Chapter 75
Energy Efficient Data Query, Processing and Routing Techniques for Green Wireless Sensor Networks

Afshin Behzadan
Ryerson University, Canada

Alagan Anpalagan
Ryerson University, Canada

ABSTRACT

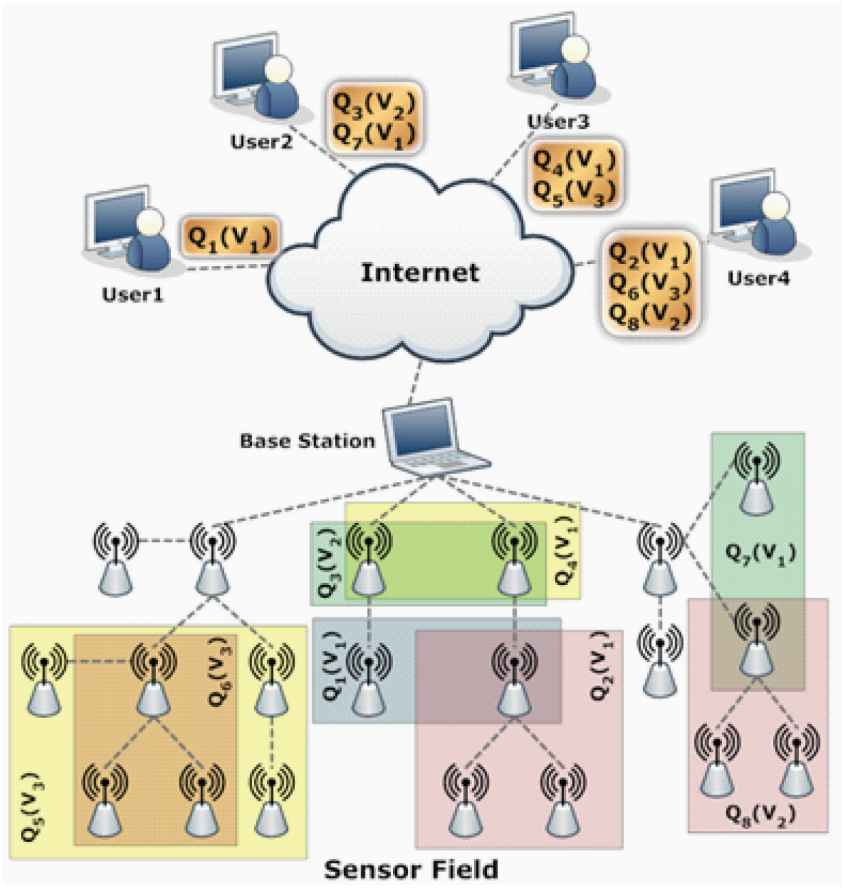
While wireless sensor networking plays a critical role in many important applications, it also contributes to the energy footprint - which continues to increase with the proliferation of wireless devices and networks worldwide. Energy-efficiency becomes a major concern in the development of next generation sensor systems and networks. This chapter discusses data management techniques from energy efficiency point of view for green wireless sensor networks.

INTRODUCTION

Wireless sensor networks (WSNs) usually contain power-constraint nodes that require energy-efficient (a.k.a. green) transmission techniques, resource sharing algorithms and networking protocols (see an example in Figure 1). Each WNS node consists of one or more sensors for sensing the surrounding environment. Sensors are small and usually inexpensive, and have limited processing resources. Sensors sense and gather information from the environment, based on the decision guidelines provided by users in forms of queries. Acquired data are transmitted, via embedded radio in nodes, among nodes in a multi-hop way and finally reach the root, i.e., the base station (Estrin, Girod, Pottie, & Srivastava, May 2001).

DOI: 10.4018/978-1-4666-4852-4.ch075

Figure 1. A wireless sensor network scheme



Usually, a WSN has no infrastructure and has an ad-hoc topology. This topology is due to the fact that sensor networks are typically deployed in hard-to-access environment. Obstructions in the environment can limit the wireless communication between nodes, affecting the network connectivity. These networks have many applications, such as military target tracking and surveillance, natural disaster relief, biomedical health monitoring and hazardous environment exploration and sensing.

Data Query, Processing, and Routing

Data sensing and transmitting consume a considerable portion of nodes' energy which is limited and vital (Potdar, Sharif, & Chang, May 2009). The main goal of *query processing* is to answer queries posed by users, while decreasing the energy consumption and prolonging network lifetime are also considered (Gehrke & Madden, March 2004). Queries are declared by users to the network and the network returns the required data by using the query processing engine (Madden, Franklin, Hellerstein, & Hong, Tinydb, An acquisitional query processing system for sensor networks, March 2005). A single query processing scheme assumes one active query in the network. However, in reality, different users may connect to the base station and query various data. In many cases, although different users may have different requests, their requests are somewhat similar. Thus, assigning a network to a single query and running queries sequentially not only