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12V DC TO 230V AC INVERTER

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Abstract - *In this paper, the discussion centers on how household inverters can aid in transforming renewable energy sources like bioenergy, wind power, and hydroelectricity to provide electricity that's usable at home. It delves into a specific model that facilitates the conversion of 12DC from either solar panels or batteries to generate 230V AC - consequently enabling direct current derived from these environment-friendly sources to turn into alternate current ready for consumption by households. Generating a high-quality output waveform is crucial for the efficiency of appliances powered by this inverter design. Utilizing renewable energy sources, known for their zero-carbon footprint attribute, plays an integral role in combating carbon pollution resulting from human activity. Additionally, the DC outputs generated from different sources mentioned previously can be utilized for domestic purposes as well. However, before it's supplied to inverters that provide appropriate alternating voltage levels suitable for home use, proper formatting input is essential. Once transformed back into AC format utilizing suitable means by being reprised forms featuring AC formats are ideal!*

Key Words: **Battery, Capacitor, Resistor, Step-up transformer, Switching**

1.INTRODUCTION

Earlier electricity production was done only by the use of non-renewable resources like coal, oil, natural gas, etc. But now the world has changed its way of production of electricity. It's now focusing mainly on renewable resources for their use in the production of electricity. These renewable resources are wind, hydro, solar, etc. During the process of production of electric energy, the turbine can give only DC electric energy but for the working of most of the appliances we need AC electric energy. Now inverter have got their chance to show their power in converting DC supply to AC. Inverters are mainly used as a source of power to run devices when there are power cuts. inverters serve as a vital emergency backup, activating electrical appliances in the absence of the main power supply. The main function of an inverter is to create an alternate voltage from a direct voltage. They come in various types and sizes. DC to AC inverters can be categorized into two main categories: pure sine wave inverters and modified sine wave inverters, with the letter providing a cleaner and more stable AC output [1]. Pure sine wave inverters create a smooth waveform that replicates the waveform of utility power, which is ideal for sensitive electronics and appliances. Modified sine wave inverters, on the other hand, create a choppy waveform that may cause problems for some devices. DC to AC inverters can also be classified based on their power output, ranging from small inverters that power laptops and cell phones to large inverters that are capable of powering entire households or businesses. Overall, DC to AC inverters are important devices that play a critical role in providing power to a wide range of applications. Inverters are essential for the application of AC power required where a DC power source is available [2]. Inverters are also called AC Drives, or Inverters, also known as VFDs (variable frequency drives) or AC drives, can transform DC (Direct Current) into AC (Alternating Current) using electronic means [3]. Inverters are required for both household and industrial purposes. As we focused on the household purpose, most of the household appliances along with other electrical equipment depend upon AC electricity. Inverters are mainly used as a source of power to run devices when there are power cuts. Solar energy is the oldest form of renewable energy. In the event of a power outage, inverters serve as a vital emergency backup, activating electrical appliances in the absence of the main power supply [4]. Their primary purpose is to convert Direct Current (DC), which is generated from a battery or solar panel, into Alternating Current (AC). It is the greatest invention in India for household appliances in case of power cuts. Different types of inverters are suitable for different purposes and environments [5]. For example, household inverters are smaller and cheaper than industrial inverters, which are used in factories and workplaces. The amount of load and the frequency of use are some of the factors that determine the best kind of inverter for a household. Another factor is the shape of the output wave, which can be a pure sine wave, modified sine wave, or square wave. A pure sine wave inverter produces a smooth and continuous voltage that alternates between positive and negative. This is ideal for power transmission over long distances, as it can be easily regulated and has low radio power emission. Most appliances are designed to work well with pure sine wave inverters, as they do not cause any interference or damage to the devices. A modified sine wave inverter tries to mimic a sine wave by using a series of positive and negative pulses with a short pause at zero volts. Here's a possible rephrased version of the sentence While this inverter is more cost-effective than a pure sine wave inverter, it may not be compatible with certain appliances that utilize SCR (Silicon

Controlled Rectifier) in their power supply section, such as digital clocks, laser printers, and some music systems."

These appliances may malfunction or shut off when they detect the sharp corners of the modified sine wave. Some variable speed fans may also buzz when used with modified sine wave inverters. A square wave inverter is the simplest and cheapest type of inverter, as it only generates a voltage that switches between positive and negative without any variation. This is enough for operating simple appliances that do not require a smooth voltage, such as lights and heaters. However, a square wave inverter may cause noise, heat, and inefficiency in some appliances, and it is not recommended for sensitive or sophisticated devices.

"DC to AC inverter by Ishtiak Mahmud"– The H-Bridge is an electronic circuit commonly utilized for regulating the movement of high-current equipment, like motors [6]. It earns its identifier as "H-bridge" due to its structural resemblance to the letter "H". When a powerful current supply energizes it, Breakdown Voltage Transistors (BJTs) act like switches. As such, with precise pulsing techniques, some BJTs can be selectively activated and deactivated alternatively generating an AC square wave from DC voltage conversion. By using good filters a better output can be found.

"Ashwin N Senior Research Power Systems Division Central Power Research Institute Bengaluru"– The PV energy market is seeing rapid growth and playing a significant role in various regions' power systems. Nearly all global PV systems, around 99%, connect to the grid with the remaining stand-alone ones utilizing batteries. In case of grid failure, an anti-islanding feature allows for disconnection by detecting islanding conditions. The system comprises a 4MW peak-power producing PV array along with DC/DC converters optimizing performance through MPPT functions while integrating it using DC/AC inverters into grids via step-up transformers and 33 kV transmission lines [7].

Non-isolated AC-module applications require high efficiency for photovoltaic, the suggested inverter utilizes MOSFETs as all active switches. The unique topology of this device incorporates the benefits of both the MOSFET DC-AC circuit while addressing the challenge posed by excessive ground leakage current. By leveraging high-side IGBTs as line frequency switches to alter output polarity and low-side MOSFETs operating at a higher frequency SPWM switch rate managing voltage or current control over output delivery [8].

The IC CD4047 and some other components form a circuit that makes a quasi-sine wave with 50Hz frequency from a DC source. The circuit uses the IC CD4047 as a unit that changes DC to AC. The output of the IC is fed to MOSFETs that produce an AC voltage, but this voltage is not a pure sine wave. To get a pure sine wave output, the MOSFETs are connected to a transformer that steps up or steps down the voltage [9].

The focus of this paper centers on the motor and inverter system custom-built for the Nissan LEAF, a mass-produced electric car. Distinguished by distinct specifications, this setup enables peak torque levels of 280 Nm alongside an output capacity reaching 80 kW that is meticulously customized to suit each vehicle's unique traits. The inverter controls the motor's current by getting commands from a network system that connects different parts of the EV. The inverter is designed to be cooled by water and has special parts that are made for EV use. This makes the inverter more reliable, cheaper, and better for EVs. The inverter of an EV drive motor must be able to work well in different situations to get the best performance from the power semiconductors [10].

"Luo-Qi Soh Research Building of A Portable Solar AC & DC Power Supply" The exploration of solar energy goes beyond being an alternative option and presents a promising cornerstone for establishing dependable power. When the circuit is linked to the solar cell, electrons are prompted into motion through it and blend with empty spaces in p-regions, creating direct current (DC). This DC can be stored in batteries before conversion by inverters into alternate current (AC), which fuels electrical devices dependent on AC as their main source of operation. There exist sufficient reasons for pursuing this path that takes us closer to realizing more sustainable ways of living [11].

2. DESIGN AND SIMULATION

The total design consists of IC- CD4047, Battery, Resistor, Capacitor, MOSFET, and Step-up transformer. Battery supplies steady 12V DC voltage, The IC-CD4047 is one kind of astable multivibrator. This requires an external resistor and capacitor. IC helps in generating square wave pulses of nearly 50Hz which will be used to alternatively switch ON one of the MOSFET [12]. These pairs of MOSFETs serve as electrical switches to deliver DC at one polarity and then the opposite polarity, generating a square wave AC waveform [13]. At last, the square waveform's amplitude gets increased by the step-up transformer 230v/50Hz [14].

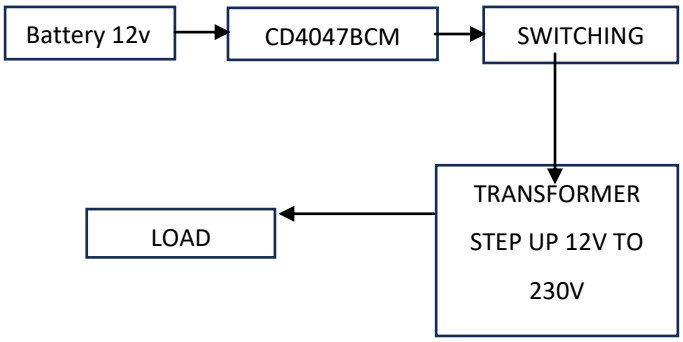

Fig-1: Block diagram of 12V DC to 230V AC inverter.

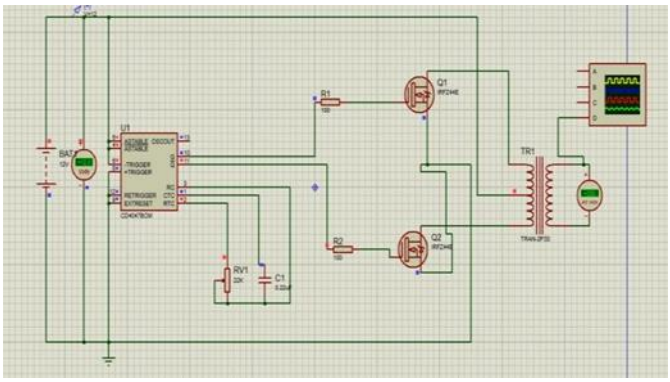

Fig-2 Circuit diagram of 12V DC to 230V AC inverter

Table -1: SIMULATION PARAMETERS

S.NO	NAME OF THE ELEMENT
1	IC CD4047BCM
2	IRFZ44E POWER MOSFET-2
3	Step-up transformer 12v to 230v
4	22KΩ variable resistor
5	100Ω/10W Resistors-2
6	0.22 µF Capacitor
7	12V Battery

3. RESULT AND ANALYSIS

Here in the circuit, we have replaced the voltmeter with a wattmeter, to check the power [15]. It has been observed that the output power is found to be 185VA by using a bulb of 230v below it is shown

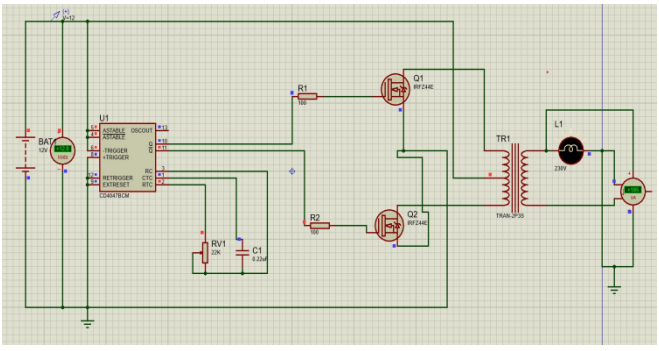

Fig-3 Circuit diagram of inverter's output power

In our analysis, we found that power is 185 VA. Then, to get the graph of the AC voltage we replaced the wattmeter and bulb with a voltmeter. We found a square wave graph with nearly 50Hz frequency as shown below

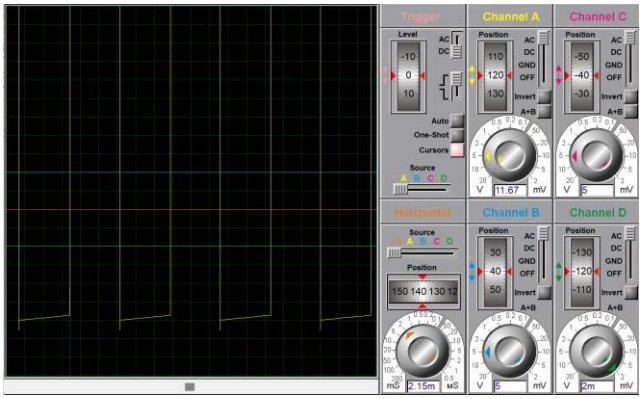

Fig-4 Square graph of output AC voltage

4. CONCLUSION

To initiate this project, we commenced with an extensive examination of inverter systems that exist globally. An inverter is a piece of electrical machinery devised for the conversion of direct current (DC) to alternating current (AC), where through implementation mechanisms such as transformers, control circuits, and switching devices any predetermined voltage or frequency can be achieved from the converted AC power output. Essentially it provides adequate energy supply permitting system operation.

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