

# Motor Project Report

## 1. Objective

The goal of this project was to test and control a DC motor using a Raspberry Pi and a motor driver (H-bridge), troubleshoot faulty outputs, and implement basic forward/backward movement with speed control.

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## 2. Hardware Setup

- **Raspberry Pi GPIO pins:**
    - Left motor (Motor A): ENA = 18, IN1 = 23, IN2 = 24
    - Right motor (Motor B, faulty): ENB = 13, IN3 = 27, IN4 = 22
  - **Motor driver:** H-bridge with 12 V motor power and logic powered from Pi
  - **Motors:** Left motor connected, right motor disconnected (faulty driver)
  - **Other:** Multimeter used to measure voltage at outputs; motors removed during testing
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## 3. Troubleshooting and Testing

1. **Testing Pi GPIO pins:**
  - Ran scripts to set pins HIGH individually and measured outputs with a multimeter
  - Observed that only **Motor A outputs (OUT1/OUT2)** responded reliably
  - Motor B outputs showed 0–0.1 V → driver partially damaged
2. **EN and IN pins:**
  - Observed that outputs require **EN pin HIGH** to activate

- IN pins control **direction** (forward/reverse)
- Without EN HIGH, no output appears even if IN pins are set

### 3. Motor driver behavior:

- When 12 V motor power was applied, some outputs turned on immediately if EN pins floated HIGH
- Solved by tying EN LOW and IN pins LOW initially

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## 4. Motor A Control Code

- Python code using **pigpio** library
- Functions implemented:
  - `run_motor(value)` → move forward (positive) or backward (negative)
  - `stop_motor()` → stop motor safely
- **PWM used to control speed:** 0–255 duty cycle

### Example usage:

```
run_motor(150)    # forward at ~60% speed
run_motor(-150)   # backward at ~60% speed
stop_motor()      # stop
```

- ENA controls speed; IN1/IN2 control direction

To control the motor with the Raspberry Pi and the L298N driver, I used Python with the **pigpio** library. The following program demonstrates how to run **Motor A** both forward and backward with adjustable speed using PWM (Pulse Width Modulation).

```
import pigpio

import time


pi = pigpio.pi()

if not pi.connected:

    raise RuntimeError("pigpio daemon not running")


# Motor A pins (left motor)

ENA, IN1, IN2 = 18, 23, 24


# Set pins as outputs

for p in (ENA, IN1, IN2):

    pi.set_mode(p, pigpio.OUTPUT)


# Set PWM frequency

pi.set_PWM_frequency(ENA, 2000)


def run_motor(value):

    """Run Motor A forward or backward.

    Positive value → forward

    Negative value → backward

    Value range: -255 to 255

    """
```

```
    forward = value >= 0

    pi.write(IN1, 1 if forward else 0)

    pi.write(IN2, 0 if forward else 1)

    pi.set_PWM_dutycycle(ENA, min(255, abs(int(value))))

def stop_motor():

    pi.set_PWM_dutycycle(ENA, 0)

    pi.write(IN1, 0)

    pi.write(IN2, 0)

try:

    # Forward

    print("Motor A forward...")

    run_motor(100)

    time.sleep(2)

    stop_motor()

    time.sleep(1)

    # Backward

    print("Motor A backward...")

    run_motor(-210)

    time.sleep(2)

    stop_motor()
```

```
finally:

    stop_motor()

    pi.stop()

    print("Motor A stopped. Cleanup complete.")
```

#### Explanation:

- The **ENA pin** is used for speed control via PWM.
- **IN1** and **IN2** control the motor's direction.
- The function `run_motor(value)` takes a positive value for forward motion and a negative value for reverse motion, where the magnitude controls the speed (0–255).
- `stop_motor()` ensures the motor halts and the GPIO pins are safely reset.
- The code runs the motor forward for 2 seconds, pauses, and then runs it backward for 2 seconds before stopping completely.

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## 5. Requirements

Item	Quantity / Notes
Lithium batteries	2
Battery charger / holder	1
DC motors	2
L298N dual H-bridge motor driver	1

Breadboard	1
Raspberry Pi	1
Jumper wires	>20

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## 6. Observations

- Only **Motor A (left motor)** works; Motor B driver is faulty
  - PWM allows **adjustable speed**
  - Safe testing requires **motors disconnected** or low voltage, especially when outputs behave unpredictably
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## 7. Conclusion

This project demonstrated how to safely test motor driver outputs using a Raspberry Pi, isolate a faulty channel, and control a single working motor with forward/backward motion and speed control. It highlights the importance of **EN pins, input logic, and careful power sequencing** when working with H-bridges.

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## 8. References / Notes

- Raspberry Pi GPIO and pigpio library documentation
- H-bridge motor driver datasheet (for pin mapping and enable logic)
- Multimeter for voltage measurements and troubleshooting