Patent Search

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Abstract:

The present invention discloses an AI-enabled approach for State of Charge (SOC) estimation in solar-powered battery systems. The system integrates photovoltaic p battery storage unit, and a data acquisition setup to collect real-time battery parameters. Machine learning techniques, specifically the Random Forest algorithm, are model battery characteristics and predict SOC with higher accuracy than conventional methods. The proposed system improves battery performance and lifespan by smart energy management and preventing harmful operating conditions. Its data-driven nature makes it a viable solution for intelligent and sustainable renewable e applications.

Complete Specification

Description:• Photovoltaic (PV) Array: Converts solar irradiance into DC electricity through the photovoltaic effect, acting as the primary power source.
- Solar Charge Controller/Buck Converter: Regulates voltage and current from the solar panels to ensure safe and efficient battery charging, preventing overchar
- Battery Bank: Stores excess energy generated during peak sunlight for use during low or no-light conditions (e.g., Lead-Acid or Lithium-ion).
- Data Collection Unit (ESP32 & Sensors): Continuously measures real-time parameters such as voltage and current, converting analog signals to digital data for p
- AI Modeling Block: Utilizes the trained Random Forest model to predict SOC based on historical and real-time data inputs.

, Claims:1. An AI-enabled system for State of Charge (SOC) estimation in solar-powered batteries, comprising a solar PV array, a regulated charging unit, a battery bank, a microcontroller with integrated sensors for real-time data acquisition, and a predictive AI modeling block.
2. The system as claimed in claim 1, wherein the predictive AI modeling block utilizes the Random Forest algorithm to analyze nonlinear battery characteristics an accurate SOC predictions.
3. The system as claimed in claim 1, wherein the microcontroller processes real-time voltage and current signals to monitor system parameters and prevent overc and deep discharge.
4. The system as claimed in claim 1, wherein the buck converter regulates the solar panel voltage to maintain an optimal charging profile for the battery bank.

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