Motor Driver Circuit Explanation

1. Introduction

The purpose of this document is to explain the working principle of the motor driver

Using MOSFETs . Additionally, PWM (Pulse Width Modulation) is implemented to regulate motor speed.

---

2. Circuit Components and Working Principle

2.1 Components Used

- **Power Supply:** 12V Battery (BAT1) for motor operation.
- **Microcontroller:** Arduino Uno (U2) to control motor direction and speed.
- **MOSFETs:**
    - PMOS Transistors (T1, T3) – Act as high-side switches.
    - NMOS Transistors (T4, T5) – Act as low-side switches.
- **Motor (M1):** The DC motor to be controlled.

2.2 Working of the Circuit

This configuration allows the motor to be driven in both forward and reverse directions by switching different pairs of MOSFETs ON and OFF.

- **Forward Motion:** One PMOS and one NMOS transistor are turned ON to allow current flow in one direction.
- **Reverse Motion:** The opposite pair of PMOS and NMOS transistors are turned ON to reverse the current direction.
- **Stopping:** All transistors are turned OFF to cut power to the motor.
- **Braking:** Both NMOS transistors are turned ON, shorting the motor terminals to stop the motor quickly.

---

3. Arduino Code Explanation

3.1 Code Structure

The Arduino sketch is designed to:

1. Define motor control pins.

2. Initialize them in the setup() function.
3. Control motor movement and speed using the loop() function.

3.2 Code Implementation

```
void setup() {
    pinMode(13, OUTPUT);
    pinMode(12, OUTPUT);
    pinMode(A0, OUTPUT);
    pinMode(A1,OUTPUT);

    // Ensure the motor is off at the beginning
    digitalWrite(13, LOW);
    digitalWrite(12, LOW);
    analogWrite(A0, 0);
    analogWrite(A1, 0);
}

void loop() {
    // Forward rotation (13 HIGH, 12 LOW)
    digitalWrite(13, HIGH);
    digitalWrite(12, LOW);
    analogWrite(A0, 150); // Adjust speed (0-255)
    delay(2000); // Run for 2 seconds

    // Stop the motor
    digitalWrite(13, LOW);
    digitalWrite(12, LOW);
    analogWrite(A0, 0);
    delay(1000);

    // Reverse rotation (13 LOW, 12 HIGH)
    digitalWrite(13, LOW);
    digitalWrite(12, HIGH);
    analogWrite(A1, 150);
    delay(2000);

    // Stop the motor again
    digitalWrite(13, LOW);
    digitalWrite(12, LOW);
    analogWrite(A1, 0);
    delay(1000);
}
```

3.3 Explanation of Code Logic

- **setup() Function:**
    - Sets pin modes for motor control and initializes the motor in an OFF state.
- **loop() Function:**

1. **Forward Motion:**
    - Sets Pin 13 HIGH, Pin 12 LOW to activate the correct MOSFETs.
    - Sends a PWM signal (150) to A0 to control speed.
    - Runs the motor for 2 seconds.
2. **Stop Condition:**
    - Turns OFF all transistors, stopping the motor for 1 second.
3. **Reverse Motion:**
    - Sets Pin 13 LOW, Pin 12 HIGH to switch the current direction.
    - Sends PWM signal (150) to A1.
    - Runs the motor in reverse for 2 seconds.
4. **Stop Again:**
    - Turns OFF all transistors, stopping the motor for another 1 second.

---

4. Conclusion

This motor driver circuit allows bidirectional control of a DC motor using an Arduino Uno and an H-Bridge circuit with MOSFETs. PWM control enables smooth speed variation. The Arduino sketch successfully implements a control sequence for forward movement, stopping, reverse movement, and stopping again, making it suitable for applications like robotics and automation.