Chapter 1
(SET) Smart Energy Management and Throughput Maximization:
A New Routing Protocol for WSNs

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ABSTRACT

Energy efficiency and throughput are critical factors in the design routing protocols of WSNs. Many routing protocols based on clustering algorithm have been proposed. Current clustering algorithms often use cluster head selection and cluster formation to reduce energy consumption and maximize throughput in WSNs. In this chapter, the authors present a new routing protocol based on smart energy management and throughput maximization for clustered WSNs. The main objective of this protocol is to solve the constraint of closest sensors to the base station which consume relatively more energy in sensed information traffics, and also decrease workload on CHs. This approach divides network field into free area which contains the closest sensors to the base station that communicate directly with, and clustered area which contains the sensors that transmit data to the base station through cluster head. So due to the sensors that communicate directly to the base station, the load on cluster heads is decreased. Thus, the cluster heads consume less energy causing the increase of network lifetime.

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INTRODUCTION

As it is known in recent years, impressive progress and extensive achievements in communication, computation, and surveillance fields have led to the development of WSNs technologies. Based on Akyildiz et al. (2002), WSNs have been used in many applications in several domains such as Healthcare applications, Environment monitoring applications, Agriculture applications, and Military applications. The energy constraint in WSNs is a very crucial issue, as sensors are usually functioned on limited and irreplaceable battery energy. Thus, the increasing network lifetime and throughput depends on efficient management of sensing sensor energy resources and topology of networks. Such disadvantages combined with a random distribution of large number of sensors and limited battery capacity of sensors, algorithms of routing in WSNs become more challenging compared to ad hoc networks refer Saleh et al. (2013). Thus, many routing protocols based on clustering algorithm have been proposed to reduce consumed energy in collecting and disseminating sensed data in WSNs. Clustering algorithm provides an effective way to extend the network lifetime of WSNs, the clustering operation is subdivided into two phases: setup phase and steady state phase. During the setup phase the cluster heads are selected and the clusters are organized. In steady state phase sensed data are transmitted from sensors to the base station through cluster heads which is already selected. Thus, the closest sensors to the base station consume more energy in information traffics and also workload on cluster heads relatively is increased, which leads to poor performance and decrease lifetime of clusters heads, so network lifetime of WSNs is decreased. To this end, energy in these sensor nodes is rare resource and must be managed in a smart manner. In this chapter the authors propose a new protocol based on smart energy management and throughput maximization for clustered WSNs, namely SET. The main goal of SET protocol is to maximize network lifetime and throughput by decreasing the workload on cluster heads in clustered WSNs which is decisive for application in various domains. After random deployment of sensors in network field, SET protocol forms two areas which are free area and clustered area. In free area where the base station is located the sensors (or closest sensors to the base station) send directly sensed data to the base station. Whereas in clustered area sensors are organized into clusters, each sensor is responsible to send data sensed to its respective cluster heads and cluster heads are responsible to forward the gathered sensed data to the base station. Therefore, in SET protocol the workload on cluster heads is decreased and number of packets successfully received at base station (throughput) is increased. SET routing protocol is employed for homogeneous and heterogeneous clustered WSNs. The sensors in SET are initially supplied with two energy levels. Thus, in this chapter the authors study impact of heterogeneity aware of sensors in terms of their energy level. In these network models there are three types of sensors