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Biometrics Based Smart Electronic Voting System Using Internet of Things

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Abstract: Wind energy has been identified as the second dominating source in the world renewable energy generation after hydropower. Conversion and distribution of wind energy has brought technology revolution by developing the advanced wind energy conversion system (WECS) including multilevel inverters (MLIs). The conventional rectifier produces ripples in their output waveforms while the MLI suffers from voltage balancing issues across the DC-link capacitor. This project deals with the design and evaluation of power electronics topology commonly called the "Vienna rectifier" that can be used for improved variable-speed wind energy conversion. This paper proposes a simplified proportional integral (PI)to minimize the output waveform ripples, resolve the voltage balancing issue and produce better quality output waveforms. This Project has emerged recently as a very important alternative in the area of high-power medium voltage energy control. The multilevel voltage source inverters unique structure allows them to reach high voltages with low harmonics without use of transformers or series connected synchronized switching devices.
Key words*:* DC-DC converter; multilevel inverter; Total harmonics distortion, Pulse width modulation. Wind energy, Space vector pulse width modulation

I. INTRODUCTION

Multilevel power conversion was rest introduced more than two decades ago. The general concept involves utilizing a higher number of active semiconductor switches to perform the power conversion in small voltage steps. Multilevel inverters are promising; they have nearly sinusoidal output voltage waveforms, output current with better harmonic pro le, less stressing of electronic components owing to decreased voltages, switching losses that are lower than those of conventional two-level inverters, a smaller size, and lower EMI, all of which make them cheaper, lighter, and more compact. One clear disadvantage of multilevel power conversion is the higher number of semiconductor switches required. It should be pointed out that lower voltage rated switches can be used in the multilevel converter and, therefore, the active semiconductor cost is not appreciably increased when compared with the two level cases. However, each active semiconductor added requires associated gate drive circuits and adds further complexity to the converter mechanical layout. Another disadvantage of multilevel power converters is that the small voltage steps are typically produced by isolated volt-age sources or a bank of series capacitors. Isolated voltage sources may not always be readily available, and series capacitors require voltage balancing. To some extent, the voltage balancing can be addressed by using redundant switching states, which exist due to the high number of semiconductor devices. In general, three main types of multilevel inverters, i.e. diode clamp, flying-capacitor, and cascade inverter with separated dc sources, have been developed. Recent research has involved the introduction of novel converter topologies and unique modulation strategies. However, the most recently used inverter topologies, which are mainly ad-dressed as applicable multilevel inverters, are cascade converter, neutral-point clamped (NPC) inverter, and flying capacitor inverter. There are also some combinations of the mentioned topologies as series combination of a two-level converter with a three-level NPC converter which is named cascade 3/2 multilevel inverter. There is also a series combination of a three-level cascade converter with a seven-level NPC converter which is named cascade 5/3 multilevel inverter.

The multilevel output is generated with a multi winding transformer. However, the design and manufacturing of a multi winding transformer are difficult and costly for high-power applications. The topology is a symmetrical topology since all the values of all voltage sources are equal. However, there are asymmetrical topologies which require different voltage sources. This criterion needs to arrange dc power sup-plies according to a specific relation between the supplies. Difference in ratings of the switches in the topology is also a

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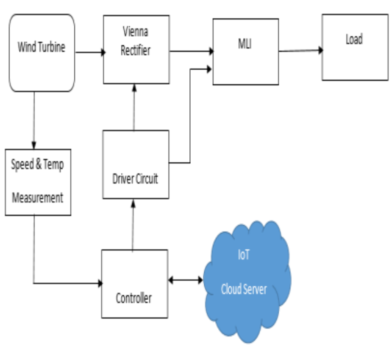
major drawback of the topology. This problem also happens in similar topologies, while some of the high-frequency switches should approximately withstand the maximum overall voltage which makes its application limited for high-voltage products. A new approach has been proposed that decreases the number of required dc supplies and inserting transformer instead. The main disadvantage of the approach is adding so many transformer windings which will add up to the overall volume and cost of the inverter.

II. PROPOSED SYSTEM

The different topologies presented in the multilevel inverter shows a number of characteristics in common. The main disadvantage associated with the multilevel inverter configuration is their circuit complexity, requiring a high number of power switches. When we are entering the simplified H-Bridge multilevel inverter, power devices will be reduction and circuit complexity also reduction so circuit losses also reducing.

- Proposing a new PI-based PWM controller to suppress the ripples of the converter DC-link voltage and resolving the voltage balancing issues across the DC-link capacitors.
- The wind turbine along with the Vienna rectifier deals with the reduction of line harmonics and switching losses are reduced. In this project novel scalar control technique is used for controlling the switching and hence Dc output will stabilize
- Proposing an industrial IoT algorithm associated with hardware prototypes to monitor the condition of WECS in real time



In proposed system consists of wind turbine, Veinna rectifier and nine level inverter. In this project to generate the gate pulses for the switches, PIC 16F877A microcontroller is used. Along with PIC microcontroller, IR2112 driver circuit is needed to generate gate signal for Veinna rectifier and MLI Inverter and we obtain low THDvalue from nine level inverter. Node MCU microcontroller also used for cloud date updating of wind temperature and Voltage values of converter and also when temperature will increases the cooler fan automatically turn on .

III. CIRCUIT DIAGRAM

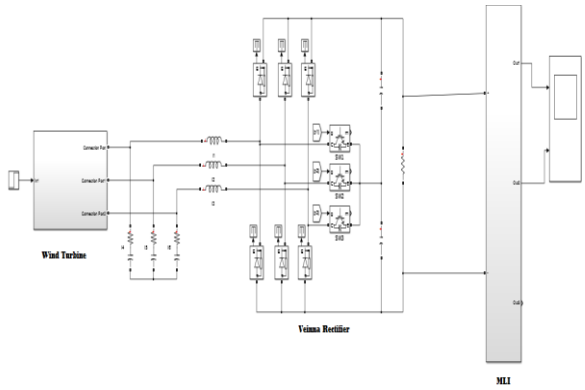


Fig: Proposed Circuit Diagram

ADVANATGES

- Simple structure
- Gives continuous sinusoidal input current
- No need for a neutral wire.
- Low harmonics.
- Low switching losses.

VIENNA RECTIFIER

The Vienna rectifier consists of three switches MOSFET; it converts the unstable AC voltage into controlled DC voltage. It can also provide sinusoidal input currents and controlled DC-voltage. The AC voltage from the three phase generator is given to the Vienna rectifier. The current flows through the three MOSFETs and the capacitors in the capacitor bank begin to charge and when the capacitors are fully charged it.

As wind generators as an energy source became more popular. Based on turbine rotation the synchronous generator generates the variable three phase AC input voltage. It has to be converted to high voltage DC (HVDC) to connect to the grid. The need arises to efficiently convert the energy provided to a usable source and also conserve

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energy by reducing reactive power consumption. The interface developed in this project will serve as a possible solution for fulfilling this need. The interface is three phase three switch, three levels VIENNA rectifier.

WIND ENERGY

WECS composed of a wind turbine (WT), a PMSG that is used for converting mechanical energy extracted by WT in to the electrical energy. Shaft of turbine directly connected to the PMSG with the help of the gearbox that provides rated torque to the PMSG, and generated three-phase voltage and current. Then the output power obtained from the PMSG is delivered to AC–DC–AC converters so that the output ac voltage (Vac) will be maintained at required amplitude and frequency. The dc-link voltage can be affected by the varying wind speed. Therefore, by keeping dc-link voltage (VDC2) constant at its reference value the amplitude of „Vac" can be controlled at the required grid voltage.

Three-phase instantaneous AC phase voltages generated by the WECS are given

$$V_{an} = v_m \sin \omega t \qquad (1)$$

$$V_{bn} = v_m \sin \left(\omega t - \frac{2\pi}{3} \right) \qquad (2)$$

$$V_{cn} = v_m \sin \left(\omega t + \frac{2\pi}{3} \right) \qquad (3)$$

The instantaneous phase voltages are converted into anintermittent DC-link voltage across the DC-link capacitors Vdc through six bi-directional switching devices as given in (4).

$$V_{dc} = \frac{1}{\pi} \int_0^{\pi} v_m \sin \omega t d(\omega t) = \frac{2 v_m}{\pi} \qquad (4)$$

Comparison Table I

3 LEVEL	5 LEVEL	9 LEVEL
32.8 % Total harmonics distortions	26.5% Total harmonics distortions	Low Total harmonics distortions compare to 5 level (16.24%)
Three phase rectifier	Three phase rectifier	Veinna Rectifier
More conduction losses with low efficiency	Low efficiency	Vienna rectifier has several advantages, such as higher efficiency, improved total harmonic distortion, etc.
More Number of Switches	More Number of Switches	Less number of switches with low switching Losses
transient stability poor	transient stability poor	High transient stability

Table: 1 Comparison of 3, 5, 9 level Inverter

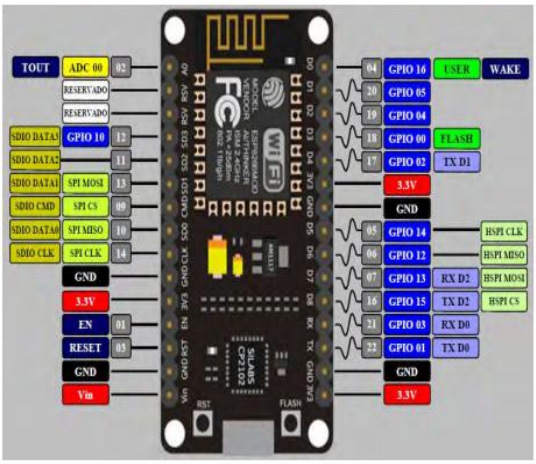
INTERNET OF THINGS

In this project monitoring the wind energy system input voltage and MLI output voltage through cloud using node mcu and also monitoring wind turbine temperature with the help of temperature sensor. Node MCU is an open source IoT stage. It incorporates firmware which keeps running on the ESP8266 Wi-Fi SoC from Expressive Systems, and equipment which depends on the ESP-12 module. The term NodeMCU typically refers to the firmware, whereas the board is termed Devkit. NodeMCU Devkit 1.0 consists of associate ESP-12E on a board that facilitates its use. It additionally contains a transformer, a USB interface. The expression "NodeMCU" of course alludes to the firmware as opposed to the improvement units. The firmware utilizes the Lua scripting dialect

The NodeMCU (Node Micro Controller Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266 is designed and manufactured by Express, contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK. When purchased at bulk, the ESP8266 chip costs only $2 USD a piece. That makes it an excellent choice for this system design. The NodeMCU aims to simplify ESP8266 development. It has two key components.

i. An open source ESP8266 firmware that is built on top of the chip manufacturer's proprietary SDK. The firmware provides a simple programming environment based on eLua (embedded Lua), which is a very simple and fast scripting language with an established developer community. For new comers, the Lua scripting language is easy to learn. And to add on NodeMCU can be programmed with the Android IDE too.

ii. ii. A development kit board that incorporates the ESP8266 chip on a standard circuit board. The board has a built-in USB port that is already wired up with the chip, a hardware reset button,



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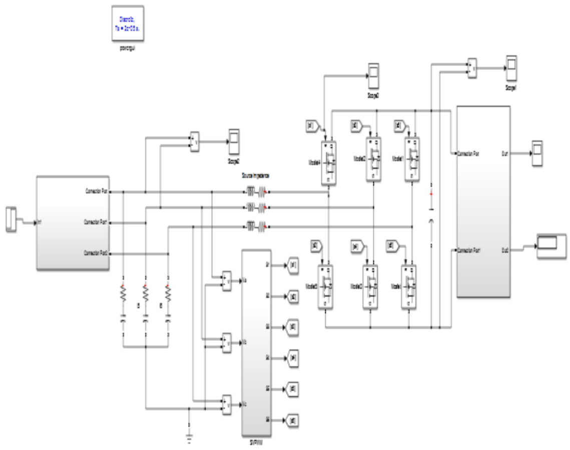
iii. Wi-Fi antenna, LED lights, and standard-sized GPIO (General Purpose Input Output) pins that can plug into a bread board. below shows the NodeMCU development board.

Fig: Esp8266 NodeMCU chip

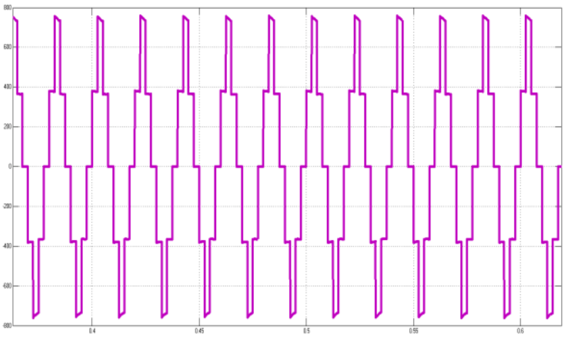
As shown in Fig it has 12 GPIO pins. One ADC pin. For this project 7 GPIO pins have been used. They are D0 to D6 which delivers digital outputs.

IV. Simulation Results

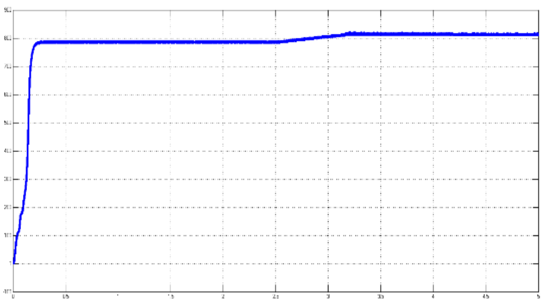
Simulation circuit diagram 5 level

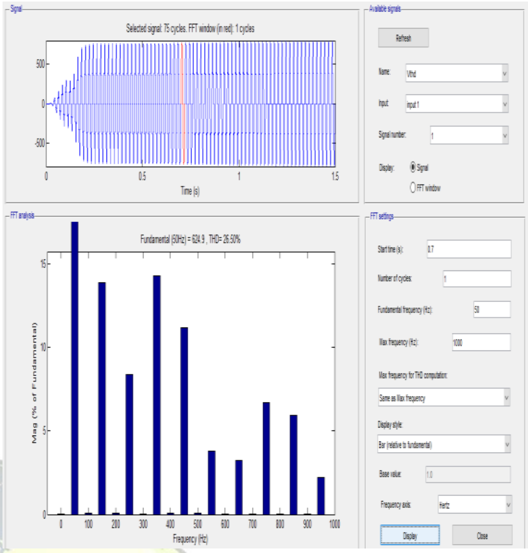


5 level output voltage

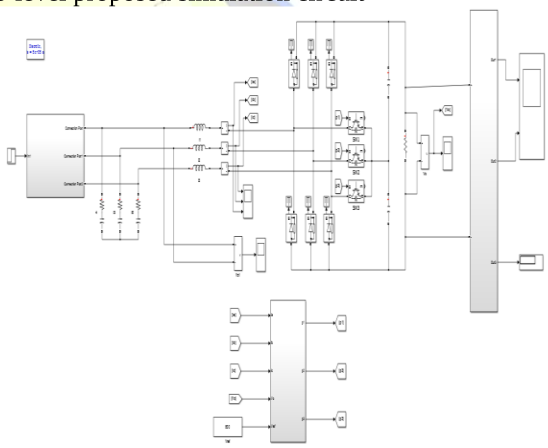


THD

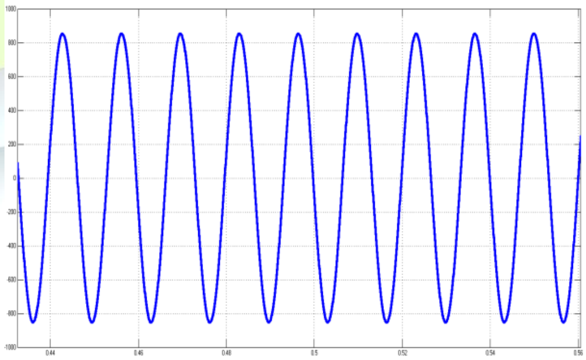




9 level proposed simulation circuit



Wind output voltage



Veinna rectifier output voltage
Nine level output voltage

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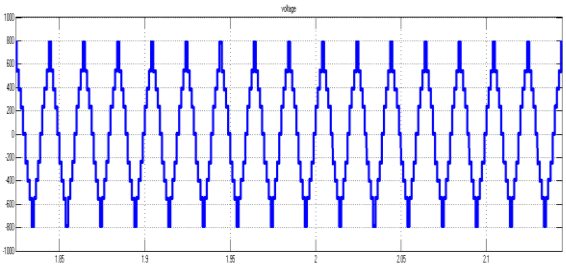
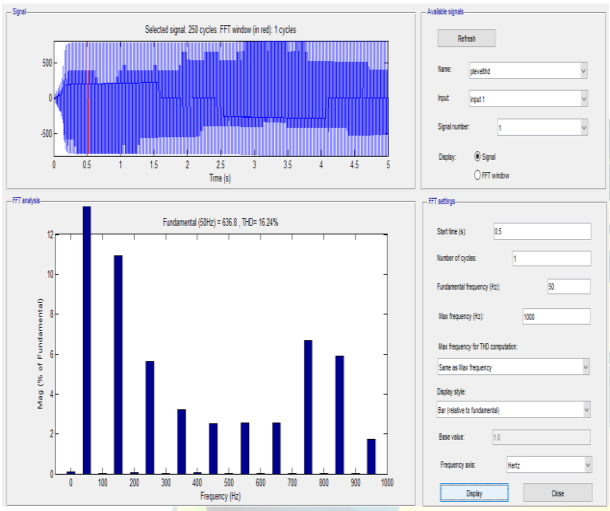


THD



V. Conclusion

This project proposed a Vienna rectifier circuit with multilevel inverter for wind power generation using IoT. Wind solar energy system fed single phase multilevel inverter presented. The advantages of this circuit are: Additional input filters are not necessary to filter out high frequency harmonics. Simulation results are compare with 5 level and 9 level inverter we obtain low THD level compared to 5 level inverter.

References

1. S. Kouro, M. Malinowski, K. Gopakumar, J. Pou, L. G. Franquelo, B. Wu, J. Rodriguez, M. A. Pérez, and J. I. Leon, "Recent advances and industrial applications of multilevel converters," IEEE Trans. Ind. Electron., vol. 57, no. 8, pp. 2553– 2580, Aug. 2010.

2. M. Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Pérez, "A survey on cascaded multilevel inverters," IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2197– 2206, July 2010.

3. G. Farivar, B. Hredzak, and V. G. Agelidis, "A DC-side sensorless cascaded H-bridge multilevel converter-based photovoltaic system," IEEE Trans. Ind. Electron., vol. 63, no. 7, pp. 4233–4241, July 2016.

4. J. Chavarría, D. Biel, F. Guinjoan, C. Meza, and J. J. Negroni, "Energy-balance control of PV cascaded multilevel grid-connected inverters under level-shifted and phase-shifted PWMs,"IEEE Trans. Ind. Electron., vol. 60, no. 1, pp. 98–111, Jan. 2013.

5. M. Coppola, F. D. Napoli,P. Guerriero, D. Iannuzzi, S. Daliento, and A. D. Pizzo, "An FPGA-based advanced control strategy of a grid-tied PV CHB inverter,"IEEE Trans. Power Electron, vol. 31, no. 1, pp. 806–816, Jan. 2016.

6. E. Villanueva, P. Correa, J. Rodríguez, and M. Pacas, "Control of a single-phase cascaded H-bridge multilevel inverter for grid-connected photovoltaic systems,"IEEE Trans. Ind. Electron., vol. 56, no. 11, pp. 4399–4406, Nov. 2009.

7. G. Farivar, C. D. Townsend, B. Hredzak, J. Pou, and V. G. Agelidis, "Low-capacitance cascaded H-bridge multilevel StatCom,"IEEE Trans. Power Electron, vol. 32, no. 3, pp. 1744–1754, Mar. 2016.

8. F. Khoucha, S. M. Lagoun, K. Marouani, A. Kheloui, and M. E. H. Benbouzid, "Hybrid cascaded H-bridge multilevel-inverter induction-motor-drive direct torque control for automotive applications," IEEE Trans. Ind. Electron., vol. 57, no. 3, pp. 892– 899, Mar. 2010.

9. S. Vazquez, J. I. Leon, J. M. Carrasco, L. G. Franquelo, E. Galvan, M. Reyes, J. A. Sanchez, and E. Dominguez, "Analysis of the power balance in the cells of a multilevel cascaded H-bridge converter," IEEE Trans. Ind. Electron. vol. 57, no. 7, pp. 2287–2296, Jul. 2010.

10. Y. Yu, G. Konstantinou, B. Hredzak,and V. G. Agelidis, "Operation of cascaded H-bridge multilevel converters for large-scale photovoltaic power plants under bridge failures,"IEEE Trans. Ind. Electron., vol. 62, no. 11, pp. 7228–7236, Nov. 2015.