Chapter 3
On Network Management of Wireless Sensor Networks: Challenges, Solutions and Research Trends

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ABSTRACT

Wireless sensor networks have become a popular research area of distributed computing. It is the emerging area of pervasive computing, for supporting daily life applications of human usage in future and could provide large amount of benefits to the society, by efficient delivery of sensed information. Network management of WSNs plays an important role for the efficient working of whole network and application. It is the research area that is recently gaining the attraction from research community. This chapter compiles some related information on the basis of studied literature regarding wireless sensors network management, including WSN background, issues and challenges, proposed solutions, and research trends.

INTRODUCTION

A WSN is a network of devices, called *nodes (stationary or moving)*, having sensing capabilities and deliver the information collected from the monitored field with the help of wireless links Buratti et al. (2009). Wireless sensor networks have attained considerable attention recently. Many researchers have attempted to improve wireless sensor networks' management efficiency. Wireless sensors networks can sense and monitor information from the physical world, and are used in the scientific, medical, and commercial domains (Ma et al. 2010; Jiang et al. 2007).

Supporting convenient and effective network management is crucial in wireless sensor net-

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works. Network management of WSNs play an important role for the efficient working of whole network and application (Zhang & Li 2009; Yu et al. 2006; Zhang, & Li 2008), because of having different architecture from normal data networks, it is more challenging task in WSNs (Buratti et al. 2009; Deb, Bhatnagar, & Nath, 2002; Zhang, Xu, & Sun, 2010). It is the research area that is recently gaining the attraction from research community (Buratti et al. 2009; Yu, Mokhtar, & Merabti, 2006; Li et al. 2005; Zhang, Xu, & Sun, 2010). Network management is the process that manages, monitor and control the network behavior. (Lee, Datta, & Oliver). Traditional network management techniques have become impractical for wireless sensor networks because of its unique network management requirements (Lee, Datta, & Oliver; Yu, Mokhtar, & Merabti, 2006). An efficient network management architecture is a challenge for proper working wireless sensor networks to support several sensor applications (Zhang, & Li, 2009; Yu, Mokhtar, & Merabti, 2006; Zhang, & Li, 2008; Frye, & Cheng, 2007; Townsend, & MicroStrain, 2004; Lee, Datta, & Oliver; Obaisat, & Braun, 2006; Ganesan et al. 2003; Zhang, Xu, & Sun, 2010).

This chapter aims at providing some relevant details regarding network management of wireless sensor networks. Objective is to provide the discussion regarding network management in perspective of wireless sensor networks' issues, challenges and proposed solutions.

BACKGROUND

Wireless sensor networks are increasingly gaining popularity today as a new category of networking technology because of their flexibility and adaptability in a variety of environments. Management of WSNs as a hot area of research these days has presented some significant management challenges to the research community, because of the unique characteristics of wireless sensor networks (Zhang, Xu, & Sun, 2010). Sensor network applications are diverse in their requirements, so research proved that network management architecture should be lightweight, robust, fault tolerant, adaptable, and scalable. Network management is the process that manages, monitor and control the network in terms of its behavior (Zhang, & Li, 2009; Lee, Datta, & Oliver). Function of the Network management system and protocol is to allow the sensor networks to self forming, self organization and self configuration in case of failures without having the prior knowledge of network topology (Frye, & Cheng, 2007: Zhang, & Li, 2008; Zhang, Xu & Gen 2010). In other words for wireless sensors networks, a network management system should provide a set of management functions for configuration, security, operation, administration and overall maintenance of sensor network elements and services (Lee, Datta, & Oliver). Several issues have been discussed that make the management of WSN a challenging task (Zhang, & Li, 2009; Yu, Mokhtar, & Merabti, 2006; Zhang, & Li, 2008; Li et al. 2005; Lee, Datta, & Oliver; Obaisat, & Braun, 2006; Ganesan et al. 2003) and authors also discussed the required design criteria for proposing an efficient management architecture/protocol for WSNs. (Zhang, & Li, 2009; Yu, Mokhtar, & Merabti, 2006; Zhang, & Li, 2008; Lee, et al. 2006; Obaisat, & Braun, 2006; Cerpa, et al. 2004)

Sensor network management is defined as a system or process for the management and coordination of sensor nodes in a dynamic and unsure environment to achieve specific objectives and perception performance with minimum energy (Li, et al. 2005). It is the research area that is recently gaining the attraction from research community (Li, et al. 2005; Yu, Mokhtar, & Merabti, 2006). Traditional network management techniques have become impractical for wireless sensor networks because of its unique network management requirements (Yu, Mokhtar, & Merabti, 2006; Lee, Datta, & Oliver). Efficient network management architecture is a challenge for proper working