IoT Applications: Energy Sector

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***Abstract*—**

***Index Terms*—**

I. Introduction

The emergence of the Internet triggered a technical change that has resulted in a sort of connectedness with limitless potential. Such is the situation with the Internet of Things (IoT), whose use has exploded. Kevin Ashton coined the phrase in 2009, despite the fact that it has been used informally since 1999. Since then, the idea has grown at a dizzying and exponential rate. [5]

Given the foregoing, its applicability is applicable to a wide range of scenarios, with the energy business being one of the most promising (Vega et al., 2015). This article will look at its development across time, as well as the principles and technology that underpin it. [5]

II. IoT in the Energy Sector

The role of IoT in the energy sector is discussed in this section, from fuel extraction to the operation and maintenance (OM) of energy-generating assets, as well as TD and end-use of energy. The Internet of Things (IoT) has the potential to significantly reduce energy losses and CO2 emissions. At each level of the supply chain, an energy management system based on IoT may monitor real-time energy use and raise awareness about energy performance. [1]

III. IoT and Energy Generation

In the 1990s, the power sector adopted automation of industrial processes as well as supervisory control and data gathering systems. Early phases of IoT began to contribute to the power sector by reducing the risk of output loss or blackout by monitoring and regulating equipment and operations. The main challenges of outdated power plants are reliability, efficiency, environmental concerns, and maintenance issues. [1]

IV. Industry's Efficient Energy Use

When integrating IoT, the goal is to create a design that is not only attractive to energy in the sector, but also flexible in terms of cost optimization. What has already been accomplished with this implementation, as previously stated. In the end, the notion is that you still need human resources to manage all of this technology, but you minimize easy errors and energy waste.

The fundamental component of the system is data processing, which analyzes data in the cloud platform to assist managers in making more effective decisions in real time. The depreciation of machines and mechanical devices is a major challenge in factories when it comes to monitoring and maintaining production assets. The optimal device size can be selected using a suitable IoT platform and tools to reduce wear and tear and associated maintenance expenses. The mechanical equipment never crosses its threshold limit thanks to IoT-based conditional monitoring. Simply put, this means the equipment will survive longer and have fewer. Furthermore, failures that result in energy loss are expected to be addressed. failures. [1]

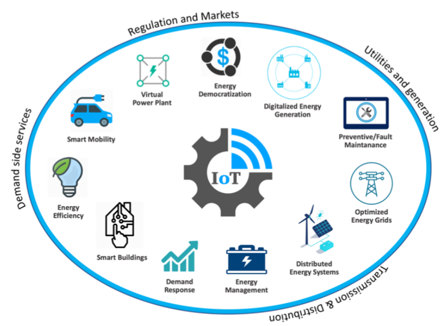

Fig. 1. Applications of IoT in a Smart Energy System [1]

V. Smart Cities

Smart cities aimed to improve quality of life while cutting energy use by implementing IoT technologies. IoT advancements can cut energy consumption, eliminate losses in the transmission and distribution of electrical energy, provide more reliable energy supply, and improve our level of living with new applications. Energy 4.0 provides businesses with the opportunity to develop new business models and long-term energy production and delivery strategies. The global demand for electrical energy continues to rise, with more than two-thirds of it anticipated to rise by 2035. As a result, the existing electrical infrastructure will be put under a lot of Traditional electricity grids still lack adequate monitoring systems. Furthermore, integrating distributed energy resources into existing power systems is a difficult task, which slows the adoption of renewable energy sources. strain. [4]

The rapid rate of urbanization, combined with overcrowding, has resulted in a slew of global issues, including air and water pollution energy access, and environmental problems. One of the most significant difficulties in this area is to provide cities with clean, inexpensive, and reliable energy sources. The application of smart, IoT-based solutions for existing problems in a smart city setting has been fueled by recent advancements in digital technology. In a city, smart industries, smart homes, power plants, and farms can all be connected, and energy data may be shared. [1]

VI. Smart Grid

It is a potential new power system design that improves grid performance while also lowering greenhouse gas emissions. It is decentralized, generally on a microgrid size, to provide greater system stability and service quality to local communities. Smart grids are self-healing, operate resiliently against physical and cyber attacks, optimize operating efficiency, and enable new services and products because they are equipped with new, innovative technologies (such as smart metering, vehicle-to-grid, energy management systems, storage systems, demand response (DR) programs, high penetration of renewable energy sources, and so on). [5]

Batteries were recharged in old grids by adapters using power wires and an AC/DC inverter. Using inductive charging technology, these batteries may be charged wirelessly in a smart grid. Furthermore, in a smart grid, end-user energy demand patterns can be evaluated by collecting data via an IoT platform, such as the time of charging mobile phones or electric cars. The nearest wireless battery charge station can then assign the appropriate time slot and charge that device/vehicle. Another benefit is that IoT will allow for improved control and monitoring of battery-powered devices, resulting in lower costs. [1]

First, energy distribution may be changed, and second, electrical delivery to these cars can be guaranteed. This will significantly cut wasteful energy consumption. [1]

VII. Smart Buildings

Cities' energy consumption can be classified into three categories: residential (domestic); commercial (services), which includes stores, offices, and schools; and transportation. Lighting, equipment (appliances), domestic hot water, cooking, refrigeration, heating, ventilation, and air conditioning are all examples of domestic energy usage in the residential sector. In most buildings, HVAC energy usage accounts for half of total energy use. [1]

IoT-based lighting control is critical for smart building management and control. To date, a variety of vendor-specific methodologies and technologies have been used in buildings to enable lighting control. It would be beneficial to apply some standard-based methodology. PoE, in addition to offering basic data/VoIP connectivity in the intranet and IoT power and access to aggregate points, turns out to have other characteristics that are important for lighting applications.LEDs are semiconductors that use direct current to power them. ”Lighting digitalization,” ”digital lighting transition,” or ”networked lighting” are terms used to describe the process of commercial LED lighting switching to PoE technology. PoE can be used as a class 2 input power source for low-voltage LED lighting systems, according to UL-2108. Organic LED-based systems are another area to keep an eye on, given the technology's growing adoption. [7]

Fig. 2. Overview of IoT in Energy Sector
https://www.electricalindia.in/iot-in-energy-sector/

VIII. Challenges of Applying IoT

Massive IoT device deployments for energy and other purposes will generate interference issues, particularly for IoT devices that use the unlicensed spectrum, such as ZigBee, Wi-Fi, Sigfox, and LoRa (see Table II). The resulting interference may result in data loss and degrade the IoT ecosystem's reliability. The technology that allows IoT devices to use unlicensed spectrum to avoid interference will increase the device's cost. The adoption of IoT devices that operate on permitted spectrum, on the other hand, is expected to decrease needless interference. Due to a lack of pilot assignments in the cellular band, however,Interference between IoT devices employing cellular licensed spectrum can still be caused by the reuse of non orthogonal multiple access schemes or frequency reuse. [8]

IoT platforms are putting a lot of work towards saving energy in energy systems. To enable IoT connectivity in energy systems, a large number of IoT devices transmit data. A significant quantity of energy is required to run the IoT system and transport the massive amounts of data generated by IoT devices. As a result, IoT system energy consumption remains a significant concern. Various ways, however, have been attempted to lower the power consumption of IoT systems. For example, you could put the sensors in sleep mode and only use them when they're needed. [1]

IX. Conclusion

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