

The Role of the Internet in Electrical Engineering (IoT & Smart Grids)



A Research Paper
Presented to Sir Al-Monte Vince M. Calo of
CITC, University of Science and Technology of Southern Philippines - CDO
In Partial Fulfillment of the Requirement for
Living in the IT Era

College of Engineering and Architecture (CEA)

**VINZ VERBO A. ALILING
TEZZA JAYNIELLE C. ROJO
RHEA JEAN R. MARFA
CLARK NEIL L. BAJAO
DALE BROAD B. SUSON**

April 2025

I. Introduction

According to Petrariu et al. (2021), Electric Power has completely revolutionized our world and our way of living. The amount of energy that is needed for this world is increasing and will rapidly grow as modernization moves forward. Also, energy systems around the world are undergoing tremendous changes. Primarily driven by carbon footprint reductions and related policy imperatives and low-carbon technological development (*Review of Big Data Analytics for Smart Electrical Energy Systems*, n.d.).

As the world faces increasing energy demands and climate-related challenges, integrating IoT and Smart Grid technologies has become essential. These innovations allow for automated energy management, data-driven decision-making, and improved system resilience, aligning with global goals for sustainability and energy efficiency.

This study explores the growing role of the Internet in electrical engineering, focusing on how it powers the integration of IoT and Smart Grid systems. It seeks to understand how internet connectivity enhances the performance of electrical power and energy systems (EPES) and how these advancements are shaping a smarter, more secure, and sustainable energy future.

Background of the Study

The rapid advancement of technology has transformed various fields, and electrical engineering is no exception. Among the most impactful innovations are the **Internet of Things (IoT)** and **Smart Grid** technologies, which are revolutionizing how electrical systems are monitored, controlled, and optimized.

The **IoT** refers to a network of interconnected physical devices embedded with sensors, software, and other technologies that enable them to collect, exchange, and analyze data. These devices—ranging from household thermostats to large-scale industrial machines—rely on internet connectivity to perform real-time monitoring, remote control, and automation.

One of the most significant applications of IoT in electrical engineering is the development of **Smart Grids**—digitally enhanced electrical grids that leverage internet connectivity and intelligent technologies to improve the efficiency, reliability, and

sustainability of power systems. Smart grids utilize real-time data to enable more efficient energy distribution, reduce transmission losses, and respond rapidly to power outages and fluctuations in demand.

II. Discussions

This Paper aims to understand the significance of the Internet in the Field of Electrical Engineering by answering the following questions that are crucial in determining the role of the Internet:

- a. How do the inherent capabilities of the Internet contribute to the enhancement of modern Electrical Systems?**
- b. How does Internet connectivity affect the functionality and applications of the Internet of Things within Electrical Engineering?**
- c. What improvements have been implemented in smart grid technologies and operations as a direct result of Internet integration?**

How do the inherent capabilities of the Internet contribute to the enhancement of modern Electrical Systems. The internet itself serves as the foundation of interconnectivity in this world. It acts as a vast network that information and communication to flow freely across geographical boundaries (Connolly, 2024). Alongside the internet is electricity, which coincides on its importance and significance. Society wouldn't even reach the heights it has achieved today without the power of electricity. The internet's fundamental strength lies in its ability to connect geographically dispersed devices and systems through standardized protocols. This allows for a seamless connection regardless of the location. Preceding this topic is where IOTs are introduced. Due to their major role in today's electrical systems, electrical devices can now communicate with each other over the internet. This will lead to more efficient energy use and better management of resources (Admin, 2024).

How does Internet connectivity affect the functionality and applications of the Internet of Things within Electrical Engineering. According to Adelakdun et al. (2024). The concept of the Internet of Things (IoT) represents an evolutionary change in modern technology. This is comprised of a network of physically connected objects. Devices are integrated with modern technology, sophisticated sensors, and innovative technologies. Data acquisition and Transmission are highlights of the Internet Connectivity's effects. It provides the pathway for data to be transmitted in real-time or near real-time to central servers, cloud

platforms, or other connected devices. The constant flow of data is ensured as it is essential for monitoring, analysis, and control. Also, data analytics and Insights must be studied (Admin, 2024). This concept turns raw data into actionable intelligence, which Cloud platforms and advanced analytics use to communicate with each other to optimize performance and provide valuable insights. Lastly, internet connectivity on IoT also serves its purpose on the enhanced efficiency and energy management towards Smart grids, in which the researchers have built a comprehensive understanding of the following research question.

What improvements have been implemented in smart grid technologies and operations as a direct result of Internet integration. Smart grids are electricity networks that use digital technologies, sensors, and software to better match the supply and demand of electricity in real time. It minimizes costs and maintains the stability and reliability of the grid (Smart Grids, n.d.). According to Khare (2024), the Internet's integration plays a role in conserving electricity while providing cost-effective distribution of electrical energy. Economics has also been modernized, ensuring benefits for both customers and service providers. Smart grids can also now enable the monitoring of energy flows and adjustment to variations in power requirements and supply in real time. The researchers believed that real-time monitoring has always been a crucial effect ever since the integration of the Internet on Smart grids. Aside from that, previous security concerns in smart grids have already been solved due to the implementation of cutting-edge technologies like the IoT. Which is utilized for renewable energy resources, improving performance and efficiency in a variety of ways, ultimately for the benefit of the consumers and stakeholders.

III. Summary

The Internet's transformational power in the field of electrical engineering is examined in this research paper, specifically through the integration of Smart Grid and Internet of Things (IoT) technologies. Real-time data collection, sharing, and analysis are made possible by the Internet's connectivity to devices equipped with sensors and software. By improving energy efficiency, dependability, security, and sustainability, these capabilities are being used to transform Electrical Power and Energy Systems (EPES).

The paper addresses three core questions:

- a. **How the Internet enhances modern electrical systems** – by enabling smarter, more distributed energy management for sustainable development.
- b. **How IoT applications benefit from Internet connectivity** – with real-time monitoring, control, and cyber-aware systems that transform traditional EPES into intelligent, cyber-enabled infrastructures.
- c. **How smart grid technologies improve with Internet integration** – through advanced automation, faster response to outages, and optimized energy distribution.

IV. Conclusion

To conclude, the development of intelligent and networked systems is made possible by the Internet, which is essential to the advancement of electrical engineering. With the help of IoT and Smart Grid technologies, the Internet is revolutionizing electrical engineering and spurring innovation. Significant advancements in the production, distribution, and management of power have resulted from the combination of IoT and smart grid technology. By meeting the demands of contemporary societies and promoting worldwide technological advancement, these technologies help to build a more resilient, efficient, and sustainable energy future. The partnership between electrical engineering and digital connectivity will become more and more important as technology develops, helping to create smart communities and promote sustainable development globally.

References

Admin, L. (2024, July 23). Revolutionizing Electrical Systems: The Power of IoT Devices.

Lyter.

<https://lyterworld.com/revolutionizing-electrical-systems-the-power-of-iot-devices/>

Connolly, C. (2024, May 24). The Power of Connection: Exploring the Impact of Technology on Communication Across Borders. *Medium.*

<https://medium.com/@ciaranpconnolly/the-power-of-connection-exploring-the-impact-of-technology-on-communication-across-borders-02d4c9d5a549>

(PDF) *Energy Internet, the Future Electricity System: Overview, Concept, Model Structure, and Mechanism.* (n.d.). Retrieved April 7, 2025, from

https://www.researchgate.net/publication/343696094_Energy_Internet_the_Future_Electricity_System_Overview_Concept_Model_Structure_and_Mechanism

Review of Big Data Analytics for Smart Electrical Energy Systems. (n.d.). Retrieved April 7, 2025, from <https://www.mdpi.com/1996-1073/16/8/3581>

Review of Internet of Things (IoT) in Electric Power and Energy Systems | IEEE Journals & Magazine | IEEE Xplore. (n.d.). Retrieved April 7, 2025, from

<https://ieeexplore.ieee.org/document/8281479>

Smart grids. (n.d.). IEA. Retrieved April 7, 2025, from

<https://www.iea.org/energy-system/electricity/smart-grids>