

A REVIEW PAPER ON CLOSED LOOP SPEED CONTROL OF BLDC MOTOR

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Abstract:

The hardware project is designed to control the speed of a BLDC motor using closed loop control technique. The speed of BLDC motor is more. BLDC motor has various application used in industries like in drilling, cars, refrigerator ,ventilation fan, projectors, spinning, electric bikes etc. The speed control of the DC motors is very essential. This proposed system provides a very precise and effective controlling the speed of motor. The user can enter the desired speed and the motor will run at that exact speed.

KEYWORDS: Hall position sensors, Brushless DC motor, Microcontroller, motor controller.

I. INTRODUCTION

When all is said in done, Brushless DC engines, for example, fans are littler in size and weight than AC fans utilizing shaded shaft or Universal engines. Since these engines can work with the accessible low voltage sources, for example, 24-V or 12-V DC supply, it makes the brushless DC engine fans helpful for use in electronic gear, PCs, portable hardware, vehicles, and axle drives for circle memory, on account of its high unwavering quality, productivity, and capacity to turn around quickly. The brushless DC engine is capable engine, its speed is high, better proficiency, better work. The yield of the engine is 80% to 85%. In this way BLDC engine is masculine utilized as a part of mechanical and all divisions. The control of the speed of the BLDC engine by utilized a microcontroller. The client can acquired as their required speed. The speed control of BLDC engine is exceptionally basic for enterprises, and so forth.

The proposed framework utilizes a microcontroller of the 8051 family and a redressed control supply.

An arrangement of IR transmitter and photodiode are associated with the microcontroller for tallying the quantity of revolutions every moment of the DC engine as a speed sensor. The speed sensor sens the speed of engine and the speed read on the interfacing show. Keypad is use as info.

Microcontroller is cerebrum of the task. It control the devided, Permanent-magnet energized brushless DC engines are winding up progressively appealing in countless because of execution points of interest, for example, decreased size and cost, diminished torque swells, expanded torque-current proportion, low clamors, high effectiveness, lessened upkeep and great control qualities over a wide range in torque– speed design.

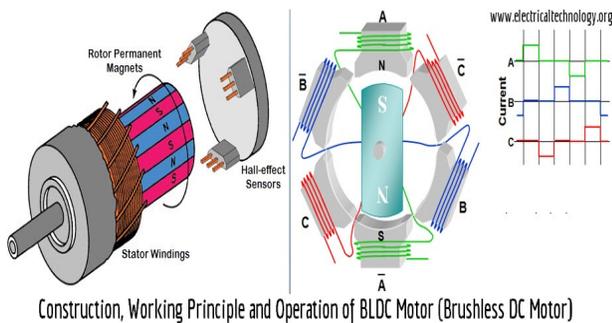
II. TYPES OF CONTROL TECHHIQUE OF BLDC MOTOR

To control the machine utilizing sensors, the present position of the rotor is required to decide the following replacement interim. Engine can likewise be controlled by controlling the DC transport rail voltage or by PWM technique. A few plans use both to give high torque at high load and high effectiveness at low load The BLDC engine can likewise be driven with predefined compensation interim. In control techniques utilizing sensors, mechanical position sensors, for example, a corridor sensor, shaft encoder

or resolver have been used keeping in mind the end goal to give rotor position data. Corridor Position sensors or basically Hall sensors are generally utilized and are well known. At whatever point the attractive presents go close on the sensors, they either give a high or low flag, showing North or South Pole is passing the shaft. The speed criticism is gotten from the position sensor yield signals. The inward current control circles keeps running at a bigger width than the external speed circle to accomplish a successful course control. This paper manages control technique to decrease speed motions and to runs the engine at correct entered speed. This is accomplish by utilizing the microcontroller programming.

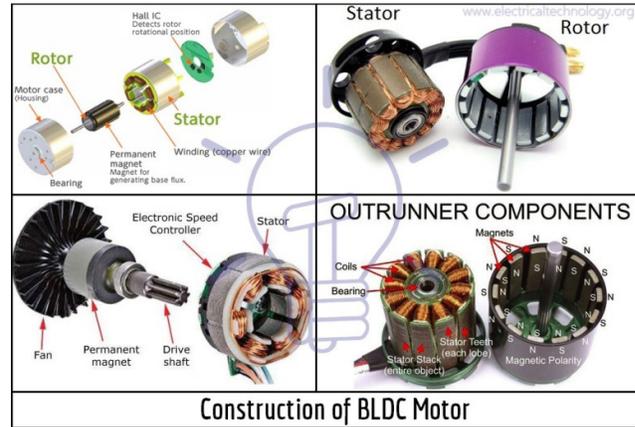
III. CONSTRUCTION AND OPERATING PRINCIPLE OF BLDC MOTOR

A BLDC motor is a type of synchronous motor that consist of a rotor that has a surface mounted permanent magnets and stator with many armature winding. As compared with convenient DC motor, it doesn't contain brushes, but the commutation is performed electrically using an electronic drive to energized the stator winding. Mostly BLDC motor stator winding is placed in slots with stacked steel lamination along with inner periphery. This is connected in a star line fashion. Numerous coils in the slots are interconnected to form a winding and to form a even number of poles, and these winding are distributed along the star periphery. These motor winding rating is choosing depending on the control power supply. With alternate north and south poles, the rotor is made with permanent magnates with a certain number of poles, that varies from 2 to 8 poles pairs. Traditionally ferrite material used as permanent magnets.



[Fig 2.]

As described above that the electronic controller circuit energizes appropriate motor winding by turning transistor or other solid state switches to rotate the motor continuously.



[Fig 1.]

At the point when the stator loops are electrically exchanged by a supply source, it moves toward becoming electromagnet and begins creating the uniform field noticeable all around hole. Despite the fact that the wellspring of supply is DC, changing makes to produce an AC voltage waveform with trapezoidal shape. Because of the power of collaboration between electromagnet stator and changeless magnet rotor, the rotor keeps on turning. BLDC engine takes a shot at the guideline like that of a traditional DC engine, i.e., the Lorentz constrain law which expresses that at whatever point a current conveying conductor set in an attractive field it encounters a power. As a result of response compel, the magnet will encounter an equivalent and inverse power. In the event that BLDC engine, the current conveying conductor is stationary while the lasting magnet moves.

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electromagnet stator and perpetual magnet rotor, the rotor keeps on pivoting. Along these lines BLDC engine is masculine utilized as a part of mechanical and in addition all segments. The control of the speed of the BLDC engine by utilized a microcontroller.

IV. BLDC MOTOR SPEED CONTROL

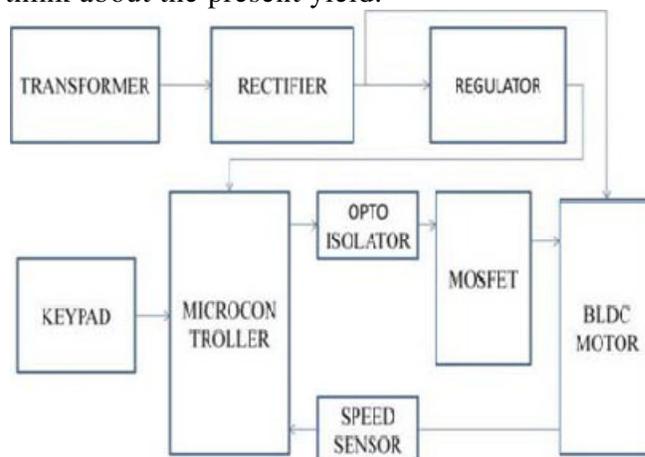
To begin with, Initialize the PWM, Capture, Ports and the Change Notification inputs. Subsequent to introducing, the catch and change notice pins are perused the lobby sensor signals. It distinguishes the info flag of corridor sensor and permitted to empower the comparing period of PWM beats. Now the engine begins turning. The Motor speed is differed relying upon the PWM obligation cycle which is balanced by utilizing a rotat-ional increase key. The obligation cycle and speed estimation esteems are shown in LCD.

Presently a BLDC engine speed is control by the setup of microcontroller. The supply is taken from the essential side. The real speed of speed is more, these can be control by utilizing input gadget keypad. Set the speed and these speed is taken to microcontroller. The embed speed is goes to the engine and engine can be run the set speed with help of microcontroller. The engine speed is perused to the IR sensor. The associated over the BLDC engine. The real speed and given speed is perused in plain view of the LCD screen, is an information gadget. Normally changing's must be completed a few times each moment in an electric stove, 120 Hz in a light dimmer, from few kilohertz (kHz) to several kHz for an engine drive and well into the tens or many kHz in sound enhancers and PC control supplies The term obligation cycle depicts the extent of on time to the consistent interim or timeframe; a low obligation cycle

compares to low power, on the grounds that the power is off for more often than not. Obligation cycle is communicated in percent, voltage and current, is in this manner in the two cases near zero. PWM works likewise well with advanced controls, which, in light of their on/off nature, can undoubtedly set the required obligation cycle. PWM has additionally been utilized as a part of certain correspondence frameworks where its obligation cycle has been utilized to pass on data over an interchanges channel.

Shut LOOP SPEED CONTROL – It include controlling the info supply voltage through the speed from engine. Therefore the supply voltage controlled relying upon the blunder flag. The shut circle speed control comprise of three essential segment

Also, gives the correct speed. The shut circle framework is otherwise called a criticism control framework, is a control framework which utilizes the idea of an open circle framework as its forward way however has at least one criticism circles or way between its yield and its info. Shut circle control framework think about the present yield.



[Fig 3: Block Diagram of speed control of BLDC motor]

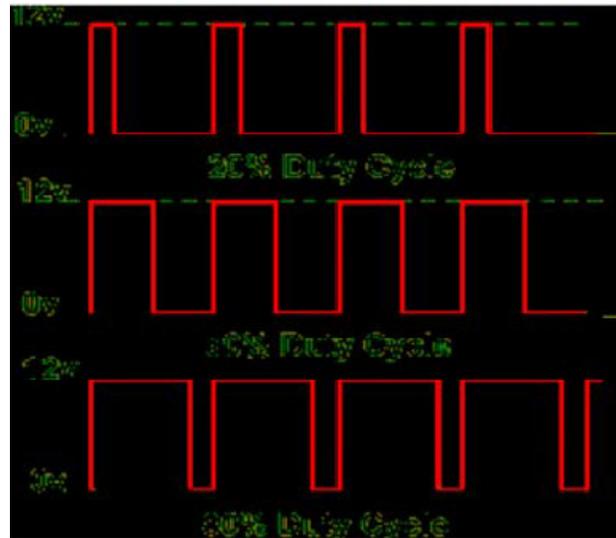
V. LOGICAL OPERATION OF BLDC MOTOR

PWM Generating Circuit While logic high during the on time duty cycle is delivered by the microcontroller to the input of the OPTO U3 , The opto led

glows to bring the opto transistor pin no 5 and 6 to conduct . Now 12V supply is given at the junction point of R7 and R8 and reaches the gate of the MOSFET Q1 by means of D4 for Q1 to direct along these lines empowering the engine to motivate supply to run. A freewheel diode is utilized over the engine to lead the charge put away in the engine amid off period. Amid off time of the obligation cycle the opto transistor does not lead and the charge which is put away in the entryway of Q1 powers Q3 to direct while the engine stops. This ON and OFF the engine decreases the speed . To detect the speed of BLDC engine an IR LED in photograph diode course of action is utilized. A 230v - 12v stage down transformer is utilized to diminish AC supply voltage to 12v, now this air conditioner voltage is redressed by utilizing a full wave connect rectifier, a blocking diode is utilized before the channel capacitor to get the throbbing D.C. to get the settled yield D.C a 7805 voltage controller is utilized in light of the fact that microcontroller settled +5v unadulterated DC. One more electrolytic capacitor is associated at the yield of 7850 to expel finish swell's if there any +5v D.C. A LED with an arrangement resistor's is associated with show the power. 40 Micro controller needs to create PWM beats according to blunder flag got from the speed detecting contribution to coordinate the console contribution to request to run the engine at the info RPM.



[Fig 4; overall system of control the BLDC motor]



[Fig.5 : PWM Pulses]

VI. OPERATION PROCEDURE

1. Press '#' once display shows the store Max RPM.
2. Press '#' again to store Max.RPM.
3. Press '*' to get the required RPM. Display shows % of Req_RPM:
4. Enter the required percentage using Keypad.
5. Press '#' to save the required RPM.

VII. SIMULATION RESULTS FOR VARIOUS PWM PULSES

The duty cycle determines the speed of the motor. The desired speed can be obtained by changing the duty cycle. The PWM in microcontroller is used to control the duty cycle of DC motor.

Average voltage = D * Vin

The average voltage obtained for various duty cycles is also mentioned and as the duty cycle percentage decreases average voltage also decreases from the supply voltage. Duty cycle is defined as the percentage of time the motor is ON. Therefore, the duty cycle is given as

$$\text{Duty Cycle} = 100\% \times \text{Pulse}$$

Width/Period

Where,

Duty Cycle in (%)

Pulse Width = Time the signal is in the ON or high state (sec)

Period = Time of one cycle (sec).

The program for the closed loop control of BLDC motor operation is written in embedded C and executed in keil software.

OUTPUT RESPONSE

INPUT DUTY CYCLE IN %	OUTPUT VOLTAGE	OUTPUT SPEED I RPM
25%	3V	650
50%	6V	1300
75%	9V	1950
100%	12V	2600

[Fig6; graph of speed of motor]

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IX. CONCLUSION

The hardware for closed loop control of BLDC motor using microcontroller is designed. By using the PWM technique speed of the BLDC motor was controlled and it made to run exact speed.

X. REFERENCES

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