Solar Tree based Home Appliance Monitoring System Using IoT

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Presentation Outline

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Introduction

- Solar energy will be a vital resource
- Cutting-edge technology - Solar fuel, artificial photosynthesis
- Arranging the solar panels like solar trees is affordable, cost-effective, usable in residential settings and less sensitive to variations in irradiation
- Fail-safe characteristics - grid fault, over temperature, over current, and short circuit
- Esp 32 reads the failsafe along with total ouput power, temperature, sun irradiance, and wind speed.
- Determines efficiency and employ an IoT-based architecture for home automation

Abstract

- Solar Energy Efficiency: Solar trees, efficient for future energy needs, maximize conversion by positioning panels perpendicular to the sun's rays.
- Autonomous Tracking: Research aims for precise sun identification, ensuring panels stay perpendicular for optimal energy conversion.
- Small Modules Advantage: Multiple polycrystalline modules outperform larger glass ones, aided by Maximum Power Point Tracking for optimal power conversion.
- Home Automation: Solar tree's energy efficiently utilized, enabling equipment energy monitoring and promoting overall efficiency.

Literature Survey

Paper Title	Journal details	Methodology	Advantages/ Disadvantages
1."IoT based real time energy monitoring system using Raspberry Pi."	Mani Dheeraj Mudaliar, N. Sivakumar. Internet of Things, Elsevier, 2020.	The method utilized involves using Raspberry Pi with Node.js programming language to gather data from energy meters, locally storing it for daily energy pattern analysis, aiming to conserve energy and identify losses caused by diverse factors.	• Advantage: Raspberry Pi with Node.js enables efficient energy data collection and local analysis for informed conservation efforts. • Disadvantage: Limited scalability, local infrastructure dependency, technical expertise needed, and potential real-time limitations.

Literature Survey

Paper Title	Journal details	Methodology	Advantages/ Disadvantages
2."Design of IoT based smart compact energy meter for monitoring and controlling the usage of energy and power quality issues with demand side management for a commercial building."	Karthick T, Charles Raja S, Jeslin Drusila Nesamalar J, Chandrasekaran K, Elsevier, 2021.	It unites Commercial Building Energy Management System (CBEMS) and Smart Compact Energy Meter (SCEM) using IoT is proposed to monitor and control the energy usage and power quality issues.	• Advantage:Optimized use of hardware like using a single hardware for multiple purpose which also reduce the power consumption. Real-time tariff calculation and power calculation with better accuracy • Disadvantage: No power quality protection system and Need subject knowledge to understand the output at the user end

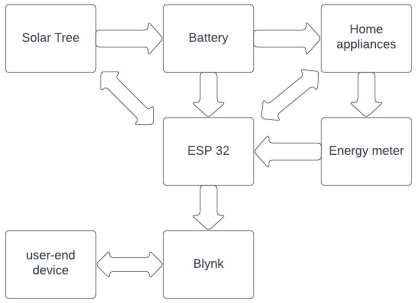
Literature Survey

Paper Title	Journal details	Methodology	Advantages/ Disadvantages
3. "An internet of things-based smart energy meter for monitoring device-level consumption of energy."	Shishir Muralidhara, Niharika Hegde, Rekha PM, Computers and Electrical Engineering, Elsevier, 2020.	It was designed and implemented using an Internet of Things (IoT) enabled smart enery meter obtaining data regarding energy consumption of all the home appliances and make them access energy expenditure patterns basedon their energy ratings.	• Advantage: Meter reading is made simpler and more accessible to consumers. Consumers are provided with features such as online bill payment. • Disadvantage: It is not a plug-and-use meter but rather a non-portable replacement to wall sockets

Objective

- Develop an autonomous sun-tracking system to accurately identify and track the sun's position.
- Implement precise adjustments of solar panel angles to ensure they are always perpendicular to the sun's rays.
- Maximize solar energy conversion into electrical energy through continuous panel orientation optimization.
- Design and deploy a solar PV system using small polycrystalline modules for enhanced energy efficiency.
- Integrate Maximum Power Point Tracking (MPPT) techniques to optimize power conversion from solar panels.
- Enable measurement and monitoring of power production from the solar tree for efficient home automation.
- Ensure efficient utilization of solar energy resources for various household equipment.
- Enhance overall energy usage monitoring & contribute to sustainable energy practices.

Block Diagram



Explanation

- The produced from solar tree is saved in batteries and used for home appliances
- The power used by each device is monitored and the information is send to the ESP 32
- The information is saved in cloud and then using the blynk software then it can be accessed from the user devices
- The devices can also be controlled from the blynk software

Hardware / Software Details

Hardware Components
- Solar tree
- Voltage sensor
- LDR sensor
- Servo motor
- ESP 32
- Lead acid batteries
- Light
- Fan
- Motor

Software
- Blynk
- Arduino IDE

Methodology for the Proposed work

- Hardware Setup:

  Solar tracking system employs ESP32, LDR sensors, and servo motor controlled by Arduino. Simulation validates circuit design.
- Adaptive Panel Control:

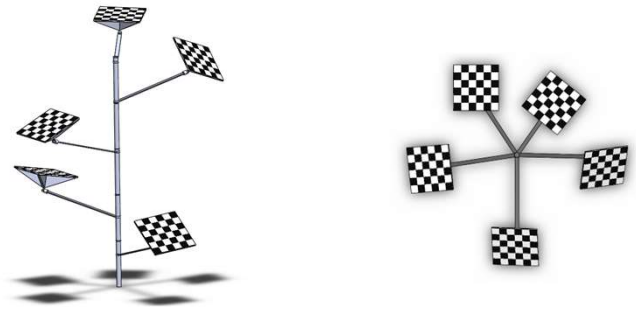
  Comparative study tests solar tree panels against fixed panels. IoT-connected model adapts panel angles for optimal energy output based on changing sun positions.
- Integrated Power Monitoring:

  The project includes power monitoring of home appliances through the solar tree system, enhancing energy efficiency and enabling informed consumption decisions.

Expected outcome or Results and Discussion

- Implementing autonomous tracking and Maximum Power Point Tracking enhances solar energy conversion, boosting power generation.
- Efficient solar energy use contributes significantly to meeting national energy demands.
- Sets path for sustainable and renewable energy future by optimizing solar resource utilization.

Model of Solar tree



Solar tree structure

Execution Plan

Third review – Implementation of Iot will be Shown

References

1. Mani Dheeraj Mudaliar, N. Sivakumar. "IoT based real time energy monitoring system using Raspberry Pi." Internet of Things, Elsevier, 2020.

2. Karthick T, Charles Raja S, Jeslin Drusila Nesamalar J, Chandrasekaran K. "Design of IoT based smart compact energy meter for monitoring and controlling the usage of energy and power quality issues with demand side management for a commercial building." Sustainable Energy, Grids and Networks, Elsevier, 2021.

3. Shishir Muralidhara, Niharika Hegde, Rekha PM. "An internet of things-based smart energy meter for monitoring device-level consumption of energy." Computers and Electrical Engineering, Elsevier, 2020.