

Research Issues in Wireless

Communications and Networking

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CHAPTER 18

PRACTICAL APPLICATIONS AND DESIGN CHALLENGES OF WIRELESS HETEROGENEOUS SENSOR NETWORKS

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18.1 INTRODUCTION

18.1.1 Conceptual Definition of Wireless Heterogeneous Sensor Networks

Heterogeneous, {hetero + genos 'type', from Greek}, is defined in Oxford Advanced Learner's Dictionary as "consisting of many different kinds of people or things" and defined in Longman Dictionary as "consisting of parts or members that are very different from each other."

The design of interconnected nodes may be heterogeneous or homogeneous with the aim of catering for the design demands and purpose of various wireless applications. The heterogeneity or homogeneity of the interconnected nodes designed is with respect to their ability to sense events, transmit desired sensed data, computing and processing user queries, managing of energy resources and minimizing the complexity of the hardware design. The participating nodes in heterogeneous networks may be different in many aspects. They could have different transmission radius, various kind of sensing units, different hardware power, and different power supply. Nodes with lesser energy resources serve as sensing nodes to collect physical information while nodes with more energy resources serve as data sinks. Heterogeneity could be viewed either in terms of capability or functionality of sensor nodes. In homogeneous networks, all the participating and active nodes are alike in nature and the same transmit power level is used for their operation. These alike nodes are inherently built with the same sensing units to track a single event [5, 9, 10]. Cluster heads and cluster members have different tasks in clustered sensor networks in the course of data delivering to the base station. An example is a tiered sensor network architecture where 802.11 mesh network comprise of high-end nodes, such as Intel XScale nodes which are deployed on a plain WSN field.

In this chapter, A network which comprises of various types of sensors with tunable transmits power level, various sensing units, and various power resources is being refer to as a wireless heterogeneous sensor network. At this juncture, it must be mentioned that this definition does not include wireless networks that comprises of different subsystems and employ various access technologies.

Heterogeneous sensor network is a promising architecture that caters for various applications in the area of environmental monitoring, unobtrusive healthcare, battle field surveillance, biochemical detection, smart home, and industrial monitoring. For example, heterogeneous wireless sensors were employed for future intelligent combat system in the air (Unmanned Airplanes), under the water and on the ground (Unmanned Underwater Vehicles).

A wireless heterogeneous sensor network for biomedical applications will be discussed in the next subsection with the aim of providing a detailed, comprehensive and illustrative explanation.

18.1.2 Heterogeneity of Biomedical Sensor Networks: A Practical Application Example