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Big Data For Smart Energy Management

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Abstract

The intelligent energy grid offers two-way power and data exchange between produces and consumers to facilitate control of the power system in terms of economic efficiency, reliability and health. Continuous sensor installation, wireless networking, network access and cloud computing technologies manage large amounts of fast data from the energy sector. This program allows micro-energy customers and producers to play a more active role in the power and competitive energy management markets. The biggest challenge with a smart grid is how customers would increase their role in rising energy costs. Smart sensor networks deliver various possibilities for smart grid applications, such as power management, power management in demand, centralized storage management and clean-energy plant integration. The analysis and evaluation of these data offers more insights that increase the quality of energy grid operation for experts. The term big data here means predictive analysis. This is often related to customer analytics or other special types of data analytics that are interested in data, but often in the scale of data collection.

Keywords

Smart grid; big data; distributed energy sources (DES); supervisory control and data acquisition systems (SCADA); Geographical Information System (GIS).

Introduction

Smart grids are power grids that provide a high efficiency, bidirectional energy supply by utilizing energy storage in compliance with requirements for generation. This involves distributed sources of electricity such as renewable energies, energy storage and other new generation energy technologies that supply residential, commercial and industrial and transportation networks using cheap and efficient power supplies. Strategic control and monitoring of various components and other main resources, such as natural gas, power, electricity, transportation and end users is required. It ensures energy efficiency, health, reliability and system protection by ensuring minimal environmental impacts. Smart grids that accommodate local loads provide critical elements of smart energy grids. Governments worldwide invest extensively in smart grids for optimum usage and availability of electricity.

It also makes it possible to accurately predict outages and recovery. Finally, heterogeneous infrastructure such as renewable energy ventures, networks of electric vehicles and intelligent housing through smart grids is further promoted. This provides greater protection and privacy for separate components within smart grids and ensures that smart, cloud and mobile applications can be incorporated with confidence. Within a smart grid, the physical parameter is transformed into its equivalent electric signal and converted to digital communication format data, many types of sensors are used. The synchronization of energy distribution sources (DES) has been accomplished through the effective, sustainable and economic use of modern digital information and communication technologies. For these purposes, the desired output must be achieved by handling a large volume of data. Data could become a big resource for the future grid and also a key driver. A key challenge consists of retaining 4Vs (volume, variety, speed and truthfulness data) for desired output using tolerant resources (time, hardware, person, etc.). In order to manage grid operations, Surveillance

Control and Data Acquisition Systems (SCADA) are important.

Through incorporating new monitoring methods to improve stability, reliability and performance, the advent of big data changed traditional energy industry. This also tackles environmental concerns through the use of non-conventional sources of energy such as solar photovoltaic cells, the wave, mare, fuel cells, biogas etc. In the study of structured data, big data processing is a technical trend. It provides a data-driven tool for the determination by the statistical parameters of statistical characteristics (particularly correlations). In addition, large-scale data modelling has been used extensively in other fields such as quantum, industrial, biological and cellular communications. Controlled learning is useful for data processing in the power system. The key components are deduced functions and analysis models that provide a predictor-specific parameter for these functions and models, generated by artificial training.

The smart grid can be represented as a cloud application with many smart devices and sensors distributed throughout the entire energy network. In the intelligent grid, the key source of data is advanced metering (AMI). AMI uses a wide range of intelligent meters and other measurement devices for end-users. Therefore, a large number of data can be obtained in power generation, transmission, distribution, and use from measuring and feedback components. In order to encourage intelligent energy management, environmental data, such as sun angle, wind speed and temperature, play an important role. The GIS data is also a part of big data tools. Data for the Geographical Information System (GIS). Data collection from various sources requires different data processing systems that are well organized in order to provide efficient Big Data analysis network integration. For intelligent energy systems the level of data collection and analysis is very high, from 5-15 minutes to sub-second intervals. Big data is a combination of structured, semi-structured, and unstructured data in the energy industry. A good marketing plan for better customer management can be built from the energy usage database.

Biography

Dr. Souvik Ganguli is presently working as the Assistant Professor in the Department of Electrical and Instrumentation Engineering, Thapar Institute of Engineering and Technology, Patiala. He has pursued B. Tech (Electrical Engineering) and M. Tech (Mechatronics) in the years 2002 and 2008 respectively. He has completed his PhD degree in system identification and control from Thapar Institute of Engineering and Technology in October 2019. He has a total of 16 years of work experience in industry, teaching and research. His research interests include model order reduction, identification and control, nature inspired metaheuristic algorithms, electronic devices and renewable energy applications. He has nearly 75 publications that have been cited over 100 times, and his publication H-index is 6 and has been serving as a reviewer of several reputed journals.