



Ministry of Higher Education
Tikrit University
College of Shirqat Engineering
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Inverter Design for Solar Energy Requirement with Smart Meter Application

A project

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Abstract

An enhanced, innovative integrated smart solar inverter system design for off-grid applications is shown in this project. The suggested solution combines a specially made inverter with sophisticated management and monitoring capabilities that can convert 12V DC from solar panels into a steady 220V AC, 700W output through a single-stage conversion procedure. Three 10W solar panels linked in parallel, a high-efficiency transformer (model i10-1114040-37), and two TIP41C transistors with heatsinks and protection resistors are essential parts.

To ensure quick reaction and little latency, an Arduino is used for both high-speed PWM generation and accurate sensor data gathering. The addition of a smart energy meter with leakage protection, which allows for remote on/off control via a GSM mobile connection and real-time WiFi monitoring of voltage, current, and power usage, significantly improves the system. A free Tuya Smart app that offers consumers an easy-to-use interface for energy tracking and management is also available for download, and the meter also shows kWh use and cost.

According to experimental data, the custom inverter outperforms traditional multistage commercial inverters in terms of voltage stability, total harmonic distortion, and reaction times, while achieving a conversion efficiency of almost 94%. Performance graphs and thorough comparison studies highlight the benefits of the suggested design in terms of system dependability, efficiency, and cost-effectiveness. This study opens the door for further developments in smart energy systems by providing a reliable, sustainable, and scalable approach to managing renewable energy in off-grid settings.

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