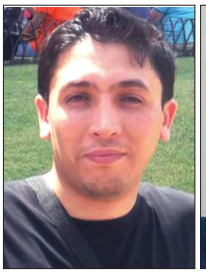
ADVANCED INDUSTRIAL WIRELESS SENSOR NETWORKS AND INTELLIGENT IOT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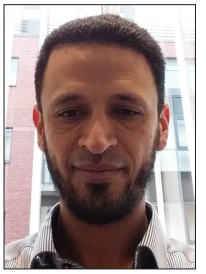
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Over the past decade, the fast expansion of the Internet of Things (IoT) paradigm and wireless communication technologies has raised many scientific and engineering challenges that call for ingenious research efforts from both academia and industry. The IoT paradigm now covers several technologies beyond RFID and wireless sensor networks (WSNs). In fact, the number of potential application fields has already exceeded expectations. According to Cisco IBSG, more than 50 billion devices are expected to be connected to the Internet by 2020, with around 20 percent from the industry sector. Therefore, integrating the IoT concept and industrial WSNs (IWSNs) is an attractive choice for industrial processes, which may optimize operational efficiency, automation, maintenance, and rationalization. Moreover, IoT ensures large-scale interconnection between machines, computers, and people, enabling intelligent industrial operations.

This emergent technological evolution has led to what has become the Industrial IoT (IIoT). IIoT will bring promising opportunities, along with new challenges. Indeed, IIoT is currently in its premature stage, and several problems need to be addressed properly. Security and reliability represent two of the main concerns that might restrain the full benefit of the IIoT, and then come the robustness and safety of the manufacturing process. Indeed, as the numbers of industrial sensors and RFID systems that use the Internet infrastructure increase, the attack vulnerability will expand. IIoT systems are often used in critical applications where security threats may provoke physical damage and even threaten human lives. Therefore, adapting existing information security concepts to IIoT systems is not straightforward and might be inefficient. Alongside the security concern, reliability is rated as a top design issue. Indeed, IIoT systems are supposed to be operable for a long time period, and should overcome data transmission and link quality problems while providing efficient data loss recovery solutions.

Data collection and processing represent another important challenge for IIoT. The critical industrial applications and the large amount of heterogeneous data sources accentuate the need for efficient data analytics approaches. Indeed, recent research works have demonstrated that applying big data solutions significantly outperforms companies' throughput by allowing more information and process control. The manufacturing productivity can also be outperformed by adopting intelligent resource management schemes that allocate the available resources based on dynamic scheduling, which reduces production costs and resource consumption. However, most existing resource management solutions are inappropriate for IIoT systems, which introduce more complexity and require smart load balancing, and distributed and self-organized-operations. Therefore, resource management is considered as an add-on challenge for efficient IIoT systems.

On the other hand, IIoT systems combine different kinds of networks, such as industrial WSNs (IWSNs) and wired/wireless fieldbus networks (WFNs), with dissimilar network requirements and constraints (data transmitting rate, energy consumption, quality of service, etc.). This brings another important IIoT key challenge where an efficient integration solution must be investigated for better network connectivity and data transmission.

In this Feature Topic, we address the major new challenges faced by IIoT systems and compile the latest proposed solutions in this field. Eight outstanding papers were selected after a rigorous review process, giving an overview of recent IIoT solutions. The first three articles address the security and reliability challenges in IIoT. Chunsheng

et al. investigate the trust-based communication for IIoT and propose three types of trust-based communication mechanisms for sensor-cloud. Next, Li *et al.* propose a signal-to-noise ratio (SNR)-assured anti-jamming clustering routing (SA-AJCR) protocol to address the problem of data transmission in an environment of high ambient noise and complex electromagnetic interference. In the third article, a multi-level distributed denial of service (DDoS) mitigation framework has been introduced by Qiao *et al.* to defend IIoT systems against DDoS attacks.

The fourth and fifth articles address the data collection and processing issues in IIoT. In the fourth article, Muhammad *et al.* investigate the prospects and challenges of big data analytics in IIoT. They also introduce a concentric computing model to cope with the IIoT challenges. Next, Kuljeet *et al.* present SDN-based edge-cloud interplay to handle streaming big data in the IIoT environment, wherein software defined networking (SDN) provides efficient middleware support.

The sixth article, "Toward Dynamic Resources Management for IoT-Based Manufacturing," deals with the resource management concern in IIoT and proposes an efficient approach for achieving dynamic resource management in the intelligent manufacturing context through the state-of-the-art scheduling methodology.

The last two articles in this Feature Topic point out the integration problem in IIoT. First, Navarro *et al.* introduce a solution to seamlessly integrate LoRaWAN, an open and standardized low power wide area network (LPWAN) technology, with fourth/fifth generation (4G/5G) mobile networks, thus allowing mobile network operators to reutilize their current infrastructures. Finally, Yun *et al.* propose a hierarchical data transmission architecture to integrate WFNs, WSNs, and mobile intelligence together within a smart factory environment by selecting different data transmission modes according to different data priorities.

BIOGRAPHIES

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