

DC Motor Documentation - Raspberry Pi 5 Integration

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1 Description

A **DC Motor** (Direct Current Motor) is a simple electric motor that runs on direct current electricity. It converts electrical energy into mechanical motion. When voltage is applied to the motor terminals, it generates torque and rotation.

DC motors are widely used for their simplicity, low cost, and ability to run at variable speeds. They can be controlled using a motor driver like the L298N or an H-bridge circuit that handles the higher current required by the motor.

2 Applications

- **Robotic Wheels:** Used for locomotion in robotic platforms.
- **Conveyor Belts:** Employed in manufacturing and sorting systems.
- **Automated Mechanisms:** Useful in fans, pumps, and small appliances.

3 Working Principle

A DC motor works based on the interaction between a magnetic field and a current-carrying conductor. When current flows through the armature inside the magnetic field, it experiences a force (Lorentz force) causing rotation.

Controlling a DC motor from the Raspberry Pi usually requires:

- A motor driver like **L298N** to handle high current
- **PWM** signals to adjust speed
- **GPIO** logic to control direction

4 Wiring Diagram

L298N Pin	Raspberry Pi Pin	Function
IN1	GPIO17	Direction Control
IN2	GPIO27	Direction Control
ENA	GPIO18	PWM Speed Control
VCC	External 12V	Motor Power
GND	GND	Common Ground

5 Libraries Used

Python: RPi.GPIO

RPi.GPIO provides control over GPIO pins and can generate PWM signals for speed control.

- Import: `import RPi.GPIO as GPIO`
- Setup: `GPIO.setmode(GPIO.BCM)`
- Set pin mode: `GPIO.setup(pin, GPIO.OUT)`
- PWM: `GPIO.PWM(pin, frequency)`

C: wiringPi + softPwm

wiringPi and softPwm provide GPIO and PWM functions in C.

- Setup: `wiringPiSetup()`
- Direction: `pinMode(pin, OUTPUT)`
- PWM: `softPwmCreate(pin, value, range)`

6 Python Example

```
import RPi.GPIO as GPIO
import time

IN1 = 17
IN2 = 27
ENA = 18

GPIO.setmode(GPIO.BCM)
GPIO.setup(IN1, GPIO.OUT)
GPIO.setup(IN2, GPIO.OUT)
GPIO.setup(ENA, GPIO.OUT)

pwm = GPIO.PWM(ENA, 1000) # 1kHz PWM
pwm.start(50) # 50% speed

try:
    GPIO.output(IN1, GPIO.HIGH)
    GPIO.output(IN2, GPIO.LOW)
    time.sleep(5)
except KeyboardInterrupt:
    pass

pwm.stop()
GPIO.cleanup()
```

7 C Example

```

#include <wiringPi.h>
#include <softPwm.h>
#include <stdio.h>

#define IN1 0 // GPIO17
#define IN2 2 // GPIO27
#define ENA 1 // GPIO18

int main(void) {
    wiringPiSetup();

    pinMode(IN1, OUTPUT);
    pinMode(IN2, OUTPUT);
    softPwmCreate(ENA, 0, 100);

    digitalWrite(IN1, HIGH);
    digitalWrite(IN2, LOW);
    softPwmWrite(ENA, 50); // 50% speed

    delay(5000); // Run motor for 5 seconds

    softPwmWrite(ENA, 0);
    return 0;
}

```

8 Conclusion

The DC motor is a versatile component suitable for many motion-based applications. When combined with an L298N driver and GPIO/PWM control, it can be precisely managed from the Raspberry Pi using either Python or C.