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SOLAR INVERTER

Rohan Jitendra Potbhare[1], Pavan Babasaheb Wagh[2], Dipak Kadu Jagtap[3]
Prof. A. A. Gawali[4]
Department of Mechanical Engineering
P. E. S. College of Engineering, Aurangabad, Maharashtra

Abstract -

A solar inverter converts the variable direct current (DC) output of a photovoltaic (PV) panel into alternating current (AC) that can be fed into a commercial electrical grid or used by local, off-grid electrical networks. It is a critical balance of system (BOS) component in a photovoltaic system, allowing the use of ordinary AC-powered equipment. Solar power inverters have special functions adapted for photovoltaic arrays and maximum power point tracking systems. While running the appliances in day time, the device will charge the battery because the solar energy only can be used during the day time, while during night the battery will support to run the appliances until next morning. Consumer can check Voltage and Current on device via the Liquid Crystal Display. Once consumer compare the off grid system from main power source, consumer will understand the power usage and also differentiate the cost. At the end of this project, inverter also provides 230V single phase same as power delivered by the grid, but the cost will be totally different.

***Key Words*:**

1. INTRODUCTION

A solar inverter is a crucial component of a solar power system that converts direct current (DC) electricity generated by solar panels into alternating current (AC) electricity, which is suitable for use in homes, businesses, and the electrical grid. It plays a vital role in enabling solar energy to be effectively utilized for various applications. The primary function of a solar inverter is to convert the DC electricity produced by solar panels into AC electricity that can be used to power household appliances, commercial equipment, or fed back into the electrical grid. Solar panels generate electricity in the form of direct current (DC), which flows in a single direction. However, most electrical devices and the grid operate on alternating current (AC), where the flow of electricity periodically changes direction. The inverter performs the crucial task of converting DC power into AC power, making it compatible with standard electrical systems.
In grid connected solar power systems, the inverter plays an importance role in control systems, as the generated power of solar photovoltaics (PV) system constantly alters due to the weather condition. The alternation of generated power can cause negative impacts on power quality of the grid, such as voltage fluctuation, change in power factor, frequency fluctuation, the increase in the harmonic distortion, etc.

The higher and higher demand on the power quality has set out a practical requirement about the necessity of having inverters that can connect flexibly, exchange power and ensure the power quality standards. The aim of the inverter is controlling power among the grid sectors to obtain the most productive capacity of the generator while avoiding sudden conflicts due to loss of transmission or the instability of the generator itself. Apart from the inverter structure, the precision control and stability of electric loop circuit are primary factors in a successful power exchange process.

The main content of this research is to set up control sequences to ensure the control of power factor by 1 and maximize the active power from the solar PV generator to the grid (applied to the non-battery grid connected system). The algorithm and control sequences are systematically analyzed; the research results are proven with the simulated diagram on Matlab and Simulink. They are then verified by a 5 kw experimental model with a PV input that is replaced by a DC source.

A solar base inverter, also known as a solar power inverter or PV inverter, is a critical component of a solar power system. Its main purpose is to convert the direct current (DC) electricity produced by solar panels into usable alternating current (AC) electricity that can be used to power electrical devices in homes, businesses, and other facilities.

The objective of a solar base inverter is to enable the efficient and reliable conversion of direct current (DC) electricity generated by solar panels into usable alternating current (AC) electricity.

2. BLOCK DIAGRAM

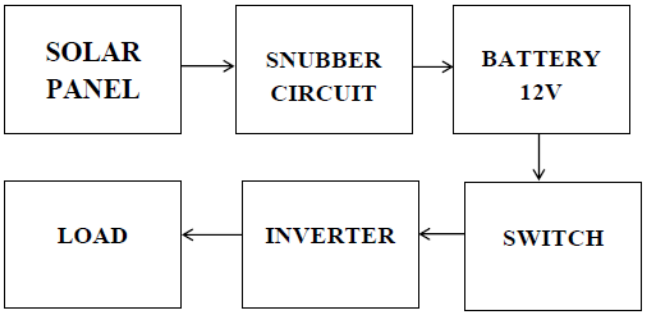

Fig.1: Block diagram

3. TECHNICAL SPECIFICATION

1. Battery

- Nominal battery voltage is 6V.
- 5Ah capacity at 20hr rate to 1.75VPC.
- Charging temperature range from -15°C to 50°C.
- Lead acid battery

Fig.2: Battery

2. Solar Panel

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Here, the solar panel is being used to power the battery which is used for the application of power to the mechanism of Automated Gutter Cleaning system. It is a panel of 6 watts consisting of photovaltic solar cells. Per hour solar panel charges 6 watts of power. Since to charge the panel of 6watts it will consume 150 minutes approximately depending on the sunrays falling on the panel.

Fig.3: Solar panel

3. Voltmeter

Voltmeter is an electrical measuring instrument used to measure the potential difference between two points. The voltage to be measured may be AC or DC. Two types of voltmeters are available for the purpose of voltage measurement i.e. analog and digital. Analog voltmeters generally contain a dial with a needle moving over it according to the measure and hence displaying the value of the same.

Fig.4: Voltmeter

4. WORKING

This circuit is DC to AC inverter, where the circuit work based on the stable multi-vibratordoes. On this circuit using CD4047 IC as the heart of multi-vibrator that functions to generatea wave 50Hz is not stable, because this type of IC to provide a complementary output stage,contrary to the other (pins 10 and 11, as shown), and 50% of the cycle to meet the obligationto produce pulse inverter.Circuit is called a simple DC to AC inverter, as there is no output signal is not sinusoidal, andthere were lots of harmonic signals on the output. To suppress this signal we have to use afilter such as capacitor C. Because of this simplicity is only suitable circuits for lighting needs.To build a sinusoidal inverter DC to AC. At the circuit this multivibrator is used to makepower is too high, then we have to use the MOSFET IRFZ44. IRFZ44 provide high current todrive step-up transformer, so power is available in addition to the high voltage transformer.

The power MOSFETs are connected in Push Pull configuration (Power amplifier). TheMOSFETs will switch according to the pulse from CD4047 astable multivibrator. Thus an ACvoltage is transferred to the primary of transformer; it is stepped up to 230V.The transformer used here is an ordinary step down transformer which is connected in invertedmanner. That is, the primary of a 230V to 12V-0-12V step down transformer can be treatedas secondary for this inverter project.This circuit uses 12V input (12V battery) to out 220V 50HZ. For safety please note for theinstallation of cooling on the components transistors, it serves to remove excess heat transistor.

5. CONCLUSION

Sun, being source of clean, pollution-free energy and Photovoltaic power production is gaining more significance as a renewable energy source due to its various advantages. The advantages include everlasting production scheme, ease of maintenance, and direct sunbeam to electricity conversion. However the high cost of installations still forms an obstacle

for this technology. Moreover the PV panel output power fluctuates as the weather conditions, such as the luminosity of the solar beam, cell temperature etc. The desired design of the system will produce the desired output of the project. The inverter will supply an AC source from a DC source. The project described is valuable for the promising potentials it holds within. Ranging from the long run economic benefits to the important environmental advantages. This work will mark an attempt and contribution in the field of renewable energy and can be implemented extensively.

5.2 Advantages

- It doesn't require frequent maintenance and operating cost is also less.
- It is one of the methods of renewable generation.
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- Constant and uninterrupted supply.
- There is no requirement of electricity and manpower to operate the device.
- It acts as a power back - up solution.
- This is an ecofriendly means of power generation.
- It can be used in distant villages where transmission cost is much high.
- Reduction in consumption from conventional sources of energy.

5.3 Disadvantages

- One of the main problems in Solar Inverter system is inefficient charging of
- Battery during cloudy weather condition.
- Initial cost is high and area required for installation is high.
- If the battery is dead the whole circuit fails.
- Area required for installation is large.
- It will be less effective in rainy days.
- Protection system installment is very high.
- Cause problems to eye sight because of solar reflectors.

5.4 Applications

- It can be used to power the traffic lights and streetlights.
- It can be used in home to power the appliances using solar power.
- It can be used in industries as more energy can be saved by rotating the panel.

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