JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DESIGNING A PRINTED CIRCUIT BOARD MOTOR

[1]SAI RAGHUNANDAN V , [2]SHRAVYA D RAO , [3] SHREE RAGHAV N , [4] SHREYA D RAO , [5] SUMA K R.

[1234]Students and [5]Assistant professor

Department of electronics and communication engineering

Global Academy of Technology, Rajarajeshwari Nagar, Bangalore, Karnataka, India-560098

Abstract: Miniaturization is a recent trend that is still going strong. A revolution in that industry may result from applying this idea to gadgets that are already in use. In fact, a reduction in size can highlight how important precision and detail are. This paper provides a brief overview of how to integrate the thick coil windings of motors on a printed circuit board to significantly reduce their size. As a stator, a four layer PCB is employed, onwhich copper-filled spiral coils are mounted. For rotational motion, a 3D-printed object that resembles a miniature rotor and contains permanent magnets would be used.

Index Terms **- ESP32, 6H-Bridge driver, BUCK Converter, Power supply, Designed PCB motor, LCD Display.**

I. INTRODUCTION

A printed circuit board (PCB) is a tool that allows for the controlled integration of electronic components on a single substrate. Electric circuits supplying the appropriate functionality areimprinted on the substrate, ensuring that they continue to serve their intended purpose and remain within the board's perimeter. An induction motor is used as the model in an effort to minimizethe weight of the windings in order to find a solution to the problem of shrinking motors. Strongpermanent magnets are employed to serve the magnetic flux instead of iron or any other metal, which reduces size and bulkiness. The axial method of designing is used when choosing between the radial and axial forms of motor flux direction.

a. EXISTING SYSTEM:

A coil wound radially over the stator's surface makesup an induction motor, which uses the induced magnetic field to generate the necessary torque. Although the current induction motors do the required operation, they have a number of drawbacks, including bulkiness, corrosion, and a short shelf life for the windings. It produces a powerful magnetic field that has been utilized for years, but if a miniature version of it is developed, it opens up new opportunities for the development of motors and their uses.

b. PROPOSED SYSTEM:

With the aid of PCB, the primary goal is to lower thesize of coil widths. Axial type motors are produced because radial type motors require significantly more space to create their coils than axial typemotors. To create the required impedance for amotor to function, the coil windings are printed as copper wire with the proper thickness and spacing. It uses a focused spiral kind of winding. There are four powerful permanent magnets inside the rotor, which together with the current they induce and thetorque they create allow the rotor to rotate.

In order for the gadget to function properly, the inputto the motor is provided by a microcontroller. Additionally, motion of the motor in both the clockwise and anticlockwise directions can be accomplished using PCB, which is not possible withthe current motors.

II Literature Survey:

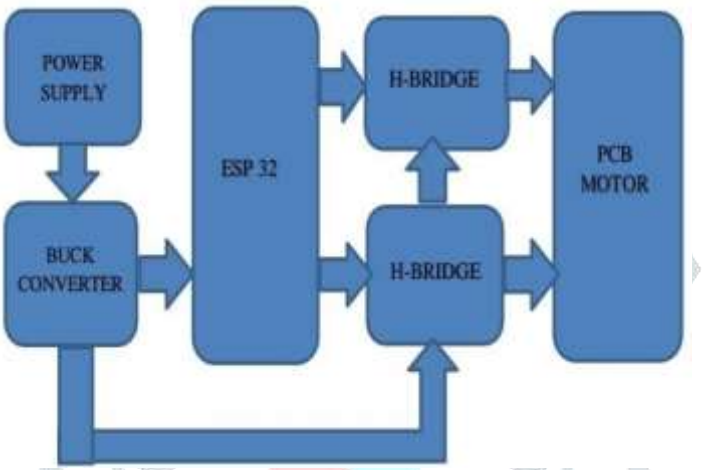
"Design aspects, winding arrangements andapplications of printed circuit board motors: a comprehensive review" by Omolbanin Taqavi, Seyed Mehdi Mirimani. This article mainly discusses about the various advantages of usingPCBs' in the field of motors and different types of winding arrangements which can be implemented while designing the layout of coils on the stator.[1].

"Design of multi-layer PCB coreless axial permanent magnet synchronous motor" by Xiaoguang Wang, Cangxian Hu, Meng Zhao, Lei Wu, Sheng Zhou, An original layout for the axial type synchronous motor has been discussed along with its implantation using different types of PCBs'and their applications. [2]

"Performance comparison between PCB-stator andlaminated-core-stator-based designs of axial flux permanent magnet motors for high-speed low- power applications" by S Neethu, Saurabh P Nikam, Saumitra Pal,Ashok K Wankhede, Baylon G Fernandes. This paper discusses about the benefits of using permanent magnets based stators instead of metalcore magnets to provide flux density and its implantation for low power applications.[3]

III Implementation:

The components typically used in this project for implementing includes power supply, ESP32,BUCK converter, 6H-Bridge driver and PCB motor.



Buck receives the power supply and then adjusts the input voltage before sending it to the ESP32. The 6H-Bridge driver also receives this controlledvoltage. The necessary program is sent to the ESP32, which transforms the analog signal input into a digital signal. Later, the 6H-Bridge driver receives this signal andconverts it into mechanical energy, which powers the PCB motor. Six coils are embedded on the PCBboard, which serves as the stator. The width of these coils is 0.1mm, and there is a 0.05mm gap between each coil. A via connection with a 0.2mmwidth is used to link each coil to the other. Four permanent magnets with an axial thickness of 3mm and a diameter of 9mm each are used tomechanically produce the rotor. It generates a 200 mT flux density at a distance of 1mm from the PCB surface. The four layers that make up the PCB have a thickness of 1.6 mm.

IV Result:

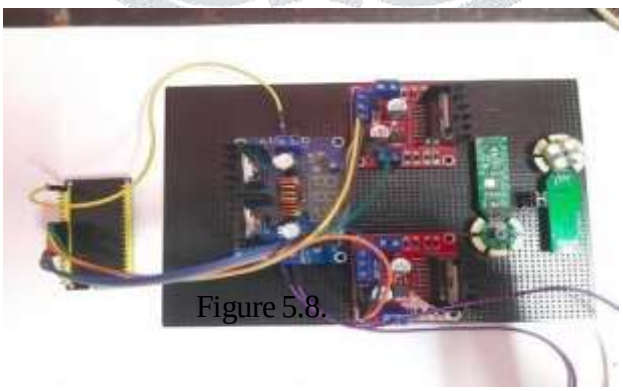


Figure 5.8.

A functioning low power motor is implementedusing the above mentioned process which can be runin both clockwise and anti-clockwise direction and some parameters which justify its operation are discussed below.

Motor Torque: A torque of 2.2 nm at 2000 rpm is measured since it is crucial for demonstrating a motor's prowess and is enough for low power applications.

Phase resistance: When voltage and current measurements were made with a multimeter, a resistance of less than 4 ohms was found.

Phase inductance: The inductance of the coil was determined through a RLC meter which was found out to be much less than the phase resistance.

BEMF constant: This value determines the inducedvoltage in the motor was calculated by abruptly stopping the motor and voltage was measured at thatinstance of time.

CONCLUSION:

In recent years, PCBs have demonstrated their ability to be used in a variety of electrical disciplines for both large and small applications. As a result, miniaturization has been successfully applied to the current motors. This will usher in a revolution in motor manufacturing and building techniques, resulting in lighter, more streamlined gadgets for everyday use.

ACKNOWLEDGEMENT

We would like to convey our appreciation to my professor and colleges for creating a conducive environment for scholastic endeavors. Finally, we would like to express our gratitude to everyone whose efforts, large and small, made thispaper possible.

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