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SOLAR POWER INVERTER

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Abstract: This paper presents the research and development of a solar power inverter as an alternative energy solution. With increasing power outages in rural and suburban areas, there is a dire need for reliable and renewable energy sources. This project focuses on designing a solar-powered UPS system that can provide backup energy during grid failures. The proposed system utilizes a solar panel to convert solar energy into electrical energy, stores it in a battery, and uses an inverter circuit to convert DC to AC, making it suitable for household and industrial applications.

Keywords: Solar Power, Inverter, Renewable Energy, UPS System, Sustainable Energy.

I. INTRODUCTION

The energy crisis in rural and suburban regions has led to the exploration of alternative energy sources. Solar power has emerged as a significant contributor to sustainable energy due to its renewable nature and cost-effectiveness. India has made considerable progress in solar power generation, increasing its capacity from 2.65 GW in 2014 to over 20 GW by 2018. This project aims to develop a solar power inverter that can efficiently convert solar energy into usable AC power, providing a reliable backup energy source during power failures.

II. PROJECT OBJECTIVE

The primary objective of this project is to design and implement a solar-powered inverter system capable of:

- Converting solar energy into electrical energy efficiently.
- Storing energy in a 12V DC battery for backup power.
- Converting stored DC energy into AC power using an inverter circuit.
- Providing an economical and eco-friendly alternative to conventional power sources.
- Reducing dependency on fossil fuels and decreasing carbon footprint.

III. LITERATURE REVIEW

Several studies have been conducted on solar inverters and their applications. Research has shown that solar photovoltaic (PV) systems are highly effective in rural electrification and emergency power supply. Various inverter topologies have been explored, including square wave, modified sine wave, and pure sine wave inverters. The implementation of MOSFET-based inverters has shown improved efficiency and reliability. This study builds upon previous research to develop a cost-effective and efficient solar power inverter.

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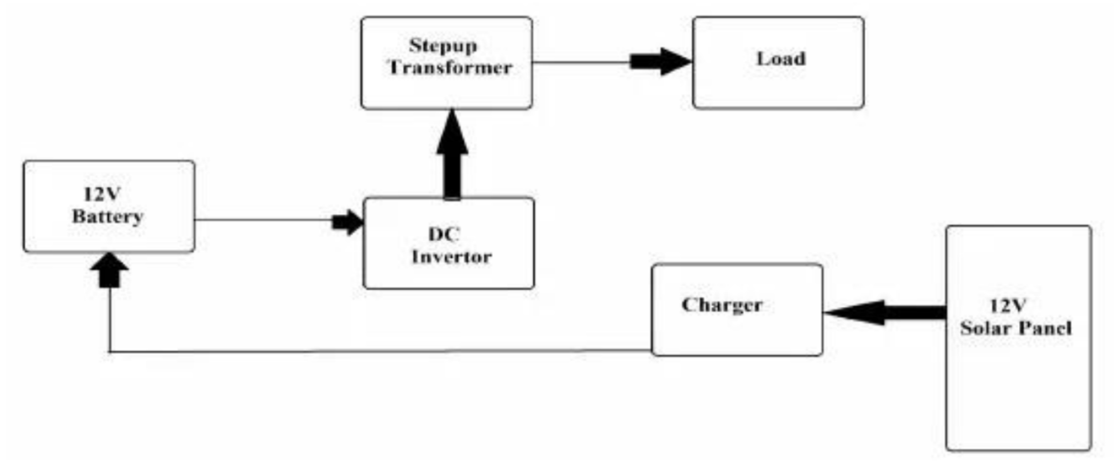
Fig. 1 BLOCK DIAGRAM



The block diagram of the proposed solar power inverter system is shown in Fig. 1. The main components include:

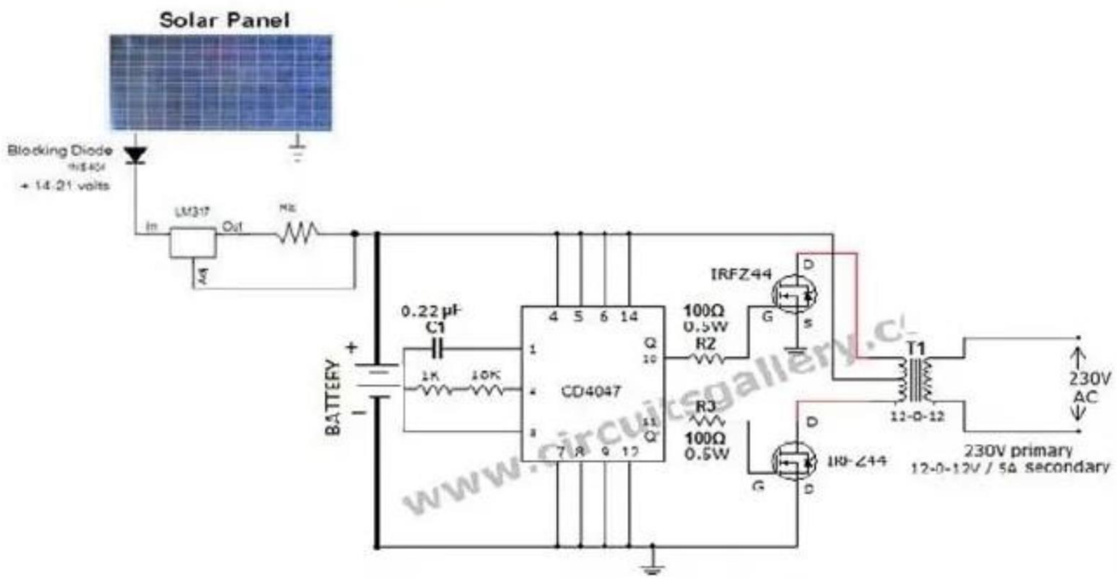
- Solar Panel: Converts solar energy into electrical energy.
- Charge Controller: Regulates voltage and current to prevent overcharging.
- Battery (12V, 4.5Ah): Stores DC power for later use.
- Inverter Circuit (CD4047 & MOSFET IRFZ44): Converts DC to AC power.
- Step-down Transformer (230V/12V, 5A): Provides required voltage levels.

IV. COMPONENT USED

The system comprises the following components:

1. Solar Plate: 6W
2. Battery: 12V, 4.5Ah
3. IC CD4047 (Astable/Monostable Multivibrator)
4. Resistors: 1K, 18K, 100K
5. Capacitors: 22µF
6. MOSFET: IRFZ44
7. Step-down Transformer: 230V to 12V, 5A

V. CIRCUITS



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The circuit consists of a solar panel connected to a charge controller, which regulates the charging of a 12V battery. The stored DC power is then fed into an inverter circuit that uses CD4047 IC and MOSFETs to convert DC to AC power. A step-down transformer ensures the correct voltage level for output appliances.

VI. APPLICATIONS

- Remote weather monitoring systems.
- Remote communication systems.
- Satellite communication.
- Solar-powered transportation systems.
- Emergency backup power for households and industries.

VII. RESULT

The designed system was tested under various conditions, and the following results were observed:

- Efficient conversion of solar energy to electrical energy.
- Reliable backup power with minimal energy loss.
- Stable AC output with negligible voltage fluctuations.
- Cost-effective and easy-to-maintain system compared to conventional UPS.

VIII. CONCLUSION

Solar power inverters provide a sustainable and eco-friendly alternative to conventional energy sources. The project successfully demonstrates an efficient method of converting solar energy into AC power using an inverter circuit. Although the initial investment in solar inverters is high, the long-term benefits, such as reduced electricity costs and environmental impact, make it a viable solution for energy crises.

IX. FUTURE SCOPE

Future advancements in this project can focus on:

- Increasing efficiency using MPPT (Maximum Power Point Tracking) controllers.
- Implementing IoT-based monitoring for real-time performance tracking.
- Enhancing battery storage capacity with Li-ion technology.
- Developing hybrid systems that integrate wind and solar power.

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