

Chapter 1

Introduction and Overview of Wireless Sensor Networks

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ABSTRACT

Wireless Sensor Networks are an exciting technology that can solve a variety of applications. Wireless sensor networks, coupled with the efficient delivery of sensed information, could provide great benefits to society. The surroundings can be the physical world, a biological system, or an Information Technology (IT) framework. The use of wireless sensors allows for fast setting up of sensing tools and access to locations that would not be realistic if cables were attached. This chapter provides a brief technical introduction to wireless sensor networks, with background and history and an understanding of sensor networks, design constraints, security issues, and a few applications in which wireless sensor networks are enabling. A brief discussion of the network topologies that apply to wireless sensor networks are also discussed.

INTRODUCTION

A sensor network is an infrastructure comprised of sensing (measuring), computing, and communication elements that gives an administrator the ability to instrument, observe, and react to events and phenomena in a particular environment. The supervisor typically is a civil, governmental, com-

mercial, or industrial body. The environment can be the corporal world, a biological system, or an information technology (IT) structure.

Network(ed) sensor systems are seen by viewers as a vital technology that will practice major exploitation in the next few years for a surplus of applications, space study, vehicular movement and critical movement detection are few examples of its applications.

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Today's wireless sensor networks are made up of a big number of inexpensive devices that are networked via low power wireless communications. It is the networking potential that basically distinguishes a sensor network from a mere collection of sensors, by enabling cooperation, coordination, and collaboration among sensor assets (Swami, Zhao, & Hong, 2007).

Whilst several sensors can be connected to controllers and processing stations directly (e.g., using local area networks), a large number of sensors send the gathered data wirelessly to a centralized processing station. This is needed since many network applications require hundreds or thousands of sensor nodes, often set up in remote and unreachable areas. Thus, a wireless sensor is equipped with not only a sensing element, but also on-board processing, communication, and storage capabilities. With these developments, a sensor node is usually responsible for data collection, for in-network analysis, correlation, and fusion of its own sensor data and data from other sensor nodes. Many sensors collectively monitoring large physical environments, form a wireless sensor network (WSN). Using their wireless radios, Sensor nodes communicate with each other and also with a base station (BS) allowing them to

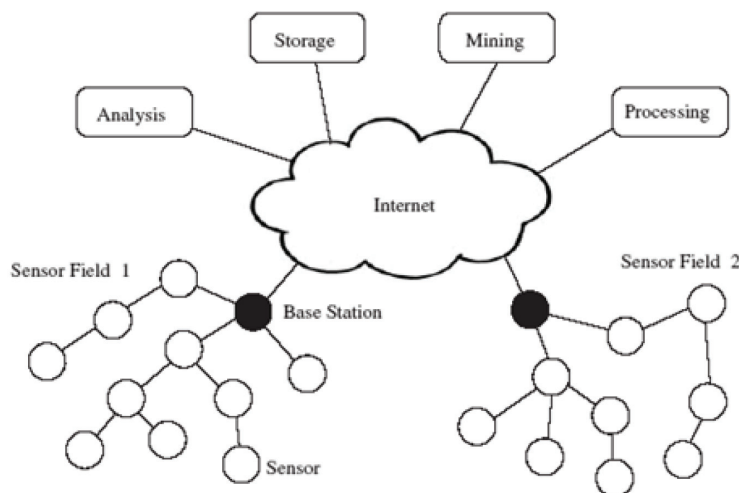
broadcast their sensor data to remote processing, visualization, analysis, and storage systems. For example, Figure 1 shows two sensor fields monitoring two different geographic regions and connecting to the Internet using their base stations (Dargie & Poellabauer, 2010).

The sensing and control technology comprises electric and magnetic field sensors; radio-wave frequency sensors; optical, electro-optic-, and infrared sensors; radars; lasers; location/navigation sensors; seismic and pressure-wave sensors; environmental parameter sensors (e.g., wind, humidity, heat); and biochemical national security-oriented sensors. Today's sensors can be described as "smart" inexpensive devices equipped with multiple onboard sensing elements; they are low-cost low-power multifunctional nodes that are logically homed to a central sink node (Sohraby, Minoli, & Znati, 2007).

BACKGROUND AND HISTORY OF WIRELESS SENSOR NETWORK

A Sensor is a device that uses a sensing technique to collect information about a physical entity or process, including the occurrence of actions such

Figure 1. Wireless sensor networks (Dargie & Poellabauer, 2010)



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