

Review on IOT Base Energy Management System of Smart Grid Connections

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Abstract - The Internet of Things (IoT) enables new technologies, primarily through sophisticated metering infrastructure and intelligent gadgets. A smart grid Energy Management System (EMS) should be built to balance energy between generation and consumption, as well as to ensure the economic, dependable, and resilient functioning of energy systems with Smart Grid (SG) applications. As a result, several models can be assigned to the EMS to handle energy exchange and data communication among participants, ensuring their privacy and self-sufficiency in the decision-making process. As a result, the IoT allows for the analysis, sharing, and use of data collected from various levels of an EMS. Furthermore, demand side management (DSM) programs, as an essential aspect of EMSs, can be provided to improve the systematic deployment of network resources and minimise peak load demands. Based on the motives outlined above, this chapter provides a complete assessment of SG's energy management techniques. The use of IoT facilities for energy management in SGs is given, taking into account the various forms of EMS at the SG, namely smart home EMS and smart building EMS. In addition, network operators, data and communication technologies, and aggregators are considered EMS players. Renewable energy sources, plug-in electric vehicles, and energy storage systems are also discussed. Furthermore, uncertainty management strategies, power quality management, and DSM programs are addressed to address critical concerns in EMS deployment.

Key Words: IOT, Smart Grid, Solar Power, Wind Power, MseB, GSM System

1. INTRODUCTION

Renewable energy sources will become a viable option for meeting future energy requirements. India's diverse size helps balance the fluctuating output of renewable energy sources in certain states by integrating them into national systems. The Indian government aims to attain 20000 MW of grid-interactive solar and 38500 MW of wind power by 2030.

Wind and solar energy are the primary sources of renewable energy for electricity generation, with rapid growth over the past three decades. Wind and solar energy now account for a significant share of the grid's overall generation.

The future of global electric networks will be influenced by government regulations, consumer efficiency needs, and the advent of new intelligent technology. Governments worldwide have implemented regulations to promote energy efficiency, conservation, and renewable sources due to environmental concerns. The following factors are driving the adoption of new renewable energy and storage technologies, as well as energy efficiency and conservation measures. Smart grid technology enables efficient control and distribution of renewable energy sources including solar, wind, and hydrogen.

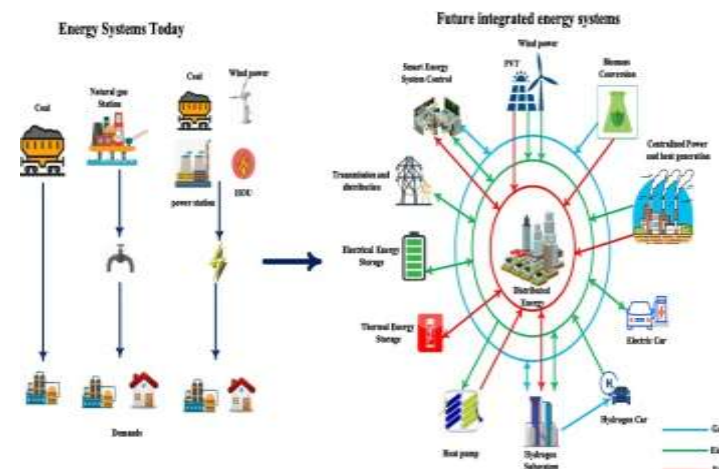


Fig. 1. A schematic diagram of traditional and future integrated energy systems

The smart grid connects various dispersed energy assets to the electricity grid. Using the Internet of Things (IoT) to collect data on the smart grid allows utilities to swiftly identify and rectify service faults through continual self-assessments. The smart grid relies on self-healing capabilities, eliminating the need for users to report failures. Consumers are more empowered to make energy-related decisions that impact their daily lives. Additionally, they are increasing their energy requirements. Consumer participation will lead to increased use of electric vehicles, remote control of home appliances,

ownership of distributed renewable energy sources, and management of electricity storage to match supply and demand. New technologies, like SCADA sensors, secure 2-way communications, integrated data management, and intelligent controllers, have created opportunities that were not possible even a decade ago.

2. Literature Review

According to H. Gharavi and R. Ghafurian "A smart grid (SG), also called next generation power grid, is generally defined as the aggregation of emerging technologies, hardware, software and practice that make the existing infrastructure of power grid more reliable, accommodating, secure, resilient and ultimately more beneficial for consumers".

According to A. Thomas[2], the smart grid differs from traditional power grids in that it allows for bi-directional power and information flow, resulting in a more dispersed and automated delivery network. Recent advancements in power systems enable seamless integration of alternative energy sources into existing power grids.

According to X.P. Zhang [3], the alternating and discrete characteristics of these sources pose a significant barrier to integration into smart grids. However, control modes can effectively address this issue. This improves performance and increases operational hours for various sources. The most often used renewable energy sources are hydro, wind, and solar. Renewable energy generation accounts for around 20% of worldwide electricity consumption as of the end of 2011.

In ref. U. Helman, [4], "problems are mentioned related to the intermittent nature of RER" and "these problems are clearly demonstrated in ref. [5]."

Kiliccote".

Cameron W. Potter [6] explains the daily, monthly, and annual fluctuation of RERs in integrated power systems. Understanding variability is crucial for modern grid stability and performance. An automated energy metering system for home use.

H. Chandler [7] The International Journal of Advanced Research in Electrical, Electronics, and Instrumentation Engineering. Smart meters are essential components of smart grids, allowing users and suppliers to regulate resources.

In this paper, energy is measured using a voltage and current controlling platform unit, level shifter, and Arduino. A single phase AC line voltage and current sensor is used with a step down transformer and level shifter, resulting in a DC output proportional to the AC system. This paper uses an Arduino Ethernet board to store data on a web page, send it to a remote server, and manage energy consumption.

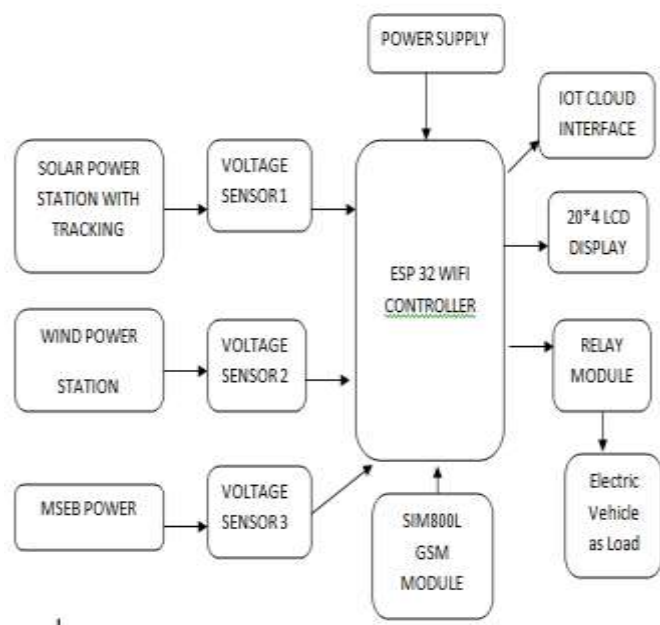
J. DeCesaro, K. Porter, and M. Milligan [8]. This paper illustrates how to measure power and energy using an Arduino microcontroller. As energy usage grows, accurate energy measurement techniques are becoming increasingly important. Providing such data aims to optimise and cut power use by thousands of units. This paper shows how to measure power using an Arduino Uno microcontroller, an offset voltage transformer, and a load. It also shows how to use offset data conditioning to clamp an AC signal against a reference DC voltage and current transformer. The voltage transformer is used to step down voltage and current to a single phase AC supply and apply signal DC offset. The project relies on Arduino Uno, an open source microcontroller that measures power in circuits with various loads (single, two, and three) and displays the results on a serial monitor and graph. M.R. Patel[9] recommends using the Internet of Things to build a smart grid and evaluate its effectiveness in various applications such as wind power estimation, overhead transmission line condition monitoring, power analysis, smart homes, and asset management.

According to R. Chedid and H. Akiki[10], the smart grid and WOT have transformed the way electricity is generated, transported, distributed, and consumed by incorporating smart sensing, communication, and control into daily operations. Electricity is essential for societal functions and ICT services. Smart grid concepts like dynamic pricing, distributed generation, and demand management have had a substantial influence on ICT services, including communication networks and data centers.

2. Proposed System

This project generates electricity using renewable resources including wind and solar power. When MSEB electricity is turned off, the system immediately switches to solar or wind power. To automatically swap the power load, we employ a Change over swap circuit. This project incorporates a snubber

circuit to improve system performance. A snubber circuit is used in semiconductor devices to provide safety and improve performance. They serve several uses, including reducing power dissipation in power electronic switching networks.



The system runs on three different energy sources: solar, wind, and MSEB electricity, all of which are easily available. The solar cell charges the battery on a continuous basis using a charge controller. The charge controller shows the status of the charged battery. The load is powered by a charged battery, and the system uses renewable energy. When solar cells are unable to charge the battery (due to darkness, gloomy circumstances, or wet weather), the load is powered by an MSEB source. The controller determines whether to switch between solar and MSEB. The system is designed to maximize the use of solar energy. The controller monitors the current status of the load.

It also uses a predefined timetable for switching. The billing area is only activated by the controller when the MSEB source is active. The captured data will be continuously updated in the cloud using the GPRS/GSM modem. The Web of Things platform provides early-stage applications for energy comprehension and control. Once the data is saved in the cloud, The Web service enables authenticated users to collect data from anywhere in the world and analyze power use using only an internet connection and no data. The login page enables customers to monitor the progress of their application execution via IoT. One advantage is the ability to monitor a home's typical

power usage. The user may monitor their energy demands and plan power sources accordingly.

Comparing consumption numbers to historical data using a graphical representation of average usage. Users can plan their energy use based on power consumption statistics. Customers of internet services can customize how energy sources are switched based on power availability. MSEB's power consumption is billed online using the Internet of Things. WoT is used to disable devices that continue to work even while we are not present at home. All operational equipment are monitored and managed via a web page.

3. CONCLUSIONS

In this suggested project, we successfully constructed a system based on a microcontroller, a solar PV panel, voltage sensors, a battery charger module, and an IoT-based system for real-time base energy management system of smart grid connections. The system was able to collect real-time data from locations other than the control centre and use a GUI to continuously monitor the voltage, current, temperature, and light output of PV panels, wind turbines and mseb connections among other environmental factors. Real-time data may be continually watched and captured with IoT. This information may then be utilized to estimate and assess future power generation capacity, revenue output, and other factors. The use of an IoT-based system will speed up and improve recorded data analysis, reduce intervention and monitoring times, streamline network management, and remove the need for periodic PV system maintenance. Because the range of solar radiation changes with place and time. To make the most use of solar radiation and maximize production, we may manage the PV panel by installing a Solar Power Tracking System. If one of the system components fails, the Solar Power Monitoring system will come in handy.

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