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Speed Control of DC Motor Using Arduino Nano

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Abstract -*This project presents a simple and effective method to control the speed of a DC motor using an Arduino Nano. DC motors are widely used in industries, robotics, and household applications where precise speed control is required. The main objective of this project is to design a low-cost and easy-to-implement system for controlling motor speed.*

In this system, the Arduino Nano acts as the main controller. The speed of the DC motor is controlled using Pulse Width Modulation (PWM) technique. By varying the duty cycle of the PWM signal, the voltage supplied to the motor changes, which in turn controls its speed. A motor driver module is used to interface the motor with the Arduino, ensuring safe and efficient operation.

User input can be given through a potentiometer or buttons, allowing real-time adjustment of motor speed. The system is compact, energy-efficient, and easy to program, making it suitable for beginners as well as practical applications.

The results show smooth and accurate speed control with minimal hardware requirements. This project demonstrates how micro-controllers like Arduino Nano can be effectively used in automation and control systems.

Key Words: DC Motor, Speed Control, Arduino Nano, PWM
Motor Driver, Microcontroller, Simple Control System

1.INTRODUCTION :-- DC motors are widely used in many applications such as household appliances, industrial machines, electric vehicles, and robotic systems. In most of these applications, controlling the speed of the motor is very important for proper performance and efficiency. Traditional methods of speed control are often complex, costly, and less flexible. With the advancement of microcontroller technology, it has become easier to design simple and low-cost systems for motor control.This project focuses on controlling the speed of a DC motor using an Arduino Nano, which is a compact and user-friendly microcontroller board. The Arduino Nano allows easy programming and quick implementation of control systems. In this system, the speed of the motor is controlled using a technique called Pulse Width Modulation (PWM). PWM works by varying the amount of power supplied to the motor, which directly affects its speed.

A motor driver is used to safely connect the motor with the Arduino, as the motor requires more current than the microcontroller can provide. The system also includes an input device such as a potentiometer to adjust the motor speed as per requirement.

The main aim of this project is to develop a simple, efficient, and cost-effective method for controlling DC motor speed. This project helps in understanding basic concepts of electronics, programming, and control systems, and it can be useful for students and beginners working on automation and robotics projects.

2. LITERATURE REVIEW :-

Previous research and applications of DC motor speed control have involved a variety of approaches, such as resistive control, voltage control, and frequency control. However, these methods often result in energy loss, complexity, and lack of precision. PWM-based motor control has been proven to be an effective solution due to its ability to adjust motor speed without significant power loss or additional components. Several studies have demonstrated the successful use of microcontrollers like Arduino and Raspberry Pi in motor control systems, particularly in robotic and industrial automation fields. This paper builds upon these findings by applying PWM for motor speed regulation using the Arduino Nano, providing a cost-effective and user-friendly solution for motor control.

II. METHODOLOGY- .

Fig -1: Figure

The DC motor speed control system was designed using the Arduino Nano as the central controller. The system uses a motor driver (L298N or similar) to interface with the motor, as the motor requires more current than the Arduino can supply directly. The speed of the motor is controlled by generating a PWM signal from the Arduino Nano's digital pins. The PWM signal adjusts the duty cycle, thereby varying the effective voltage supplied to the motor, which directly influences the motor speed.

A potentiometer is used to provide real-time input for adjusting the motor speed. The analog value from the potentiometer is read by the Arduino, which maps this value to the PWM signal controlling the motor. The motor driver ensures that the motor receives sufficient current and voltage while being controlled by the Arduino's PWM signal.

The components used in the system include:

- Arduino Nano: Central controller.
- DC Motor: The object being controlled.
- Motor Driver (L298N): Interface between Arduino and the motor.
- Potentiometer: Input device to control motor speed.

Power Supply: External supply for the motor.

3. CONCLUSION :- This project presents a straightforward and efficient method for controlling the speed of a DC motor using the Arduino Nano. By employing Pulse Width Modulation (PWM), the motor speed can be precisely adjusted, making the system both energy-efficient and cost-effective. This approach is versatile and can be applied in robotics, automation, and other applications where motor speed control is required. Future improvements could include adding feedback mechanisms, such as encoders, to enhance accuracy and overall performance. The Arduino-based design offers a practical solution for educational purposes, prototyping, and small-scale automation projects, providing a strong foundation for further development in motor control systems.

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