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Design and Implementation of Juicer Using BLDC Motor

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Abstract: ***In a present scenario, the usage of energy efficient appliances is occupying the market to deal with the problem of increasing energy demand. The mixture with universal motor having commutator brush assembly cause sparking and increase the chances of maintenances results in reduction of lifespan all the above problem can eliminated by use of BLDC motor for Juicer. So the BLDC motor is suitable for mixture grinder because it is capable to give easy speed torque control and it is compact in size. Application of a mixture grinder to the performance and losses analysis of a conventional universal motor and proposed BLDC motor, it has lower power consumption compared to the existing universal motor available.***
Keywords: BLDC-Brushless DC Motor, Universal Motor, Conventional Mixer, Energy Savings, Fossils Fuels

I. INTRODUCTION

Now a days, the usage of energy efficient appliance is occupying the market to deal with the problem of increasing energy demand, thus fossil fuel scarcity. In home appliances induction motor and universal motor because it takes very high current at start can cause of voltage sag. It will cause malfunctioning of other appliances in home. Universal motor having commutator assembly, cause sparking and increase chances of maintenance results in reduction of life span. Fine speed control is difficult as the tapped windings are provided at stator. The mixers with universal motor are difficult to use with UPS system because of high starting current. All the above problems can be eliminated by using BLDC motor for juicer.

BLDC motors are very small in size. BLDC is capable of give the easy speed-torque control required for mixer. Electronic commutation increases the efficiency and reliability of operation. Some of the applications required the lower speed for mixing it can be achieved by this motor. Efficiency verses torque characteristics is nearly flat. Energy saving can be achieved at any torque and speed. These advantages makes possible to use the BLDC Motor for juicer.

II. NEED OF SYSTEM

A study by Berkeley National Laboratories calculates that 33% of energy savings could be achieved when AC appliances are replaced with high-efficiency DC appliance. In a system with DC sources, and DC appliances, energy saving of 47% could be achieved. Universal motor employed in mixers can work on DC supply, but it is very inefficient because of mechanical commutator and brushes. In addition, it draws high starting current. So in place of universal motor, BLDC (Brushless Direct Current Motor) is used in mixer grinder, it saves abundant energy.

III. WHY BLDC?

The brushes in universal motors wear out over the time and may cause sparking. This is illustrated . As a result the universal motors require occasional maintenance. Controlling the brushes spark is also a difficult affair. Thus the brushed motor should never be used for operations that demand long life and reliability. For this issue and the other issues listed in the introduction, BLDC motors are used in most of the modern equipment. Efficiency of BLDC motor is typically around 85-90%, whereas the brushed motors are only 75-80% efficient. BLDC motors are also suitable for highspeed appliances (10000 rpm or above). The BLDC motors are also well known for their better speed control and efficiency.

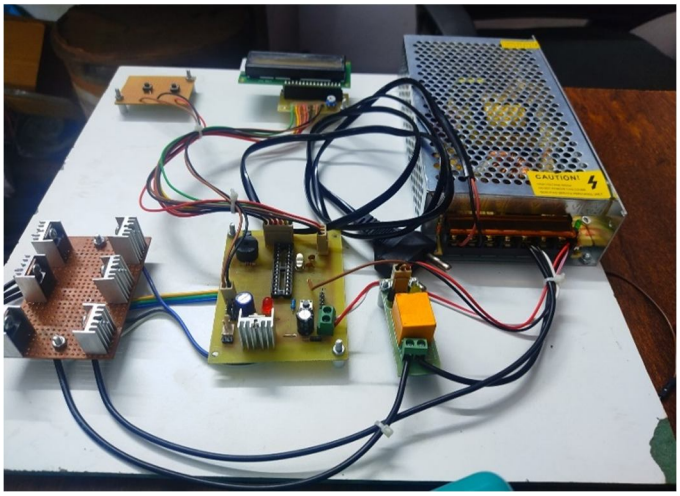
A. Brushless DC Motor is More Efficient

While converting electricity into mechanical power, brushless motors are more efficient than brushed motors primarily in that there is brushes which reduces mechanical energy loss due to friction. BLDC motors are also suitable for high speed appliances. Motor has the 3000 rpm speed at full load. According to the requirement of load it can vary by using speed regulator provided with controller of motor. On load the slightly change in speed with respect to the standard speed. BLDC has good speed regulation. Motor has 300Watt maximum power .The BLDC motors are also well known for their better speed control.

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IV. COMPONENTS



A. SMPS

SMPS stands for switching mode power supply. SMPS is an electronic power supply system that makes use of a switching regulator to transfer electrical power effectively.



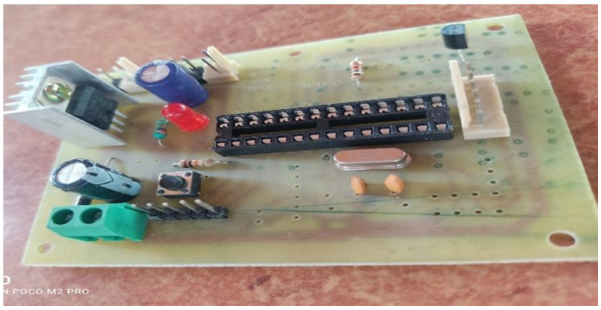
B. Regulator IC

The 7805 voltage regulator is a three-terminal voltage regulator IC. In various applications, A voltage regulator maintains the output voltage at a constant value.



C. Controller

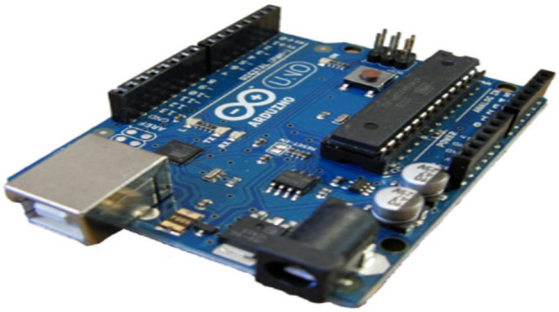
A device that controls the flow of electrical power to a motor and used to control speed .



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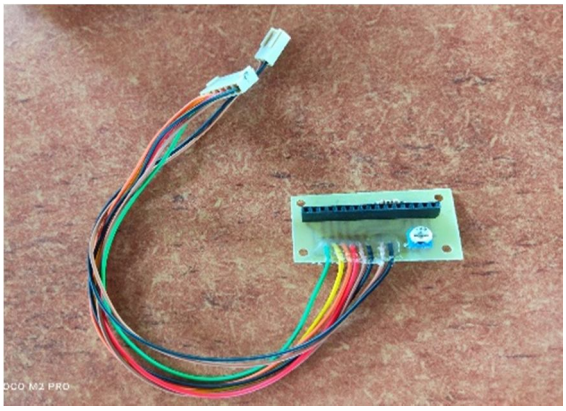
D. Arduino UNO

It is main controller belongs to Arduino family. which is used to control the signal received from any input voltage source like sensor and transmitter/receiver module. It is attached LCD display to show the command.



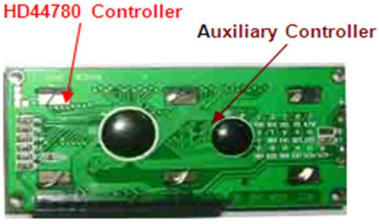
E. LED

LED Stands for light emitting diode.



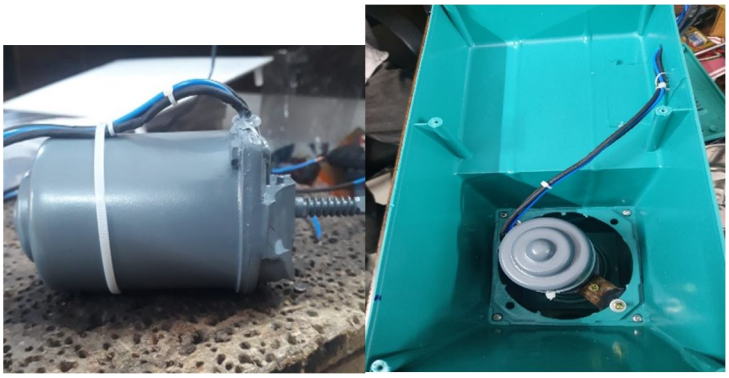


Front View



Back View

F. BLDC Motor



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V. SPECIFICATIONS OF MOTOR

Motor has the 3000 rpm speed at full load. According to the requirement of load it can vary by using speed regulator provided with controller of motor. On load the slightly change in speed with respect to the standard speed. BLDC has good speed regulation. Motor has 1200 Watt power and operated at 12V dc supply.

Table -1: Motor Details

Sr. No	Parameter	Value
1	Operating Power	120 W
2	Operating Voltage	12 V
3	Current	10A
4	No Load Speed	3000 RPM
5	Rated Speed	2750 RPM
6	Rated Current	6A
7	Maximum power	300W
8	Weight	2.56 Kg
9	Efficiency	>= 78%
10	Length(mm)	108

VI. BLOCK DIAGRAM AND SPEED CONTROL

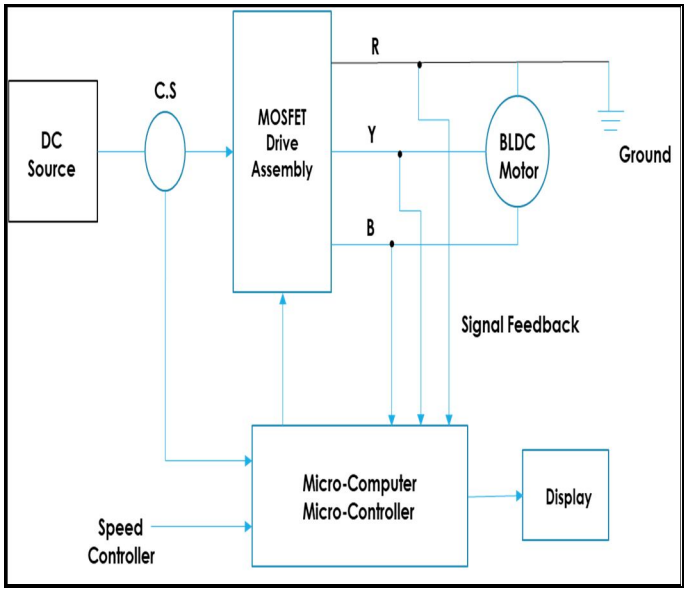


Fig.1 Block Diagram

For household purpose single phase 230V AC supply is available, but the motor needs 12V DC supply for operation. First need to step down the voltage to 12V AC, for this operation 230/12V, 10A SMPC is connected to supply mains. For this operation we need DC then AC to DC conversion is done by bridge rectifier unit. The rectifier gives the 12V DC at output. Then this 12V DC is given to the input to the controller which drives the motor.

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The speed of the BLDC motor can be controlled by different methods like input voltage control, PWM control.

Table -3: Comparison with Existing System

Sr. No	Feature	BLDC Motor	Universal Motor
1.	Commutation	Electronic commutation based on rotor position information	Mechanical brushes and commutator
2.	Efficiency	High	Moderate
3.	Thermal performance	Better	Good
4.	Maintenance	Little/None	Periodic
5.	Speed/Torque Characteristics	Flat	Moderately flat
6.	Speed Range	High	High
7.	Lifetime	Long	Short

VII. FUTURE SCOPE

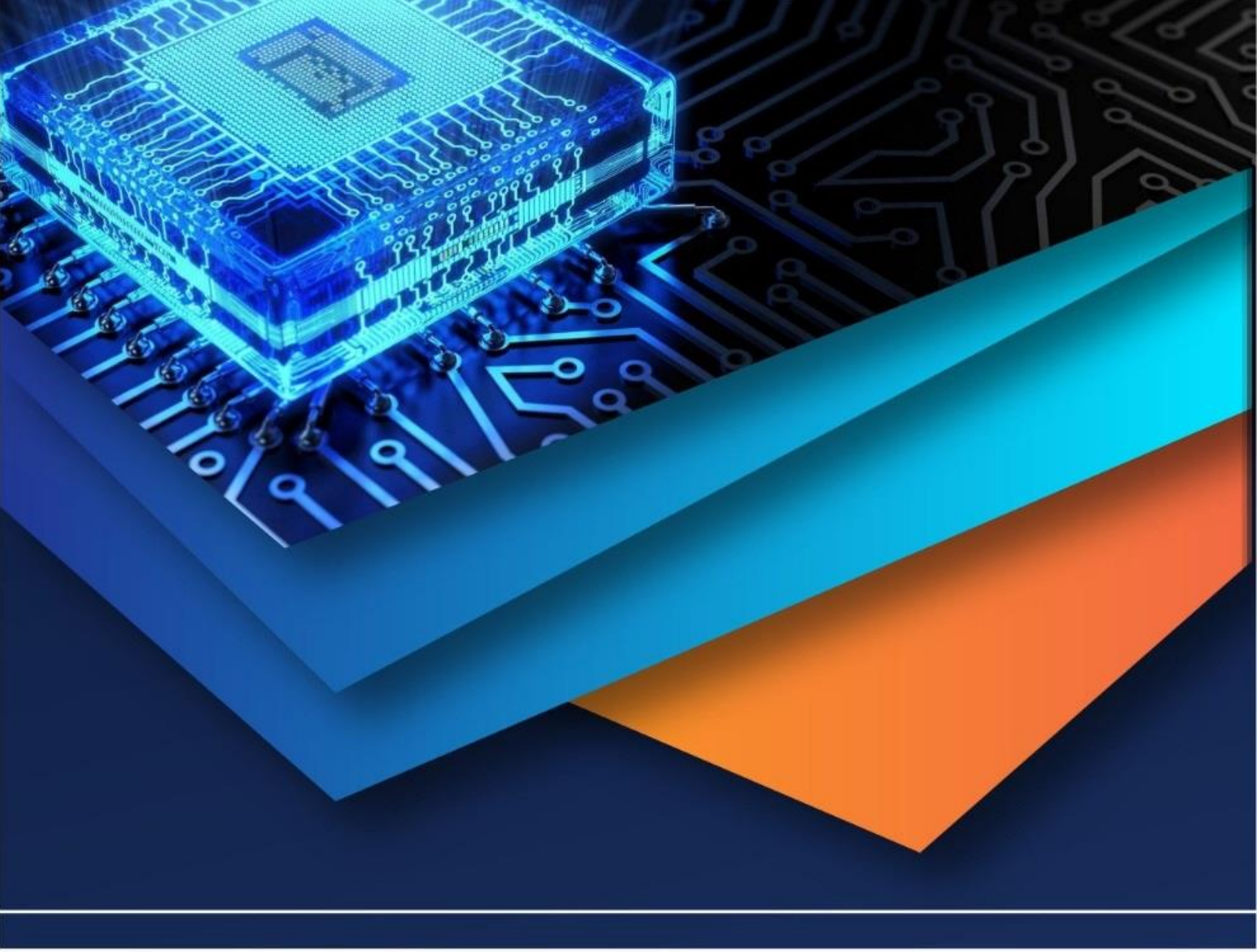
In the future all AC equipment replaced by the DC equipment because in the DC equipment the power loss is low as compare to the AC equipment so BLDC motor can be used in juicer. Also the use of Photovoltaic cells goes on increasing, so the juicer+ with BLDC motor can directly operate on DC supply without any converting devices and also the energy saving is achieved by use of energy efficient BLDC motor. This is a main reason of representing this paper.

VIII. CONCLUSION

In the project, in order to provide an efficient alternative to universal motor in a juicer, design of a low cost ferrite magnet based BLDC motor is carried out. It is found that, iron and copper losses are just 5.1%. BLDC motor can operate at DC supply and because of efficient design, it consumes very less power than universal motor. Thus, it is suitable for operation with the DC distribution system. In addition, its size is smaller than universal motor.

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