**MECHATRONICS SYSTEM INTEGRATION**

**SECTION 2**

**SEMESTER 1 2025/2026**

**LECTURER:**

**Dr. Wahju Sediono**

**Dr Zulkifli bin Zainal**

# LAB REPORT WEEK 5:

# CONTROLLING A DC MOTOR USING L298P MOTOR DRIVER SHIELD AND GPIO

**GROUP 14**

| NAME | MATRIC NUMBER |
|---|---|
| Ahmad Aidil Adha bin Rosehaizad | 2118165 |
| Ahmad Hafizi Bin Ishak | 2111775 |
| FIRZANAH BINTI ABDUL AZEEZ | 2211430 |

# TABLE OF CONTENTS

# OBJECTIVE

- To comprehend how the L298P Motor Driver Shield operates.
- To use GPIO pins to regulate a DC motor's direction and speed.
- To use pulse width modulation, or PWM, to regulate speed.
- To create and upload Arduino code to run DC motors.

# Introduction

This experiment was carried out to understand how a DC motor could be controlled using the L298P Motor Driver Shield together with an Arduino UNO. The purpose was to learn how the shield allowed control of both the speed and direction of the motor using GPIO pins and Pulse Width Modulation (PWM). The L298P acted as an interface between the Arduino and the motor, providing enough current and voltage to drive the motor safely without damaging the microcontroller.

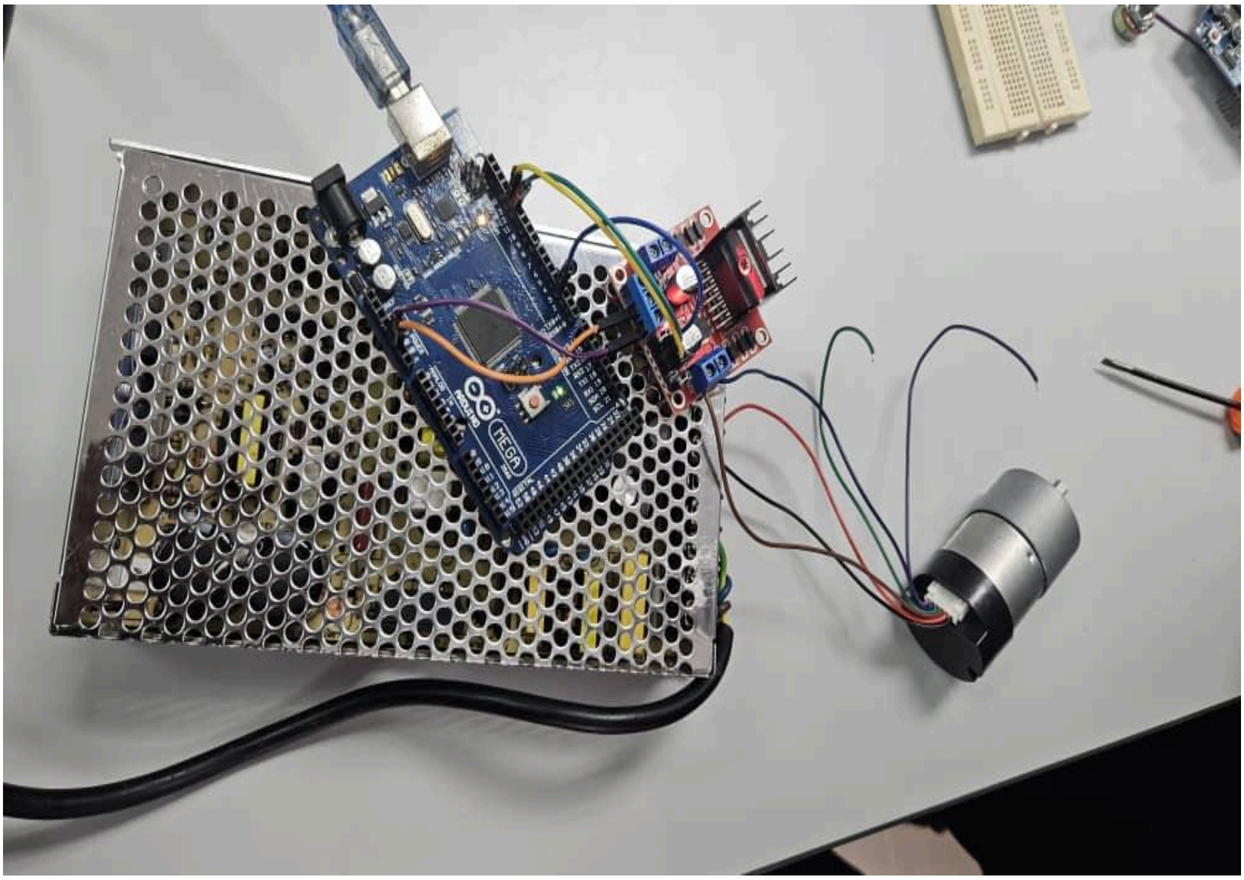
Through PWM control, the speed of the motor could be adjusted by changing the duty cycle of the signal sent from the Arduino. This method allowed smooth speed variation without using extra hardware.The experiment helps in understanding the fundamentals of speed control and motor driving, which are important to mechatronic and automation systems.

## MATERIALS AND EQUIPMENTS

REQUIRED HARDWARE

- Arduino UNO
- L298P Motor Driver Shield
- DC Motor (6V–12V) 1–2
- External Power Supply (9V/12V)
- Jumper Wires
- Breadboard

## EXPERIMENTAL SETUP



1. The L298P Motor Driver Shield was connected to the Arduino UNO board.
2. The DC motor was connected to the Motor output terminals on the shield.
3. The ENA pin (D3) was used to control motor speed using PWM signals.
4. The IN1 (D12) and IN2 (D13) pins were connected to control the motor's direction.

   An external 12V power supply was connected to the shield's screw terminal:
    - +12V to the positive terminal
    - GND to the negative terminal
5. The ground of the Arduino and the power supply was shared to ensure a common reference.
6. The Arduino UNO was connected to the computer using a USB cable.
7. The control code was uploaded to the Arduino through the Arduino IDE.
8. After uploading the program, the motor's rotation direction and speed were observed.
9. The PWM value in the code was adjusted to observe changes in motor speed.

OBSERVATION TABLE

| PWM value | Direction | Observed speed |
|---|---|---|
| 255 | Forward | ~120 RPM |

| | | |
|---|---|---|
| 128 | Forward | ~70 RPM |
| 255 | Reverse | ~120 RPM |
| 64 | Reverse | ~40 RPM |

**PROCEDURE**

- The Arduino UNO, a DC motor, and the L298P Motor Driver Shield were used to assemble the entire circuit.
- On the PC, the Arduino IDE program was launched.
- The motor control Arduino code was entered or copied into the IDE.
- The COM port and the appropriate board type (Arduino UNO) were chosen.
- After verification, the code was uploaded to the Arduino.
- After being uploaded, the motor began to rotate ahead for a short while.
- Then, in accordance with the code instructions, the motor rotated in the opposite direction.
- To see the impact on motor speed, the PWM value in the code was altered.
- The direction and speed of the motor were noted and entered into the observation table.

**RESULT**

## RESULT

The DC motor was successfully controlled using the L298P Motor Driver Shield and Arduino UNO. By varying the PWM value, the motor's speed changed accordingly, and its direction reversed when the input logic was modified. The results are summarized in Table 1.Observation of Motor Speed and Direction Increasing the PWM value increased the motor speed proportionally.Setting both IN1 and IN2 HIGH caused the motor to stop, demonstrating the braking effect.The PWM control provided smooth speed adjustment without fluctuations or instability. The braking function was immediate and effective, confirming the correct implementation of the control logic through the L298P Motor Driver Shield.

## TASK

1. Function of ENA and ENB pins

   The ENA and ENB pins were used to enable and control the speed of the two DC motors. ENA controlled Motor A, while ENB controlled Motor B. When these pins were connected to PWM-enabled pins on the Arduino, the speed of each motor could be varied by changing the PWM signal. If the enable pin was set to LOW, the motor stopped running.

2. Reason PWM is used for speed control

   PWM (Pulse Width Modulation) was used because it allowed control of the motor speed without losing much power. By changing the duty cycle of the PWM signal, the average voltage sent to the motor changed. A higher duty cycle made the motor spin faster, while a lower duty cycle reduced the speed. This method was more efficient than using resistors or variable voltage sources.

3. When both IN1 and IN2 were set to HIGH, the motor stopped turning. This was because both terminals of the motor received the same voltage, hence canceling the potential difference across the motor. This acted like an electrical brake to the motor.
4. How  the L298P was used for braking Braking was performed by setting both input pins, IN1 and IN2, to the same logic level, either HIGH or LOW. Because of this, there was a short circuit across the motor terminals, causing an abrupt interruption of the motor's rotation. This was a quick and efficient way to stop the motor without progressively changing its direction.
5. Due to the limitation of acquiring only one DC motor, the task has been skipped.

## DISCUSSION

The experiment successfully demonstrated how the L298P Motor Driver Shield can be used together with an Arduino UNO to control the speed and direction of a DC motor. Using the shield as an interface provided the necessary current and voltage to drive the motor safely without damaging the microcontroller. The use of Pulse Width Modulation (PWM) to regulate motor speed was effective, as adjusting the PWM duty cycle allowed smooth variation in motor speed without additional hardware. The ENA pin controlled motor speed via PWM, and the IN1 and IN2 pins provided directional control. Observations confirmed that higher PWM values resulted in higher motor speeds and changing the logic states of IN1 and IN2 changed the motor's direction. The braking function using both input pins set to the same logic level successfully stopped the motor abruptly and efficiently. The experiment met its objective of understanding key principles of motor control relevant in mechatronic and automation systems.

## RECOMMENDATION

1. Using multiple DC motors instead of only one would allow a more comprehensive study of the dual motor control capabilities of the L298P and better simulate real-world applications.
2. Incorporate feedback mechanisms such as encoders to measure actual motor speed, allowing closed-loop control rather than relying on preset PWM values alone.
3. Test the motor under different loads to observe how load variations affect speed and braking performance.

4. Explore using different PWM frequencies to evaluate their impact on motor performance and noise.
5. Implement gradual braking methods (e.g., reducing PWM duty cycle progressively) alongside the abrupt braking technique to compare effects on motor wear and control smoothness.

These recommendations can increase the quality and depth of the experiment, giving a more thorough understanding and practical insights into DC motor control using the L298P Motor Driver Shield and Arduino UNO.

## STUDENT'S DECLARATION

## Certificate of Originality and Authenticity

This is to certify that we are responsible for the work submitted in this report, that the original work is our own except as specified in the references and acknowledgement, and that the original work contained herein have not been untaken or done by unspecified sources or persons.

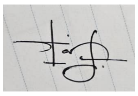
We hereby certify that this report has not been done by only one individual and all of us have contributed to the report. The length of contribution to the reports by each individual is noted within this certificate.

We also hereby certify that we have read and understand the content of the total report and no further improvement on the reports is needed from any of the individual's contributors to the report.

We therefore, agreed unanimously that this report shall be submitted for marking and this final printed report has been verified by us.

Name: Firzanah binti abdul azeez

Matric Number: 2211430

Signature: 

Read /
Understand /
Agree /

Name: Ahmad Aidil Adha bin Rosehaizad

Matric Number: 2118165

Signature: 

Read /
Understand /
Agree /

Name: Ahmad Hafizi Bin Ishak

Matric Number: 2111775

Signature: Hafizi

Read /
Understand /
Agree /