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Research Paper

DESIGN AND IMPLEMENTATION OF SOLAR INVERTER

:- Aniket Sanjay Desai, Santosh Mahadev Latne, Pavan Ramkishan Sontakke, Tejaswini Jalindar Kamble, Pallavi pramod Mane

Department of Electrical Engineering, Sanjay Ghodawat Institute Atigre, India

ABSTRACT

Most countries of the world are at crucial juncture relating to use of non-conventional energy to meet ever growing demand of energy. In India; free, unlimited, clean solar energy has amply proved its utility and potential in energy sector. This article highlights the design of a simple, clean, cheap to built yet powerful voltage driven inverter circuit using power MOSFETS as switching device which converts 12V DC signal to single phase 220V AC; charged by solar energy. The emergence of monocrystalline solar panels, the most efficient solar panels till date has ushered a revolutionary concept of solar farming in India. This design can be charged by solar energy and contribute significantly towards reducing carbon emission, helping energy starved rural region of India in domestic sector where electric supply is frequented by regular cuts or no supply.

Key Words:
Key words- Inverter, Microcontroller,Solar panel Battery.

INTRODUCTION

Solar panels are simply solar cells lined up together in series and parallel so as to get sufficient voltage and are p-n junction semiconductor devices with pure silicon wafer doped with 'n' type phosphorous on the top and 'p' type boron on the base. If the PV(Photovoltaic) cell is placed in the sun, photons of light strike the electrons in the p-n junction and energize them, knocking them free of their atoms. These electrons are attracted to the positive charge in the n-type silicon and repelled by the negative charge in the p-type silicon. Connecting wires across the junction will have a current in them [1].

We need to understand solar panels so as to understand their applications. Today, we have mono crystalline, polycrystalline and amorphous thin film panels. Mono crystalline is so far the most efficient, given that they have the maximum silicon in a unit area so more current for the same number of photons. They are made out of a single silicon crystal as a continuous lattice .Solar panels are really useful in broad daylight but we need energy when the Sun isn't shining above our rooftops. That's why we need solar chargers which will store energy in rechargeable batteries.

A device that converts DC power into AC power at desired output voltage and frequency is called an Inverter. Phase controlled converters when operated in the inverter mode are called line commutated inverters. But line commutated inverters require at the output terminals an existing AC supply which is used for their commutation. This means that line commutated inverters can't function as isolated AC voltage sources or as variable frequency generators with DC power at the input [2] .Therefore, voltage level, frequency and waveform on the AC side of the line commutated inverters can't be changed. On the other hand, force commutated inverters provide an independent AC output voltage of adjustable voltage and adjustable frequency and have therefore much wider application.

. Electronic devices run on AC power, however, batteries and some forms of power generation produce a DC voltage so it is necessary to convert the voltage into a source that devoces can use. Hence a need for power rating inverter to smoothly operate elctrical and electronic appliances. Most of the commercially available inverters are actually spaure wave inverter. Electronic devices run by this inverter will damage due to harmonic contents. Available sine wave inverters are expensive and their out is not so good. For getting pure sine wave we have to apply sinusoidal pulse width modulation technique (SPWM). This technique has been the main choice in power electronic because of its simplicity and it is the mostely used method in inverter application. To generate this signal, triangular wave is used as a carrier signal is compared with sinusoidal wave at desired frequency.

Advances in microcontroller technology have made it possible to perform function that were previously done by analog electronic components. With capability, microcontroller today are able to perform function like comparator, analog to digital conversion, setting input/output counter/timer, analog other replacing dedicated analog components for each specified task, greatly reducing number of components in circuit and thus, lowering components production cost.

This paper investigate the application of microcontroller based solar power inverter operation during power disturbances. Also study the cost of effectiveness and reduses the complexity of system of this microcontroller based inverter. In this report, it is detaild how the inverter controls are implemented with a digital approach using a microprocessor for the control system amd how effective and efficient a a 3-level PWM inverter. The inverter device will be able to run more sensitive devices that a modified sine wave may cause damage to such as; laser printer, laptop, computer, power tools, digital clocks, and medical equipment. This form of AC power aslo reduces audible noise such as fluorescent lights and runs inductive loads like motors, faster and quiter due to the low harmonic distortion.

Components Description

Solar Panel

A solar cell is a solid state electrical device that converts the energy of light directly into electricity by the photovoltaic effect. Assemblies of cells used to make solar modules

are used to capture energy from sunlight, are known as solar panels. Solar Panel burn no fuel and have no moving parts hence, they are clean and silent and producing no atmospheric emissions of greenhouse gases

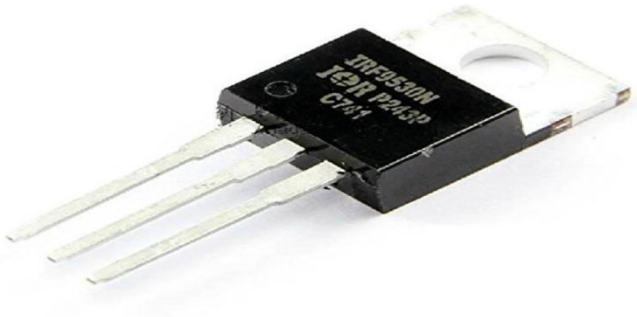
Battery

This circuit is designed for three 12V, 8 Ah battery. This means a 8A current will charge the battery in 1hour. Lead acid batteries are not the best available options in rechargeable batteries (unlike portable and easy to use Li-ion batteries). But for small applications they are good enough. Secondary (rechargeable batteries) can be discharged and recharged multiple times i.e. the original composition of the electrodes can be restored by reverse current.

Transister 2N3904

The **2N3904** is a common NPN bipolar junction **transistor** used for general-purpose low-power amplifying or switching applications. It is designed for low current and power, medium voltage, and can operate at moderately high speeds.

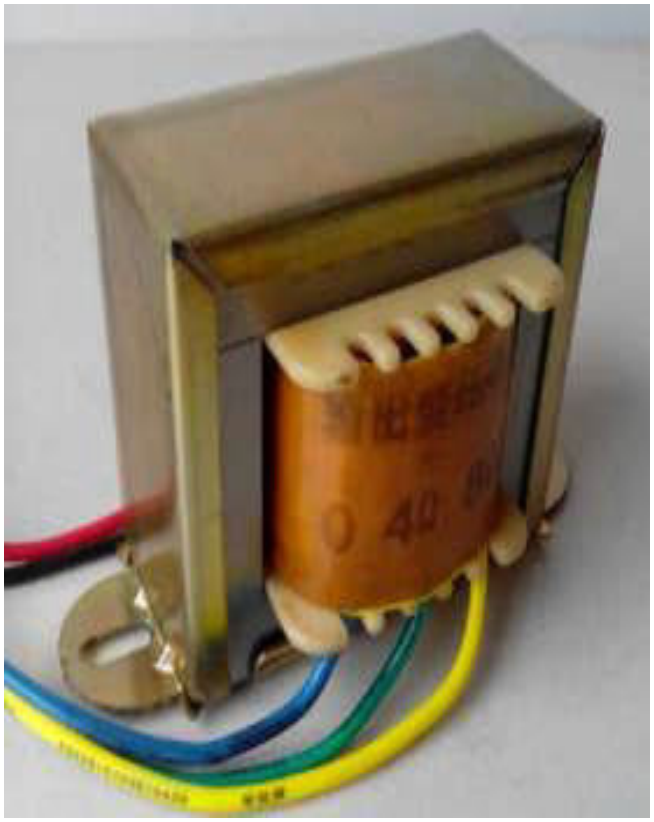
Microcontroller



IRF9530 is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. It is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.

Transformer

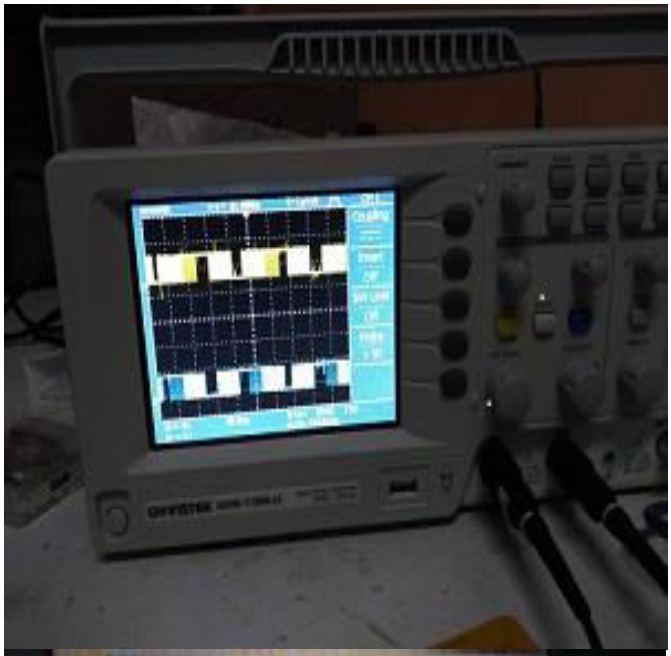
A transformer is a static electrical machine which transforms electrical power from one circuit to another circuit, without changing the frequency. Transformer can increase or decrease the voltage with corresponding decrease or increase in current.
When, primary winding is connected to a source of alternatinginduced in the secondary winding according to Faraday's law of electromagnetic induction.
A common topology for DC-AC power converter circuits uses
a pair of transistors to switch DC current through the centertapped
winding of a step-up transformer, like this

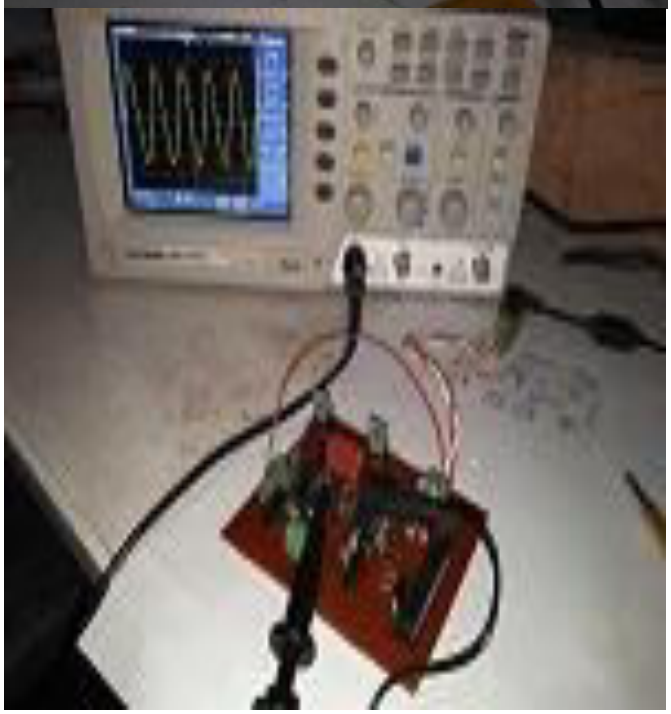


Landscape lighting, however, is typically supplied in lower voltage (12 Volts) spread out through several different lights. A **transformer** can convert the 120v electrical currently supplied from your house down to the **12v** needed for each low voltage landscape lighting fixtures in your lawn!

A **Transformer** is a static apparatus, with no moving parts, which transforms electrical power from one circuit to another with changes in voltage and current and no change in frequency. ... A Step down **Transformer** on the other hand, steps down the input voltage i.e. the secondary voltage is less than the primary voltage.

Simulation





Observation

1) Average voltage (Vavg): 715mv

2) Frequency :50HZ

3) Duty cycle: 50.63%

4) Rise Time: 5.737ms

5) peak to peak voltage (Vpp):2408v

Componant Analysis

1.	Diodes	IN4001, IN 4007
2.	Capacitors	470µF, 50V
3.	Voltage regulator IC 7812	IC 7812
4.	Transistor	BC547
5.	Resistors (Each 0.25 watt)	10kΩ,1.5kΩ,100kΩ
6	MOFET	IRF9530
7	Microcontroller	MEGA328P
8	TUXGR	15*2R2
9	LED	2 bulb
10	Battery	12V,8Ah
11	Solar Plate	10W

Conclusion

Here, a simple voltage driven inverter circuit using power MOSFETS as switching devices is build, which converts 12V DC signal to single phase 220V AC.
1. This circuit can be used in cars and other vehicles to charge small batteries.
2. This circuit can be used to drive low power AC motors
3. It can be used in solar power system.
4. This appliance can be very useful in rural areas where power supply is erratic and cost is a big concern.
5. It can be charged by solar energy and can significantly reduce carbon emission

Future Scope

When considering possible performance enhancements for th from the systems provides certain challenges. Firstly, their ratio-changing function is quite important. Optimally-loaded PV operational voltages on a 600VDC limited system run from typically 300 to500 VDC. Distribution systems in North America that are capable of accommodating these power levels are almost always 480 VAC. The respective DC voltages are far too low to allow direct inversion into 480VAC.The actual inversion voltage is usually 208VAC.A high- power, transformer less 208VAC three-phase inverter is only of use on a relevantly sized 208VAC distribution system. Such a system requires immense amounts of conductor. (It also requires all other appliances to be 208VAC-configured).As one would expect, such high-current, low-voltage distribution systems are rare and unlikely to be built purely for the convenience of a PV inverter.[6]
Aside from eliminating transformers, another likely improvement to commercial PV arrays is to go to higher PV voltages. This would, depending on how the arraysare wired, reduce DC-side conductor costs and losses. However, under traditional ground referencing of either the positive or negative rail, any increase in voltage would exceed the 600VDClimits on low-voltage equipment. Given the healthy step in cost to go to medium-voltage equipment, this apparently makes modest PV-voltage increases on traditionally referenced arrays not particularly useful with regard to cost reduction and operational performance.

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