Solar Energy Fed Brushless DC Motor

Yash R Kotadiya
BE Student
Department of Electrical Engineering
SAL Institute of Technology and Engineering Research, Ahmadabad, Gujarat, India

Akshay R Sevak
BE Student
Department of Electrical Engineering
SAL Institute of Technology and Engineering Research, Ahmadabad, Gujarat, India

Vaibhav S Joshi
BE Student
Department of Electrical Engineering
SAL Institute of Technology and Engineering Research, Ahmadabad, Gujarat, India

Kapil R Dave
Assistant Professor
Department of Electrical Engineering
SAL Institute of Technology and Engineering Research, Ahmadabad, Gujarat, India

Abstract

All industries are work on motors, without motors industrial work is nothing. But mostly all motors are works on fuel like diesel. Diesel motors are very noisy and very high maintenance. So these motors are very costly. But solar energy is costless; its use is very simple. So here we make a BLDC motor with use of solar energy. This is very useful and costless. We decide to make a BLDC motor, which works without fuel or electricity; it is only work on solar energy. Solar panel gain solar energy, this energy pass into charge circuit it is convert variable energy into fix energy and this energy store in battery, so we use this energy in night also. Here we use microcontroller which is control the LCD, switch input and BLDC drive also and finally from BLDC drive BLDC motor will run. On LCD battery energy, motor speed all will display. Switch input because it is bidirectional.

Keywords: Solar Panel, Charge Circuit, Arduino Uno Microcontroller, Switch Input (Preset), BLDC Motor

I. INTRODUCTION

In industry, all machines are works based on DC motor. There are different types of DC motors are available. Types are like Brushed DC motor, Shunt DC motor, Series motor, Compound motor.

A. Brushed DC Motor:

In this type of motors, magnetic field is produced by passing current through a commutator and brush which are inside the rotor. Hence, they are called Brushed Motors. The brushes are made up of carbon. These can be separately excited or self-excited motors.

)) Disadvantages:

- Inadequate heat dissipation caused by the rotor limitations.
- High rotor inertia.
- Low speed range due to limitations imposed by the brushes.

B. Shunt DC Motor:

In case of shunt DC motors, the field winding and armature winding are connected in parallel across the same supply and hence the field windings are exposed to entire terminal voltage. Even though the supply is same, the field current and armature current are different. The speed of a shunt DC motor is constant and doesn't vary with mechanical load at the output.

)) Disadvantages:

- Requires commutator which lead to sparking at brushes.
- For variable speed drive, we can't use it.

C. Series Motor:

In a series DC motor the field is connected in series with the armature. The field is wound with a few turns of large wire because it must carry the full armature current. A characteristic of series motors is the motor develops a large amount of starting torque. However, speed varies widely between no load and full load. Series motors cannot be used where a constant speed is required under varying loads.

)) Disadvantages:-

- Speed regulation in the series motor is quite poor.
- If speed decreases torque will decrease.

D. Compound Motor:

Compound motors have a field connected in series with the armature and a separately excited shunt field. The series field provides better starting torque and the shunt field provides better speed regulation**.**

Brushed DC motors have a high maintenance cost, it is too costly and its life is short. So it is so costly for industry and also DC motors are worked on fuels like petrol and diesel, it is also costly, so its cost price is high.

Brushless DC Motor is works on permanent magnet, its name tells us motor is works without brush, so maintenance cost is low, its life is longer. This BLDC Motor works on battery so no fuel cost, and motor price is not high in compare to DC Motors. If industries are use this motor then net maintenance cost is getting low and company's growth is high and they are in profit and profit is high.

E. Difference between Brushless DC Motor and DC Motor:

Table - 1

Brushless DC Motor	*DC Motor*
It requires less maintenance.	*It requires periodic maintenance.*
It has longer life.	*It has shorter life.*
It has higher efficiency.	*It has moderate efficiency.*
The speed range is higher.	*The speed range is lower.*
The cost of building higher. Because it has permanent magnets.	*The cost of building lower.*
Motor control is complex and expensive.	*Motor control is simple and inexpensive*
A controller always required to keep the motor running. The same controller can be used for variable speed control.	*No controller is required for fixed speed. A controller is required only if variable speed is desired.*

There are many disadvantages of DC Motors, that's why BLDC Motor is a best option to use in industry. So we made a project on BLDC Motor. How they work? Let see it, start from construction.

II. CONSTRUCTION

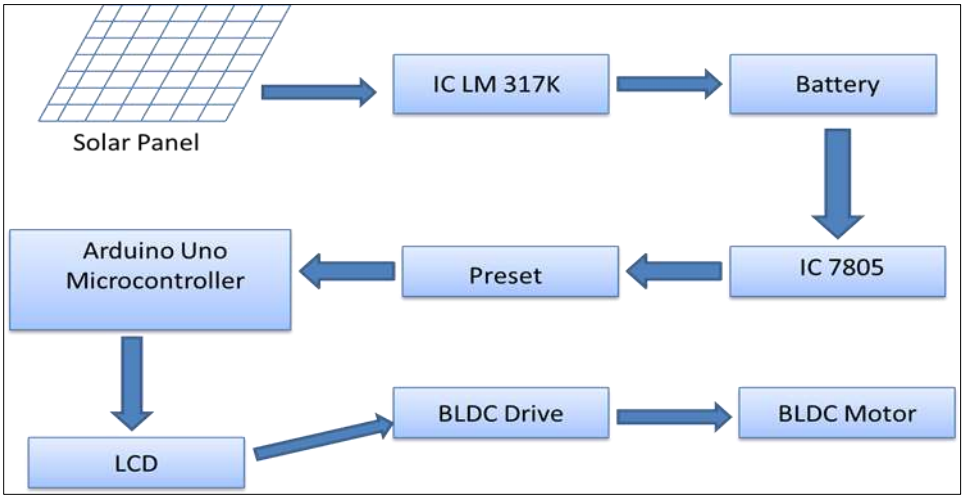

Fig. 1: Block Diagram

A. Useful Components:

1) Solar Panel
2) IC LM317K
3) Battery
4) IC 7805
5) Preset
6) Arduino Uno Microcontroller
7) LCD
8) BLDC Drive
9) BLDC Motor

From sun rays are attack on solar panel and panel gain the energy. Solar panel is connecting with the charge circuit which is IC LM317K; it is use for convert variable energy into fixed energy. And then battery is connected for storage of energy and when we require use the energy also in night. Here use the Arduino Uno microcontroller which is control the BLDC motor, LCD and preset

also. Preset is a bidirectional device. From preset rotate the BLDC motor when which direction is require. And then BLDC motor is run and also measure the RPM.

B. Working

Now see the working of solar energy based BLDC motor:

From sun, solar rays are attack on solar panel. But there is a one problem is that sun rays are in variable form but we need a fixed energy. So use a LM 317K charge circuit. This charge circuit is useful for convert variable energy into fixed energy. This fixed energy we use for BLDC motor.

This energy we save in battery. This battery is useful because from this battery adjust require energy. For example, if solar panel is 12 Watt and battery is 15 Volt and BLDC motor is require 9 Watt then adjust a battery voltage from preset (Preset is a device who is use for adjust a voltage). There is an IC 7805 is put, it is a one type of voltage regulator and it has a three pin like input, ground and output. Here another preset device is use; this preset is a bidirectional device which is useful for rotating BLDC motor in clockwise and anticlockwise.

Then Microcontroller is come. It is a main device in this project. From microcontroller LCD and preset are connected. All information and data are send to microcontroller and project is in working condition, then set the preset for BLDC motor in which direction it is rotate is display on LCD and motor is run. Approximately this motor has a 23000 RPM speed.

1) Diagram:

Fig. 2:

C. Simulation

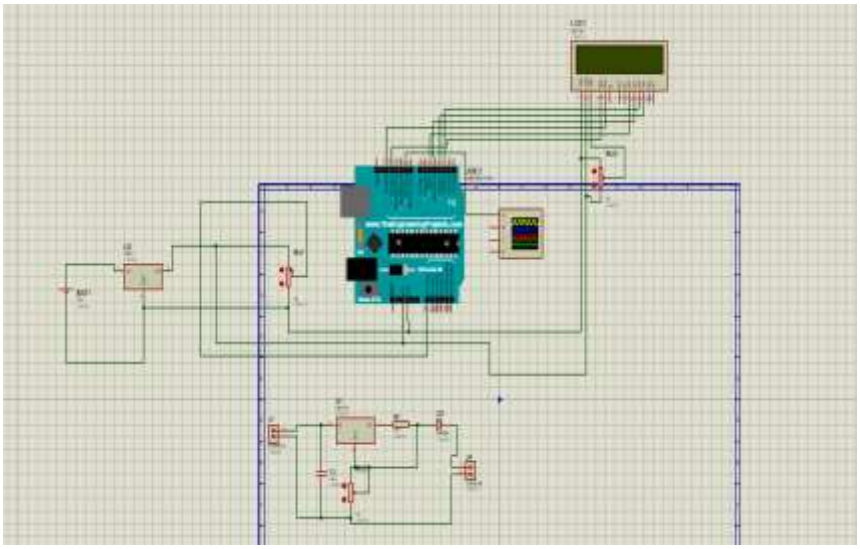

Fig. 3: Simulation Diagram

III. ADVANTAGES

- Electricity is neither use.
- Good efficiency.

- Cost is less in comparison of other DC motor.
- Maintenance is less.
- Torque and RPM is high.

REFERENCES

[1] Brushless DC Motor Speed Control Using Microcontroller (India Technical Research Organization)
[2] Design of solar PV water pumping system using BLDC drive using sensor less method (B.Kavitha, S.Karthikeyan, B.Iswarya – 2014 The International Journal Of Engineering And Science (IJES) || Volume || 3 || Issue || 3 || Pages || 41-46 || 2014 ||)
[3] Circuits Today – Battery Charge Circuit using LM317 (https://www.circuitstoday.com/battery-charger-circuit-using-lm317)
[4] https://www.arduino.cc/en/Guide/Introduction
[5] Solar powered car using Brushless DC hub motor with microcontroller.
[6] Solar charge controller working using Microcontroller (https://www.edgefx.in/solar-charge-controller-circuit-using-microcontroller/)
[7] http://www.completepowerelectronics.com/pmbldc-vs-dc-motor-comparison-between-bldc-motor-and-conventional-dc-motor/
[8] Solar battery charge circuit (https://www.electroschematics.com/6888/solar-battery-charger-circuit/)
[9] Microcontroller based controller programming: (https://www.quora.com/Which-is-better-arduino-or-8051-microcontroller)