REAL-TIME SMART ENERGY MONITORING SYSTEM

Technology in Brief

An indigenous Internet of Things (IoT)-based Energy Monitoring and Prediction System has been developed for real-time monitoring, analysis, and prediction of electrical energy consumption and solar energy utilization. The developed technology is designed to monitor electrical parameters from two energy sources, namely the utility electricity grid and solar photovoltaic (PV) installations, facilitating efficient energy management in residential, commercial, and institutional buildings. The developed system comprises a microcontroller-based data acquisition and processing unit integrated with various sensors and communication modules. The working process involves continuous acquisition of electrical voltage, current, temperature, and humidity data through the integrated sensing modules. The measured and processed parameters are transmitted through Wi-Fi connectivity to a centralized, API-based web dashboard for real-time visualization, data storage, and analysis. The system incorporates Machine Learning (ML)-based predictive analytics for forecasting future electrical energy consumption using historical energy consumption patterns, temperature, humidity, and time-dependent parameters.



Salient Features/Advantages

- In-house developed energy monitoring system
- Real-time three/single-phase electricity monitoring
- Voltage, current, power and energy measurement
- Temperature and humidity monitoring
- Wi-Fi-based web dashboard connectivity
- LCD display for local readings
- Monthly records and interactive charts
- Compact PCB-based electronic design



End Product(s)	In-house developed smart energy meter with three-phase monitoring, local LCD display and web dashboard connectivity.
License/Commercialization	To be confirmed
TRL	6
Environmental Impact	Supports tracking of electricity consumption and can help users identify opportunities to reduce unnecessary energy use.
Setup – Equipment Required	ESP32 DevKit, three PZEM energy meters with current transformers, DHT22, Hi-Link AC–DC converter, LCD, RTC module, LEDs, PCB and Wi-Fi network.