ROLE OF IoT IN TRANSFORMATION TOWARDS SMART GRID

Technology is growing faster thus, energy demands. Earlier, in traditional grids. the localized power generation was done which consists of one-way interaction, which is from the power plant to homes or industries, and monitoring and restoration of the grid are done manually, which is not useful for rising energy demands.

The smart grid is a two-way interaction where electricity and information can be exchanged between the power plant and its customers in developing a network of communication controls, computers, automation, and new technologies and tools working together to make the grid more efficient, more reliable, more secure and greener.
This smart grid enables newer technologies to be integrated such as wind and solar energy production and plug-in electric vehicles charging with our participation as informed consumers. The smart grid will replace the ageing infrastructure of today's grid, and utilities can better communicate with us to help manage our electricity needs.

Components of Smart Grid

Components of Smart grid includes:

1.Smart Home

The smart home communicates with the grid and enables consumers to manage the home's electricity consumption more frequently through a smart meter. Thus utilities can provide their consumers with much better information to manage their electricity bills. Inside the smart home, a Home Area Network(HAN) connects smart appliances, and devices will adjust their run schedule to reduce electricity demand on the grid at critical times and reduce the energy bills of consumers. These smart devices can be controlled by a web or a TV.

2.Renewable Energy

Renewable resources such as wind and solar are a sustainable growing source for electric power. However, renewable power sources are variable by nature and add complexity to normal grid operations. The smart grid provides the data and automation needed to enable solar panels and wind farms to put energy onto the grid and optimize its use to keep up with increasing energy demands.

3.Consumer Management

Utilities turn power plants on and off depending on the amount of power needed at certain times of the day. Electricity is more costly to deliver at peak times because additional often less efficient power plants must operate to meet the higher demand. The smart grid will enable utilities to manage and moderate electricity usage with the cooperation of their consumers, especially during the peak demand times. As a result, utilities will be able to

reduce their operating costs by deferring electricity usage away from peak hours and having appliances and devices operate at other times.

4.Operation Center

Electricity generation proceeds throughout the day. The power being used right now is generated less than a second ago many miles away. At each instance, the amount of electricity generated equals consumption across the entire grid. Smart grid technologies provide detailed information that enables grid operators to examine and manage electricity consumption in real-time. This greater insight and control reduces outages and lowers the need for peak power. In control rooms across the grid, engineers will be able to more precisely and predictably manage electricity production, reducing the need to fire up costly secondary power plants.

5.Distribution Intelligence

The distribution system routes power from the power plant to residential and commercial customers through power lines, switches, and transformers. The power plants typically rely on complex, power distribution schemes and manual or switching to keep power flowing to their consumers. Any break in this system caused by storms and bad weather or sudden changes in electricity demand can lead to outages. The smart grid intelligence counters these energy fluctuations and outages by automatically identifying problems in rerouting and restoring power delivery. Utilities can further use distribution intelligence to predict electricity usage with the cooperation of their customers, leading to low production costs.

6.Plug-in Electric Vehicle

The charging of a plug-in electric vehicle could be managed over a Home Area Network(HAN). The HAN can balance the demand for electricity across the household and prioritize between electric vehicles, and other appliances to manage electricity usage and reduce costs. Using Smart grid technologies and consumer participation power plants can more easily handle the increased power to operate the electric vehicles and ensure charging needs are met by adding more plug-in vehicles to the grid.

We have the potential to reduce fuel costs, lower our dependency on fossil fuels, and reduce greenhouse gas emissions.

Industrial Internet of things provides disruptive technology that will change the way that grid operates. It proves the viability of real-time communications and control framework, which combines distributed edge located processing and control applications with intelligent analytics. Real-time secured connectivity framework enables machine to machine, machine to control centre, and machine to cloud data connectivity. The framework will run in real-world power applications and interface with operational equipment at the core of the new smart microgrid, critical infrastructure is a high-speed field data bus that connects devices and intelligent nodes. The data bus also interacts with the central station and the cloud taking advantage of both local and remote states. To optimize operations the data bus streamlines the delivery of real-time data to any node on the network edge or cloud. It is based on the Data Distribution Protocol(DDS), which operates without a centralized message broker and ensures high efficiency making the smart grid infrastructure interoperable, scalable, resilient, and secure.

The properties of the smart grid include asset management and optimal utilisations, self-healing, distribution automation, and protection, power monitoring, frequency monitoring, and control and load forecasting.
The smart grid is a cyber-physical system, so there are several vulnerabilities present. The vulnerabilities include the integrity of data collected and transferred over the grid, accessibility to every grid component as well as information transmitted through the grid, dynamic system attacks based on the previous same type of request can be replicated by the attacker, coordinated threats, etc. In the smart grid, cloud applications can have several aspects such as energy management, information management, and security.

1.Energy Management

The energy management in the smart grid becomes more efficient using cloud-based applications. With cloud-based applications, the request from the consumers is scheduled according to the priority, availability of resources, and other constraints.

2.Information Management

Information from different components and the supply and demand state conditions can be shared with the help of IoT. Real-time data management and parallel processing of information can be utilized smart grid data cloud applications.

3.Security

Private cloud platforms are suitable for scaling out processing millions of data from users. Using a cloud-based application, electrical utilities can effectively and quickly deal with malicious software.
Thus, the smart grid is not a distant dream.IoT plays a vital role in the smart grid, thereby achieving reliability in power systems and more benefits to both consumers and energy service providers or stakeholders.