Editorial

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IoT-enabled Industrial Wireless Sensor Networks for Next Generation Smart Grid Industry 4.0

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THE existing complex and aging electricity grid systems infrastructure due to lack of the user utility interaction and one-way power flow is suffering from fraud detection, distribution automation, overload conditions, power quality issues, peak load management, energy loss, and power fault diagnostics [1]. To meet the 21st-century energy requirements, next-generation power grid is envisioned to fully address these concerns in a sophisticated manner.

Recently, the rise of new digital industrial technology Internet-of-Thing (IoT) and Industrial Wireless Sensor Networks (IWSNs)-based networking systems introduces the fourth stage of industrialization, commonly known as Industry 4.0 [2-3]. Recently, Industry 4.0, has lately gained a lot of interest from researchers, manufacturers, and application developers. Industry 4.0 will make it possible to produce higher-quality goods at reduced costs due to timely gathering and analyzing data across machines. This will increase manufacturing productivity and faster industrial growth in a more flexible manner which results in more economic benefits. This economics shift, in turn, will ultimately change the profile of people due to changing the competitiveness of companies and regions in the world.

The wired or wirelessly integration of various components inside a factory to implement a flexible and reconfigurable manufacturing system, i.e., smart factory, is one of the key features of Industry 4.0. In Industry 4.0, the wireless or wired connected systems located in different remote places can interact with one another using standard internet-based protocols and analyze data to predict failure, configure themselves, and adapt to changes. Thus resulting in Intranet or Internet-of-Things. Currently, within factories, most devices are wired connected working over industrial protocols for reliable automation and systems control in a sophisticated manner. However, the wireless infrastructure-based solutions are increasingly popular and playing a complementary role to wired solutions [5]. The industrial wireless network is the key technology enabling the deployment of Industry 4.0 since it can offer a reduction in energy consumption, increase economic benefits with least maintenance and breakdowns, and enable smart production. This does not only affect machine-to-machine communication but will also have far-reaching consequences for the interplay of humans and technology.

In the context of smart grid industry (SGI) 4.0, the cooperative communication requirement is focused on multiple factors such as reliability, latency, scalability especially for a very large area of coverage and longevity of communicating devices [6]. The factors accelerating the adoption of IWSNs alternatives to wired networks.

The IWSNs can significantly improve product quality, streamline operations, speed up production, make installation easier, increase the flexibility and reduce expenditure for the infrastructure in the SGI 4.0. The potential applications of IWSNs in the SGI 4.0, includes dynamic pricing, advanced metering infrastructure, overhead transmission line monitoring, distribution automation, outage management, load control, demand response, substation automation, and energy management [7]. Importantly, all these applications would lead to new products, processes, and services, improving industrial efficiency and use of sustainable energy resources. At the same time, it would ensure the reliability of the electric power infrastructure, helping to improve the daily lives of ordinary citizens while providing a competitive edge for in the fourth generation global marketplace. The realization of all these applications directly depends on reliable and efficient communication capabilities of the deployed network in the smart grid.

However, recent field tests conducted have shown that the static wireless links have varying link qualities and high packet loss rates for various wireless sensor network-based smart grid applications. This is due to equipment noise, electromagnetic interference, multipath, obstructions, and fading effects in the power grid [8]. This leads to excessive corrupted data packets, communication delay and computational complexity for various smart grid applications. For SGI 4.0 to come true a reliable, accurate, robust monitoring and real-time diagnosis IWSNs-based communication framework is essential. Thus, designing a highly reliable and self-healing industrial communication system that rapidly responds to real-time events appropriately and, consequently is still a challenging issue for various smart grid applications in order to provision SGI 4.0.

With regards,
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