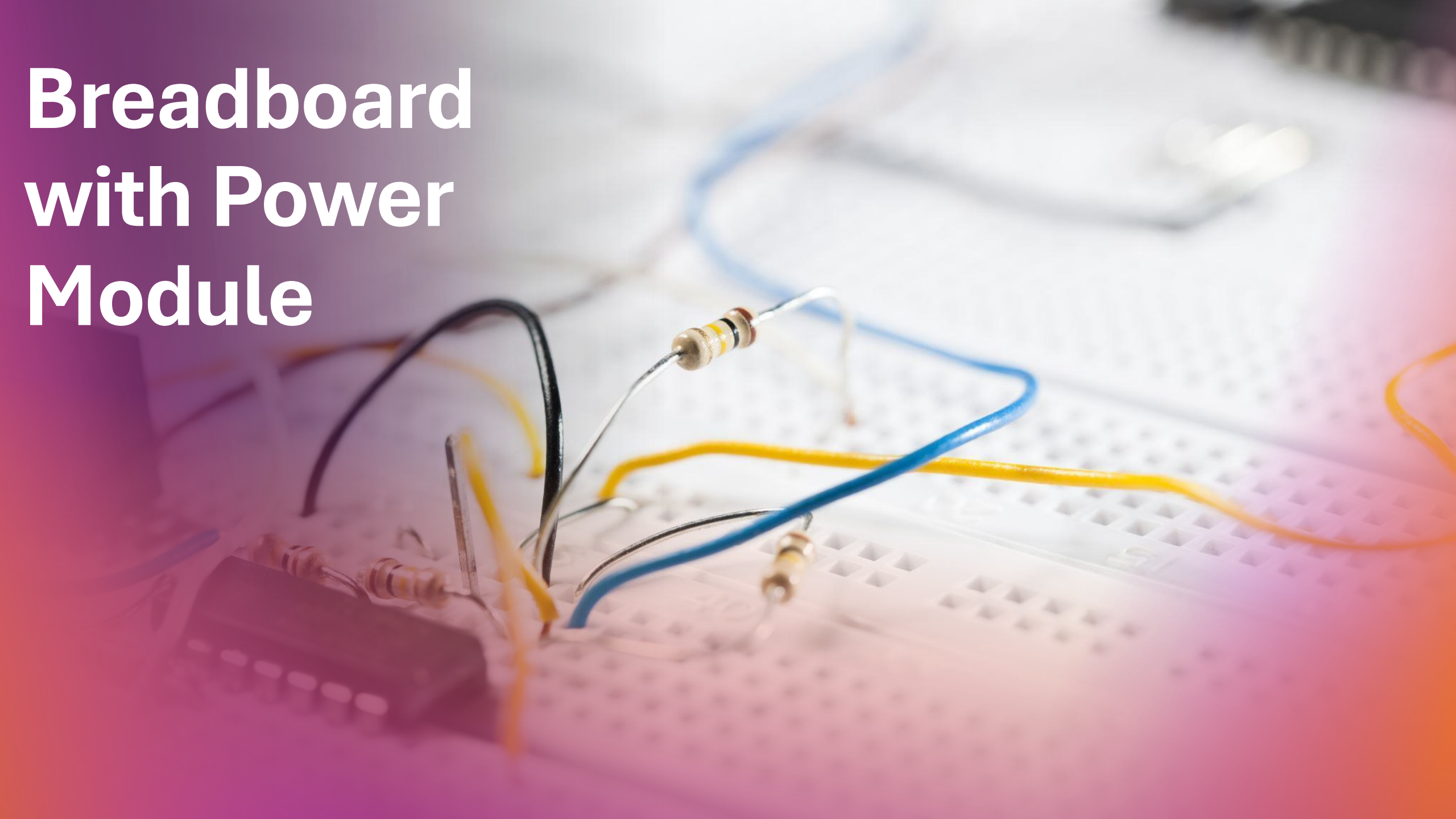
Open Design & Technology

Week 7

Empowering Designers to Embrace Technology

Breadboard with Power Module



Servo Motor using List

2 Push Button Controlling the Servo Motor

1st Push Button : Duty 40 to Duty 110 (Duration 2 seconds)

2nd Push Button : Duty 110 to Duty 40 (Duration 2 seconds)

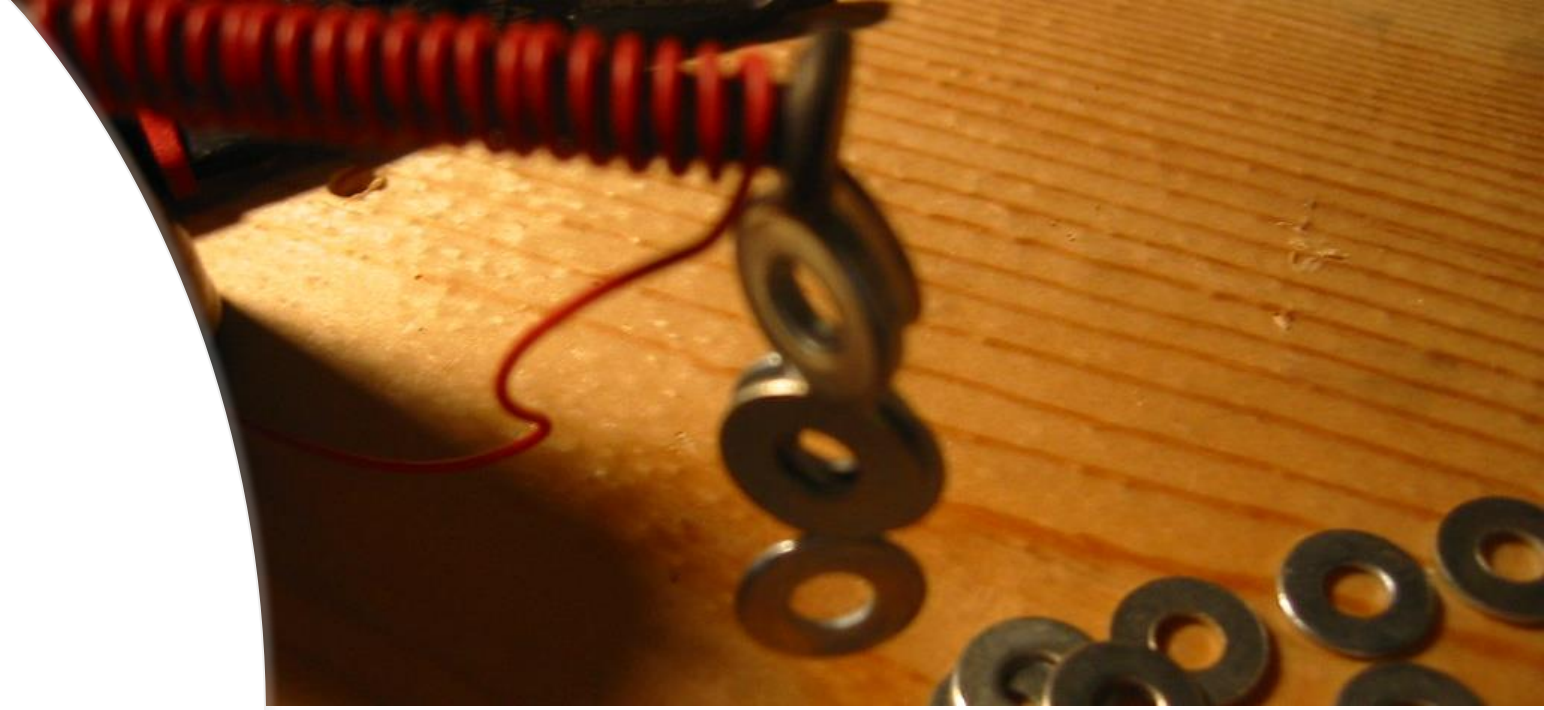
Interface **4 LEDs** to **ESP32** and make then **glow sequentially one after the other**....

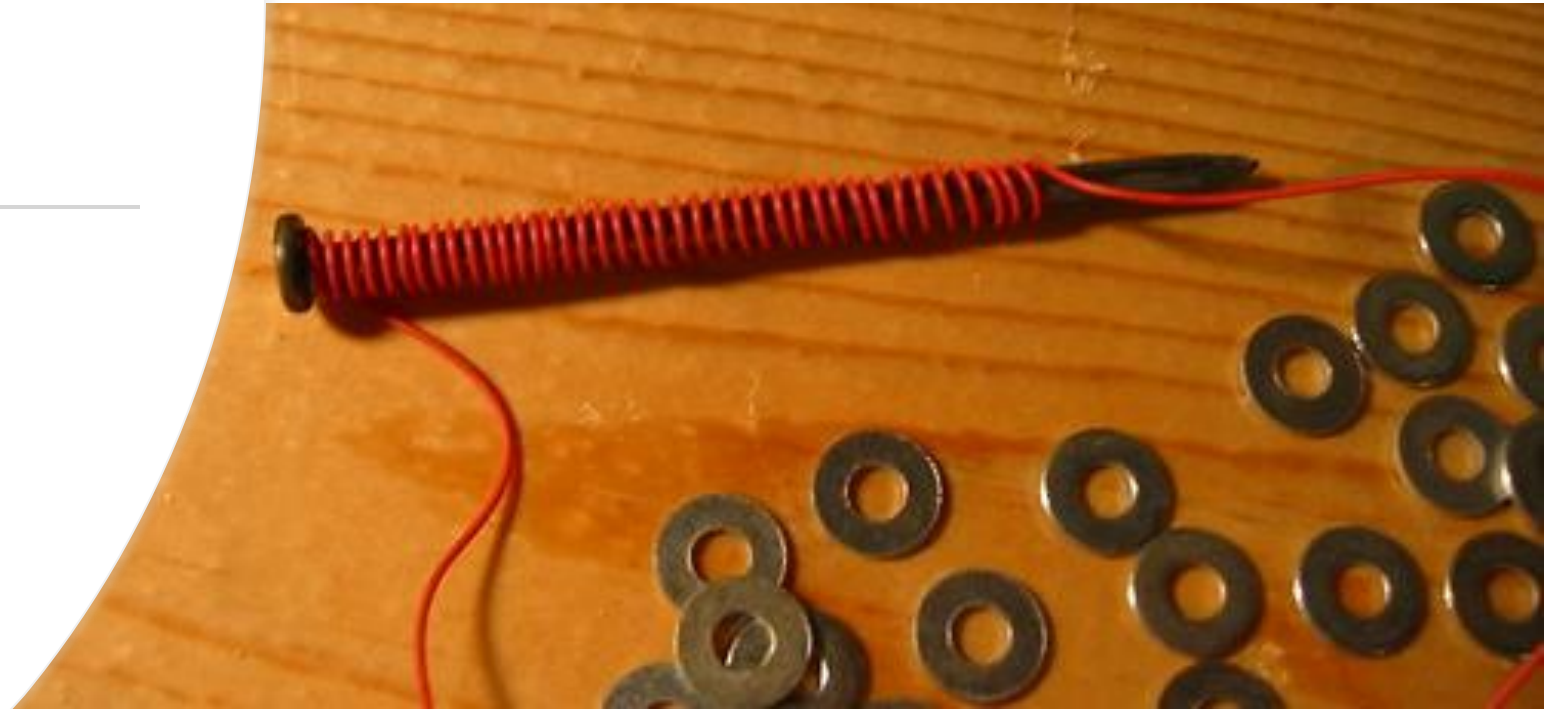
1. Circuit Diagram
2. Practical Implementation of the Circuit
3. Code

Timeline	LED 1	LED 2	LED 3	LED 4
1st second	**On (1)**	Off (0)	Off (0)	Off (0)
2nd second	Off (0)	**On (1)**	Off (0)	Off (0)
3rd second	Off (0)	Off (0)	**On (1)**	Off (0)
4th second	Off (0)	Off (0)	Off (0)	**On (1)**
1st Second	**On (1)**	Off (0)	Off (0)	Off (0)
...				

List within a List

Permanent Magnet

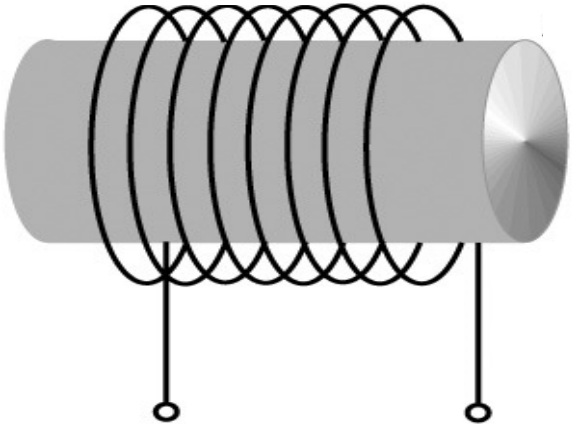


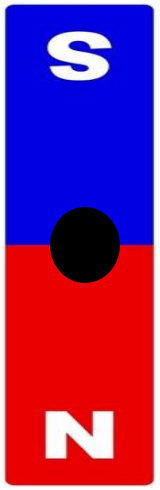


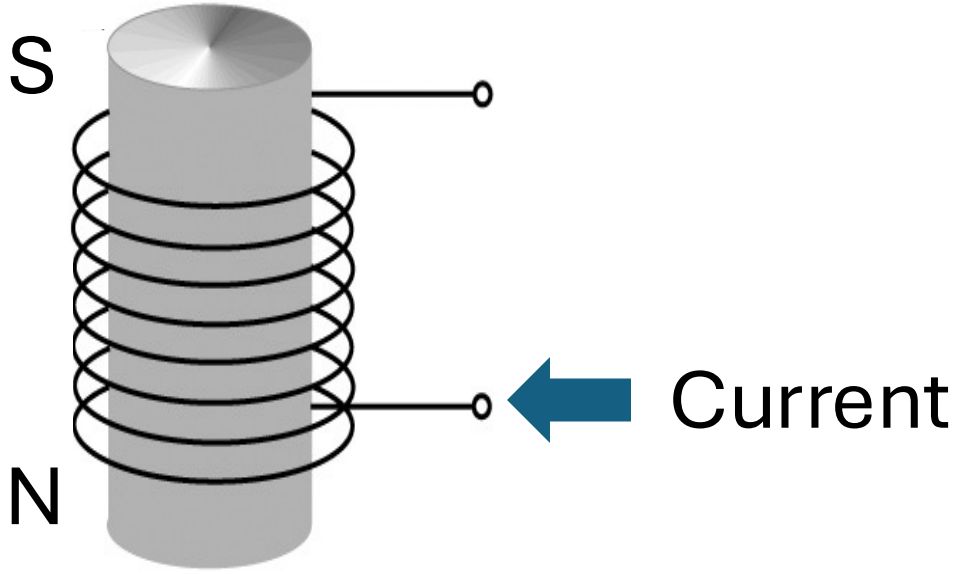
Electromagnet!

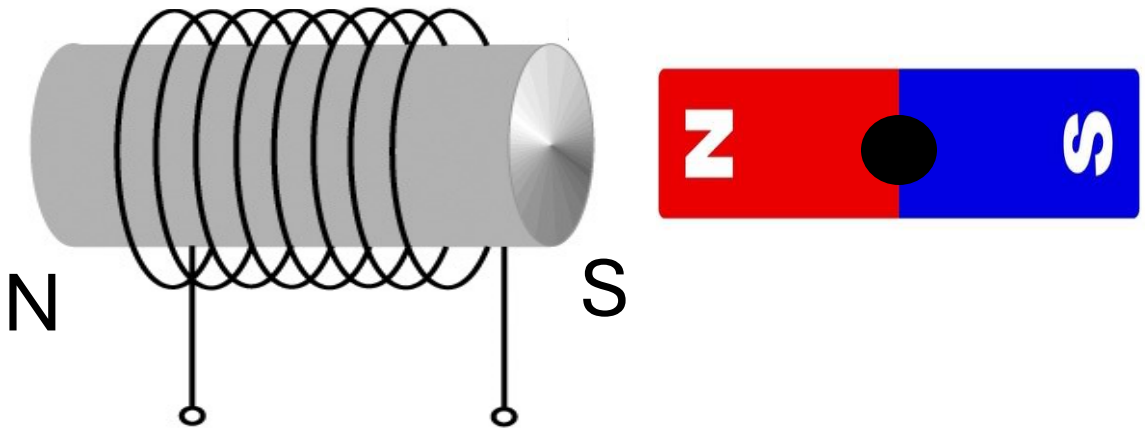
Strength

Polarity

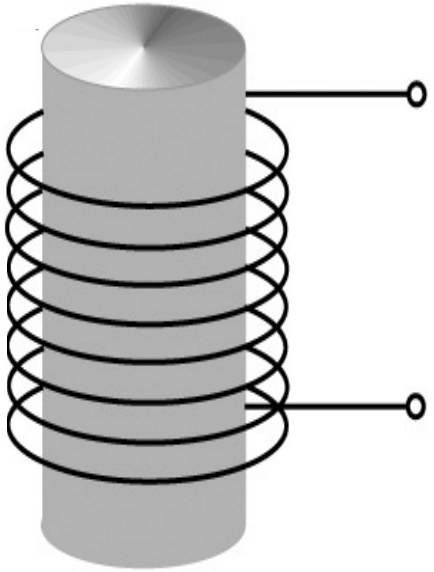


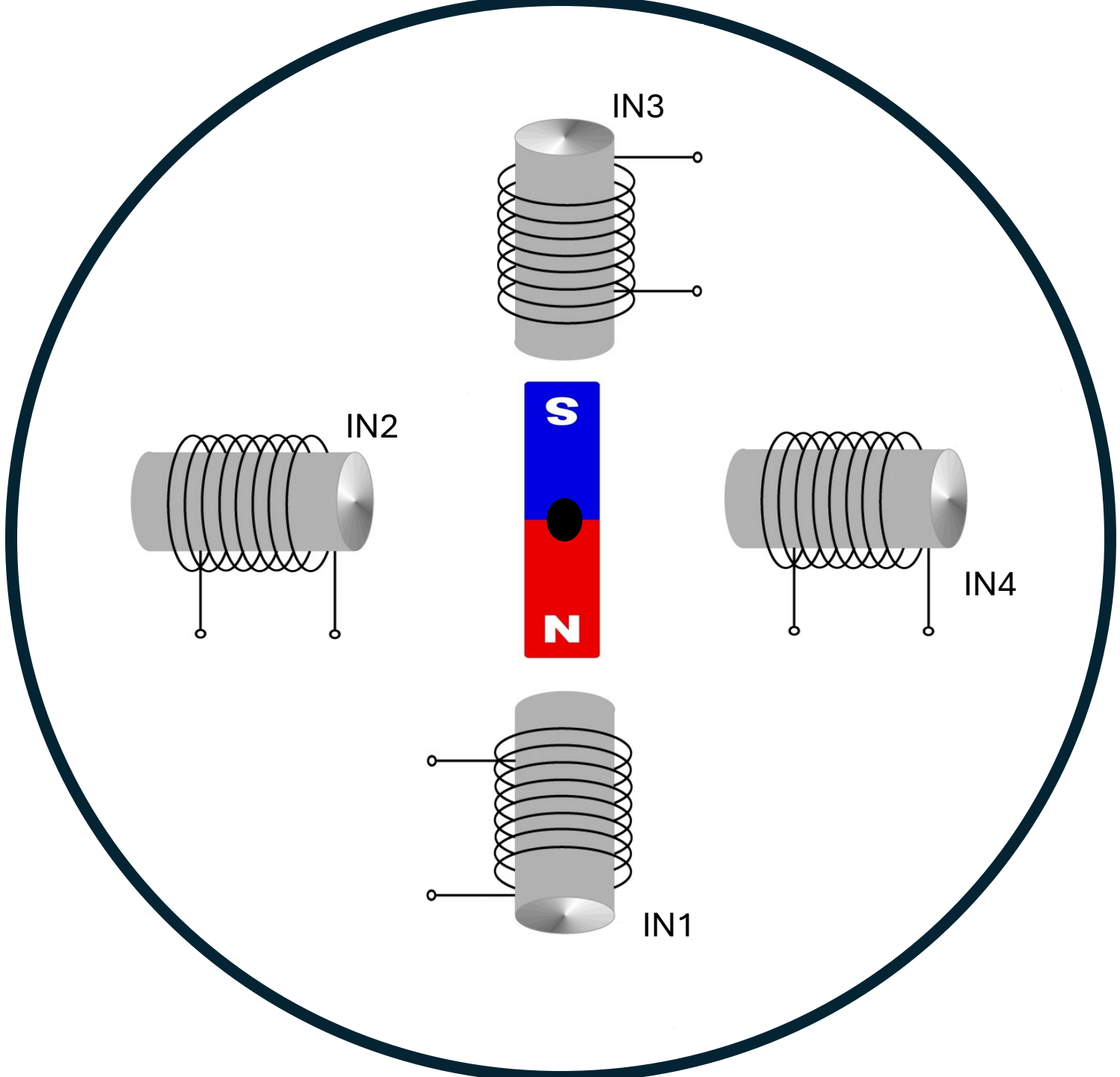

S
N

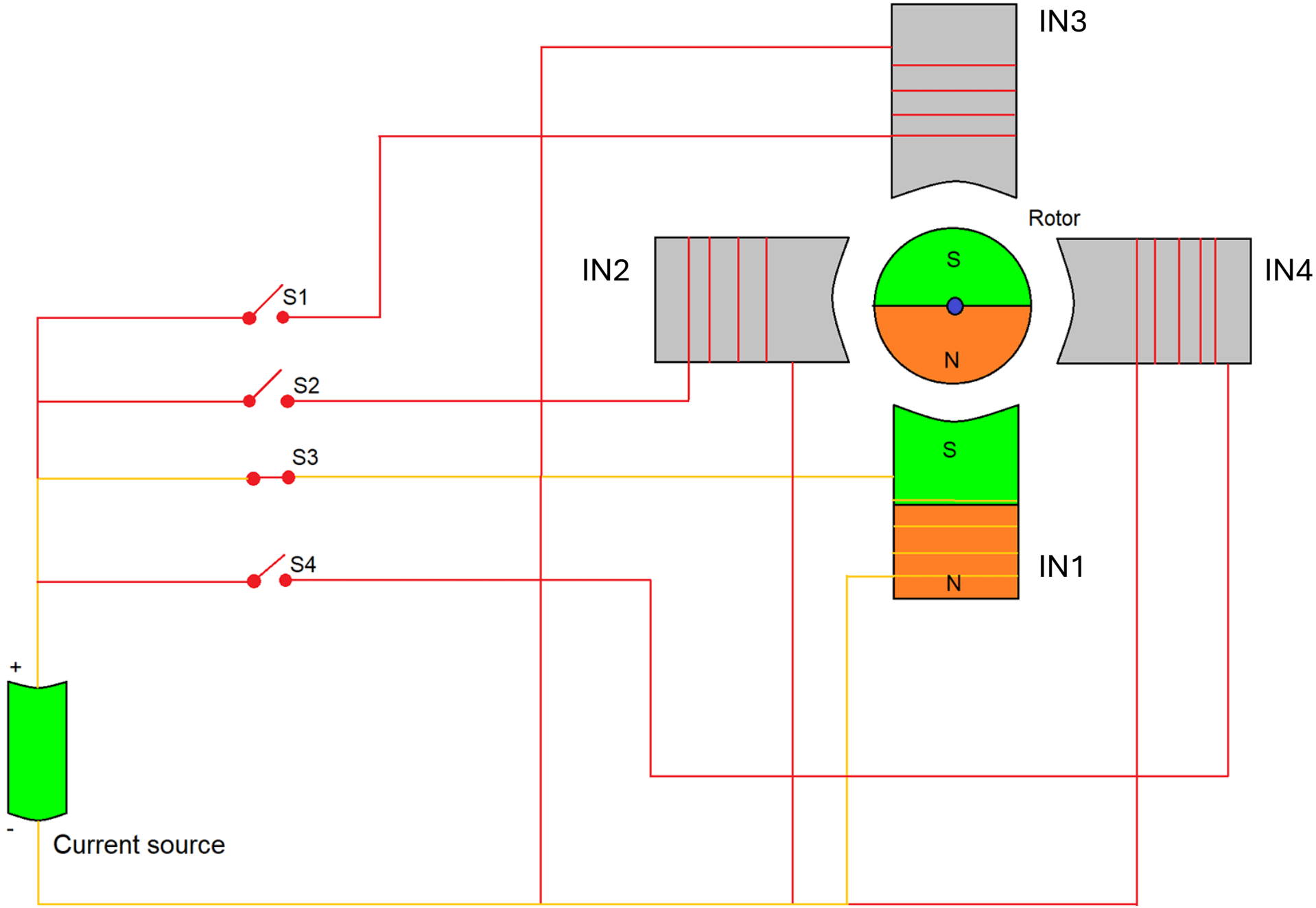

S
N
Current



Current



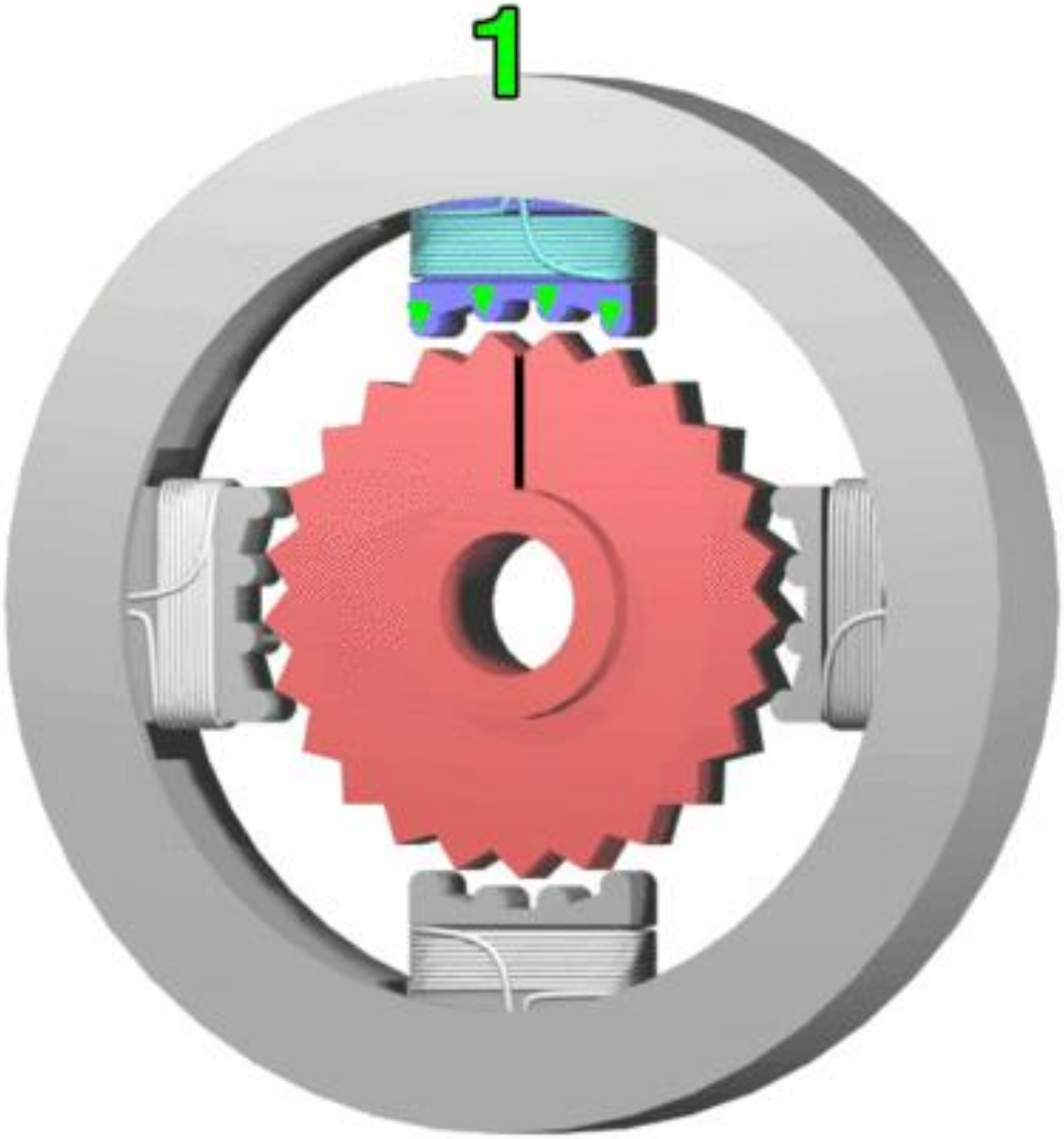

IN3
IN2
S
N
IN4
IN1


IN3
Rotor
IN2
S
IN4
N
S1
S2
S3
S
S4
IN1
N
+
-
Current source

Step angle :

If "1 step = 1 degree"

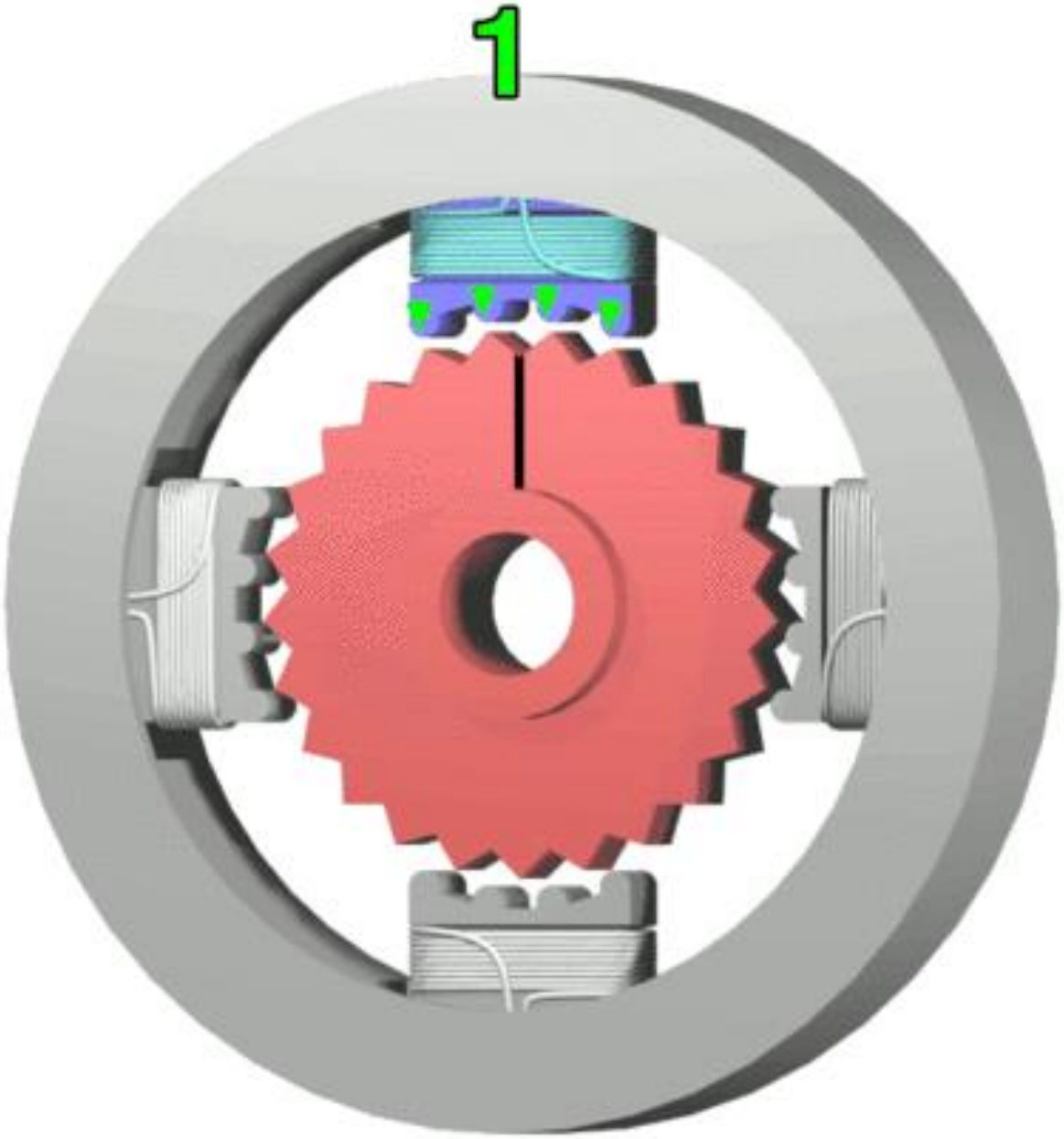
How many steps required for 1 complete rotation?



Step angle :

If "1 step = 0.18 degree"

How many steps required for 1 complete rotation?

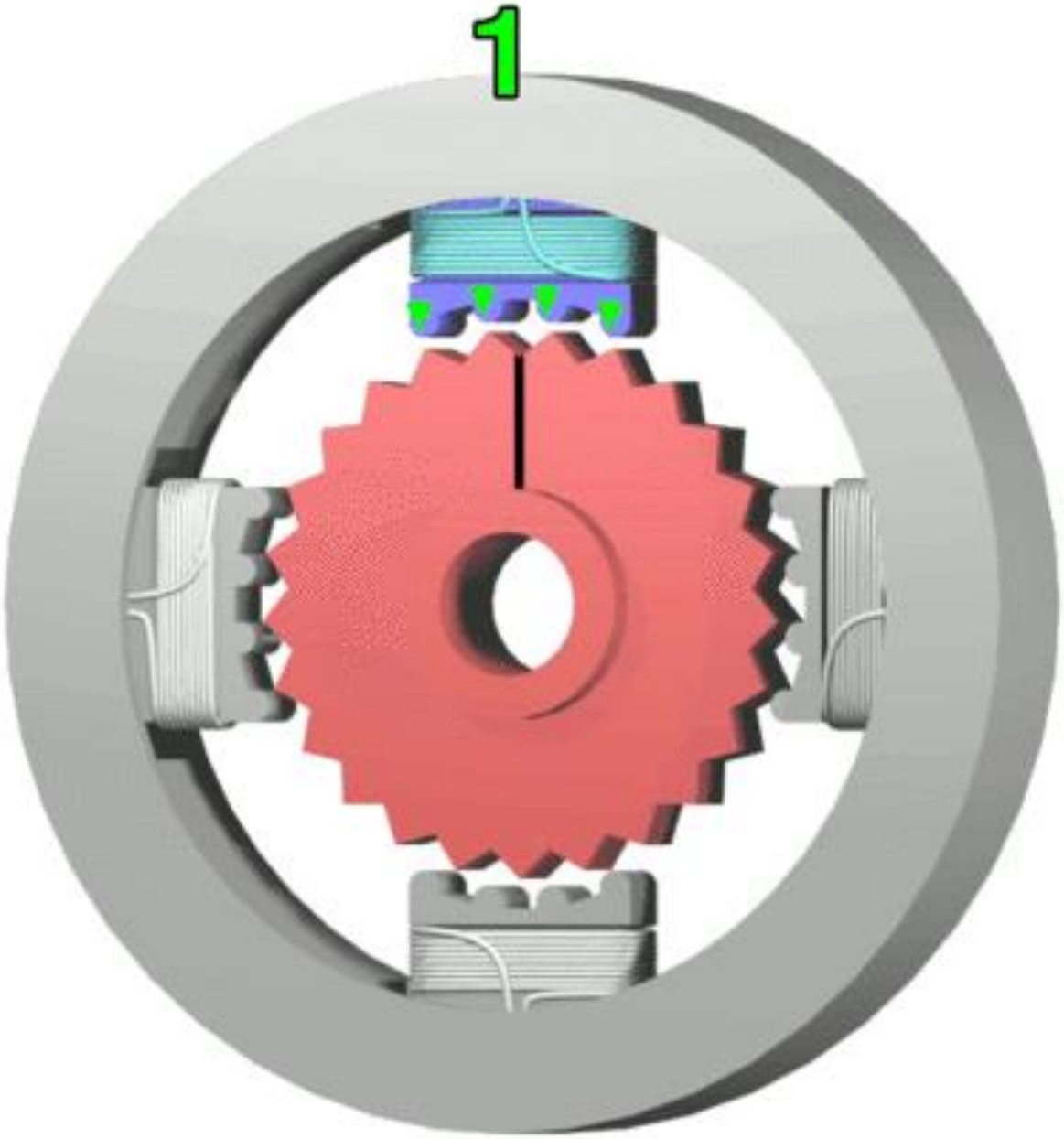


Step angle :

1 step = 0.18 degree

Steps?? = 360 degree

~2000 steps = 360 degree

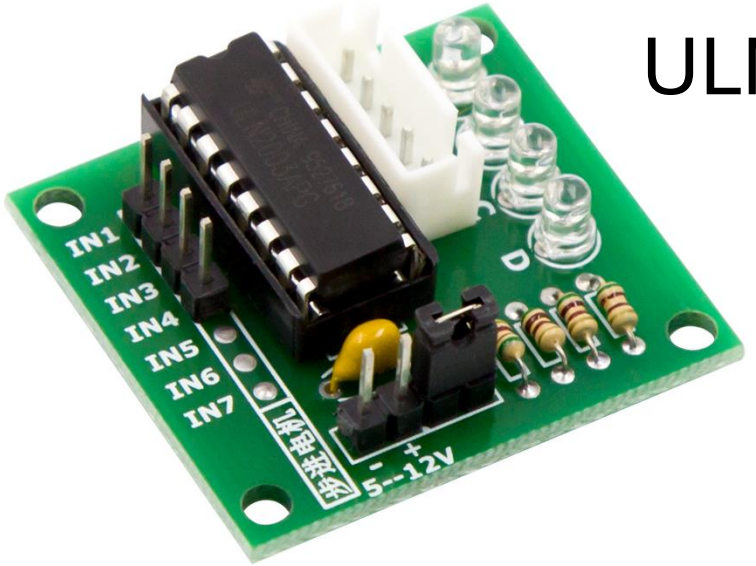


Wave drive

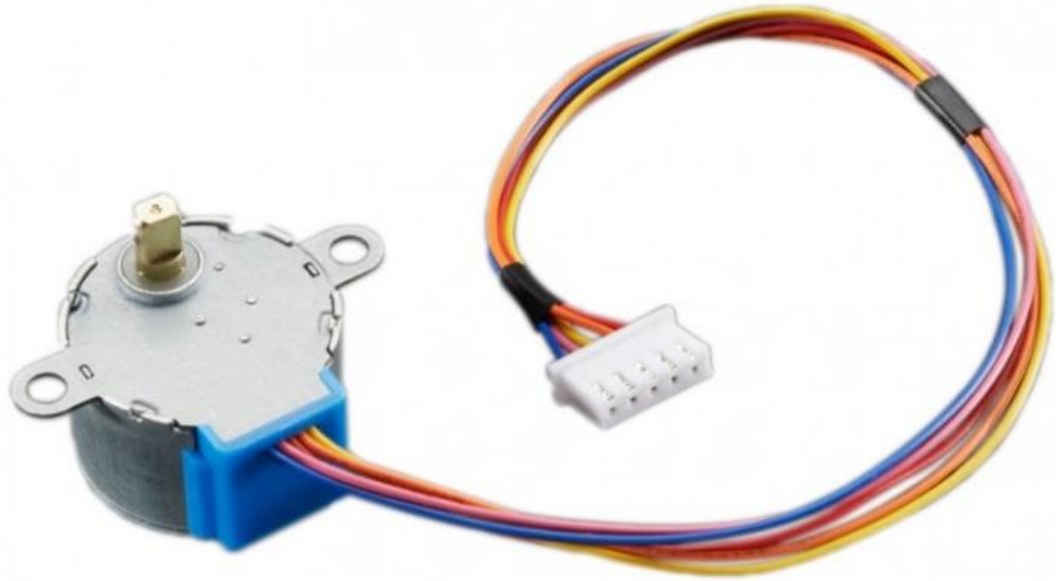
Step	Coil A	Coil B	Coil C	Coil D
1	1	0	0	0
2	0	1	0	0
3	0	0	1	0
4	0	0	0	1

Interfacing Stepper Motor to ESP32

Driver ULN2003A	ESP32	Power Module
IN1	14	
IN2	25	
IN3	26	
IN4	27	
+		+ (5v)
-	GND	- (GND)



ULN2003A



28BYJ-48

Full Step

Step	Coil A	Coil B	Coil C	Coil D
1	1	1	0	0
2	0	1	1	0
3	0	0	1	1
4	1	0	0	1

Half Step

Step	Coil A	Coil B	Coil C	Coil D
1	1	1	0	0
2	0	1	0	0
3	0	1	1	0
4	0	0	1	0
5	0	0	1	1
6	0	0	0	1
7	1	0	0	1
8	1	0	0	0

Stride Angle (for Full Step Operation) :

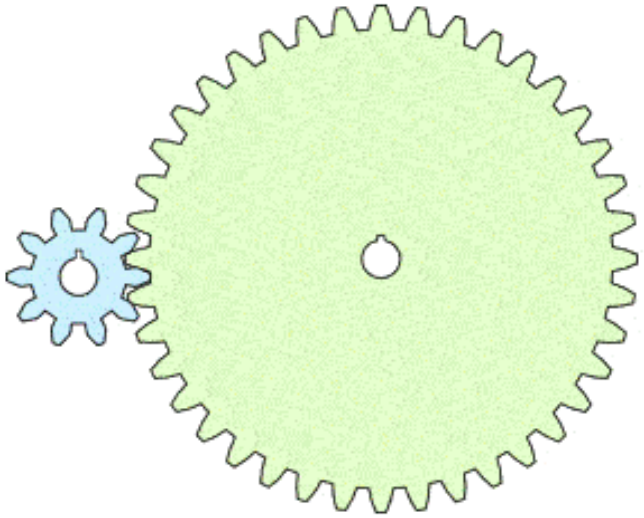
1 step = 11.25 degrees

For 360 degree rotation :

11.25 x N = 360 degrees,

N is calculated to be :

32 step = 11.25 degree x 32 = 360 degree = 1 revolution of internal motor



Gear ratio : 64 : 1

Internal motor rotates 64 times = external shaft completes one rotation

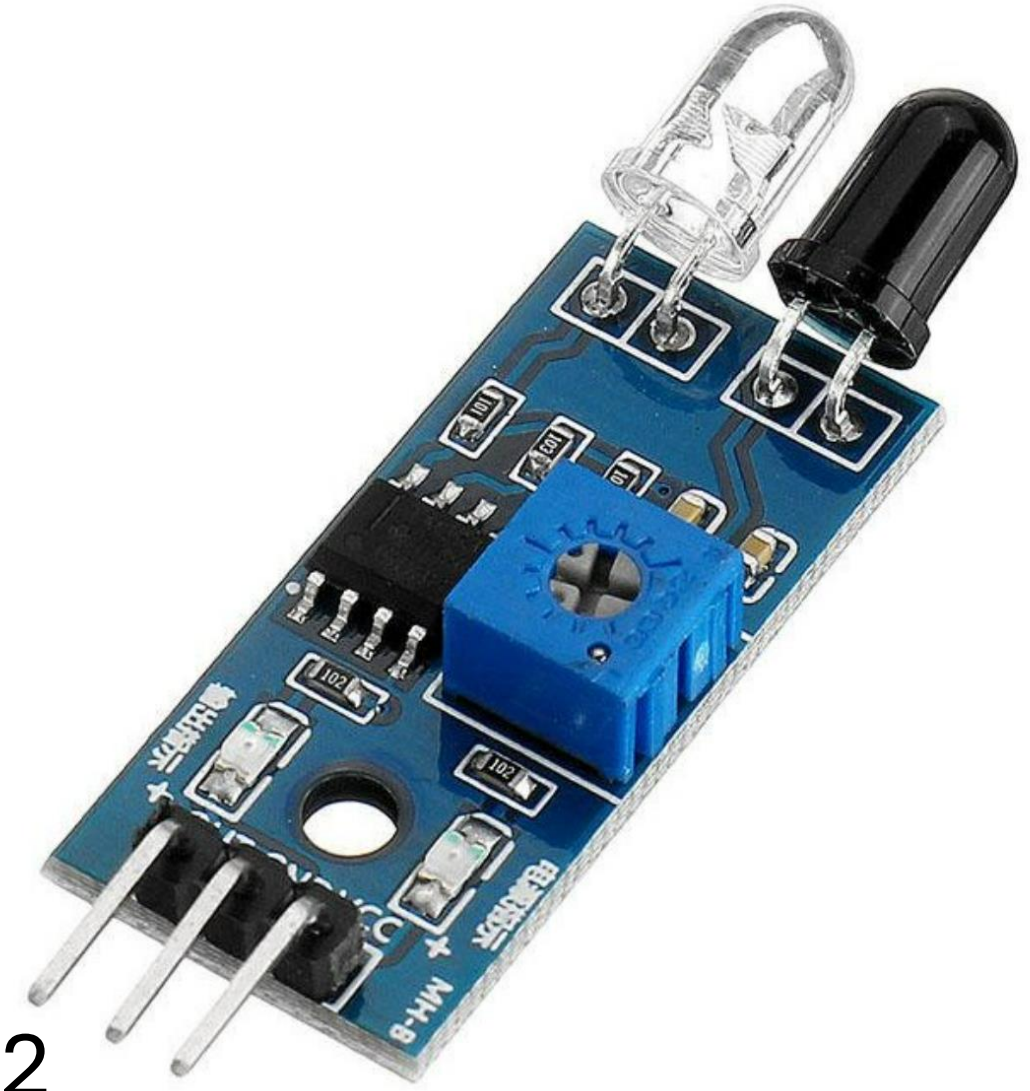
Number of steps for rotation on external shaft = 32 x 64 = 2048 steps per revolution

Step angle = 360 / 2048 = 0.18 degree

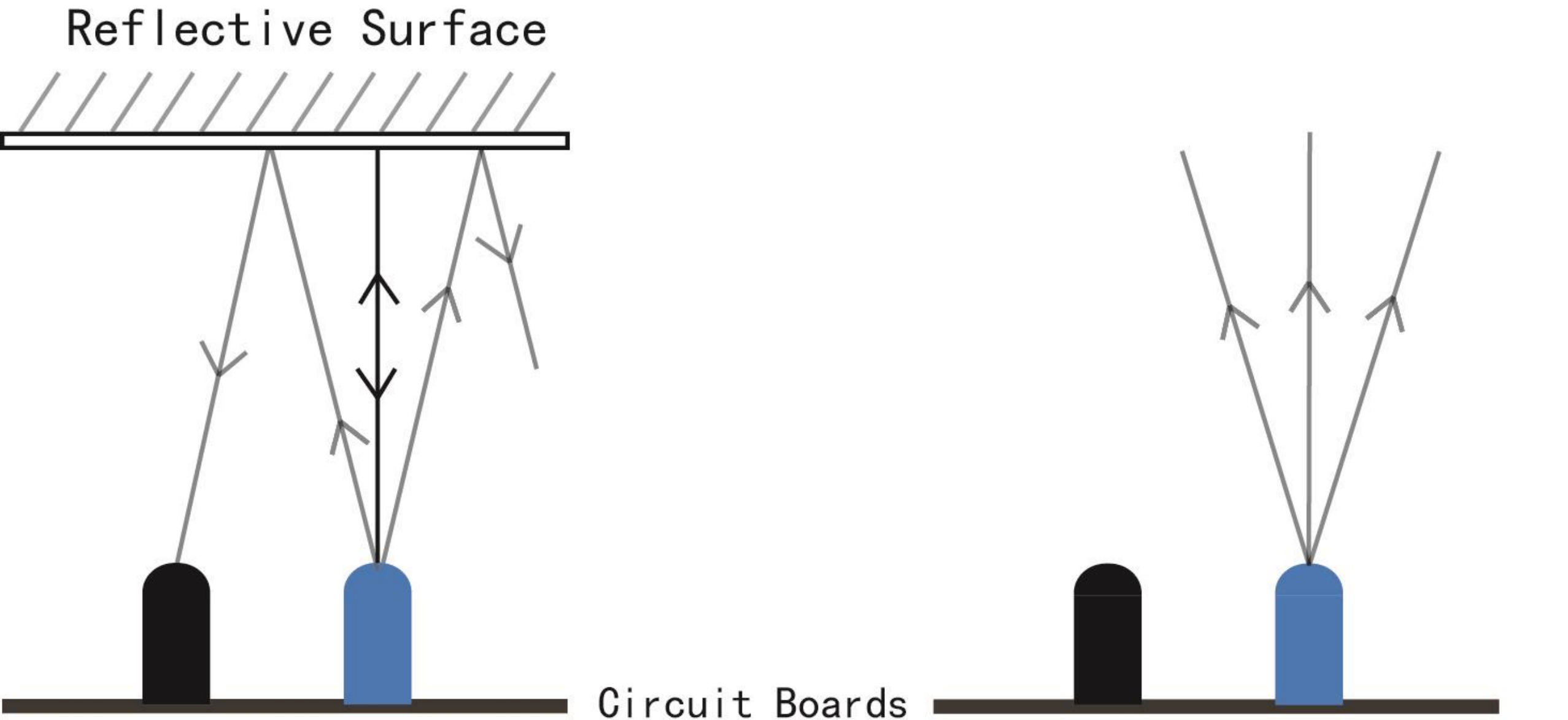

Sensors!!

IR Obstacle Avoidance Sensor

Practical Range: ~10cm



Vcc → 3v3 of ESP32
GND → GND of ESSP32
DO → GPIO 4/ 5/18/19/21/22


Reflective Surface
Circuit Boards
Photodiode
IR Receiver
IR LED
IR Transmitter
Photodiode
IR Receiver
IR LED
IR Transmitter

Light Dependent Resistor

Output

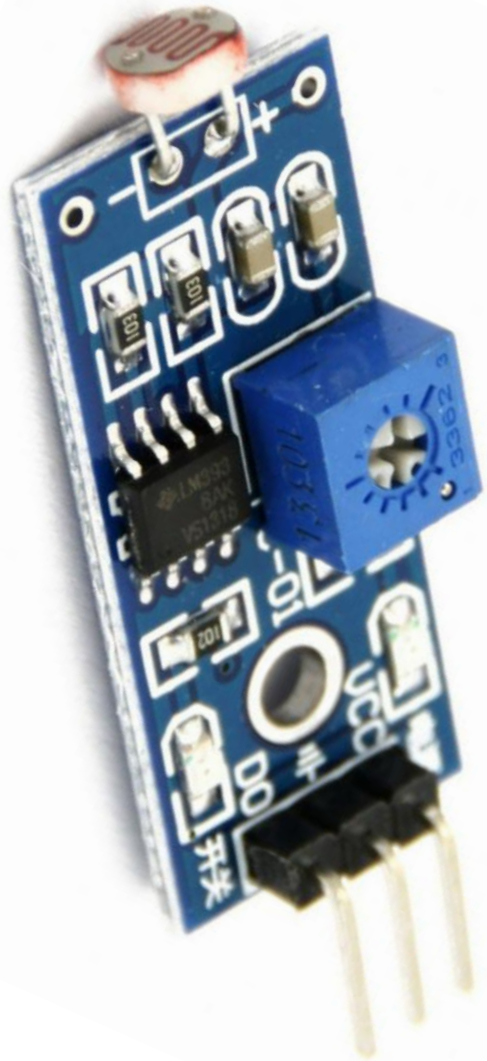
0 → Light level crosses threshold

1 → Light level below threshold

Vcc → 3v3 of ESP32

GND → GND of ESSP32

DO → GPIO 4/5/18/19/21/22



Microphone / Sound Sensor

Output

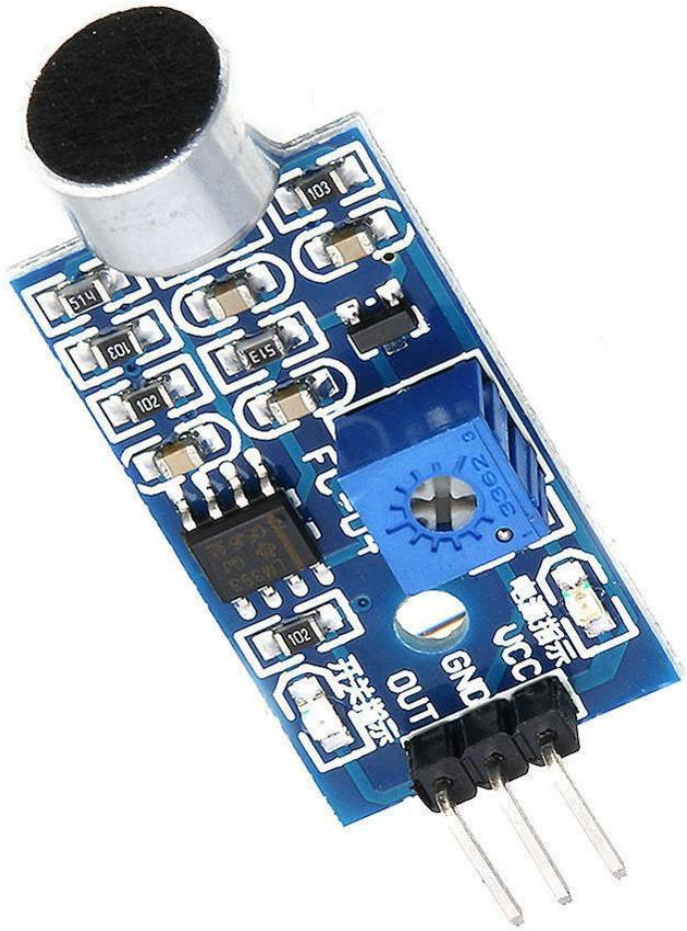
0 → Sound level crosses threshold

1 → Sound level below threshold

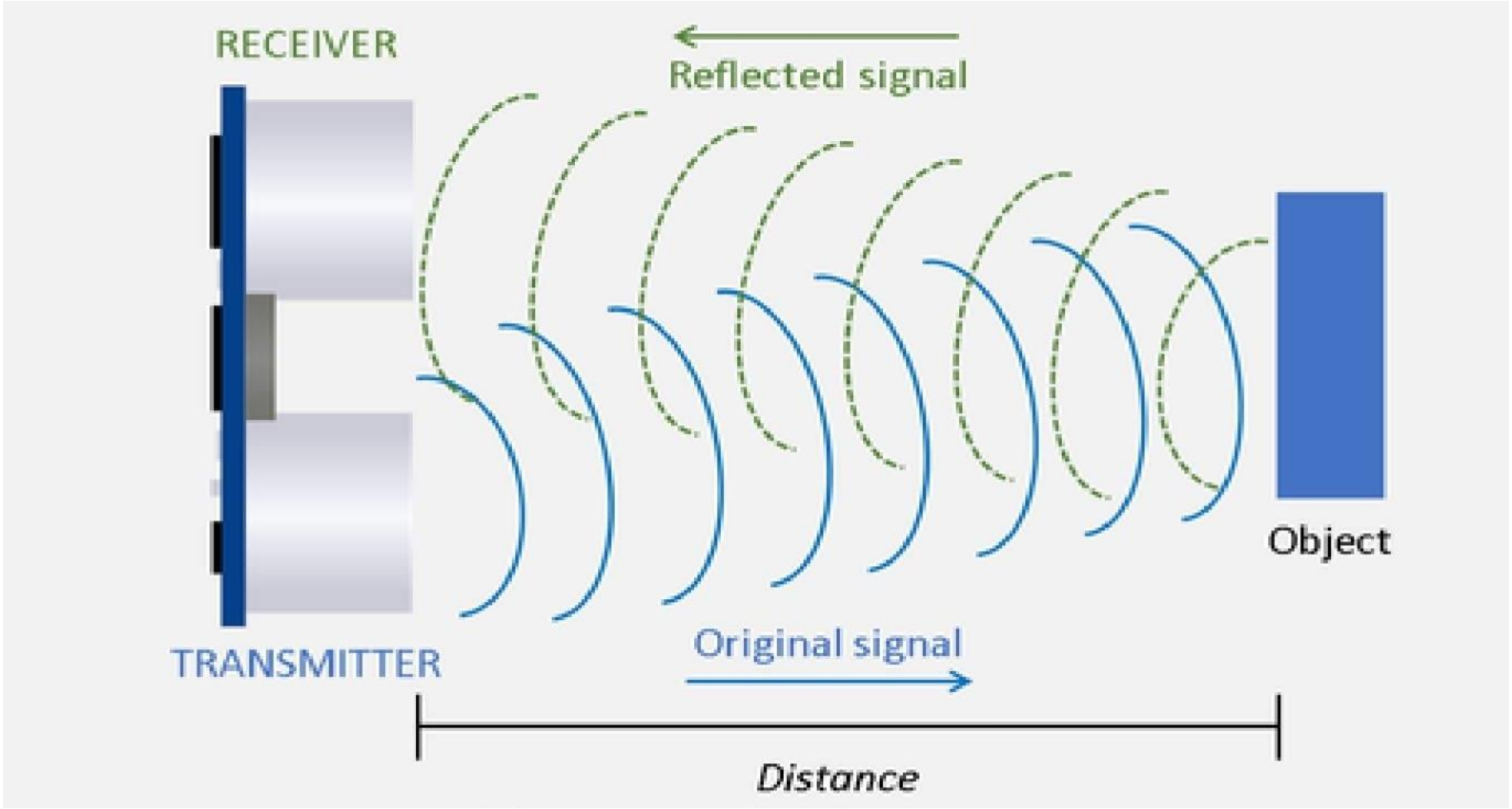
Vcc → 3v3 of ESP32

GND → GND of ESSP32

DO → GPIO 4/ 5/18/19/21/22



Distance Measurement : **HC-SR04**


RECEIVER
Reflected signal
Object
TRANSMITTER
Original signal
Distance

Learning Objectives Week 7

- ✓Using "For" Loop with list
- ✓List in a List
- ✓Stepper Motor
- ✓IR Sensor sensitivity
- ✓LDR Sensor
- ✓Sound Sensor
- ✓Ultrasonic Sensor HC-SR04