Chapter 24
Performance Improvement of Clustered WSN by Using Multi–Tier Clustering

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ABSTRACT

In the last few decades, the Wireless Sensor Network (WSN) paradigm has received huge interest from the industry and academia. Wireless sensor networking is used in various fields like weather monitoring, wildfire detection/monitoring, battlefield surveillance, security systems, military applications, etc. Moreover, various networking and technical issues still need to be addressed for successful deployment of WSN, especially power management. In this chapter, the various methods of saving energy in sensor nodes and a method by which energy can be saved are discussed with emphasis on various energy saving protocols and techniques, and the improvement in the Performance of Clustered WSN by using Multi-tier Clustering. By using a two-tier architecture in the clustering and operation of sensor nodes, an increase in the network lifetime of the WSN is gained. Since this clustering approach has better results in term of energy savings and organizing the network, the main objective of this chapter is to describe power management techniques, two-tier architecture, clustering approaches, and network models to save the energy of a sensor network.

1. INTRODUCTION

Networking is an important phenomenon for communication. Since a long time, wired network is used for communication. Wired network is considered to be more reliable and suitable. The main reason behind it was that we were more familiar to wired network in comparison to wireless. But in recent years, use of wireless network has increased dramatically. Different types of wireless networks such ad hoc networks, mesh networks and Wi-max etc. have come into existence since past few years (Goldsmith, 2005).

Wireless networks had a significant presence in the world as far back as World War II. Through the use of wireless networks, information could be sent overseas or behind enemy lines easily, efficiently and more reliably. Since then, wireless networks have continued to develop and their uses have grown significantly. Cellular phones are part of huge wireless network systems. People use these phones daily to communicate with one another. Sending information overseas is possible through wireless network systems using satellites and other signals to communicate across the world. Emergency services such as the police department utilize wireless networks to communicate important information quickly. People in business use wireless networks to send and share data quickly whether it be in a small office building or across the world (Kahn, Katz, & Pister, 1999; Cerpa, Elson, Estrin, Girod, Hamilton, & Zhao, 2001).

In recent time, a new application of wireless network known as sensor network has developed and used for a number of purposes. It is an efficient way of monitoring an area and receiving information. So a lot of research work is going on this field.

1.1 Wireless Network

Wireless network refers to any type of computer network that is wireless, and is commonly associated with a telecommunications network whose interconnections between nodes is implemented without the use of wires. Wireless telecommunications networks are generally implemented with some type of remote information transmission system that uses electromagnetic waves, such as radio waves, for the carrier and this implementation usually takes place at the physical level or "layer" of the network.

Important use for wireless networks is as an inexpensive and rapid way to be connected to the Internet in countries and regions where the telecom infrastructure is poor or there is a lack of resources, as in most developing countries. Compatibility issues also arise when dealing with wireless networks. Different components not manufactured by the same company may not work together, or might require extra work to fix these issues. Wireless networks are typically slower than those that are directly connected through an Ethernet cable.

A wireless network is more vulnerable, because anyone can try to break into a network broadcasting a signal. Many networks offer WEP - Wired Equivalent Privacy - security systems which have been found to be vulnerable to intrusion. Though WEP does block some intruders, the security problems have caused some businesses to stick with wired networks until security can be improved. Another type of security for wireless networks is WPA - Wi-Fi Protected Access. WPA provides more security to wireless networks than a WEP security set up. The use of firewalls will help with security breaches which can help to fix security problems in some wireless networks that are more vulnerable (Goldsmith, 2005; Meena, Singh, & Chandel, 2012).

There are various hazards also related to wireless network. But we are going to mainly focus on wireless sensor network in our chapter. We are going to describe mainly features of wireless sensor network.

1.2 Wireless Sensor Network

A wireless sensor network typically consists of a large number of inexpensive, small, low-power communication devices called sensor nodes and one or more computing centres. Advances in energy-efficient design and wireless technologies have enabled the manufacture of the small devices to support several important wireless applications, including real-time multimedia communication (Nikmard & Taherizadeh, 2010; Robinson, 1998), medical application, surveillance using WSNs and home networking applications (Agre & Clare,

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