

Energy Conservation in Ceiling Fan Using BLDC Motor

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Abstract- A BLDC motor is a synchronous motor which keeps running on the supply of direct current power. In these motor there is the straight relationship amongst current and torque furthermore in the between voltage and rpm of BLDC motor. This straight relationship is the main reason for which BLDC motor give excellent result in the routine ceiling fans. This paper introduces the similarity of BLDC motor for utilization of ceiling fans with the comparison of measurement of actual power with conventional ceiling fans not running on BLDC motor.

Keywords- BLDC Motor, ceiling fans, energy conservation.

I. INTRODUCTION.

We use energy faster than it can be produced - Coal, oil and natural gas - the most utilised sources take thousands of years for formation. Energy resources are limited - India has approximately 1% of world's energy resources but it has 16% of world population. Most of the energy sources we use cannot be reused and renewed - Non renewable energy sources constitute 80% of the fuel use. It is said that our energy resources may last only for another 40 years or so. Energy saved is energy generated - When we save one unit of energy, it is equivalent to 2 units of energy produced Save energy to reduce pollution - Energy production and use account to large proportion of air pollution and more than 83 percent of greenhouse gas emissions An old Indian saying describes it this way - The earth, water and the air are not a gift to us from our parents but a loan from our children. Hence we need to make energy conservation a habit.[1]

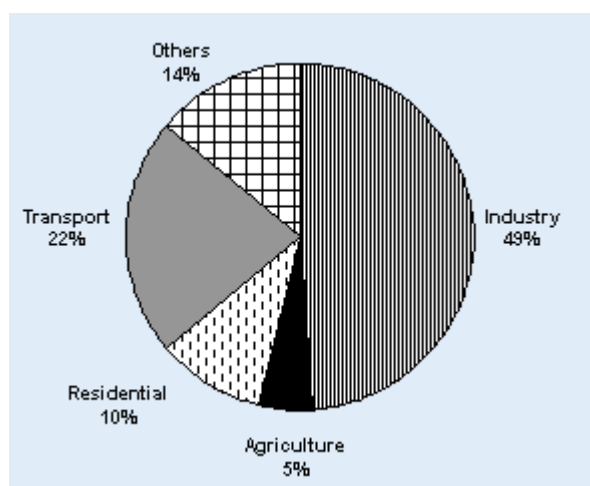


Figure ;1 Energy consumption by various segments[2]

As residential sector is the one where the greatest conservation can be made conceivable in contrast with this alternate divisions are so tremendously marketed that it is not neither conceivable nor is there adequate motivator to present and manage any vast preservation of vitality through other substitute vitality productive types of gear in these parts. So

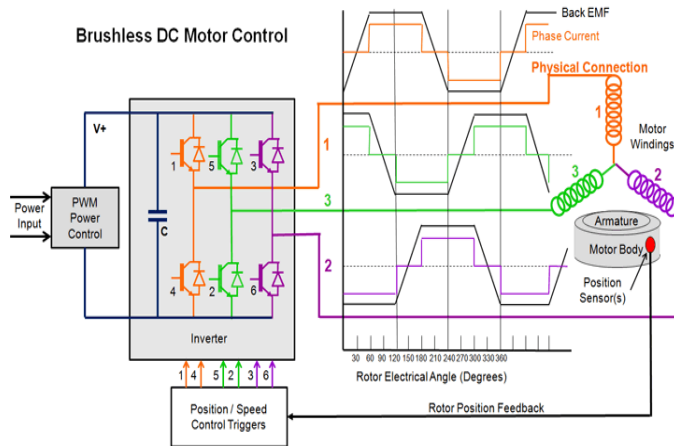
this paper has concentrated fundamentally on the residential area and all the more particularly on the ceiling fans which offers more than 30 million units for each annum with an introduced base of more than 250 million units in India. Encourage, when the residential consumption was completely concentrated on, it is found that aggregate utilization of force by the ceiling fans add up to 6% which is more than that of TV& Fridge consolidated utilize. With this paper the technique for utilizing BLDC motor to decrease the power utilization of the ceiling fans by half with no performance along with the other features is described.[3]

II. WHY BLDC FOR CEILING FAN?.

Ceiling fans utilized today keeps running on the AC motor and they expend tremendous power. These AC running fans are power devouring as well as they have rpm control by the assistance of capacitor or resistor based controllers and there is misfortune in itself to some degree so they are not productive. In addition the RPM control is by controlling the voltage and it turns out to be exceptionally troublesome and testing to have steady rpm in light of AC mains supply because of voltage changes of the mains. Ac MOTOR facilitate brings about power consider (PF) degradation.

The air flow depends on the sharp edge measure and rpm of fan and does not change because of whatever other variable. By utilizing BLDC motor based ceiling fan we can produce same measure of air flow with less of vitality utilization alongside enhancing the power factor. BLDC motor ceiling fan has much better efficiency and excellent constant RPM control in comparison to conventional ceiling fan as it operates out of fixed DC voltage. [4]

III. WORKING OF BLDC MOTOR.



A brushless DC motor (known as BLDC) is a permanent magnet synchronous electric motor which is driven by direct current (DC) electricity and it accomplishes electronically controlled commutation system (commutation is the process of producing rotational torque in the motor by changing phase currents through it at appropriate times) instead of a mechanically commutation system. BLDC motors are also referred as trapezoidal permanent magnet motors are positioned around the stator. The rotor position feedback

Figure :2 BLDC motor control [6]

Sr. No	Parameter	Induction Motor Fan	BLDC Fan
1	Power Consumption	75 Watt	58 Watt
2	Capacitor Required	Yes	No
3	Speed Regulator	Yes	No
4	Effect of Change in Voltage	Yes	No
5	Humming/Vibration	Yes	No
6	Body Heating	Yes	No
7	Time Required	Required Extra Circuit	Remote Inbuilt function
8	Total Energy Saving(Per Annum)	--	168.4 Kwh (Rs 1347.2 Approx)
9	Total Cost	--	Rs : 3500
10	Simple Payback Period	---	32 Month

Table :1 :hComparison table of oldinary and BLDC Fan configuration

Unlike conventional brushed type DC motor, wherein the brushes make the mechanical contact with commutator on the rotor so as to form an electric path between a DC electric source and rotor armature windings, BLDC motor employs electrical commutation with permanent magnet rotor and a stator with a sequence of coils. In this motor, permanent magnet (or field poles) rotates and current carrying conductors are fixed. The armature coils are switched electronically by transistors or silicon controlled rectifiers at the correct rotor position in such a way that armature field is in space quadrature with the rotor field poles. Hence the force acting on the rotor causes it to rotate. Hall sensors or rotary encoders are most commonly used to sense the position of the rotor and from the sensor helps to determine when to switch the armature current. This electronic commutation arrangement eliminates the commutator arrangement and brushes in a DC motor and hence more reliable and less noisy operation is achieved. Due to the absence of brushes BLDC motors are capable to run at high speeds. The efficiency of BLDC motors is typically 85 to 90 percent, whereas as brushed type DC motors are 75 to 80 percent efficient. There are wide varieties of BLDC motors available ranging from small power range to fractional horsepower, integral horsepower and large power ranges.[5]

IV. ADVANTAGES OF BLDC MOTOR.

Motor has several advantages over conventional DC motors and some of these are
It has no mechanical commutator and associated problems

- 1 High efficiency due to the use of permanent magnet rotor
- 2 High speed of operation even in loaded and unloaded conditions due to the absence of brushes that limits the speed
- 3 Smaller motor geometry and lighter in weight than both brushed type DC and induction AC motors
- 4 Long life as no inspection and maintenance is required for commutator system
- 5 Higher dynamic response due to low inertia and carrying windings in the stator
- 6 Less electromagnetic interference
- 7 Quite operation (or low noise) due to absence of brushes [5]

V. DISADVANTAGES OF BLDC MOTOR.

- 1 These motors are costly
- 2 Electronic controller required control this motor is expensive
- 3 Not much availability of many integrated electronic control solutions, especially for tiny BLDC motors
- 4 Requires complex drive circuitry
- 5 Need of additional sensors[5]

VI. CONCLUSION.

BLDC fans are much more efficient and power saving in comparison to conventional ceiling fans. Which will save up to Rs.1347.2 per annum at medium speeds, easy remote control based operation Brushless DC (BLDC) motors offer several advantages over conventional AC operated ceiling fans, including higher efficiency and reliability, reduced noise, longer lifetime (no brush and commutator erosion), elimination of ionizing sparks from the commutator, and overall reduction of electromagnetic interference (EMI).

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