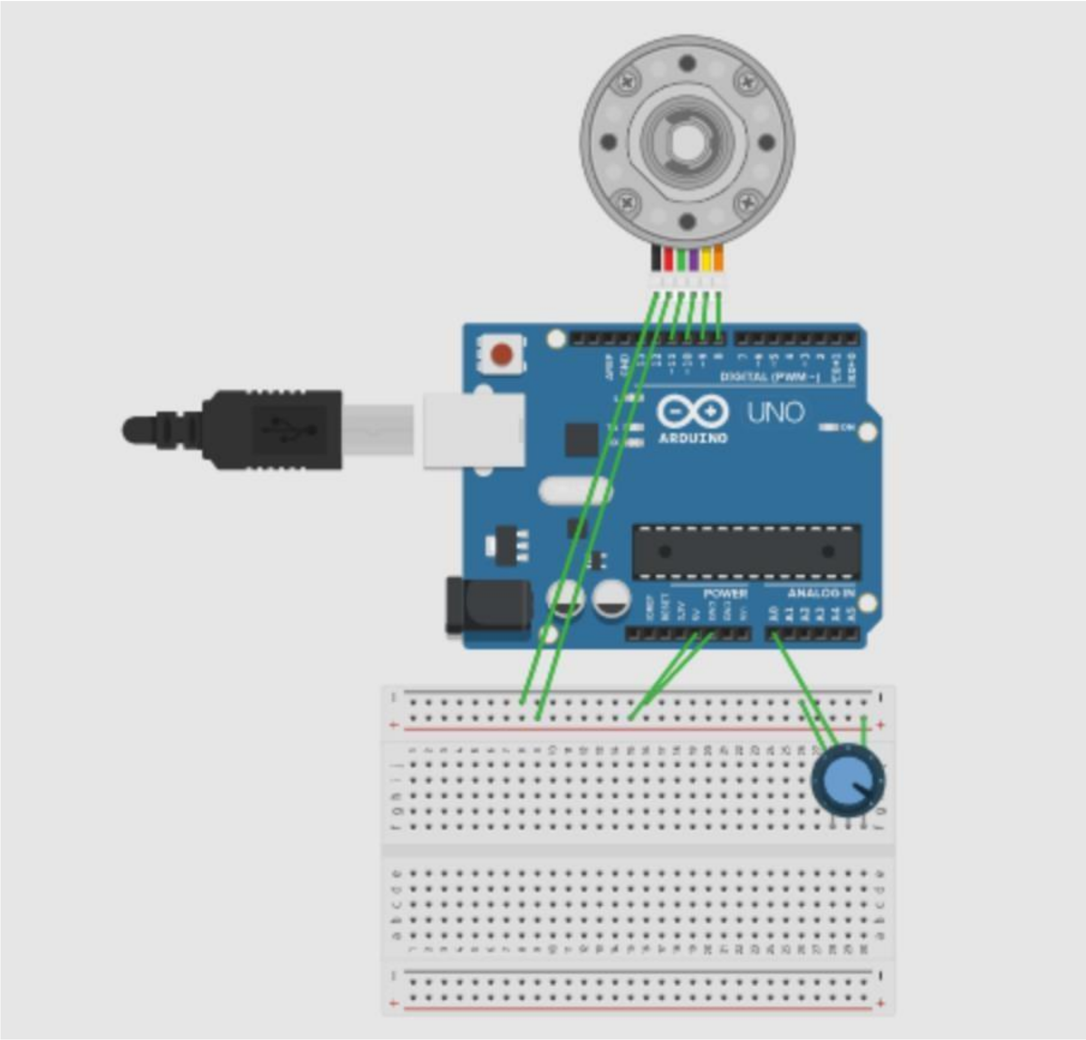
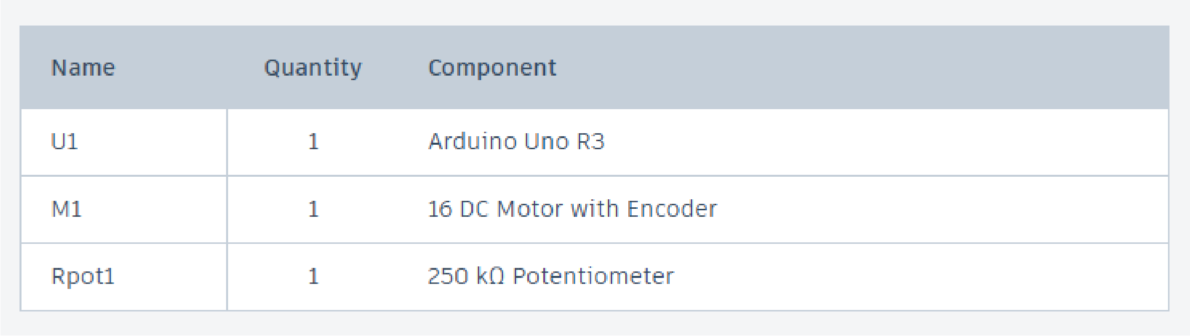
Practical No. 5

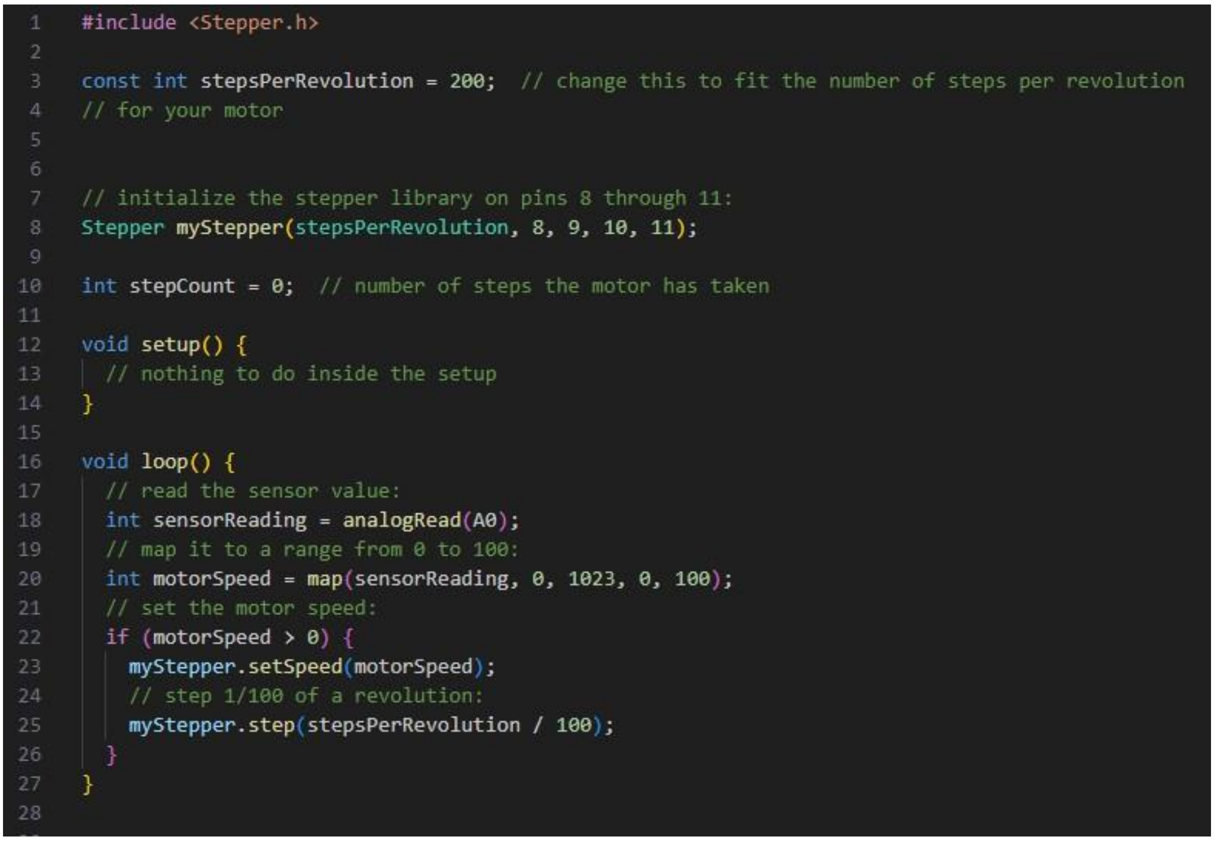
Aim - Stepper Motor Control: PWM to manage stepper motor speed using Uno/Raspberry Pi.

1) Virtual



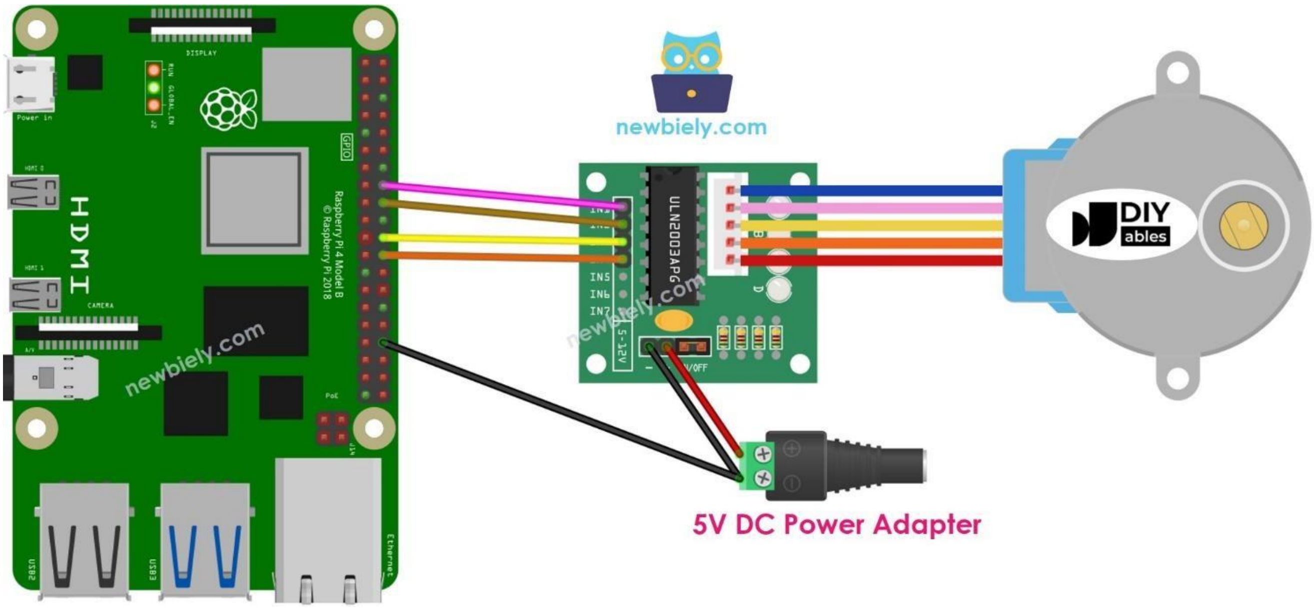


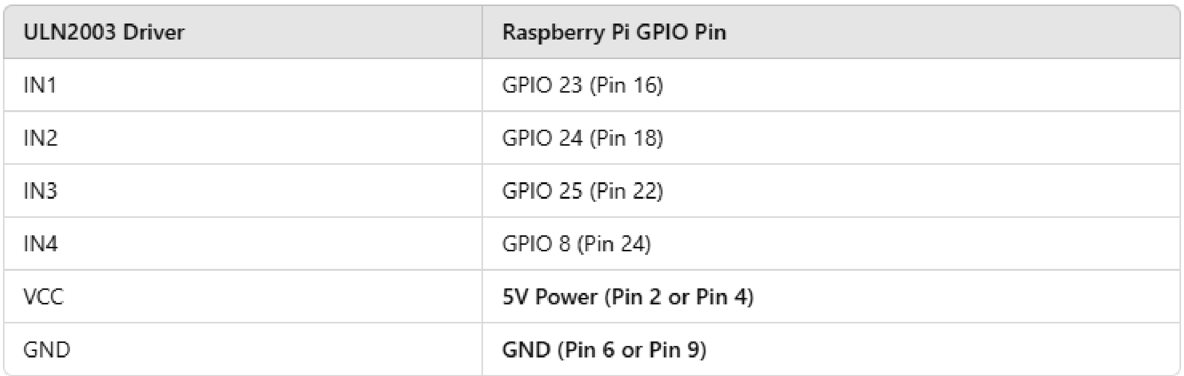
Name	Quantity	Component
U1	1	Arduino Uno R3
M1	1	16 DC Motor with Encoder
Rpot1	1	250 kΩ Potentiometer



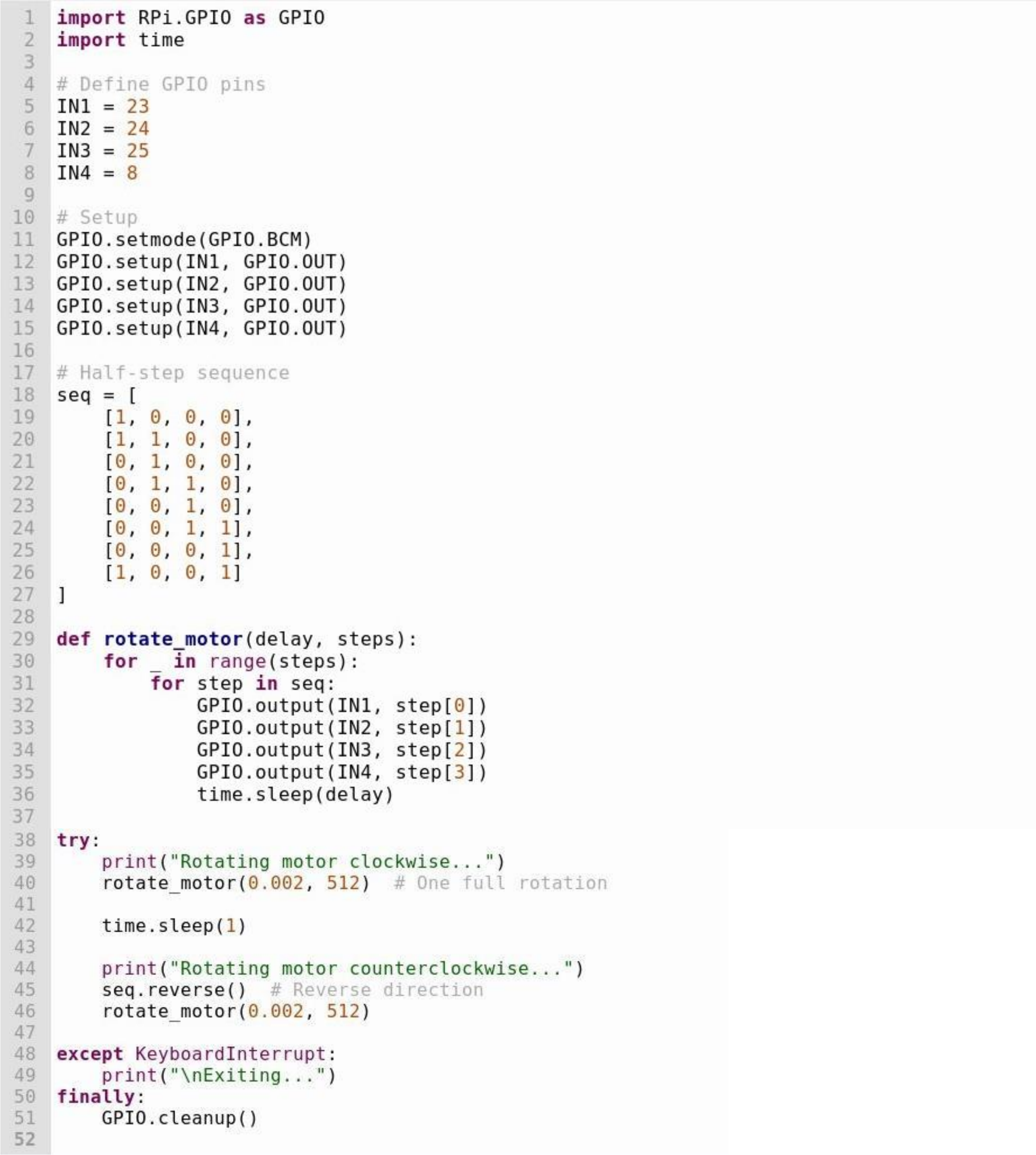
```
#include <Stepper.h>

const int stepsPerRevolution = 200;  // change this to fit the number of steps per revolution
// for your motor


// initialize the stepper library on pins 8 through 11:
Stepper myStepper(stepsPerRevolution, 8, 9, 10, 11);

int stepCount = 0;  // number of steps the motor has taken

void setup() {
  // nothing to do inside the setup
}

void loop() {
  // read the sensor value:
  int sensorReading = analogRead(A0);
  // map it to a range from 0 to 100:
  int motorSpeed = map(sensorReading, 0, 1023, 0, 100);
  // set the motor speed:
  if (motorSpeed > 0) {
    myStepper.setSpeed(motorSpeed);
    // step 1/100 of a revolution:
    myStepper.step(stepsPerRevolution / 100);
  }
}

```

2) Physical

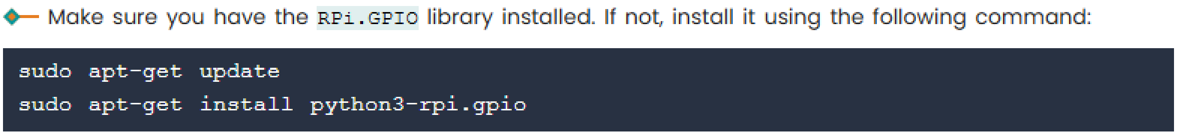




ULN2003 Driver	Raspberry Pi GPIO Pin
IN1	GPIO 23 (Pin 16)
IN2	GPIO 24 (Pin 18)
IN3	GPIO 25 (Pin 22)
IN4	GPIO 8 (Pin 24)
VCC	**5V Power (Pin 2 or Pin 4)**
GND	**GND (Pin 6 or Pin 9)**

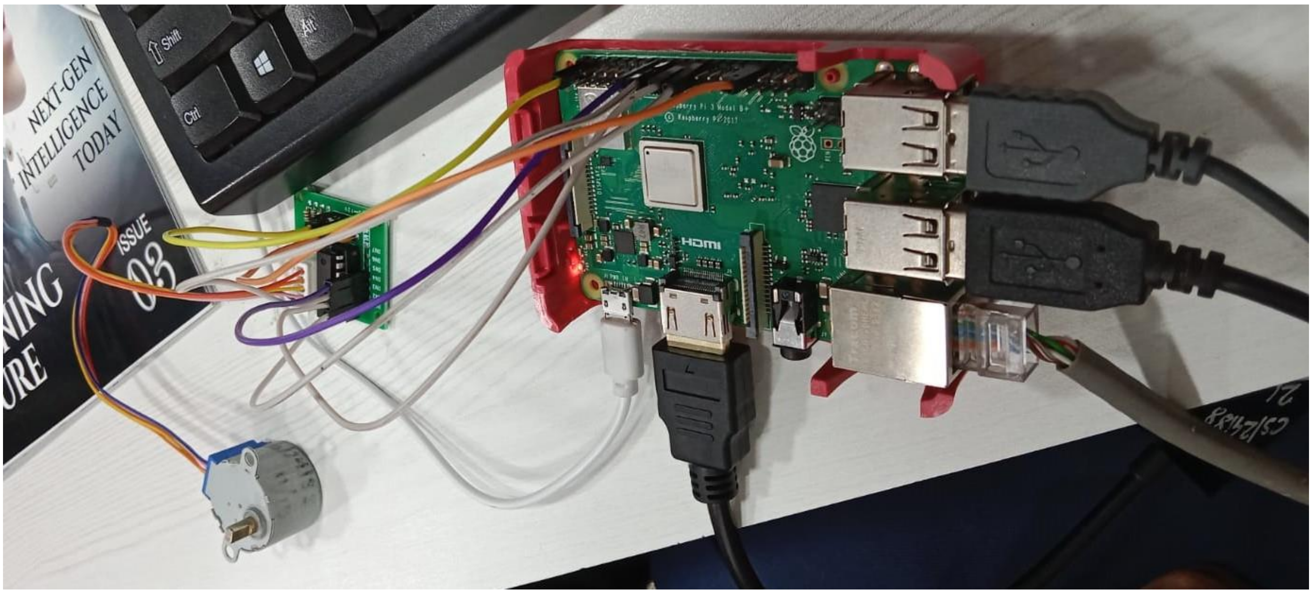


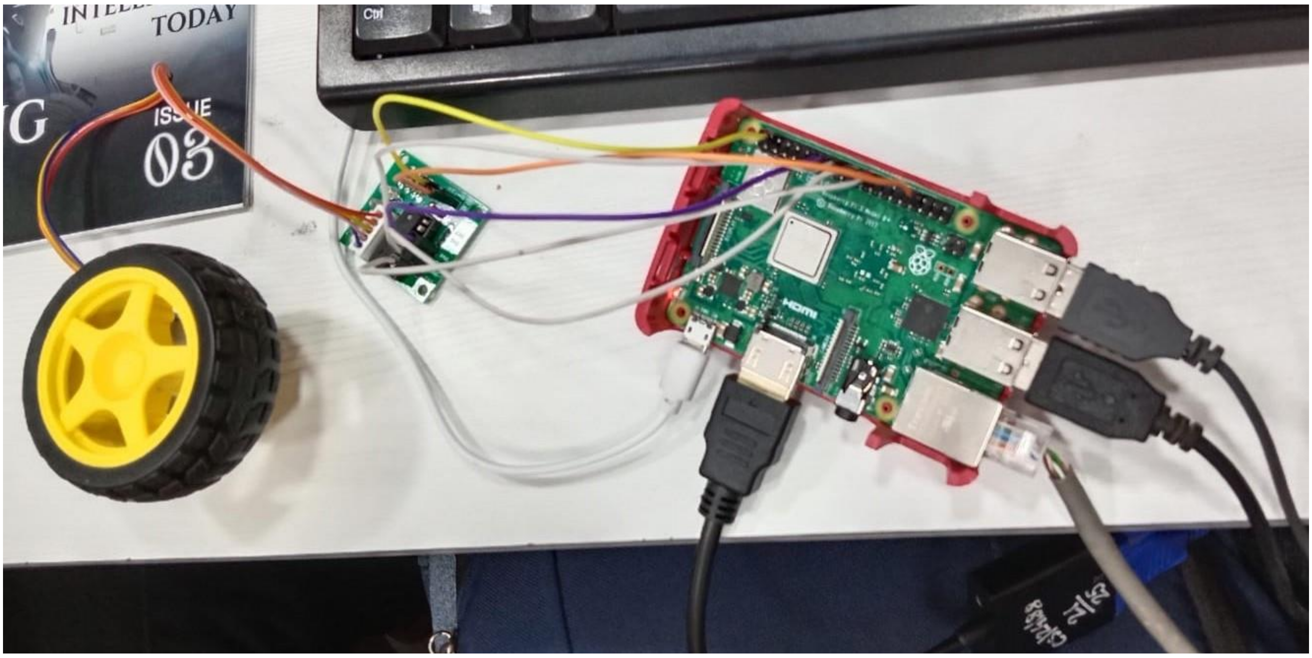
```python
import RPi.GPIO as GPIO
import time

# Define GPIO pins
IN1 = 23
IN2 = 24
IN3 = 25
IN4 = 8

# Setup
GPIO.setmode(GPIO.BCM)
GPIO.setup(IN1, GPIO.OUT)
GPIO.setup(IN2, GPIO.OUT)
GPIO.setup(IN3, GPIO.OUT)
GPIO.setup(IN4, GPIO.OUT)

# Half-step sequence
seq = [
    [1, 0, 0, 0],
    [1, 1, 0, 0],
    [0, 1, 0, 0],
    [0, 1, 1, 0],
    [0, 0, 1, 0],
    [0, 0, 1, 1],
    [0, 0, 0, 1],
    [1, 0, 0, 1]
]

def rotate_motor(delay, steps):
    for _ in range(steps):
        for step in seq:
            GPIO.output(IN1, step[0])
            GPIO.output(IN2, step[1])
            GPIO.output(IN3, step[2])
            GPIO.output(IN4, step[3])
            time.sleep(delay)

try:
    print("Rotating motor clockwise...")
    rotate_motor(0.002, 512)  # One full rotation

    time.sleep(1)

    print("Rotating motor counterclockwise...")
    seq.reverse()  # Reverse direction
    rotate_motor(0.002, 512)

except KeyboardInterrupt:
    print("\nExiting...")
finally:
    GPIO.cleanup()
```



Make sure you have the `RPi.GPIO` library installed. If not, install it using the following command:

```
sudo apt-get update
sudo apt-get install python3-rpi.gpio
```





Conclusion: Hence, we have successfully completed Stepper Motor Control: PWM to manage stepper motor speed using Uno/Raspberry Pi.