IJARETY

International Journal of Advanced Research in Education and TechnologY (IJARETY)

Volume 11, Issue 2, March 2024

Impact Factor: 7.394

www.ijarety.in editor.ijarety@gmail.com

International Journal of Advanced Research in Education and TechnologY(IJARETY)

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

Speed and Direction Control of DC Motor through WiFi Using Arduino

Tushar Navnath Rathod, Sachin Rameshwer Rathod, Avinash ulhas Jadhav, Pratik Sanjay Navale,

Prof.Punam M.Chabukswar

UG Students, Trinity College of Engineering and Research Pune, India

Assistant Professor, Trinity College of Engineering and Research Pune, India

ABSTRACT: It focuses on utilizing WiFi technology and Android smartphones to remotely monitor and control the speed and direction of DC motors. By interfacing a microcontroller with a WiFi module, commands from the Android application are transmitted wirelessly to adjust motor parameters via PWM techniques and relay circuits. This approach enhances accessibility and convenience, offering potential applications in various industries such as robotics and industrial automation, promising increased productivity and efficiency. The paper provides a comprehensive overview of hardware and software implementations, discussing benefits, drawbacks, and future prospects of smartphone-based DC motor control systems.

I.INTRODUCTION

DC motors are used in most sectors today. Therefore, speed control of DC motors is essential. Thus, the focus of our work is on leveraging WiFi technology to monitor and control the speed of a DC motor through the use of Android mobile applications. Because smart phones come with built-in WiFi, an external WiFi module is used to interface the microcontroller (ARDUINO) to enable wireless connection. The Android application on a mobile phone issues commands to the WiFi module. Therefore, MOSFET may be utilized to adjust the voltage and speed of the DC motor using PWM technique with the aid of an Arduino and the input signal. Relay circuits and H-Bridge networks can also be used to change the direction of a DC motor. For DC motors, speed control is highly important. WiFi technology is used to monitor and control the speed of DC motors using Android smartphones; therefore, an external WiFi module called the HC05 is interfaced with the PIC microcontroller unit to establish a wireless connection. The Android app on the smartphoneprovides a signal to the WiFi module. As a result, based on the I/P signal, an IR sensor and PIC can typically be used to adjust the speed of a DC motor through the use of PWM techniques. A driver circuit or H-Bridge network can also be used to change the direction of a direct current motor. Some benchmark characteristics, such as steady operation, linear control, and dependability, should be present in the electric drive systems. In these respects, DC-driven machinery has considerable advantages. The ways in which DC motors are speed-controlled are critical to the drive's operation. The major goal of a DCdrive is to maintain a system with a stable speed regardless of the load state, and the main aim of a speed controller is to concentrate on how we can utilize WiFi-based devices to regulate the speed and direction of a DC motor at the required speed. This paper describes a recently built smartphone control experimental setup that can be accessed via WiFi, called "Android-based speed control of DC motor."Wireless technology is used by the smartphone to send and receive data to and from the microcontroller via WiFi. The user downloads and installs an Android application on their phone, which functions as a display panel to send, receive, and view the DC motor's input and output. The microcontroller in this research can transmit a visual display of the motor's current position using sensors to a smartphone. It is simple to use our microcontroller-based remote control methods with an Android smartphone to adjust the motor's speed.There is a growing need for effective and adaptable motor control systems as companies seek to incorporate automation and smart technology into their operations. Specifically, a major improvement in control is the capability to use cellphones to remotely monitor and alter the speed and direction of DC motors.This improves accessibility and convenience while also creating new

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

opportunities for applications in a variety of industries, including robotics, industrial automation, and home appliances. Engineers and researchers have developed creative solutions for real-time motor control by utilizing the widespread use of smartphones and WiFi communication capabilities. This has opened the door for increased productivity, efficiency, and flexibility in a variety of industrial and consumer applications. In this work, we offer a thorough review of the hardware and software implementation of such systems, investigate the possibilities of smartphone-based DC motor control systems, and talk about their benefits, drawbacks, and future prospects.

II.LITERATURE REVIEW

Chaubey, Ritesh et al.Using an Android mobile application, a microcontroller may be implemented to control the speed and direction of a DC motor in either clockwise or counterclockwise directions. To operate the DC motor, a high frequency PWM signal is supplied to the DC chopper. The duty cycle of this PWM signal can be adjusted to control the DC motor's terminal voltage, which in turn directly regulates the motor's speed. The microcontroller in this system is interfaced with a DC motor. The main components of this system are the DC motor, WiFi module, and Arduino UNO. The entire system is powered by a 12v transformer. The WiFi module receives orders from an Android handset and forwards them to the microcontroller. When the The motor can run in both directions at any time when it is turned on. The dc motor's speed and status are shown on an LCD. A signal from an Android device will be supplied to the microcontroller via the WiFi module in order to regulate the speed and direction of the DC motor signal. The motor's direction and speed will be indicated by a single direction in this signal. The three orientations of rotation—clockwise, counterclockwise, and stopping the motor— will be represented by different letters. This letter will change the motor's speed in relation to the Arduino code. The PWM signal's duty cycle is adjusted between 0 and 255 to alter the DC motor's speed. An H-bridge concept is used to control the direction of a DC motor. [1]

Barsoum N. et al.The speed of a DC motor can be easily controlled by sending an SMS from a mobile device. The user can send an SMS to the GSM module specifying the desired motor speed in RPM. When an SMS is received on the GSM module, the MCU will process it and turn it into a proper duty cycle for a PWM pulse that will regulate the DC motor's speed. Every five seconds at position 1, the MCU is configured to send an AT command to the GSM module, instructing it to check for messages in the SIM. Following receipt of the massage, the program will proceed to the next stage. The MCU will then receive the SMS, extract the speed, and modify it to a duty cycle that is appropriate for the PWM. By utilizing a PWM pulse to regulate the motor drive L2931, an appropriate voltage is generated. The motor receives this appropriate voltage in order to operate at the intended speed. Following this procedure, an AT command was used to remove the message from position 1 of the GSM module. The message was then read again in the SIM by looping back to the initial step. This will be an ongoing process. Sending and receiving SMS commands to a motor has numerous benefits. Manual labor will decrease because the motor's speed is managed by providing instructions to the MCU. The cost of wiring will also decrease since wireless technology allows DC motor speed management from a distance.[2]

Sivanagappa etal, V.J.The rectifier, filter capacitor, and DC/DC converter make up this system. IGBT, the primary part of the DC/DC converter, is powered by PWM pulses that are supplied by the microcontroller. By connecting the Ethernet module to an RJ45 cable, an Arduino Ethernet shield is used to link the Arduino on-board microcontroller to the internet. Data is communicated to the microcontroller via the internet by swiping the slider on the Android app. Digital values ranging from 0-255 are set up on the slider. The data is transferred to the Ethernet shield and a corresponding pulse with a duty ratio is achieved based on the value that the user has fixed. By using the microcontroller signal to drive the IGBT, the motor's speed may be adjusted.[3]

Mr. Arindam Bhattacharjee, Esq.The BLDC motor's speed can be controlled via a mobile application and secure WiFi. An Android application transmits a signal to the WiFi module, which is then received by the Arduino Uno, to control the speed

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

and direction of a BLDC motor. This design allows us to operate the motor in either a clockwise or counterclockwise direction. Reversing the direction of current flow in the armature or field winding of the BLDC controls the direction of the motor. Android mobile, BLDC motor, WiFi module, and Arduino Uno ATmega328 microcontroller are the four primary pieces of hardware used in this technique. Using this method, the user uses an Android smartphone that is wirelessly connected to a WiFi module to give instructions to the Arduino Uno ATmega328 microcontroller. The Arduino Uno microcontroller, which powers the BLDC motor, receives information from the user that is read by the WiFi module. The PWM approach is used to regulate the BLDC motor's speed and direction. The implementation of PWM technology is mostcommon in speed control. The duty cycle of the PWM pulse is changed to regulate the speed of the DC motor. The motor's speed rises with increasing duty cycle and falls with decreasing duty cycle. Researchers come to the conclusion in this work that a BLDC motor's speed and direction can be controlled via WiFi using an Arduino Uno. A change in duty cycle has resulted in a change in terminal voltage. The duty cycle is adjusted by PWM control. [4]

The author N.Barsoum et al. used GSM technology to transmit SMS messages from a mobile device to regulate the speedof a DC motor. The user can send an SMS to the GSM module specifying the desired motor speed in RPM. When an SMS is received on the GSM module, the MCU will process it and turn it into a proper duty cycle for a PWM pulse that will regulate the DC motor's speed. Every five seconds at position 1, the MCU is configured to send an AT command to the GSM module, instructing it to check for messages in the SIM. Following receipt of the massage, the program will proceed to the next stage. The MCU will then receive the SMS, extract the speed, and modify it to an appropriate duty cycle for the PWM. By utilizing a PWM pulse to regulate the motor drive L2931, an appropriate voltage is generated. This voltage is appropriate...[5].

Using an Android mobile application, R. Chaubey et al. studied the use of a microcontroller to regulate the speed and direction of a DC motor in either a clockwise or counterclockwise direction. To operate the DC motor, a high frequency PWM signal is supplied to the DC chopper. The duty cycle of this PWM signal can be adjusted to control the DC motor's terminal voltage, which in turn directly regulates the motor's speed. The microcontroller in this system is interfaced with a DC motor. The main components of this system are the DC motor, WiFi module, and Arduino UNO. The entire system is powered by a 12v transformer. The WiFi module receives orders from an Android handset and forwards them to the microcontroller. The motor can run in both directions at any time when it is turned on. The dc motor's speed and status are shown on an LCD. A signal from an Android device will be supplied to the microcontroller via the WiFi module in order toregulate the speed and direction of the DC motor signal. The motor's direction and speed will be indicated by a single direction in this signal. The three orientations of rotation—clockwise, counterclockwise, and stopping the motor—will be represented by different letters. This letter will change the motor's speed in relation to the Arduino code. The PWM signal's duty cycle is adjusted between 0 and 255 to alter the DC motor's speed. An H-bridge concept is used to control the directionof a DC motor. This system has the advantage of using a WiFi module, which uses less power than other devices while yet offering an environment that is easy to use. Technically speaking, this system does not require more skilled workers. However, using an Android app on a smartphone drains battery life, and using a WiFi module restricts use to a small area.[6]

III.METHODOLOGY OF PROPOSED SURVEY

Any rotational electrical machine that transforms electrical energy from direct current into mechanical energy is called aDC motor. The most often used kinds depend on the forces generated by magnetic fields. Almost all varieties of DC motors contain an internal mechanism—electromechanical or electronic—that allows the motor's portion to periodically reverse the direction of current flow. Due to their ability to draw power from the direct-current lighting power distribution networks already in place, DC motors were the first to be employed extensively. A DC motor's speed can be adjusted throughout a broad range by varying the field windings' current strength or the motor's supply voltage. Appliances, toys, and tools all employ small DC motors. The universal motor is a lightweight motor used for portable power equipment and appliances

International Journal of Advanced Research in Education and TechnologY(IJARETY)

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

that runs on direct current. Larger DC motors are utilized in steel rolling mill drives, elevators, hoists, and electric carpropulsion. In many applications, AC motors can now replace DC motors thanks to the development of power electronics.

Development
ToolsHardware
–

1. Arduino UNO
2. DC Motor
3. LCD Display
4. MOSFET
5. WiFiModule
6. Optoisolator
7. Power Adapter

Software – Arduino IDE, Proteus

IV.BLOCK DIAGRAM AND CIRCUIT DIAGRAM

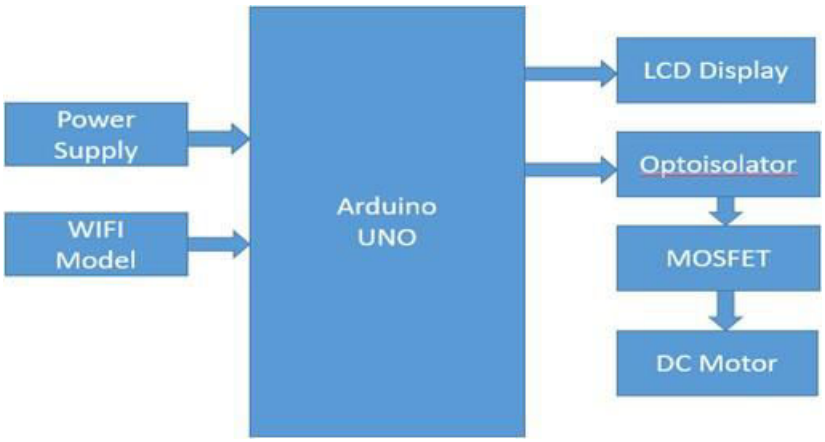

Figure 1. Block Diagram

The major elements of block diagram are:

- Arduino UNO
- WiFi Module
- DC motor

ARDUINO UNO

An ATmega328P-based microcontroller board is called the Uno. Being the mainstay of the Arduino ecosystem, it is well- known for its adaptability, usability, and extensive feature set. At its core is the ATmega328P, a potent yet effective microcontroller that can easily handle a variety of tasks. With its wide range of functionality, the Uno is a valuable tool for professionals, educators, and aficionados of electronics.The Uno has fourteen digital input/output (I/O)

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

pins, which means there are lots of options for integrating it with other parts and accessories. Users can control devices like LEDs, motors, andsensors by configuring these pins as inputs or outputs. Furthermore, six of these digital pins have the ability to do Pulse Width Modulation (PWM), which allows for precise control over analog devices and makes jobs like dimming LEDs and regulating motor speed easier.Apart from its digital I/O functionalities, the Uno is equipped with six analog input pins that facilitate the interface of analog sensors and transducers. Users can now record temperature, light intensity, and sound levels, among other physical world data, creating a plethora of opportunities for sensing and monitoring applications. The 16 MHz quartz crystal of the Uno guarantees quick and effective code execution, allowing for responsive and real-time control of linked devices. Additionally, its USB connection makes it simple to communicate with a host computer, which makes debugging and programming easier. In standalone applications, the power jack ensures continuous functioning by offering a convenient way to deliver external power to the board.The preprogrammed bootloader of the Uno, which enables users to upload fresh code to the board without the use of an external hardware programmer, is one of its primary advantages.

WiFi MODULE

A WiFi module is an electrical component that makes use of WiFi (Wireless Fidelity) technology to facilitate wireless communication. Usually, these modules are made up of a chip, or chipset, and the related hardware and software needed to establish a WiFi network connection. They are frequently utilized in many different applications, such as consumer electronics, industrial automation, Internet of Things (IoT) devices, and more.WiFi modules can be purchased alone or as part of development boards for testing and prototyping, or they can be integrated into already-existing hardware designs. They frequently support a variety of WiFi technologies, including 802.11b/g/n/ac. They may also have features like encryption, power management, and security protocols (WPA, WPA2, WEP).

Popular producers of WiFi modules include Qualcomm, Texas Instruments, MediaTek, Espressif Systems (best known for their ESP8266 and ESP32 series), and others. With the help of these modules, engineers and developers may easily add wireless connectivity to their projects without starting from scratch when designing and implementing WiFi capabilities.

DC MOTOR

Nearly all the mechanical motion we observe in our surroundings is powered by an electric motor. Energy conversion is accomplished by electrical machinery. Motors generate mechanical energy from electrical energy. Numerous everyday products we use are powered by electric motors. Hand power tools, food blenders, cars, and robotics are a few examples of small motor applications. Electric motors are ubiquitous in modern civilization, which emphasizes their vital function in supplying power to a plethora of gear and devices. Electric motors power a plethora of mechanical movements that are a part of every day life, from the modest electric toothbrush to the powerful industrial robots. These motors are the foundation of many industries, including consumer electronics, manufacturing, and the automotives.

A DC motor's fundamental working principle is electromagnetic induction, which uses the interplay of magnetic fields to transform electrical energy into mechanical energy. Motors can be used for a variety of purposes, such as moving fans, churning materials, and powering machinery in addition to pushing cars. This basic principle makes motors possible.

OPTOISOLATOR

An optoisolator is an electronics device that maintains electrical isolation between two circuits while transferring electrical energy between them via a brief optical transmission channel. High voltages are coupled from one side of the circuit to the other via an optoisolator, which prevents direct electrical contact. Using a light emitting diode, the devices transform electrical energy into a beam of light. The light is then directed towards a light sensor, such as a photodiode or phototransistor, which transforms optical energy back into electrical energy. In addition to preventing voltage spikes and reducing noise and interference related to communication links, this isolates the two circuits.

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

ADVANTAGES AND APPLICATIONS

Advantages

Low Cost

Applications

1) Wireless Control
2) Easy to use
3) WiFi consumes less power than other devices.
4) Android applicationsare user-friendly.
5) Technically expert persons are not required.
6) Wireless communication is enhanced.
7) Programming is simpler.

1. Home automation.

2. Many industrial applications require adjustable speed drive and constant speed for improving the quality product.

3. Intensity of light can also be controlled with the help of android app.

4. Can be used in simple robotic application to control direction and speed of signal motor.

5. Many applications require adjustable speed drive and constant speed for improving the quality product.

6. The circuit shown here control a single dc motor but can be extended to control motors with independent speed anddirection controls.

7.Motor control is vital for regulating various components in vehicles, including power windows, windshield wipers, andelectric seat adjustments, enhancing comfort and convenience for drivers and passengers.

8. Motor control enables precise movement and positioning of projector screens, motorized curtains, and rotating TVmounts, creating immersive home theater experiences and flexible living spaces.

VI.CONCLUSION AND FUTURE WORK

Thus, an Android smartphone application and WiFi technology are used to control the speed and direction of the DC motor.Wireless communication is also accomplished in this way. It has been built with features that integrate all of the hardware components that are used. Each module's inclusion has been thoughtfully chosen and arranged to enhance the unit's functionality.Second, by utilizing really sophisticated ICs with the aid of developing technology.

FUTURE WORK

1.In the future, the same method can be used to regulate the direction and speed of DC motors in addition to single- and three-phase AC motors.

2. A WiFi module can be utilized for long-range wireless communication.

3.Touch screen technology is an additional option.

4. The technique's application to electric vehicles and industrial gear is expanded by using single-phase and three-phase ACmotors.

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 2, March 2024 ||

DOI:10.15680/IJARETY.2024.1102028

5. Long-range wireless communication is made possible by integrating Wi-Fi modules, which improves connectivity andallows motor control systems to be monitored remotely.

REFERENCES

[1] RiteshChaubey, Deepak Kumar, Saketh, Dr. Sudeshna, "Speed & Direction Control of DC Motor using Android MobileApplication", International Journal of Electrical Electronics & Computer Science Engineering.
[2] N.Barsoum," DC motor speed control using SMS application, Journal of Intelligent Control and Automation 5", 2012.
[3] V.J. Sivanagappa, K. Haribalan "Speed control of DC motor via Internet for Traction Applications" IEEE, 2016.
[4] Arindam Bhattacharjee, Gaurav Ghosh, Vijay Kumar Tayal, PallaviChoudekar, "Speed Control of BLDC Motor through Mobile Application via Secured WiFi", Recent Development Control & Power Engineering (RDCAPE), 2017.
[5] N.Barsoum,et al. "DC motor speed control using SMS application", Journal of Intelligent Control and Automation, vol.5, no. 4, pp. 205-212, 2014.
[6] R. Chaubey, et al., "Speed and Direction Control of DC Motor using Android Mobile Application", International Journal of Electrical Electronics & Computer Science Engineering, pp. 101-102, 2018.
[7] Hemalatha, M. C., Nagarajan, M. R., Suresh, P., Shankar, G. G., & Vijay, A. (2017). Brushless DC Motor Controlled byusing Internet of Things. IJSTE-International Journal of Science Technology & Engineering, 3(09), 373-377.
[8] Lefley, P., L. Petkovska, and G. Cvetkovski. Optimization of the design parameters of an asymmetric brushless DC motor for cogging torque minimization in Power Electronics and Applications (EPE 2011), Proceeding of the 2011- 14th European Conference on 2011.
[9] G.H. Jang and M.G. Kim, "A Bipolar-Starting and Unipolar-Running Method to Drive an HDD Spindle Motor at High Speed with Large Starting Torque," IEEE Transactions on Magnetics, Vol. 41, no.2, pp. 750- 755, Feb. 2005.
[10] S.Baldursson, "BLDC Motor Modelling and Control A MATLAB/Simulink Implementation", Master Thesis, May 2005.
[11] TashaKori, A., Ektesabi, M., & Hosseinzadeh, N. (2011, July). Modeling of bldc motor with ideal back emf for automotive applications. In Proceedings of the World Congress on Engineering (Vol. 2, pp. 6-8).

International Journal of Advanced Research in Education and Technology

ISSN: 2394-2975 **Impact Factor: 7.394**

www.ijarety.in editor.ijarety@gmail.com