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A Review Paper on Energy Efficient Routing in Wireless Sensor Networks

Jamna Kaur[1] , Rachna Rajput[2]

[1]Guru Kashi University, Department of CSE,
Talwandi Sabo, Punjab, India
jamnaparmarg7@gmail.com

[2]Guru Kashi University, Department of CSE,
Talwandi Sabo, Punjab, India
Rachna12cse@gmail.com

Abstract: ***The wireless sensor networks have been studied extensively in the recent years. Such networks are made of several thousand of sensors propagated in a geographical area. There are many different applications for such networks including military, environment monitoring, disaster, fire fighting and protection, and home applications. Sensors are very simple identical electronic devices equipped with a processor and small storage memory and a communication channel. The sensors can communicate to each other through wireless links, and most of the times we use radio frequency channels for the purpose of communication. The routing problem in the sensor networks has been studied by many researchers. Sequential Assignment Routing (SAR) is proposed in [5], and it takes into account the energy constraints by making a tree rooted in the central node. The tree starts to -grow toward the sensors on the paths with enough residual energy.***

Keywords: Energy efficient routing, Routing, Wireless sensor networks.

1. Introduction

WSN is a collection of wireless nodes with limited energy capabilities that may be mobile or stationary and are located randomly on a dynamically changing environment. The routing strategies selection is an important issue for the efficient delivery of the packets to their destination. Moreover, in such networks, the applied routing strategy should ensure the minimum of the energy consumption and hence maximization of the lifetime of the network [1]. One of the first WSNs was designed and developed in the middle of the 70s by the military and defense industries. WSNs were also used during the Vietnam War in order to support the detection of enemies in remote jungle areas. However, their implementation had several drawbacks including that the large size of the sensors, the energy they consume and the limited network capability. Since then, a lot of work on the WSNs field has been carried out resulting in the development of the WSNs on a wide variety of applications and systems with vastly varying requirements and characteristics. At the same time, various energy-efficient routing protocols have been designed and developed for WSNs in order to support efficient data delivery to their destination. Thus, each energy-efficient routing protocol may have specific characteristics depending on the application and network architecture. The WSNs may be used in a variety of everyday life activities or services. For example a common application of WSNs is for monitoring. In the area of monitoring, the WSN is deployed over a region in order to monitor some phenomenon. A practical use of such a network could be a military use of sensors to detect enemy intrusion. In case that the sensors detect an event (change on heat or on the blood pressure) then the event is immediately reported to the base station, which decides the appropriate action (send a message on the internet or to a satellite). A similar area of use may be the monitoring of the air pollution, where the WSNs are deployed in several cities to monitor the concentration of dangerous gases for citizens. Moreover, a WSN may be used for forest fires detection to control when a fire has started. The nodes will be equipped with sensors to control temperature, humidity and gases which are produced by fire in the trees or vegetation. In addition to the above, an important area of use is the healthcare sector. this area the WSNs may offer significant cost savings and enable new functionalities that will assist the elderly people living along in the house or people with chronic diseases on the daily activities. In wired systems, the installation of enough sensors is often limited by the cost of wiring. Previously inaccessible locations, rotating machinery, hazardous or restricted areas, and mobile assets can now be reached with wireless sensors. Moreover, the use of WSNs on agriculture may benefit the industry frees the farmer from the maintenance of wiring in a difficult environment. The gravity feed water systems can be monitored using pressure transmitters to monitor water tank levels, pumps can be controlled using wireless I/O devices and water use can be measured and wirelessly transmitted back to a central control center for billing. The water industry may be

benefited for power or data transmission can be monitored using industrial wireless I/O devices and sensors powered using solar panels or battery packs.

2. Literature Survey

2.1 Jayashri Deb Sinha, Subhabrata Barman, Energy Efficient Routing Mechanism in Wireless Sensor Network.

This paper gives a brief idea about wireless sensor networks and energy efficient routing in wireless sensor networks. Sensor networks are deployed in an ad hoc fashion, with individual nodes remaining largely inactive for long periods of time, but then becoming suddenly active when something is detected. Sensor Networks are generally battery constrained. They are prone to failure, and therefore the sensor network topology changes frequently. In this paper, authors propose a routing algorithm for Wireless Sensor Networks combining Energy Efficient and Hierarchical based routing techniques which minimize the energy consumption, increase the lifetime of the sensor nodes and saves battery power. This paper presents HDP, an energy efficient Hierarchical routing algorithm based on Height, Distance and Power Consumption. This algorithm presents a shortest path between source and destination, which ensures that this algorithm provides low cost communication and low power consumption because transmitted power, is taken as input. Main aim of the proposed work is to reduce the power consumption among the sensor nodes in wireless sensor network. So, an interesting future work is localization of these sensors using topology control algorithms and location based services. Authors have considered LEACH, which is an existing energy efficient routing protocol based on Hierarchical Routing. Various other Energy Efficient routing algorithms could be taken into consideration while analyzing the performance of proposed algorithm.

2.2 Nikolaos A. Pantazis, Stefanos A. Nikolidakis and Dimitrios D. Vergados, Energy-Efficient Routing Protocols in Wireless Sensor Networks: A Survey

The distributed nature and dynamic topology of Wireless Sensor Networks (WSNs) introduces very special requirements in routing protocols that should be met. The most important feature of a routing protocol, in order to be efficient for WSNs, is the energy consumption and the extension of the network's lifetime. During the recent years, many energy efficient routing protocols have been proposed for WSNs. In this paper, energy efficient routing protocols are classified into four main schemes: Network Structure, Communication Model, Topology Based and Reliable Routing. The routing protocols belonging to the first category can be further classified as flat or hierarchical. The routing protocols belonging to the second category can be further classified as Query-based or Coherent and non-coherent based or Negotiation-based. The routing protocols belonging to the third category can be further classified as Location-based or Mobile Agent-based. The routing protocols belonging to the fourth category can be further classified as QoS-based or Multipath based. Then, an analytical survey on energy efficient routing protocols for WSNs is provided. In this paper, the classification initially proposed by Al-Karaki, is expanded, in order to enhance all the proposed papers since 2004 and to better describe which issues/operations in each protocol illustrate/enhance the energy efficiency issues.

2.3 Shashidhar Rao Gandham, Milind Dawande, Ravi Prakash and S. Venkatesan, Energy Efficient Schemes for Wireless Sensor Networks with Multiple Mobile Base Stations.

One of the main design issues for a sensor network is conservation of the energy available at each sensor node. We propose to deploy multiple, mobile base stations to prolong the lifetime of the sensor network. Author split the lifetime of the sensor network into equal periods of time known as rounds. Base stations are relocated at the start of a round. Our method uses an integer linear program to determine new locations for the base stations and a flow-based routing protocol to ensure energy efficient routing during each round. We propose four evaluation metrics and compare our solution using these metrics. Based on the simulation results authors show that employing multiple, mobile base stations in accordance with the solution given by their schemes would significantly increase the lifetime of the sensor network. In this paper authors have proposed an energy efficient usage of multiple, mobile base stations to increase the lifetime of wireless sensor networks. Our approach uses an integer linear program to determine the locations of the base stations and a flow-based routing protocol. We conclude that using a rigorous approach to optimize energy utilization leads to a significant increase in network lifetime. Moreover, the trade off between solution quality and computing time allows us to compute near-optimal solutions within a reasonable time for the network sizes considered. To adopt the approach presented in this paper to very large sensor fields, it might be appropriate to decompose the underlying flow network into sub-networks and optimize energy usage in each sub-network independently. A challenging and promising direction for future work is to explore the use of graph partitioning algorithms, particularly those for finding balanced partitions within such a framework.

2.4 Mehdi Kalantari and Mark Shayman, Energy Efficient Routing in Wireless SensorNetworks.

In this paper we introduce a new scheme for the purpose of routing in the wireless sensor networks. Proposed approach is for the case in which many sensors need to collect data and send it to a central node. Authors will show that in order to find the routes that give energy efficiency, authors can solve a set of partial differential equations similar to the Maxwell's equations in the electrostatic theory. These partial differential equations give the geographical paths from each sensor to the destination. In order to find the actual routes, authors approximate the found paths by a sequence of wireless links each between a pair of sensors. Simulation results show considerable improvement in the life of the network compared to the traditional shortest path approach. In this paper authors introduced an approach for the purpose of routing in the sensor networks that gives energy efficiency, and increases the network life. The main idea of routing approach is to find routes that avoid using places of the network that have small residual energy and to make a higher utilization of the places with higher residual energy. Authors showed that for this purpose a set of partial differential equations similar to the Maxwell's equations in the theory of electrostatic should be solved. By solving these equations, authors found the routes that give a considerable improvement in the network performance in terms of energy efficiency and the life of the sensors.

3 Conclusion

In this paper we present a review on energy efficient routing for wireless sensor networks. Literature of various authors along with their advantages and disadvantages is present in this paper. It is found that a more energy efficient routing for wireless sensor network is required which is based on multiple routing protocols.

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Author Profile

Jamna Kaur received the B.Tech degree in Computer Science Engineering from Punjab Technical University Jalandhar in 2011. Currently she is pursuing M.Tech degree in Computer Science Engineering from Guru Kashi University, Talwandi Sabo, Bathinda (Punjab). Her research interests include Energy efficient routing in Wireless sensor networks.