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IoT History, Development and Structural Views

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Introduction

Businesses that are connected in some way to renewable sources of energy have witnessed tremendous expansion on a global scale over the course of the past few years. This scaling should maintain the same level of earnings and productivity throughout the process. According to the findings of the surveys, it is anticipated that the share of electricity provided by renewable sources would increase to around 22.5% across the globe. The Internet of Things can help reduce the amount of wasted electrical energy through its application in the development of alternative forms of power. The Internet of Things is doing research into the many methods that may be utilized to increase the carrying capacity of expanding grids in remote locations. As a result, businesses who prioritize the internet of things have a lot to gain and might benefit significantly from doing so. Over the course of the last several decades, there has been a considerable shift in the energy industry as a consequence of the development of sources of renewable energy and the depletion of resources that have a limited supply. The International Energy Agency forecasts that the combined growth of the internet of things economy and renewable energy sources will reach 43% by the year 2022. This increase is expected to occur by the end of the decade. The Internet of Things is playing an essential part in the contemporary energy industry, which is experiencing fast transformation. If there was no such thing as the Internet of Things (IoT), imagining the future of a limitless resource would be difficult. Let us thus study the several ways in which the Internet of Things may assist the renewable energy business in satisfying the growing demand for power while also enhancing the overall efficiency of the sector.

Literature Review

Sivagami Ponnalagarsamy (2015) The Internet of Things, often known as IoT, is the type of computer technology that consumers presently have access to that is the most cutting-edge and futuristic in its approach. The phrase "internet of things" (IoT) refers to the network of intelligence that links various electronic gadgets and computer systems that are located in various regions of the world by utilizing cloud portals to communicate with one another. This network of intelligence is referred to as the "internet of things." Several computer systems and electrical gadgets are connected to one another through this intelligence network. There might be millions or perhaps billions of linked gadgets in the world one day thanks to the Internet of Things. This is certainly not outside the bounds of the possible. As a result of the Internet of Things, the management of massive volumes of data, the analysis of those enormous amounts of data, and the execution of beneficial management activities are all made simpler and more secure. The Internet of things will eventually lead to the replacement of communication between persons and other people with communication between items. This will happen as a direct result of the IoT. Instead of the other way around, this change will take place. There is not a single sector that will not be affected in some kind by the Internet of Things and the applications that operate on it in the foreseeable future.

Razzaque et al. (2016) offered a comprehensive analysis of a research study that focused on the middleware solutions that are currently available to handle the heterogeneity of the existing Internet of Things (IoT) infrastructure. This study was conducted to investigate the middleware solutions that are currently accessible. The authors detailed the components of the Internet of Things system that would be included into the system, including RFID, M2M, and SCADA, among other components. These components would be included into the system in some way. The high degree of unpredictability may be avoided in a number of different ways, and putting middleware solutions into place is one of those methods. The writers have conducted research on the needs for a number of different middleware solutions, and as a consequence of their findings, they have highlighted both existing issues and prospective future research pathways. This is because the authors want to ensure that their work is useful to others.

Sajid et al. (2016) recently published the findings of a research in which they found that the connectivity of Cyber-Physical Systems (CPS) with Internet of Things (IoT) and cloud services

will expose these systems to a number of probable vulnerabilities in terms of data security. These findings were based on the findings of a study that was conducted in the past. Even a very little security breach can result in a large amount of property damage, especially when it comes to the industrial systems that are a component of the infrastructure. SCADA is utilized to aid in the execution of the tasks of monitoring and regulating the plant operations. Their analysis revealed the best practices and research gaps that need to be addressed in order to make CPS systems that make use of IoT even safer. This information was uncovered as a result of their inquiry.

Advance Information of IoT

The advancement of information and communication technology plays an essential role in the creation of future smart grids, which will cover all elements of electricity generation, transmission, distribution, and consumption. These networks will span the globe. Individual consumers and individual service providers stand to profit from the smart grid's improvements to grid operations, monitoring, reliability, efficiency, and general stability. These improvements were made possible by the implementation of the smart grid. In this regard, the internet of things (IoT) is a promising piece of technology that is projected to play a significant role in enabling the electric power system to fulfill its intended goals in terms of monitoring, protection, and control.

The potential of the internet of things (IoT) to link commonplace devices to the internet will make this a reality. One strategy for achieving this objective is to design the network in such a manner that it incorporates sensors, actuators, and metering devices, and also provides support for a range of system automation and network functions. Developing technologies that are connected to the Internet of Things provide robust infrastructures that make it feasible for a range of smart grid applications to gather, process, send, and store data. The Internet of Things (IoT) technology has gained great attention across a broad number of application domains, including smart homes and buildings, healthcare, agriculture, and urban areas, amongst others.

Internet of Things (IOT)

The term "Internet of Things" (IoT) refers to the interconnection of multiple networks and devices that are both employed in day-to-day life and are also connected to the internet. These networks and devices are typically implanted into people's bodies. The goal of the Internet of Things (IoT) is to automate a wide variety of domain operations, such as those found in health care systems, surveillance systems, security systems, industrial systems, and so on. The fully automated process won't be able to carry out until all of the many gadgets in each domain have transceivers, microcontrollers, and protocols built into them. The system that makes up the Internet of Things (IoT) may be broken down into three distinct layers: the perception layer, the network layer, and the application layer. The perception layer consists of the individual's possession of electronic devices that are capable of establishing an internet connection. These devices have the capability to observe and detect the object, and after that comes the information collecting about the system. In the last step, the information is transmitted to one another with the use of a communication network. Cameras, global positioning systems, radio frequency identification readers, and other similar technologies are some of the components that make up the perception network. The layer that comes after the physical layer is called the network layer, and its job is to ensure that the data gets from the physical layer (PL) to the logical layer (AL). In this sense, the Internet of Things need long-range networks such as the Internet in addition to short-range networks like as Bluetooth and Zigbee in order to transmit data from perception networks to short-distance gateways. Bluetooth and Zigbee are examples of such short-range networks. It is accomplished by utilizing 2G, 3G, and 4G networks in addition to PLC in order to transmit the information over wide distances. The application layer is responsible for the processing of incoming information with the aim of acquiring a better knowledge of the situation. The outcomes of this processing are used to inform the development of methodologies for electricity distribution and management.

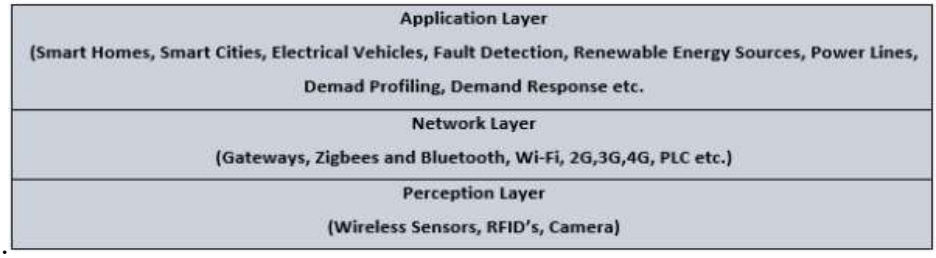

Figure: IoT Layers

IoT Applications

The use of cutting-edge disruptive technology has the potential to stimulate the use of renewable energy sources to a larger level, which would therefore lead to a more sustainable world. The Internet of Things (IoT) is proving to be a huge growth catalyst for the renewable energy sector as it is being introduced into that sector. Applications that are powered by the Internet of Things provide answers to a variety of issues that are limiting the mainstream use of renewable energy sources.

Internet of Things (Information Technology)

The Internet of Things (IoT) does not yet have a clear meaning, nor is it restricted in any way that can be said to be final. This indicates that there is no one definition that has been agreed upon by the vast majority of users or by the community of users around the globe. As a consequence of this, the Internet of Things is developing into a more mature notion while simultaneously maintaining its position as the most cutting-edge and widely discussed idea in the realm of information technology. In the context of the Internet of Things, the term "Thing" can refer to any item that is fitted with a sensor of any sort and has the capability to autonomously gather data and transmit it over a network. In other words, a "Thing" can be any connected device. The embedded technology in the product makes it possible to interact with both the internal state of the object and the external world, which, in turn, makes the process of making decisions easier.

In a presentation that he delivered to Proctor & Gamble in 1999, Kevin Ashton was the one who initially presented the idea of a "Internet of Things" (IoT). He is considered a pioneer in the field of automated recognition and was instrumental in the establishment of the automated Recognition Lab at the Massachusetts Institute of Technology. In the field of supply chain management, he was an early adopter of the RFID technology that is now used in barcode scanners. This makes him a pioneer in the field. In addition to this, he founded the firm Zenji, which is now engaged in the manufacturing of energy sensing and monitoring devices. The Internet of Things is a burgeoning industry that is significant from a social, economic, and technological point of view. Internet connectivity and powerful data processing capacities are being built into a wide variety of everyday objects, including consumer products, durable goods, vehicles and trucks, industrial components and facilities, sensors, and a number of other everyday things. This has the potential to change the way in which we work as well as the way in which we live.

The rise in popularity of technologies and gadgets that are connected to the Internet of Things (IoT) has coincided with a substantial shift in the routines that we follow in our day-to-day lives. Although the Internet of Things is present in every aspect of our life, there are times when we are unable to see it or are unaware that a certain device is connected to it. The development of new consumer Internet of Things products, such as Internet-enabled devices, home automation components, and power management devices, is propelling us toward the notion of the "smart home," which provides a higher level of safety and an improved capacity to conserve energy. Other Internet of Things personal devices, such as wearable fitness and health monitors, are complementing network-enabled medical equipment to change the delivery of healthcare services. These wearable fitness and health monitors complement other network-enabled medical equipment. As a result of the Internet of Things (IoT), which transforms real-world objects into an information ecosystem that enables data to be shared across transportable, wearable, and even implanted devices, the quality of our lives will be enhanced by an increased amount of both data and technology.

People who are unable to care for themselves due to age or a handicap may discover that the technology known as the Internet of Things (IoT) might assist them in maintaining or improving their quality of life at a cost that is reasonable to them. Internet of Things technology, such as networked autos, intelligent traffic systems, and sensors embedded in roads and bridges, are bringing the notion of "smart cities" closer to reality. This is an exciting development. Smart cities have several advantages, one of which is that they help reduce traffic congestion while also cutting down on energy use. One of the ways in which the Internet of Things technology has the potential to change agriculture, industry, and the supply of energy is by increasing the availability of information along the production value chain through the use of networked sensors. This is just one example of how this technology might have a significant impact.

The IoT for Sustainable Energy

From what has been said about energy and its long-term viability, it is plainly evident that the goal of providing universal access to energy cannot be accomplished without the use of proper technical methods. By utilizing technology, it is feasible to create robust solutions for dependable energy access at cheap costs. These solutions, in turn, may improve the performance and operation of the energy systems that are currently in existence. As a consequence of this, the criterion that the community must have access to energy at a cheap cost may be achieved through the utilization of sensing and communication technologies that will be developed in subsequent generations.

The Internet of Things (IoT) has to be evolved into a system that is able to successfully supply services that are both inexpensive and efficient in order to meet this essential demand of human life. The Internet of Things (IoT) in sustainable energy systems is envisioned as the interconnection of the energy things in the entire paradigm grid system, services supply chains, and human capital using state-of-the-art technologies with the ability to meet future needs and clean energy access challenges of the current century. These challenges include the need for more energy that is accessible in a clean form. One of these difficulties is the limited availability of environmentally friendly forms of electricity.

IoT-Based Monitoring System Framework

The Internet of Things (IoT) must be able to manage and analyze data in real time while experiencing extremely low latency if it is to stand out from other technologies. This is one of the characteristics that distinguishes IoT from other technologies. One of the differentiating characteristics that sets IoT apart from previous technologies is the presence of this functionality. Real-time monitoring systems are able to provide information to system operators about the general status of the monitoring objects they are keeping an eye on when they are placed in power substations. These systems are keeping an eye on. As a consequence of this, there is a chance that not only the dependability of the system, but also the efficiency with which it is operated, will be enhanced. During the course of this inquiry, we will make use of a Field-Programmable Gate Array (FPGA) integrated controller that is built in accordance with a particular industry standard.

The Direction of Future Research

Internet of Things (IoT) applications are investigated in this article-based dissertation in the context of power system monitoring, power system demand-side management, and power system protection. This dissertation is made up of a total of six pieces that have been published in various academic publications throughout the world. The Internet of Things (IoT), which offers a platform that enables the conveyance of data without being constrained by either time or place, is the most significant component in the development of smart grids. This is due to the fact that it provides a platform that enables the conveyance of data.

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