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IOT MONITORED BRUSHLESS DC MOTOR SPEED CONTROL USING ARDUINO

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ABSTRACT:

Brushless Direct Current motors are synchronous motors which operate on DC current. Brushless DC motors (BLDC) feature high efficiency and excellent controllability, and are widely used in many applications. The BLDC motor has power-saving advantages relative to other motor types. Speed of the motor is controlled by (ESC) electronic speed controlled. The parameters like Speed, Current, Power, Temperature and Voltage are Monitored on from remote access through the configured electronic gadgets by using the Internet Of things. The motivation of this project is to control and monitor the Brushless DC (BLDC) motor by using IOT. An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments.IOT is an interface that helps communication between objects Brushless DC Motor (BLDCM) has various features like high efficiency, reliability, high weight to torque ratio. Hence these motors have major significances in the industries. By utilizing this IOT, controlling and monitoring of a system is done to obtain expected output.

Keywords - Arduino, BLDC motor, Controlling and Monitoring, Electronic speed controller, IOT.

I. INTRODUCTION

DC motors with no brushes are energized with Permanent magnets are widely used in a wide range of applications due to their good performance benefits such as higher torque current ratio, less noise, higher efficiency, small size and low cost, lower torque ripples, less supervision, and well control characteristics over a wide torque speed range. Brushless DC motors, which are utilized in ceiling fans, are smaller and lighter than AC fans using Universal motors. Because these motors can work with low supply voltages, they are ideal for low-voltage applications. A Brushless DC motor's commutation mechanism is regulated by an electronic speed controller (ESC). The ESC energizes the stator windings in a specific order, allowing the Brushless DC motor to rotate. The Internet of Things is a type of technology that uses an Internet Protocol (IP) address to connect to the internet and communicate with other internet-connected devices and systems. IoT technology is gaining popularity due to a number of advantages, including reduced time spent obtaining real-time data, less human labour, and ease of system control. For parameter monitoring, a variety of methods are utilized, including mathematical modeling, finite element methods, and optimization techniques, although these methods are time

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demanding and require more human work. Because of the newly established notion of internet of things (IOT), achieving industrial automation through remote access and monitoring parameters has never been easier.

II. BLOCK DIAGARAM

Hardware consists of the following are

1. Microcontroller (Arduino Board)
2. Electronic Speed Controller
3. IOT Device
4. LED Display
5. Power Supply
6. Sensors
7. BLDC Motor
8. Variable resistor (POT).

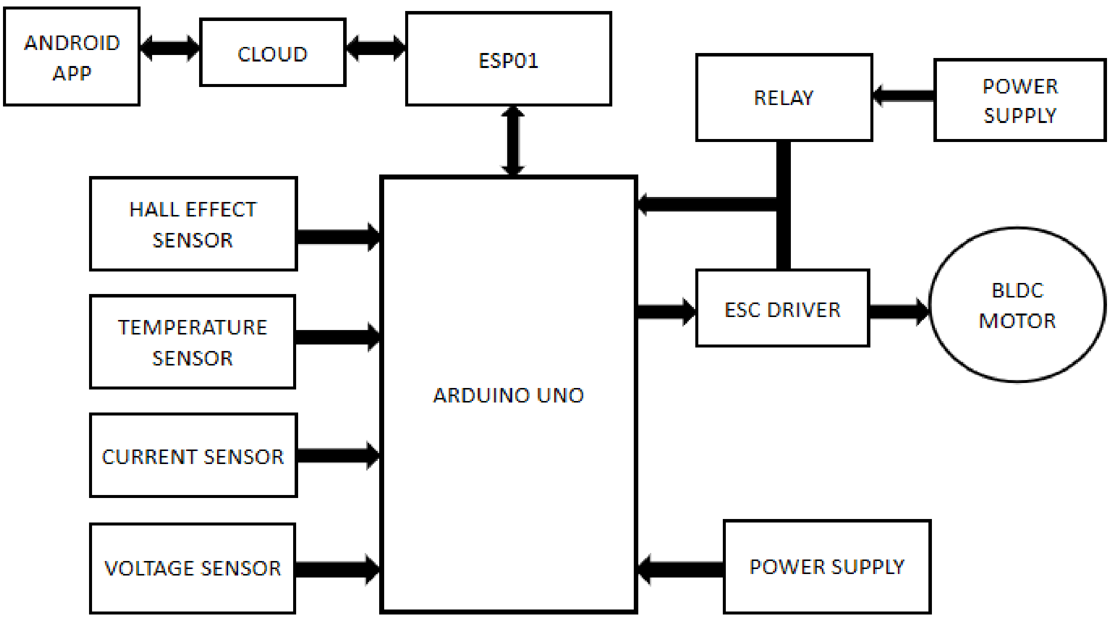

Figure 1: Block Diagram

The hardware consists of two primary components: the Arduino board and the ESC. The Arduino board has a programme written in the embedded C language. When a 12v supply is provided, Arduino generates PWM signals by adjusting the pot, and the ESC drives the motor based on the pulse width duration. As soon as the ESC receives the pulses from Arduino, the Phase wires of the Brushless DC motor are energized, and the motor begins to rotate. The Brushless DC motor's speed is controlled by the ESC. Brushless DC motor speed, current, and voltage are all different parameters. The IR sensor functions as a digital tachometer, measuring rotational speed in terms of RPM. The LED display may show the rotation of the speed and other information. On the IOT-configured device, the same output will be monitored.

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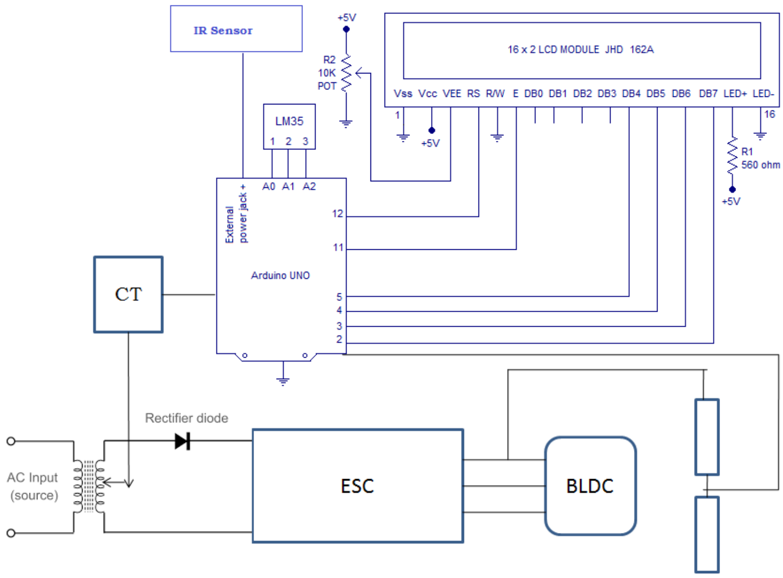

Figure 2: Functional diagram of proposed System

III. FLOW CHART

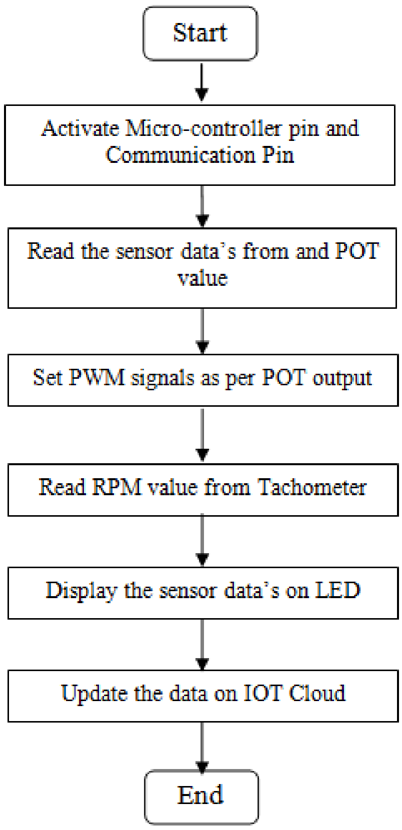

Fig. 3 Flow chart of the Proposed System

IV. DESIGN METHODOLOGY

The sensors in the circuit are used to measure various motor properties like current, voltage, temperature, and speed. The Hall Sensor is used to determine the motor's RPM or speed. The temperature of the BLDC motor will be monitored using an LM35 temperature sensor. The current through the device is monitored by the

ACS712 Current Sensor, while the voltage across the device is monitored by the Voltage Sensor. This data is saved in a cloud server called thing talk. The microcontroller in this project is an Atmega328P. As well as the Atmega328P Wi-Fi capabilities are added using an ESP8266-01 chip. The system's BLDC motor is a 1000 KV motor, which means it spins at 1000 RPM for every volt. The BLDC Motor's speed is controlled by PWM signals, and the motor may be turned on and off remotely using relays that activate or deactivate in response to a signal from a mobile phone. The BLDC Motor is driven by an ESC. A 30 Amp Electronic Speed Controller is employed in the system. If a user uses their phone to send a command to change the speed, the command is sent to the ESC driver via the cloud server and Arduino UNO. To get the desired output, the ESC driver will adjust the duty cycle.

V. HARDWARE ASSEMBLY

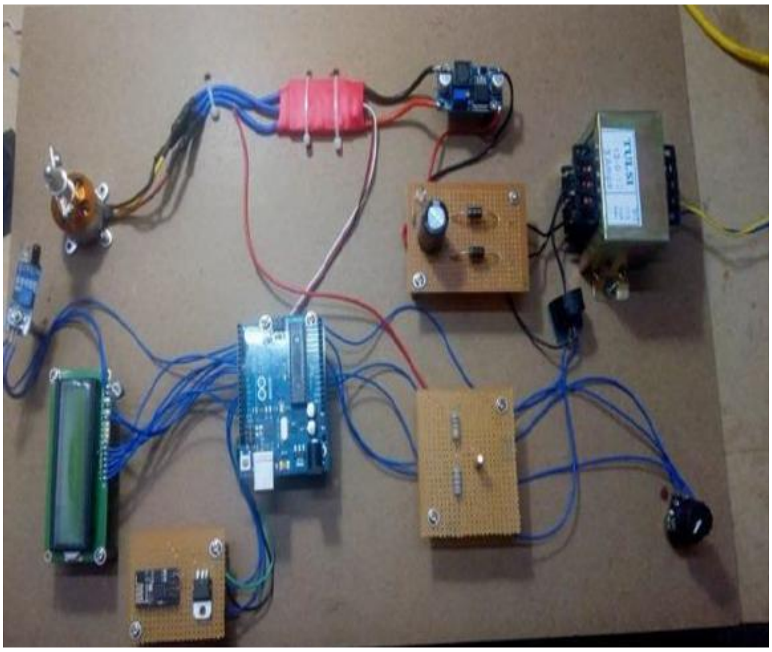

Fig.4 Hardware Assembly of proposed System

Mathematical Modeling:

INPUT VARIABLES:

PWM value: pulse with modulation value

R state: Relay state

OUTPUT VARIABLES:

Current: current of BLDC motor

Volt: voltage of BLDC motor

Temperature: temperature of BLDC motor

RPM: speed of BLDC motor

ALGORITHM:

R state =1 then motor = on

R state=0 then motor = off

0<PWM value<=1023

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PWM value = rpm of motor

BLDC motor rating =1000 kv

Current <=30A

Voltage<=25V

Power = current *volt

55°C <temp<150°C

RPM CALCULATION:

RPM= no. of times blades sensed/n

Where, n = no. of blades on propeller

VI. RESULT AND DISCUSSION

The rear emf can be detected in this study using a sensorless mode and IOT-based control. The IoT is used to monitor and regulate the characteristics of BLDC motors in this project. This method uses an online mode with WI-FI control to control the speed. The Arduino Uno WIFI board is utilized for this control. When speed control is required, this device can adjust the speed from any location. We'll be able to turn off the WIFI after we've got the speed under control. Temperature, voltage, and current sensors are among the sensors used to check parameters, while the hall sensor is also utilized to determine the rotor's speed. Through IOT automation, the speed is changed to the required value, and the corresponding parameters are monitored. IoT allows for easy control and sensing of many system parameters that are located far away. This will aid in the improvement of efficiency, precision, and the reduction of human effort. To efficiently modify Brushless Direct Current motor rpm, the Arduino Uno Pulse Width Modulation can be used to monitor the Brushless Direct Current motor working duration. The LCD16x2 Panel can display frequency and voltage. Using IoT technology on installed computers, the same metrics may be tracked from remote places. The table below shows the speed for various voltages and currents.

Voltage in Volts	Current in milliamps	Speed in RPM
8	350.52	13200
9	322.50	16050
10	305.21	17501

VII. CONCLUSION

BLDC motors have a number of advantages over brushed motors. Brushes are removed from motors to eliminate a mechanical component that used to limit efficiency, wear out, or false catastrophically. The BLDC motors use powerful rare earth magnets to deliver the same amount of power as a brushed DC motor while still fitting into a smaller size. The sole disadvantage of a BLDC motor is that, unlike brushed DC motors, it requires an electronic system to monitor the coil's energizing sequence. Motors are unable to work without the use of an electronic circuit. For communication between a remote user and a source device, the suggested architecture leverages IOT technologies in a web service. The "Thing speak" application can be started in any browser and used to monitor the parameters using the credentials. The proposed mode of work allows for flexible and long-

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distance connectivity between the industrial environment and the user. Electronic speed controllers (ESC) successfully control the speed of a Brushless Direct Current motor, and parameters can be viewed on an LCD display as well as on the specified electronic gazettes.

VIII. FUTURE SCOPE

We can use Arduino wireless NRF communication in the future to control speed via wireless technology. The Brushless Direct Current motor can be powered by solar energy. Additional sensors can be added to measure other characteristics such as temperature and humidity around the motor. We can use Arduino wireless NRF communication in the future to control speed via wireless technology. The Brushless Direct Current motor can be powered by solar energy.

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