Things Software-Defined Network

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The Industrial Internet of Things (IIoT) network generates great economic benefits in processes, system installation, maintenance, reliability, scalability, and interoperability. Wireless sensor networks (WSNs) allow the IIoT network to collect, process, and share data of different parameters among Industrial IoT sense Node (IISN). ESP8266 are IISNs connected to the Internet by means of a hub to share their information. In this article, a light-diffusion algorithm in WSN to connect all the IISNs is designed, based on the Peano fractal and swarm intelligence, i.e., without using a hub, simply sharing parameters with two adjacent IINSs, assuming that any IISN knows the parameters of the rest of these devices, even if they are not adjacent. We simulated the performance of our algorithm and compared it with other state-of-the-art protocols, finding that our proposal generates a longer lifetime of the IIoT network when few IISNs were connected. Thus, there is a saving-energy of approximately 5% but with 64 nodes there is a saving of more than 20%, because the IIoT network can grow in a $3n$ way and the proposed topology does not impact in a linear way but $\log 3$, which balances energy consumption throughout the IIoT network.

Keywords: energy-efficient systems ; industrial Internet of things ; software-defined network

1. Introduction

Advances in technology at different times have given rise to three industrial revolutions, communication systems, intelligent robots, and the Internet of Things (IoT), which are thought to lead humanity to the fourth-industrial revolution by connecting devices, people, data, and processes. IoT is a new generation of networks made up of several elements for the identification, perception, communication, computing, services, and semantics of the information obtained from the environment, allowing connectivity between the digital and the physical world using different technologies [1][2].

In 2020, IoT is expected to provide a huge amount of intelligence available in the cloud to billions of mobile devices, delivering an enormous amount of new values with more than 55 million applications available to almost any human. This implies an interconnection of four million people over the world [3]. This has had a strong impact on the environment that surrounds people both in households (IoT) and industry (Industrial Internet of Things (IIoT)). The latter combines autonomous and intelligent machines with advanced predictive analytics as well as gets information from humans and machines collaboration, yielding improvements in productivity, efficiency, and reliability, which all together give rise to a communication infrastructure that allows each device to be accessible in a barrier-free context without sacrificing integrity and information security [4].

One fundamental technology for IIoT performance is Wireless Sensor Networks (WSNs) as they permit collecting, processing, and sharing data of different natures along the whole network. WSNs have been used in applications such as healthcare, monitoring of the environment or traffic, and industry, among others [5]. In IIoT, on the one hand, connected devices are restricted in terms of power supply, training factor, external wiring, computing power, bandwidth, memory, and storage. Thus, it is necessary to determine the points where the sensors are placed to avoid lack of connectivity among devices [6].

On the other hand, in a plant distribution, where an IIoT network is located with a WiFi access point (CN), it is possible to connect all devices to the Internet or an intranet as the hub node. Therefore, if an IIoT Sensor Node (IISN) seeks to share parameters with another one, they must do so by connecting to the CN first.

2. Conclusion

Therefore, this entry proposes an algorithm that effectively allows the transmission and distribution of parameters in all devices connected to WSN. This makes it necessary to use many networked sensors to obtain information in real time and, consequently, an efficient IIoT network, which in turn allows the protocol proposed in this work to be applied in an industrial plant.

References

1. Arshad, R.; Zahoor, S.; Shah, M.A.; Wahid, A.; Yu, H. Green IoT: An Investigation on Energy Saving Practices for 2020 and Beyond. IEEE Access 2017, 5, 15667–15681.
2. Hossein Motlagh, N.; Mohammadrezaei, M.; Hunt, J.; Zakeri, B. Internet of Things (IoT) and the Energy Sector. Energies 2020, 13, 494.
3. Moreno, J.; Morales, O.; Tejeida, R.; Posadas, J.; Quintana, H.; Sidorov, G. Distributed Learning Fractal Algorithm for Optimizing a Centralized Control Topology of Wireless Sensor Network Based on the Hilbert Curve L-System. Sensors 2019, 19, 1442.
4. Dobrescu, R. Perspectives of developing Industrial Internet. Ann. Acad. Rom. Sci. Ser. Sci. Technol. Inf. 2018, 11, 35–46.
5. Long, N.B.; Tran-Dang, H.; Kim, D. Energy-Aware Real-Time Routing for Large-Scale Industrial Internet of Things. IEEE Internet Things J. 2018, 5, 2190–2199.
6. Iwanicki, K. A Distributed Systems Perspective on Industrial IoT. In Proceedings of the 2018 IEEE 38th International Conference on Distributed Computing Systems (ICDCS), Vienna, Austria, 2–6 July 2018; pp. 1164–1170.