


Chapter 8

Wireless Sensor Networks for Intelligent Control Systems in Smart Environments

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ABSTRACT

Wireless sensor networks (WSNs) are widely accepted technology for developing smart control systems in smart environments. These networks support real-time sensing, getting information, and making decision through incorporation of in-

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telligent sensing, communication, and computation technologies. This chapter discusses the WSNs design, deployment and opportunity area in intelligent control systems such as home, city, healthcare and industries. A literature review provided here points to important advancements, issues, and research opportunities in the field. The chapter introduces a new WSN-based control framework that aims at tackling fundamental issues like limited energy, delay and scalability. Conclusion: A performance evaluation conducted on simulated and real case studies shows a substantial increase in the reliability and effectiveness of the proposed system. The discussion also points out several emerging technologies like Artificial intelligence, block chain, and ultra-low-power nodes that can even improve the performance of WSNs in smart environment.

INTRODUCTION

Wireless Sensor Networks (WSNs) have transformed the manner in which data acquisition, processing, and communication occur in existing technological systems. A WSN mainly comprises sensor nodes in a geographical area containing a sensing module, a processing module, a communication module and a power unit. These nodes are hence synchronous in sensing physical or environmentally-caressed parameters like temperature, humidity, lighting and pressure (J. Wu and H. Qin, 2008). Data acquired is transmitted through wireless path to a base station or gateway where it is analyzed and used in decision making. Based on the architecture, WSN can further be divided into two subclasses: flat architecture and the hierarchical architecture. In flat architectures, all nodes possess the same prominence but in hierarchical architectures like cluster based systems; the sensor nodes are grouped to boost efficiency with energy related to information consolidation and conveyance (S. H. Baeg and J. H. Park, 2007). Therefore, the key benefits of WSNs like scalability factor, flexibility in implementing new revisions, and real time monitoring have positioned WSNs element of intelligent control systems.

Smart environments are therefore a radical shift from conventional human environment interactions. As physical environments integrated with sensors, actuators and intelligent systems, smart environments are intended to improve comfort, efficiency, safety (C. Li and K. Dong, 2019). The applications include; homes with automatic lighting and energy control, smart city with smart traffic system and waste management, the health facilities where patients'; monitoring and diagnosis can be done from a distance. Some of the uses in industrial areas are also emerging where WSNs used for predicting the time for maintenance of machinery (R. Wang and J. Morris, 2008), for optimizing different processes in manufacturing industries and factories, and for safety monitoring in plants and factories (N. D. Thokare and

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