

Speed Control of DC Motor Using Arduino-uno And Wifi Module ESP8266

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Abstract—In this project, the IOT based control of dc motor has been reported. Internet is the most widely used, high speed and easily accessible communication medium in modern day world. In this system, the switching and the speed of dc motor can be controlled by using self-developed android application. In industry dc motor is widely uses for speed control and load characteristics, speed control of dc motor is very crucial in application where required speed is precision and correcting signal representing and to operate motor at constant speed, so we use PWM method.

Keywords— Iot, android application, Internet

I. INTRODUCTION

In This project We are going to implement speed control of a DC motor using an Arduino Uno and ESP8266 WiFi module. The Arduino Uno is a microcontroller board based on the Arduino-uno microcontroller, and the ESP8266 WiFi module is a low-cost Wi-Fi microchip. The combination of these two devices enables wireless communication between the motor and a smartphone or computer connected to the WiFi network.

The project involves connecting the motor to the motor driver, which is connected to the Arduino Uno board. The ESP8266 WiFi module is connected to the Arduino Uno board through serial communication. The system is programmed to receive commands from the user via the WiFi network and use these commands to control the speed of the motor. The user can send commands through a smartphone or computer connected to the WiFi network. Overall, the speed control of a DC motor using an Arduino Uno and ESP8266 WiFi module is an innovative project that can be used in various industrial applications to enhance automation and productivity. It is a cost-effective and efficient way of controlling the speed of a DC motor wirelessly, which can be useful in many applications

II. LITERATURE SURVEY

This Chapter reviews the various literature survey done on Speed Control of DC Motor. This Chapter also discussed the work done by other researcher in the field of Dc Motor. In a study published in the International Journal of Emerging Technologies and Innovative Research (IJETIR), researchers proposed a speed control system for a DC motor using an Arduino Uno and ESP8266 WiFi module. The study discussed the design and implementation of the system and the use of PWM (Pulse Width Modulation) to control the motor's speed. The results showed that the system could effectively control the speed of the motor wirelessly.

Another study published in the International Journal of Engineering and Advanced Technology (IJEAT) proposed a similar system using an Arduino Uno and ESP8266 WiFi module for controlling the speed of a DC motor. The study

used a mobile application to send commands to the system, and the results showed that the system could control the motor's speed accurately and efficiently.

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- [4] T. Castagnet and J Nicolai (1994).” discussed a permanent magnet DC motorspeed control using micro controller generated PWM signal”. Software flexibility for modifying drive parameters like maximum power, time constant etc. were also explained in that paper.
- [5] Y. S. E. Ali, S. B. M. Noor, S. M. Uashi and M. K. Hassan” discussed a micro controller based brush DC motor speed control through direct voltage compensation and motor power limitation”
- [6] N. J. Ploplys, P. A. Kawka and A.G. Alleyne (2004). “discussed a distributed control method using Bluetooth network and provided solution for two specific problems occurring while using Bluetooth in a control loop: long random delays and bit errors”.

III. PROPOSED HARDWARE

1. Aurdino uno

An Arduino uno is an open-source 8-bit microcontroller development board. In simple English Language we can use Arduino to read sensors and control things like motors. This allows you to develop programs to this board which can then

interact with things in the real world. With this, you can make devices which respond and react to the world at large. ATmega328p, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc to support microcontroller. AT mega has 32KB flash memory for storing the code and EPROM is 1KB.

ATmega328p can be powered using a Micro USB jack and VIN pin (External Supply Pin). You can connect external power source up to 12V and it will regulate it both 5V and 3.3V.



Figure 3.1 Arduino uno ATmega328p

2. Wifi Module (ESP8266)

There are a number of ways in which the Arduino microcontroller can be connected with the internet. One way is using the Arduino UNO Wi-Fi board. It has been represented in Fig 3.2. It is a microcontroller board with Wi-Fi module embedded in it. Another way is to use a separate ESP8266 Wi-Fi module. It has integrated TCP/IP protocol stack. It comes pre-programmed with AT command set firmware. It has 1MB Flash memory. It is IEEE 802.11 b/g/n Wi-Fi. It has 16 GPIO pins. It supports SPI as well as I2C communication protocols. Predefined library is also available for coding.



Figure 3.2 ESP8266 Wifi Module

3. DC Motor

The DC Motor is the motor which converts the direct current into the mechanical work. It works on the principle of Lorentz Law, which states that the current carrying conductor placed in a magnetic and electric field experience a force.



Figure 3.3 DC Motor

4. Servo Motor

A servo motor is a closed-loop system that uses position feedback to control its motion and final position advantages A servo motor is controlled by sending a series of pulses through the signal line. The frequency of the control signal should be 50Hz or a pulse should occur every 20ms. The width of pulse determines angular position of the servo and these type of servos can usually rotate 180 degrees (they have a physical limits of travel). Generally pulses with 1ms duration correspond to 0 degrees position, 1.5ms duration to 90 degrees and 2ms to 180 degrees. Though the minimum and maximum duration of the pulses can sometimes vary with different brands and they can be 0.5ms for 0 degrees and 2.5ms for 180 degrees position.



Fig 3.4 Servo Motor

5. Power Supply

Power supply is main source to operate any electronics based circuit and need of supply should at direct current low voltage, for low voltage we used the step down transformer from 230VAC to 12V DC. The 12VDC is getting after the full wave bridge rectifier is used to convert AC to DC by combination of 4 diode which are connected in bridge type.



Figure 3.5 Power Supply

6. Android Application

The android application is developed using an open source platform like android studio. The application thus developed will have options for both the operator and the control person. The application would provide a two-way control. The first mode of control can be a control where the controller can select the machine whose parameter is to be controlled. Once this is done, the current activity will be linked to the next activity which will contain different values for the speed control. Once the selection is made, authorization token will authorize the user using a predefined password in the application. Once the password matches with the predefined password, the internet on the phone sends the control data to the cloud web server. However, in contrast to the conventional cloud-centric architecture, virtual resources for the Internet of Things, a software architecture to resolve the tension between effective development and efficient operation of IOT applications has also emerged. Now in the first mode of control, an operator can be physically present at the machine location and can download the required machine running parameters from the web server from time to time and thereby, he can operate the machine accordingly. In the second proposed method, the running parameters of the machine will be obtained by the microcontroller and through the code uploaded in the microcontroller, it will send required instructions to the motor driver through switching array and the machine will run at the given parameters.



Figure 3.6 Mobile Application

IV. PROPOSED SYSTEM

1. Block Diagram

The block diagram below represented a detailed view of the proposed system. It provides complete information about this proposed system. This diagram explains how the existing system works and how the actual signal travels from one system to another and what are the main components used in this proposed system.

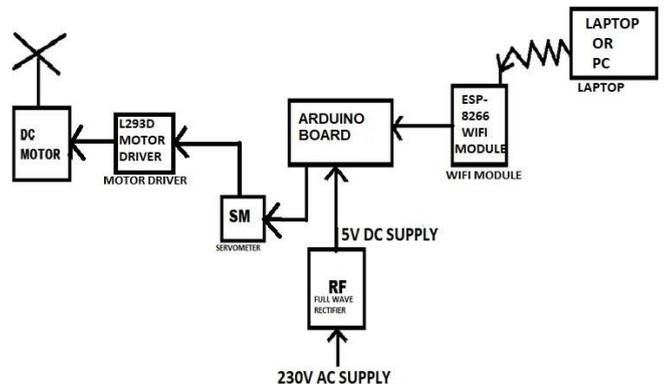


Figure 4.1 Block Diagram

- Steps involve preparing project
 - Step 1: Connect all components as per block diagram.
 - Step 2: Open the Laptop or Pc it asks for Wifi connection.
 - Step 3: scan for the wifi device and connect to ESP8266 WIFI Module.

Step 4: give the message from Laptop for increasing or decreasing the speed or on and off the motor or reverse the dc motor.

Step 5: The message is received by microcontroller and processed message is sent to Arduino.

Step 6: PWM program/coding is stored in Arduino. It gives the required output and the motor speed changes with respect to the message given by the user.

- Signal from Android gadget will be sent through wifi module (ESP8266). This signal will be communicated with a Arduino with the assistance of transmitter and receiver of both the gadgets. This signal will be addressed by a solitary letter which signifies the speed of the motor.
- In this way we can control the dc motor easily.

V. PIN DIAGRAM OF PROPOSED OF WORK

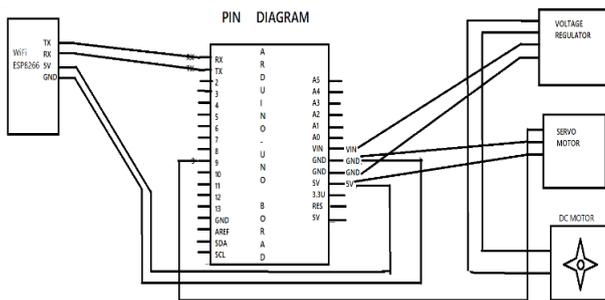


Figure 5.1 Pin Diagram

Controlling the speed of a DC motor using an Arduino Uno and an ESP8266 Wi-Fi module is a popular project in the field of electronics and automation. This project involves controlling the motor speed using Pulse Width Modulation (PWM) signals generated by the Arduino Uno and controlling it remotely using the Wi-Fi module.

Here are the steps to implement this project:

Materials:

- Arduino Uno board
- ESP8266 Wi-Fi module
- DC motor
- Power supply

Steps :

- [1] Connect the motor driver to the Arduino Uno board. The motor driver has four input pins, two for each motor terminal. Connect the two input pins of the motor driver to two digital output pins of the Arduino Uno.
- [2] Connect the ESP8266 Wi-Fi module to the Arduino Uno board. The ESP8266 module requires a 3.3V power supply, so connect its Vcc pin to the 3.3V output of the Arduino Uno. Connect the ESP8266's TX and RX pins to the RX and TX pins of the Arduino Uno, respectively.
- [3] Connect the DC motor to the motor driver. The motor driver has two output pins for each motor terminal. Connect one of the motor terminals to one of the motor driver's output pins, and the other motor terminal to the other output pin.
- [4] Connect the power supply to the motor driver and the Arduino Uno board.

[5] Upload the code to the Arduino Uno board. The code should generate a PWM signal on the digital output pins connected to the motor driver. The speed of the motor can be controlled by adjusting the duty cycle of the PWM signal.

[6] Connect to the Wi-Fi module using a mobile device or a computer. The Wi-Fi module can be configured as an access point or as a client that connects to an existing Wi-Fi network. Once connected, the user can send commands to the Arduino Uno board to change the motor speed.

VI. APPLICATION

Speed control of dc motor using Arduino Uno and esp 8266 wifi module Application

The speed control of a DC motor using an Arduino Uno and an ESP8266 Wi-Fi module has various practical applications in the field of automation and robotics. Here are some examples:

- [1] Smart home automation: The project can be used to control the speed of ceiling fans, curtains, or blinds using a mobile device or a voice assistant. The user can adjust the motor speed based on their preference or the ambient temperature or light.
- [2] Industrial automation: The project can be used to control the speed of conveyor belts, pumps, or mixers in manufacturing or processing plants. The user can monitor and adjust the motor speed remotely using a computer or a web-based interface.
- [3] Robotics: The project can be used to control the speed of wheels, arms, or grippers in robotic systems. The user can program the motor speed and direction based on the desired task or behavior of the robot.

[4] Education and experimentation: The project can be used as a learning tool for students or hobbyists who want to explore the basics of electronics and automation. The user can modify the code or the hardware to achieve different functionalities or performance characteristics.

Overall, the speed control of a DC motor using an Arduino Uno and an ESP8266 Wi-Fi module offers a flexible and low-cost solution for various automation and control applications. It enables remote monitoring and adjustment of motor speed, reduces the need for manual intervention, and can improve the efficiency and accuracy of the system

VII. RESULT

The results of the project depend on the implementation and the specific hardware used. However, here are some general observations and possible outcomes:

[1] The project should allow remote control of the DC motor speed using a mobile device or a computer. The user can connect to the Wi-Fi module and send commands to the Arduino Uno board, which adjusts the PWM signal on the motor driver accordingly.

[2] The accuracy and precision of the speed control depend on the resolution and frequency of the PWM signal, as well as the quality of the motor driver and the DC motor. Higher PWM frequencies can provide smoother and more precise control, but they may also generate more electrical noise and heat.

[3] The stability and reliability of the project depend on the robustness of the software and hardware components, as well as the quality of the power supply and the wiring. Poor connections or unstable power can cause erratic motor behavior or even damage to the components.

[4] The project can be extended to include additional features, such as feedback control using sensors or encoders, automatic speed control based on user-defined criteria, or integration with other automation systems. However, these features may require additional hardware and software complexity and may increase the overall cost and complexity of the project

[2] Machine learning and predictive maintenance: The project can be enhanced with machine learning algorithms to predict and prevent motor failures or anomalies based on the historical data and real-time sensor readings. This would enable proactive maintenance and reduce downtime and repair costs.

[3] Multi-motor coordination: The project can be extended to control and coordinate the speed of multiple motors in a synchronized or interleaved manner. This would enable more complex and coordinated motion control, such as in robotics or CNC machines.

[4] Sensor integration: The project can be integrated with various sensors such as temperature, humidity, pressure, or vibration sensors to provide feedback and adjust the motor speed based on the environmental conditions or the load requirements.

[5] Wireless communication standards: The project can be adapted to support other wireless communication standards such as Bluetooth, ZigBee, or LoRaWAN to enable longer range or low-power communication with the motors.

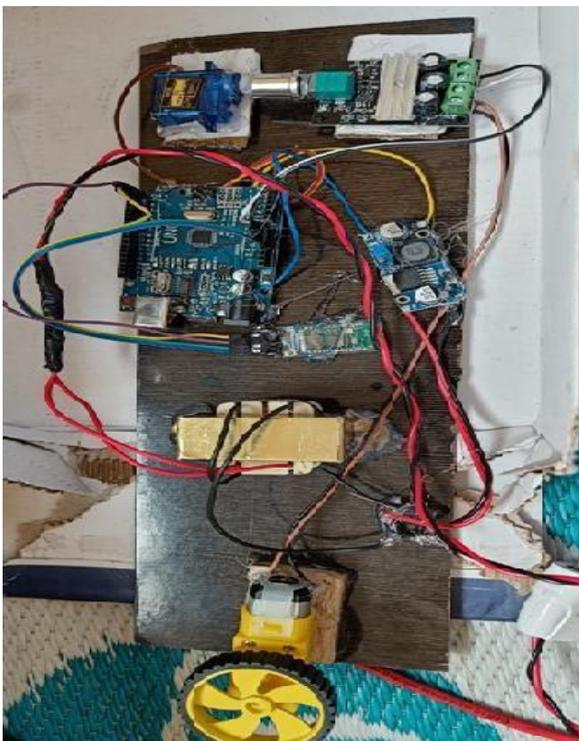


Figure 7.1 Implemented Prototype

VIII. FUTURE SCOPE

The speed control of a DC motor using an Arduino Uno and an ESP8266 Wi-Fi module has a lot of potential for future development and improvements. Here are some of the possible future scopes:

[1] Integration with cloud services: The project can be integrated with cloud-based services such as AWS, Azure, or Google Cloud to enable remote monitoring and control of multiple motors across different locations. This would allow the user to access and manage the motors from anywhere in the world.

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