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# IoT Based Smart Solar Inverter for Solar Power Generation

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## ABSTRACT

***The integration of Internet of Things (IoT) technology in solar power systems has led to the development of smart solar inverters that can efficiently generate and manage solar power. In this paper, we present an IoT-based smart solar inverter for solar power generation. The proposed system consists of a solar panel, a smart inverter, and a battery bank. The smart inverter is equipped with sensors and communication modules that allow it to monitor the solar panel's output and communicate with the battery bank. The system's performance is controlled by an IoT platform that uses algorithms to optimize energy generation and storage. The proposed system is designed to improve energy efficiency, reduce energy costs, and increase the reliability of solar power systems. The experimental results demonstrate that the proposed system can efficiently generate and manage solar power, making it a promising solution for renewable energy generation.***

**Keywords:** *Inverter, Solar Panel, IoT, Battery.*

## I. INTRODUCTION

The increasing demand for clean energy has led to the widespread adoption of solar power as an alternative to traditional sources of electricity. However, solar power systems can be expensive and inefficient, especially in areas with fluctuating sunlight intensity. To address this issue, an IoT-based smart solar inverter for solar power generation is proposed, which uses sensors to optimize the power output of solar panels and provide real-time insights into the system's performance.

## II. PROPOSED METHODOLOGY

The solar panel captures the energy from the sun and converts it into DC energy. The DC energy is then fed to the inverter, which converts it into usable AC energy. The microcontroller is programmed to optimize the power generation from the solar panel and manage the power consumption in the connected devices.The real-time monitoring and control of the system parameters make it a smart and efficient way of using solar energy. The project promotes the use of renewable energy sources and reduces the dependence on non-renewable energy sources, making it a sustainable and eco-friendly solution. Microcontroller: An ESP32 microcontroller is used to control and monitor the system parameters. voltage, and current sensors are used to measure the system parameters. A 16x2 LCD display is used to display the system parameters and status.A relay is used to control the power supply to the connected devices.

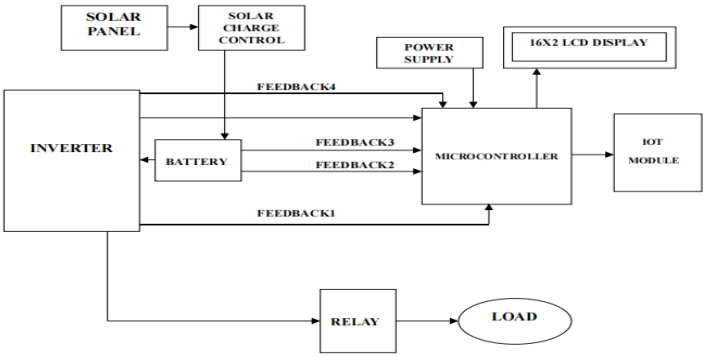
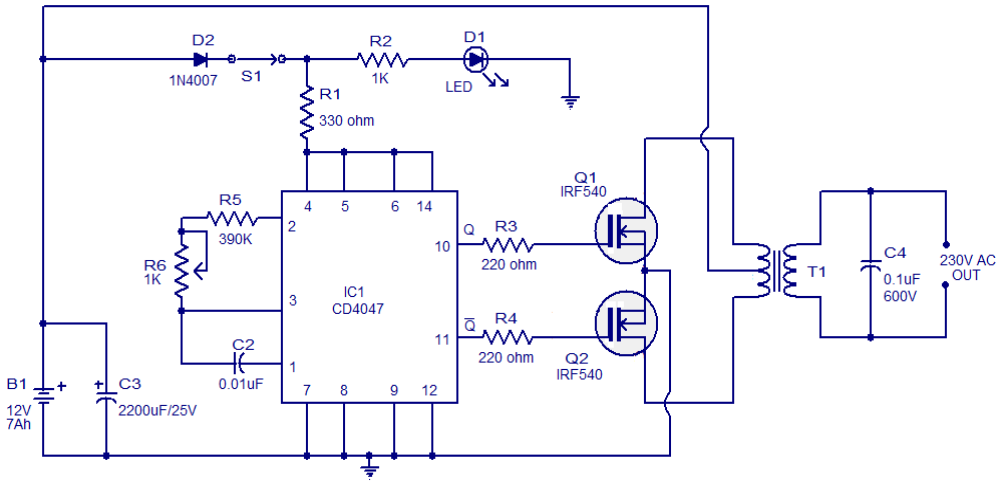



**Fig 1. Block diagram of proposed system**

## III CIRCUIT DIAGRAM

In the circuit diagram we can observe that 12V battery is connecter to the diode LED and also connected to the pin8 of the IC 4047 which is VCC or power supply pin and also to pin 4 and 5 which are astable and complement astable of the IC. Diode in the circuit will help not give any reverse current, LED will work as a indicator to the battery is working or not. IC CD4047 will work in the astable multivibrator mode. To work it in astable multivibrator mode we need an external capacitor which should be connected between the pin1 and pin3. Pin2 is connected by the resistor and a variable resistor to change the change the output frequency of the IC. Remaining pins are grounded .The pins 10 and 11 are connected to the gate of the mosfets IRF540. The pin 10 and 11 are Q and ~Q from these pins the output frequencies is generated with 50% duty cycle. The output frequency is connected to the mosfets through resistor which will help to prevent to the loading of the mosfets. The main AC current is generated by the two mosfets which will act as a two electronic switches. The battery current is made to flow upper half or positive half of the primary coil of transformer through Q1 this is done when the pin 10 becomes high and lower half or negative half is done by opposite current flow through the primary coil of transformer, this is done when pin 11 is high. By switching the two mosfets current is generated.This AC is given to the step up transformer of the secondary coil from this coil only we will get the increased AC voltage , this AC voltage is so high; from step up transformer we will get the max voltage. Zenor diode will help avoid the reverse current




***HARDWARE SETUP***

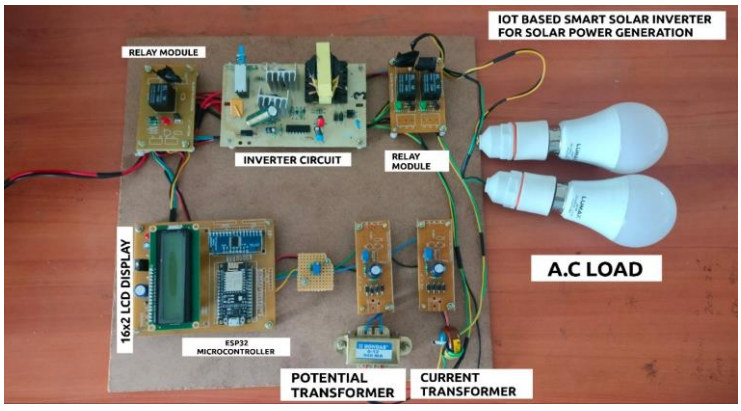



**Fig 3. Hardware Setup**

## IV. RESULT

Smart inverters can monitor energy consumption in real-time and adjust power output accordingly to optimize energy use and reduce waste. By communicating with other devices in the power system, smart inverters can help balance the grid and prevent power surges and blackouts it can increase grid stability. By optimizing energy use and reducing waste, smart inverters can help lower energy costs for consumers . IoT technology allows for monitoring and control of smart inverters, providing greater visibility and control over the power system. Overall, an IoT-based smart inverter project has the potential to create a intelligent and efficient power system that benefits all.The parameters BV[BATTERYVOLTAGE], LV[LOAD VOLTAGE], LC[LOAD CURRENT], LP[LOAD PERCENTAGE] are monitored in the LCD Display.The Blynk app is used to show these parameters in the mobile application.

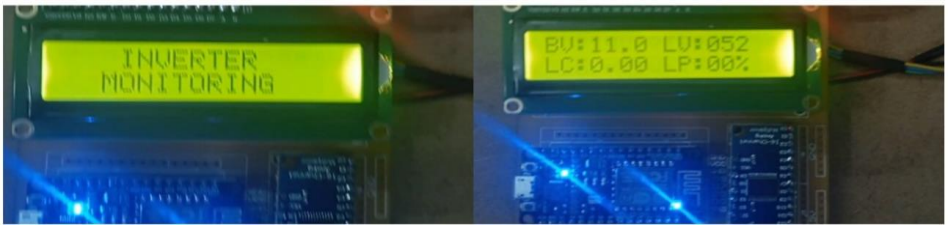



**Fig 4. Output parameters monitored in LCD display**

## V. CONCLUSION

An IoT based smart inverter project is an innovative solution that aims to provide a more efficient and convenient way of managing and monitoring the power supply in homes and offices. The project involves the use of sensors, microcontrollers, and communication devices to enable the inverter to connect to the internet and communicate with other devices.Another advantage of the IoT based smart inverter project is its ability to provide real-time monitoring and control of power consumption, which allows users to track their energy usage and make informed decisions about their energy consumption habits. In conclusion, the IoT based smart inverter project is a promising solution that can greatly improve the efficiency and convenience of power management in homes and offices. As the demand for more sustainable and energy-efficient solutions continues to grow, this project has the potential to play a significant role in shaping the future.

## VI. REFERNCES

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