DJNZ R2, L1

RET

LCD Interfacing

* LCD (Liquid Crystal Display) has the ability to display numbers, characters and graphics.

LCD pin discriptions:

Pin	Symbol	I/O	Description
1	V _{SS}	-	Ground
2	V _{CC}	-	+5V Power Supply
3	V _{EE}	-	Power Supply to control contrast
4	R _S	I	R _S = 0, to select command register R _S = 1, to select data register
5	R/ \bar{W}	I	R/ \bar{W} = 0 for write R/ \bar{W} = 1 for read
6	E	I/O	Enable (To latch the information presented to its data pins, high-to-low pulse)

7	DB0	I/O
8	DB1	I/O
9	DB2	I/O
10	DB3	I/O
11	DB4	I/O
12	DB5	I/O
13	DB6	I/O
14	DB7	I/O

} 8-bit data bus (Bidirectional)