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Solar Based Power Inverter

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Abstract

This project describes the design and construction of a solar-powered power inverter system for converting solar power into usable electricity for domestic and industrial use a 12v solar panel provides dc power which is stored in a battery and then converted to 220v ac 50hz by a solar inverter the system automatically switches between solar and main supply through a relay-based switching mechanism to provide an uninterrupted supply the inverter offers a high-efficiency ac sine wave output with lesser losses and is capable of handling multiple loads at the same time it's an environmentally friendly system that decreases reliance on fossil fuels helps in reducing carbon emission and provides a clean affordable option for rural tribal and urban areas with poor grid connectivity.

Keyword: Solar based power inverter

solar based power inverter solar powered inverter clean energy photovoltaic array dc ac conversion pure sine wave inverter auto switching relay control energy storage facility green power low total harmonic distortion and stable power

I. Introduction

This project harnesses solar power to generate electricity with the aid of a 12v solar panel during the day and stores it in a 12v 4ah battery for night use or for use in transport vehicles a 150w half sine wave inverter converts the dc output of the solar panel to 220v ac for powering home appliances such as lamps tvs music systems and mobile chargers it is a low-cost efficient and environmentally friendly source of power for rural and tribal areas with restricted access to electricity easy to install and requiring no maintenance the system improves living standards while promoting clean energy reducing co emissions and enhancing environmental sustainability solar and wind are viable alternatives to renewable energy as they are predominantly available easy to install and help eliminate environmental pollution and global warming.

II. Literature Survey

This paper introduces a hybrid solar-wind power generation system with battery energy storage simulated and modelled in Simulink it contrasts the solar wind and combined system power outputs with conclusions drawn about their performance the system is implemented to feed electricity into the power grid with precise working principles and conditions the hybrid solar-wind system provides a clean reliable and sustainable power solution due to diminishing coal resources increasing thermal power prices transmission losses and environmental contamination from traditional energy hybrid renewable systems are crucial for the future experiments indicate that an association of solar panels with a vertical axis wind turbine vast yields constant power production all day long making it appropriate for fossil fuel- free rural electrification the system can lower pollution promote energy security and electrify small villages sustainably.

Methodology

This project has an automatic hybrid system based on solar panels and main supply as two sources of power a relay circuit automatically toggles between solar and main supply in case sunlight is present the relay switches on to utilize solar power in case of unavailability of solar

power or malfunctioning the relay switches off to utilize main supply there's no need for manual switching or rewiring the system automatically switches according to relay status the power so generated is stored in a battery bank and it is converted into 220v ac through an inverter and supplies electrical load.

Block Diagram:

Figure 1: Block diagram

This system has two power sources solar panel and main supply a relay is used to switch automatically depending on solar availability when solar power is available the relay turns on to utilize solar energy when solar is not available or is faulty the relay turns off to utilize the main supply no wiring alteration or manual action is required switching is completely automatic the energy is stored in a battery bank and inverted to 220v ac by an inverter to power the load.

SIMULATION MODEL

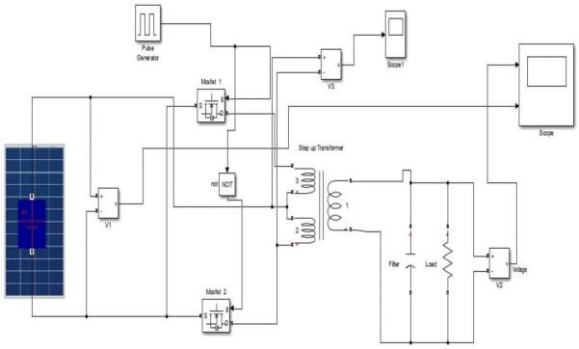


Figure 2: Simulation model

The inverter system was simulated and analyzed with MATLAB Simulink to check whether it gives a pure sine wave output the performance of the inverter was tested with inductive and capacitive loads and irms vrms and Thdv were measured photo voltaic array radiation temperature and load values influenced irm and vrms Thdv key elements such as the photo voltaic array dc-dc converter battery charge controller and connectors were simulated in Simulink this inverter system is appropriate for home business and industrial use by converting dc to ac to power household appliances.

HARDWARE IMPLEMENTATION

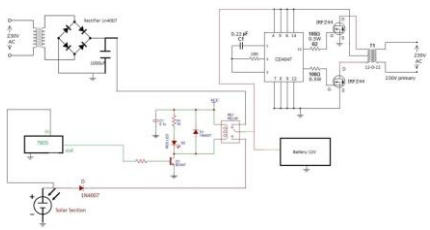
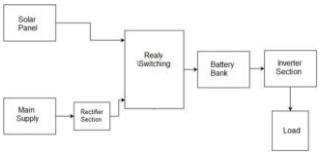


Figure 3. Circuit diagram

As photons strike a solar cell free electrons move in response to the electric field of the cell and generate voltage and current the two are multiplied as power it is stored energy in a 12v battery through a charge circuit using a 7812- voltage regulator and two bc548 transistors the circuit supplies regulated 12v and shows charging status an led lights up when the battery is charged over 105v and extinguishes below that for inverter design typical topologies are push-pull for square modified square wave and h- bridge for sine modified square wave to transform dc to ac power.



IV. Merits, Demerits:

Merits:

- Renewable and Environment-Friendly is Solar-based inverter that harnesses solar power, which is clean, renewable, and sustainable, lowering fossil fuel dependence.
- Energy Independence Solar power lowers dependence on the electrical grid, offering more energy security and protection from fluctuating energy prices.
- Backup Power is with a battery storage system, solar inverters can supply backup electricity during power outages, providing uninterrupted power supply.
- There is an Incentive Much of the country has government rebates and incentives for solar setups, lowering start-up costs.
- Low Maintenance Solar power systems, inverters etc., require low maintenance and so are a cost-effective option with low operational costs.

Demerits:

- High Initial Cost: The initial setup costs, that include solar panels, inverters and batteries, can be expensive, though this is recovered over the years through saved energy.
- Dependence on Weather: Solar power generation is weather-dependent and influenced by conditions such as cloud cover, rain, and night, resulting in intermittent power generation.
- Complex Installation: Solar power system installation can be complex and must be

carried out by experts to guarantee safety, compliance, and optimal efficiency.

- Space Requirement: Solar panels need a vast amount of space for installation, which can be impractical in congested or small spaces.
- Efficiency Loss: Efficiency loss can be incurred by solar inverters at conversion, and both temperature and system configuration may impact performance.

V. Result & Discussion

A solar inverter is necessary for the conversion of dc electricity supplied by solar panels into usable ac electricity 220v 50hz for domestic and industrial applications the inverter provides a stable output that can be used for powering different devices solar panels operate by converting sunlight into dc through the photovoltaic effect and then the inverter converts it to ac which has grid voltage and frequency the system is highly efficient e.g. 85- 95 with little energy lost it is capable of supporting multiple loads at the same time hence making it scalable for both industrial and domestic use the system is zero-emission which means it helps in environmentally friendly production of energy and less dependence on fossil fuels at peak sunlight hours the inverter provides stable ac output with minimal variations even with changing load conditions.

VI. Conclusion

The solar inverter system efficiently converts the dc electricity produced by solar panels to stable usable ac electricity 220v 50hz which can be used for powering domestic and industrial appliances with maximum efficiency 85-95 and negligible energy loss the system performs at its best during peak sunlight hours and continues to supply a constant output even under changing load conditions the system provides great advantage in both home and industrial usage handling more than one load at a time its green nature being emission-free is part of sustainable energy generation less reliance on fossil fuel and minimization of carbon footprint by providing a consistent output and scalability the solar inverter is key to solar energy becoming a viable and efficient source of power supporting a cleaner and greener future.

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