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IOT Based Load Monitoring System for Industrial Application

V. Gnanavel[1], A. Logaraj[2], R. Kabilan[3], M. Santhosh Kumar[4], S. Saravanan[5]

UG Scholars, Department of Electrical and Electronics Engineering, Muthayammal Engineering College (Autonomous) Rasipuram, Tamil Nadu, India[1,2,3]

Assistant Professor, Department of Electrical and Electronics Engineering, Muthayammal Engineering College (Autonomous) Rasipuram, Tamil Nadu, India[4]

Professor, Department of Electrical and Electronics Engineering, Muthayammal Engineering College (Autonomous) Rasipuram, Tamil Nadu, India[5]

ABSTRACT: This system proposes a simple, cost effective and efficient DC motor water pump drive for battery (EMS) array fed dc load system. A DC-DC converter is utilized in order to extract the maximum available power from the SBT array. The proposed control algorithm eliminates phase current sensors and adapts a fundamental frequency switching of the Z source inverter (ZSI), thus avoiding the power losses due to high frequency switching. The speed is controlled through a variable DC link voltage of ZSI. An appropriate control of DC-DC converter through the perturb and observer conductance maximum power point tracking algorithm offers soft starting of the BLDC motor. The proposed wind system is designed and modelled such that the performance is not affected under dynamic conditions. The suitability of proposed system at practical operating conditions is demonstrated through simulation results using MATLAB/ Simulink followed by an experimental validation.

KEYWORDS: The project highlights the potential of IoT technology in load management, offering a versatile solution for various industrial applications.

I.INTRODUCTION

The application of adjustable-speed drives (ASD's) in commercial and industrial sectors is increasing due to improved efficiency, energy savings, and process control. The traditional adjustable-speed drives system is based on the voltage-source inverter. The new technology is used in adjustable-speed drive system based on z-source inverter. The v-source inverter based adjustable speed drive system has certain limitations and problems they are obtainable output is limited quite below the input line voltage, voltage sags can interrupt an adjustable speed drive system and shut down criticalloads and processes, performance and reliability are compromised. The z-source inverter based adjustable speed drive system has certain limitationsand problems they are the source network inductor has the limited value to guarantee the input current in>0. In some applications, the inductance should be minimized in order to reduce cost, volume, and weight. The design of z-source network inductor and system control become very complex, and the output voltage becomes uncontrollable with small inductor even operate in full load light-load operation is the problem in z-source inverter based adjustable speed drive system. The dc-link voltage is increasing infinitely when the system is operated with light load. The dc-link voltage will be uncontrollable and the system is unstable.

The original z-source inverter adjustable speed drive system cannot obtain the high performance due to its light-load operation limitation. The dc/dc boosted PWM inverter topology can alleviate the stresses and limitations, however, suffers problems such as high cost and complexity associatedwith the two-stage power conversion. The newly proposed Z-source inverter has the unique feature that it can boost the output voltage by introducing shoot through operation mode, which is forbidden in traditional voltage source inverters. The simple boost control PWM technique is used to simulate the single-phase Z-source inverter for induction motor control. The speed control of such motors can be achieved by controlling the applied voltage on the motor by the use of power electronic devices. Z-Source inverter is used for power control of single-phase motoras compared to the traditional voltage source inverter (VSI) and current source inverter (CSI) inverters. This project is based on the performance of the Switched Reluctance Motor (SRM) drives using Inverter with the simplified rule base of Fuzzy Logic Controller(FLC) with the output scaling factor (SF) self-tuning mechanism are proposed. The aim of this project is to simplify the program complexity of the controller by reducing the number of fuzzy sets of the membership functions (MFs) without losing the system performance and

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stability via the adjustable controller gain. ZSI exhibits both voltage-buck and voltage-boost capability. It reduces line harmonics, improves reliability, and extends output voltage range.

The output SF of the controller can betuned continuously by a gain updating factor, whose value is derived from fuzzy logic, with the plant error and error change ratio as input variables. Then the results, carried out on a four-phase 6/8 pole SRM based on the dSPACEDS1104 platform, to show the feasibility and effectiveness of the devised methods and also per practicaloperation mechanism is the FLC. It has been shown that fuzzy control can reduce hardware and cost and provide better performance than the classical PI, PD, or PID controllers. Recently, fuzzy control theory has been widely studied, and various types of fuzzy controllers have also been proposed for the SRM to improve the drive performance further. Performance of the FLC is scaling factor (SF) tuning, rule base modification, inference mechanism improvement, and membership function redefinition and shifting. The initial parameters and scaling gains of the controller are optimized by the genetic algorithm to minimize overshoot, settling time, and rising time.
Inverter can boost dc input voltage with no requirement of dc-dc boost converter or step up transformer, hence overcoming output voltage limitation of traditional voltage source inverter as well as lower its cost. A comparison among conventional PWM inverter, dc-dc boosted PWM inverter, and inverter shows that inverter needs lowest semiconductors and control circuit cost, which are the main costs of a power electronics system. This results in increasing attention on inverter, especially for the application where the input DC source has a wide voltage variation range, such as the battery (BT) grid-tied generation and fuel cell motor drive system. Moreover, for inverter we have not to worry about EMI influence since shoot through are welcome and even exploited. This in turn enhances the inverter reliability. There are various methods can be used to control inverter. These can be classified into two categories according to the different shoot- through (ST) states insertion methods. The first category has the principle that ST states are generated by properly level shifting the modulation signals of voltage source inverter. ST states then will be inserted at every state transition, six ST state insertions in one switching cycle. The second category, in the other hand, directly replaces the –In this project, two different control methods for Sources inverter are examined. The Simple Boostand the Maximum Boost control methods of the inverter are analyzed and comparedeach other using simulation with MATLAB/Simulink. The Simple Boost control with independence relation between modulation index and shoot-through duty ratiois also simulated and analyzed. The selection of high modulation index and shoot- through duty ratio can reduce the inverter's dc link voltage overshoot and increasingpower delivery capacity of the inverter.

II.EXISTING SYSTEM

This system presents a power factor correction (PFC)-based bridgeless Luo (BL-Luo) converter-fed EV brushless DC (BLDC) motor drive. A single voltage sensor is used for the speed control of the BLDC motor and PFC at ac mains. The speed of the BLDC motor is controlled by an approach of variable dc-link voltage, which allows a low-frequency switching of the voltage source inverter for the electronic commutation of the BLDC motor, thus offering reduced switching losses. The proposed BLDC motor drive is designed to operate over a wide range of speed control with an improved power quality at ac mains. The power quality indices thusobtained are under the recommended limits of IEC 61000-3-2. The performance of the proposed drive is validated with test results obtained on a developed prototype of the drive.

III.PROPOSED SYSTEM

The proposed PFC-based bridgeless DC-DC (BL-DC-DC) converter-fed DC motor drive. A single-phase Supply followed by a filter and a DC-DC converteris used to feed a VSI driving a DC motor. The speed of the AC motor is controlled by adjusting the dc-link voltage of VSI using a single voltage sensor. This allows VSI to operate at fundamental frequency switching and hence has low switching losses in it, which are considerably high in a PWM-based VSI feeding a DC motor. The proposed scheme is designed, and its performance is simulated for achieving an improved power quality at AC mains for a wide range of speed Control and supply voltage variations. Finally, the simulated Performance of the proposed drive is validated with test results on a developed prototype of the drive. The operation of the proposed PFC BL-DC-DC converter is classified into two parts which include the operation during the positive and negative half cycles ofsupply voltage.

The operation of the PFC bl-DC-DC converter for positive and negative half cycles of supply voltage, respectively. The bridgeless converter is designed such thattwo different switches operate for positive and negative half cycles of supply voltages. Switch sw1, inductors li1 and lo1, and diodes up and dp1 conduct during thepositive half cycle of supply voltage. In a similar manner, switch sw2, inductors li2 and lo2, and diodes do and dn1 conduct during the negative half cycle of supply voltage the associated waveforms demonstrating the variation of different N parameters such as supply voltage (vs), discontinuous input inductor currents (ili1 and ili2), output inductor current (ilo1 and ilo2), and the

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intermediate capacitor's voltage (vc1 and vc2) during the complete cycle of supply voltage.

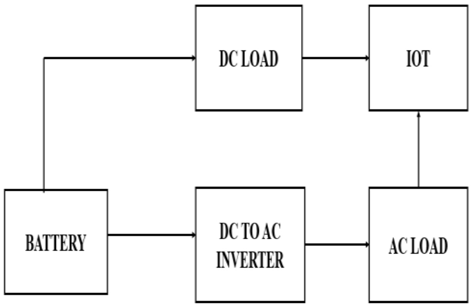

Figure.1.Block Diagram

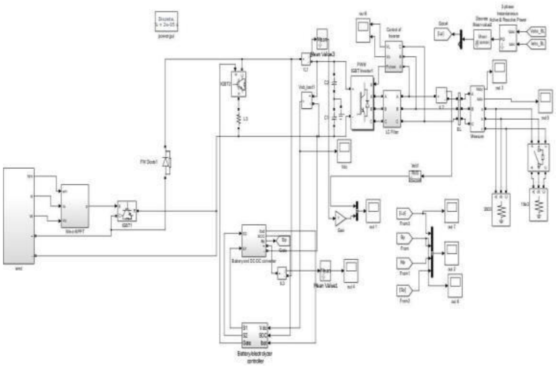

Figure.2.Simulation Diagram

ARDUINO UNO R3 MICROCONTROLLER

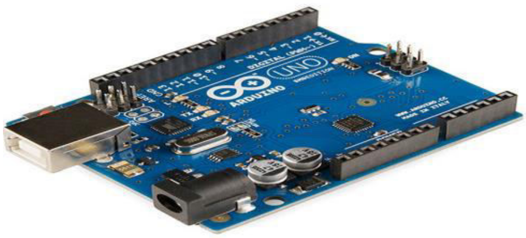

Figure.3.ARDUINO UNO

Arduino Nano controls the other components Raspberry Pi, motors, motor driver module, ultrasonic sensor.

DISPLAY (LCD)

Figure.4.Display

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The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888. By 2008, worldwide sales of televisions with LCD screens exceeded annual sales of CRT units; the CRT became obsolete for most purposes.

AT MEGA

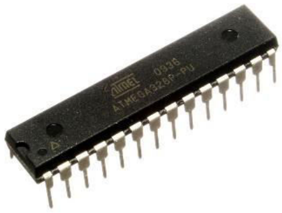

Figure.5.ATMEGA328 Microcontroller

AT mega, a series of microcontrollers by Atmel, continues to evolve. With advancements in technology, we can expect more powerful, efficient, and versatile AT mega chips. These could have enhanced features like increased memory, lower power consumption, and better connectivity options.

TEMPERATURE SENSOR

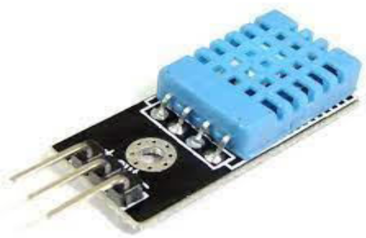

Figure.6.Temperature Sensor

The output of increases in proportion to the temperature by 10 mv per degree.This varying voltage is feed to a comparator IC 741 (op amplifier). Op amplifier are among the most widely used electronic devices today. The op-amp is one type of differential amplifier. It has two input inverting (-) and non-inverting (+) and one output pin.

VOLTAGE SENSOR

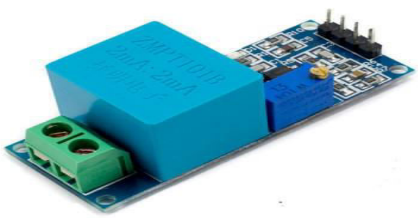

Figure.7. Voltage Sensor

Voltage sensors enable to measure DC, AC or voltage with a galvanic insulation between primary and secondary circuits.

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WI-FI NODE MCU MODULE

Figure.8.WI-FI NODE MCU MODULE

Node MCU is an open-source Lua based firmware and improvement board uniquely focused on for IoT based Applications. It remembers firmware that runs for the ESP8266 Wi-Fi SoC from Express if Systems, and equipment which depends on the ESP-12 module. Real-time monitoring and data analysis optimize operations, ensuring resources are allocated effectively and processes run smoothly.

IV.RESULT

MATLAB is a high-level language and interactive environment for numerical computation, visualization, and programming. Using MATLAB, you can analyze data, develop algorithms, and create models and applications. The language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such asC/C++ or Java.

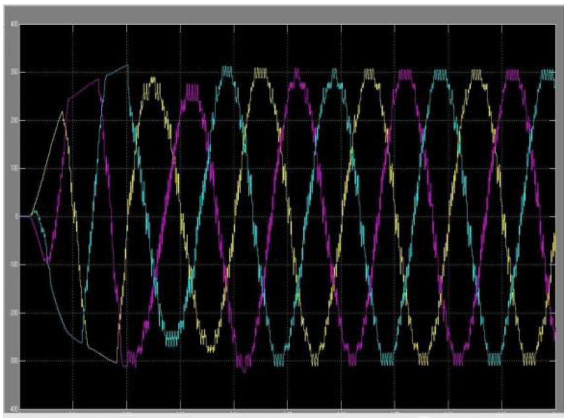

Figure.9.Simulation Result

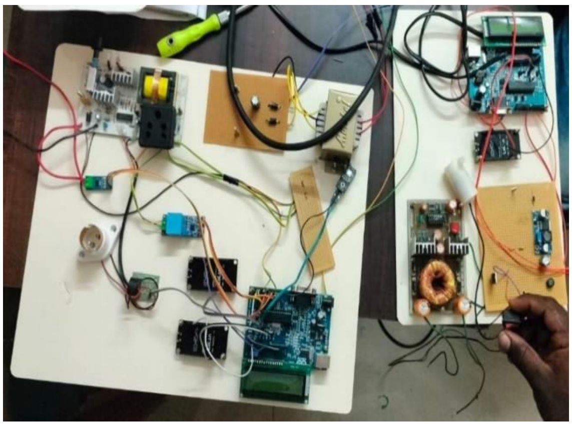

Figure.10.Simulation Model

V.CONCLUSION

A PFC based BL-DC-DC converter-fed BLDC motor drive has been proposed for a wide range of speeds and supply voltages. A single voltage sensor- based speed control of the BLDC motor using a concept of variable dc-link voltage has been used. The PFC BL-DC-DC converter has been designed to operate in DICM and to act as an inherent

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power factor pre regulator. An electronic commutation of the BLDC motor has been used which utilizes a low-frequency operation of VSI for reduced switching losses. The proposed BLDC motor drive has been designed and its performance is simulated in MATLAB/Simulink environment for achieving an improved power quality over a wide range of speed control. Finally, the performance of the proposed drive has been verified experimentally on developed hardware prototype. A satisfactory performance of the proposed drive has been achieved and isa recommended solution for low-power applications.

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