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RECENT ADVANCES IN GREEN INDUSTRIAL NETWORKING

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Due to the explosive increase in energy usage, the development of green and low-carbon economy has recently become a hot issue in the industry. Addressing such a key problem will hopefully allow us to reach the realization of sustainable development. We believe that networking technologies will be critical and will greatly contribute to achieving large-scale energy savings in all areas of the industrial productions. In addition, the role of green industrial networking technologies includes not only energy savings in products and services, but also enabling low-carbon emissions in other industries. The need for green industrial networking technologies has been recognized as a challenge during the last few years by our research communities. However, many challenges still remain to be addressed.

After a rigorous review process, nine papers have been selected for this Feature Topic (FT), which covers a wide range of perspectives. The first paper, “Green Alarm Systems Driven by Emergencies in Industrial Wireless Sensor Networks”, first presents a tracking module to continuously monitor emergency events. Then, a sleeping schedule is employed to reduce energy consumption of sensor nodes. Finally, the Security Sector which consists of an efficient data technique, decision level data fusion and data query technique is proposed to process emergency data and further evaluate emergency situations.

In the second paper “Toxic Gas Boundary Area Detection in Large-scale Petrochemical Plants with Industrial Wireless Sensor Networks”, the authors overview the boundary detection of continuous object, and propose a novel boundary area detection technique based on planarization algorithms, to ensure a safe boundary area rather than only detecting the boundary of the toxic gas.

In the third paper “Green and Reliable Software-Defined Industrial Networks”, a new architecture of software-defined industrial networks (SDIN) is proposed. Simulation results show that a packet delivery rate of 100% and a maximum packet delay less than 10 ms can be achieved. More importantly, compared with traditional architecture, 18%-less energy consumption can be achieved.

The fourth paper “Green Industrial Networking: Recent Advances, Taxonomy, and Open Research Challenges” provides a detail survey of recent research efforts carried out in the areas of industrial and green networking. To encourage researchers to come up with new ideas to build a green industrial network, the energy efficient approaches that can be leveraged to enable the green industrial networking are further discussed.

Next, the paper entitled “Key Design of Driving Industry 4.0: Joint Energy-Efficient Deployment and Scheduling in Group-based Industrial Wireless Sensor Networks” attempts to save energy consumption of GIWSNs by using a hybrid harmony search and genetic algorithm. It incorporates node deployment and sleep scheduling problems. Initially, an optimal deployment of sensor nodes is determined with consideration of their sleep schedules. Then, for the later time periods, the sleep time of sensor nodes is scheduled to save energy consumption and maximize the network lifetime.

In the sixth paper “Embracing Big Data with Compressive Sensing: A Green Approach in Industrial Wireless Networks”, with the aim to save energy consumption in big data based smart industries, a green collection framework is proposed. The redundant information is no longer collected and transmitted. Thus, a large amount of wireless transmissions are cancelled, which dramatically reduces the number of transmissions and decreases the energy consumption for data transmission.

Vehicular delay tolerant networks (VDTNs) are investigated for Smart Grid Data transmission in the next paper “Vehicular Delay Tolerant Networks for Smart Grid Data Management using Mobile Edge Computing”. The goal is to reduce transmission delay during overloading and congestion situations. In addition, to deal with the high mobility of vehicles, the mobile edge computing algorithm is proposed. Simulations show that the proposed solution outperforms existing state-of-the-art solutions in terms of network throughput, response time and transmission delay.

The potential gain when applying energy systems’ technologies into manufacturing systems is addressed in the next paper “Towards Dynamic Energy Management for Green Manufacturing Systems”. Energy management mechanisms for manufacturing systems are explored. First, existing techniques that can be applied to current green manufacturing are analyzed. Then, based on a case study, a simple approximation of the percentage of energy saving for the peak and the total amount of load is derived.

The last paper in this FT, “On the Design of Energy-Efficient Protocols for Underwater Sensor Networks”, provides a top-down thorough review and a detail study on the emerging strategies and methodologies on the design of energy-efficient underwater sensor networks. The effects on mitigating the drawbacks of underwater acoustic communication are further discussed. Finally, existing problems and potential research directions are presented.

In closing, we sincerely would like to thank all the people who significantly contributed to this FT, including the contributing authors, the anonymous reviewers, and the IEEE Communications Magazine publications staff. We believe that the research findings presented in this FT will stimulate further research and development ideas in green industrial networking.

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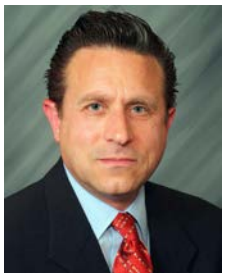

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