Review on Hybrid Inverter

*Abhirup Bhowmick
Department of Electronics and Communication Engineering
Guru Nanak Institute of Technology
Kolkata, India

Sayan Singh
Department of Electronics and Communication Engineering
Guru Nanak Institute of Technology
Kolkata, India

Trinika Das
Department of Electronics and Communication Engineering
Guru Nanak Institute of Technology
Kolkata, India

Debasree Saha
Department of Electrical Engineering
Guru Nanak Institute of Technology
Kolkata, India

***Abstract*— It is a review paper about hybrid inverters. Hybrid inverters are used to perform in multimode operation. A micro grid system consisting of different types of renewable energy sources are used to get uninterrupted power supply with the help of hybrid inverter. In this paper authors have proposed a design of micro grid having hybrid inverter using matlab simulink. And they have designed a single phase inverter which perform properly under different loading conditions.**

Keywords—Hybrid; inverter; renewable energy; simulink; waveform; microcontroller.

I. INTRODUCTION

Conventional power sources are reduced day by day. Research is going on to increase the use of renewable energy sources. Hybrid inverters are needed to get uninterrupted power supply from the weather dependent renewable energy sources. A hybrid inverter system can be used in both high power cut area or areas .There is rare or less power cut in rural areas. Under normal operating conditions it can supply power to the home, charge the batteries and excess power can fed into the grid. In case of a power cut the unit will automatically switch on the battery, supply and continue independently from the power grid. They saves money and easy to install and maintain.

II. LITERATURE SURVEY

When an AC power goes off, the storage supplied by the battery should be maintained the batteries would be precisely charged by solar AC grid source on night-time or muddy weather when source light is obtainable in any case of AC line status would be charged battery [1].Introduce solar in addition to wind hybrid energy system also the main supply. The design allows the three sources energy to the battery too supply the load individually on concurrent depending on the accessibility of energy. This will be applicable in hill/ village areas. A hybrid design of battery system and its implementation is the topic of the paper [2]. The paper designed in this way that we get the battery of the limitation of solar energy. Charging system of solar battery has an inverter fueled by 12v battery and the inverter create up to 230v AC. Thus batteries are charged from two sources that is main power and solar energy. If main power supply is available then the relay switches to main power supply for applying the load [3]. With the help of the solar battery charging system has an inverter that is fueled by a 12v battery. It helps generate 110v AC driven circuitry and a massive load transformer. The solar panel can use as a isolated system or as a large solar system connected to a power grid[4] .The earth receives the 84 terawatt of power and absorbs only 12 terawatts. PCS can able to work in grid commended mode in regular operation and also can charge the batteries [5]. It is able to operate standard mode during grid side faults and deliver power to local loads with the help of controlled in loop relation in result, the posed will be balanced [6]. A bidirectional diode converter connective PV diode which controls the battery state and optimize the PV pole. By these process the inverter efficiency in battery will improve [7]. The hybrid inverter is mainly runs on wind turbine and solar energy is able to feed a certain amount of power to load under all conditions because it can be used as an uninterruptible power source and different modes of operation like solar, wind, hybrid and battery power transfer takes place. If solar mode and wind mode does not work then hybrid mode will work after we enable it. The paper [8] based on the design of solar inverter which is need to run AC loads mostly used as flammable motive. The power output of the plotted inverter is 100W, input voltage is 12V, output is 220V, and 50Hz square wave output. The paper [9] design and execution of 1Kw SPWM form inverter to convert the applied DC voltage from photovoltaic array in pure sinusoidal AC voltage and frequency standard grid output that is 220V and 50Hz.The essence of their research work is use of an economical and advanced 16bit PIC micro controller to generate the popular SPWM with very high carrier frequency to control the inverter circuit. The paper [10] presents grid connected PV inverter has a control strategy. This system study is ready under LVRT condition. The plan is build on current loop under single axis along with rotating co-ordinate system. Grid connected PV system own three phase inverter to bits DC-DC converter which will be taken care of maximum power point in their project a 100kw PV system was considered. A microcontroller based grid hitched solar inverter (GTSI) was designed and developed in [11]. Keeping in mind that solar PV power is costly

MOSFET switching is used for higher DC to AC conversion efficiency. Paper [12], used microcontroller and cascade H bridge topology which increase the efficiency and reliability of the system used by a solar multilevel pulse width modulator inverter. Also the maximum power point tracking is recognize by us is needed for higher efficiency . The main motive of paper [13] is the composition of an inverter which enable the inversion of a DC power source, supplied by Photovoltaic (PV) Cells, to an AC power source used to drive a three phase induction motor. In the paper [14], the Sinusoidal pulse width modulation SPWM) method have been proposed for a three phase inverter. Authors demonstrated the simulation study of inverter designed with 50 Hz transformers Sub topology and reported in [15]. The results reported in the paper are found on the actual design of SPWM inverter and its simulation carried out found on mathematical model. Study of output voltage regulation with respect to variation in Battery voltage, sampling frequency and for different loads is carried out. It was observed that in the battery range 7.5 to 12.2V the regulation is within + 10% of expected output. However it is necessary to trip the battery voltage beyond 13V, sampling frequency 10 KHz and that output is 230V. The central attention of the paper .

III. WORKING OF SINGLE PHASE INVERTER

A single phase full bridge inverter converts DC power to AC power. For this mainly four switches are required. Switches are triggered with a very high frequency. Output voltage waveform follows the switching pattern. Depending on the load characteristics the current waveform varies. For resistive load current will be in same phase with voltage, it will be lagging for inductive load and leading for capacitive load.

IV. RESULT AND DISCUSSION

We have done the simulation work on MATLAB Simulink 2007b version (fig. 1). In our model we have used 4 MOSFETs, series RLC branch, 2 pulse generators, one DC voltage source, voltage measurement block, 2 scopes , 2 display screens. For 1st pulse generator we take amplitude – 1 , Period – 2e-3 , pulse width 50% , Phase delay – 0 (for frequency of 50 Hz , time period is 20 ms , and for 2nd pulse generator we take amplitude – 1 , Period – 2e-3 , pulse width 50% , Phase delay – 1e-3 (same frequency and pulse with here the phase difference is 180 degree which is 10 ms in time (1e-3) seconds . and for DC voltage source amplitude is 200 . Output voltage and current wave form are shown in fig 2, fig 3, fig 3, fig 4, fig 5 and fig 6 respectively for different loading conditions. The single phase inverter is which we have designed perform properly.

Inverter gives us AC output from DC input, but we have seen from our result that output current waveforms are not showing pure AC pattern. They have harmonics. To reduce this harmonics, we have to use proper filter.

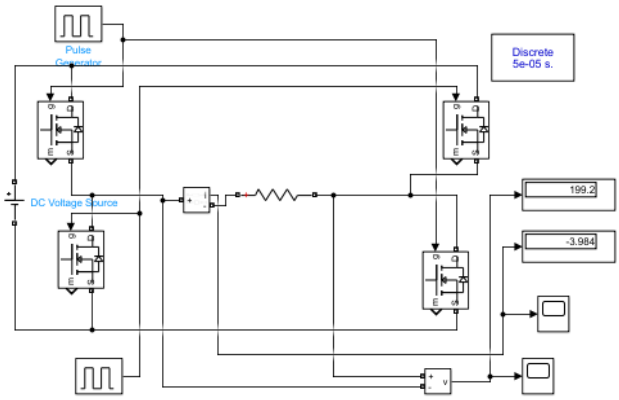

Fig. 1: Inverter circuit

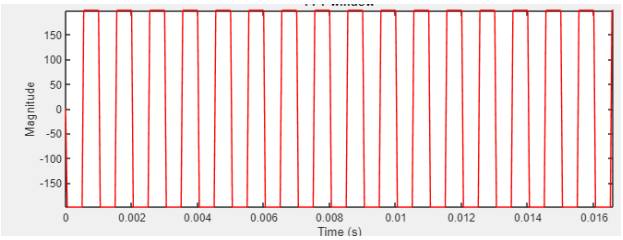

Fig 2: voltage waveform for resistive load

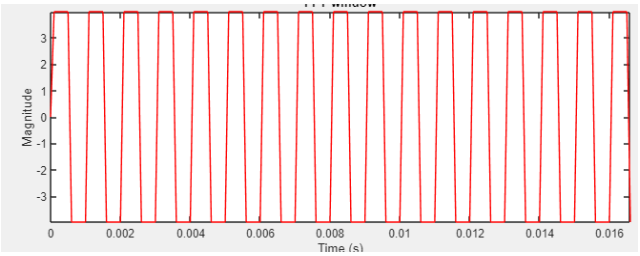

Fig. 3: Current waveform for resistive load

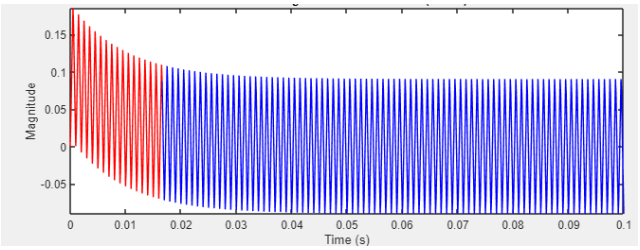

Fig. 4: Current waveform for RL load

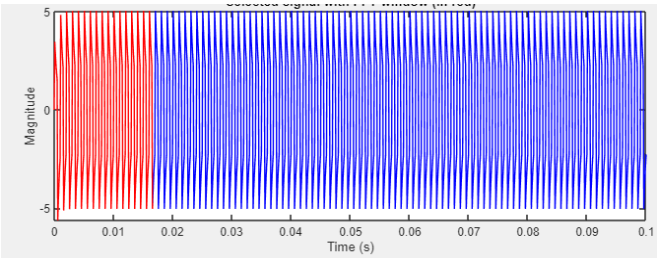

Fig. 5: Current waveform for RC load

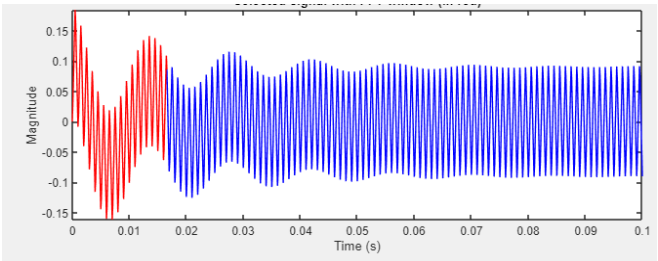

Fig. 6: Current waveform for RLC load

V. OUR PROPOSED WORK

Hybrid inverter generally used in office/university/ home. Let, there is a college /university/hospital situated on high road/national highway. Street lights in front of those college/university/hospital may not take supply from the electric office for some natural reason or some artificial reasons (some time it happens a lot). So suppose there are three hybrid inverter in that college/university/hospital we will make a separate connection line from the inverter and we will also add a button for this separate line. Now from three hybrid inverters three separate line will come and will join together. Also we know that the inverter converts DC to AC and also we know that street light runs on ac so we will add a dc to ac converter on the separate line which we take from the inverters and we will store the current into some batteries . So

in case of emergency we can pass the current to the street light in front of the college/university/hospital. By this we can prevent the accidents happening daily. So in case of emergency we can easily do that and also if the college/university/hospital want extra current supply in case of emergency we can also take the current from the batteries used for street lights ....and totally we will add three buttons in the inverter.

When sun rays fall on the solar panel then with the help of inverter we convert dc voltage to ac voltage and then it goes to run home appliance and charge the battery for further use and the excess charge is gone to the electricity post when power cut off happens then there is no excess charge to transfer to the electricity post and with the help of battery the home appliances will work at a minimum voltage. Fig. 7 shows the block diagram of the scheme.

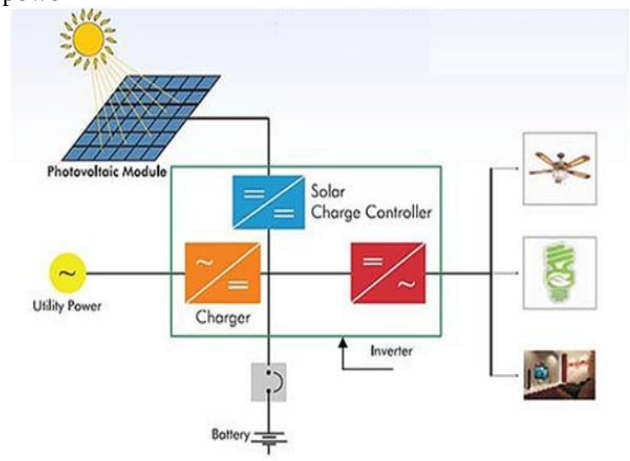

Fig. 7: Block diagram of solar inverter [16]

VI. CONCLUSION

After reviewed several papers, we have gathered advanced knowledge on hybrid inverter. In our future scope we want to implement our proposed work to serve our society with the advanced technology of hybrid inverter.

REFERENCES

[1] Imtiaz, Masudul Haider, MST RUMANA AKTAR Sumi, KAZI RIZWANA Mehzabeen, MD ISTIAQ MAHBUB, and NAFISA SHAHERA NUR. "Design & implementation of an intelligent solar hybrid inverter in grid oriented system for utilizing PV energy." *International Journal of Engineering Science and Technology* 2, no. 12 (2010): 7524-7530.

[2] Layyar, Srashti, Tushar Saini, Abhishek Verma, and Ashwani Kumar. "Hybrid Inverter with Wind and Solar Battery Charging." *International Journal of Engineering and Technical Research* 8, no. 7. 2018

[3] B. Ravi teja,2 Dr. G. Jayakrishna,3Akhib Khan Bahamani "hybrid inverter with solar battery charging" Journal of Emerging Technologies and Innovative Research 2018 JETIR July 2018, Volume 5, Issue 7

[4] Ashiq P A , Anand P H , Akhil Suvarnan , Lithul Krishna , Rejoice Thomas Paul , " Hybrid Inverter with Solar Battery charging ". Global research and development journal for engineering ,national conference on emerging research trend in electrical and electronics engineering, May 2019

[5] Kapil S. Sonare , Palash N. Meshram , Mayur R. Choudhary "Literature survey for sun tracking Hybrid Solar Inverter" International Journal of Research Available at Journals Volume 05 Issue 12 April 2018.

[6] Subramaniam, Umashankar, Sridhar Vavilapalli, Sanjeevikumar Padmanaban, Frede Blaabjerg, Jens Bo Holm-Nielsen, and Dhafer Almakhles. "A Hybrid PV-Battery System for ON-Grid and OFF-Grid Applications—Controller-In-Loop Simulation Validation." *Energies* 13, no. 3 (2020): 755

[7] Jagadeesh, Y. "A new concept of intelligent hybrid inverter for battery charging." 2020

[8] Vijay Sarade , Sarade, Prof B.G.Hogade "Hybrid Inverter Incorporating Solar , wind,battery, on grid and off grid"Journal of Engineering Research and Application Vol. 9,Issue 5 (Series -II) May 2019, pp 29-32

[9] Gaurav Arora, Neha Aggarwal, Debojyoti Sen, Prajjwal Singh "Design of solar power inverter" International Advanced Research Journal in Science, Engineering and Technology (IARJSET) National Conference on Renewable Energy and Environment (NCREE-2015) IMS Engineering College, Ghaziabad Vol. 2, Special Issue 1, May 2015

[10] Hannan, Sundas, Sohaib Aslam, and Muhammad Ghayur. "Design and real-time implementation of SPWM based inverter." In *2018 International Conference on Engineering and Emerging Technologies (ICEET)*, pp. 1-6. IEEE, 2018.

[11] Ashokkumar, Mr R., Raajeshwar Elangovan, K. Vinoth, and S. Vijayakumar. "Analysis of SPWM Technique for Solar Inverter." *International Journal of Engineering and Applied Sciences* 5, no. 3: 257254.

[12] Hossain, Md Nahid, Tushar Kanti Routh, Abdul Hamid Bin Yousuf, Miah Md Asasduzzaman, Md Iqbal Hossain, and Ummul Husnaeen. "Design and development of a grid tied solar inverter." In *2012 International Conference on Informatics, Electronics & Vision (ICIEV)*, pp. 1054-1058. IEEE, 2012.

[13] Krishnan, Nithin, and H. Divya. "Solar Smart Inverter: A Novel Design using Multi level Topology and PulseWidth Modulation with Load Detection." *International Journal of Engineering Research and* 4, no. 06 (2015).

[14] Shubhangi Landge, Ankita Jadhav, Pranali Bomble, Muqadas Khan "Design of solar inverter" Vol-3 Issue-2 2017 IJARIIE-ISSN(O)-2395-4396
[15] T.B. Mohite Patil, , S.R. Sawant ,"Mathematical and simulation model of an SPWM Inverter" International Journal of Electronic and Electrical Engineering.ISSN 0974-2174 Volume 4, Number 1 (2011), pp.23-32
[16] https://www.instructables.com/HYBRID-SOLAR-UPS/