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A review of industrial wireless communications, challenges, and solutions: A cognitive radio approach

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Abstract

Integral and crucial to performance of wireless sensor networks (WSNs), and specifically industrial wireless sensor network (IWSN) is stable, robust, reliable, and ubiquitous communications system. Though, wired communications system is suitable for industrial communications and is resilient to shadowing and multipath fading effects of industrial-WSN environments, yet its wireless counterpart is a much preferred industrial communications technology due to reduced cost and high flexibility which it offers in comparison to wired communications. However, overcrowding of the industrial, scientific, and medical band, where IWSN is deployed together with other heterogeneous technologies, as well as resultant scarcity of usable frequency spectrum has restrained exclusive application of wireless technology for industrial communications. Nonetheless, cognitive radio (CR) has ability to increase spectrum utilization efficiency and channel capacity for industrial wireless communications (IWC) through opportunistic/dynamic spectrum access (DSA) technique. In this review article, we examine how DSA can benefit IWC through exploitation of new perspectives of white space definitions in the licensed bands as well as unlicensed bands. While discussing the potential of DSA for IWC, we have considered the unique characteristics of IWC as well as technical challenges and issues imposed by industrial-WSN. Accordingly, we have suggested and proffered appropriate CR-based solutions in mitigating some of the challenges where necessary.

1 | INTRODUCTION

Industrial wireless communication (IWC) is the communication system (hardware and software) of wireless communication networks. These systems are typically deployed in specific application areas that include industrial and process automation, avionics, and automotive, as well as control applications.[1] In addition, IWC has unique characteristics with specific challenges. For instance, the IWC has the ability to wirelessly connect several hundred sensors and devices. Undoubtedly, this ability imposes an inimitable requirement of delivering massive network throughput at guaranteed high level of quality of services (QoS).[2] For this reason, a major concern among industrial communication stakeholders has been whether wireless technology can be the exclusive tools for industrial communication revolution. Or, if it will only complement its wired counterpart in the advancements of IWC. Nonetheless, wireless technology has driven the telecommunication and information market in the last few years as a major competitor.[1] Still, from an industrial perspective, despite the huge benefits of wireless technology, it has not yet achieved the estimated wide deployment.

