



Study on Cluster Generation Process in Congested Sensor Network

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Abstract: In case of Sensor network the nodes loss some amount of energy after performing the communication. To improve the life of network a energy efficient communication approach is required. In case of multicast network an aggregative approach is used by LEACH protocol by creation of Cluster of nodes. Now the major requirement is the approach to build such Cluster over the network in an optimized way. The presented work is the improvement over the LEACH protocol respective to some parameter. Here we are proposing the three decision parameters to select the next node these parameters include the distance, energy and the load. The clustering process improves the efficiency even in case of congested network and improves the network life.

Keywords: LEACH, Enegy, Life time, Cluster based, WSN

I. INTRODUCTION

A Wireless Sensor Network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, enabling also to control the activity of the sensors. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer application, such as industrial process monitoring and control, machine health monitoring, environment and habitat monitoring, healthcare applications, home automation, and traffic control. The WSN is built of "nodes" - from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from hundreds of dollars to a few pennies, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth... The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

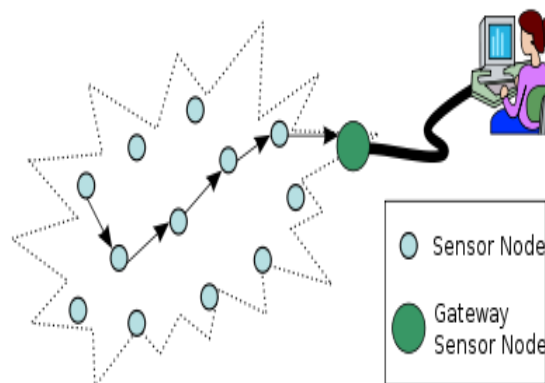


Figure 1: Typical Wireless Sensor Network Architecture

Sensors integrated into structures, machinery, and the environment, coupled with the efficient delivery of sensed information, could provide tremendous benefits to society. Potential benefits include: fewer catastrophic failures, conservation of natural resources, improved manufacturing productivity, improved emergency response, and enhanced homeland security. However, barriers to the widespread use of sensors in structures and machines remain. Bundles of lead wires and fiber optic "tails" are subject to breakage and connector failures. Long wire bundles represent a significant installation and long term maintenance cost, limiting the number of

sensors that may be deployed, and therefore reducing the overall quality of the data reported. Wireless sensing networks can eliminate these costs, easing installation and eliminating connectors. The ideal wireless sensor is networked and scalable, consumes very little power, is smart and software programmable, capable of fast data acquisition, reliable and accurate over the long term, costs little to purchase and install, and requires no real maintenance. Selecting the optimum sensors and wireless communications link requires knowledge of the application and problem definition. Battery life, sensor update rates, and size are all major design considerations. Recent advances have resulted in the ability to integrate sensors, radio communications, and digital electronics into a single integrated circuit (IC) package. This capability is enabling networks of very low cost sensors that are able to communicate with each other using low power wireless data routing protocols. A wireless sensor network (WSN) generally consists of a base station (or “gateway”) that can communicate with a number of wireless sensors via a radio link. Data is collected at the wireless sensor node, compressed, and transmitted to the gateway directly or, if required, uses other wireless sensor nodes to forward data to the gateway. The transmitted data is then presented to the system by the gateway connection.

A. WSN Architecture

The design of a layered architecture would normally consist of a base station and sensors scattered in the field. The layers of sensor nodes around the base station constitutes

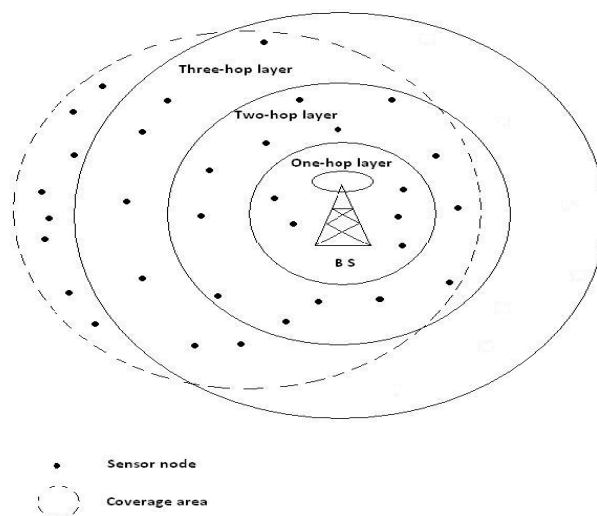


Figure 2: Layered Architecture

nodes that are in a single hop count to the base station, while nodes that are farther away can be multiple hop count to the BS depending on the size of the network, this is shown in Figure 2. One of the earliest protocols to complete the implementation of the layered architecture is the UNPF (Unified Network Protocol Framework), designed for a multi-hop infrastructure network architecture. The UNPF protocol is unified in the sense that it combines three different protocol structures: the network organization, medium access control (MAC) and the routing protocol to achieve the objectives of a robust protocol. These schemes are briefly described next.

B. ROUTING

Routing or routing is the process of selecting paths in a network along which to send network traffic. Routing is performed for many kinds of networks, including the telephone network (Circuit switching), electronic data networks (such as the Internet), and transportation networks. This article is concerned primarily with routing in electronic data networks using packet switching technology. In packet switching networks, routing directs packet forwarding, the transit of logically addressed packets from their source toward their ultimate destination through intermediate nodes, typically hardware devices called routers, bridges, gateways, firewalls, or switches. General-purpose computers can also forward packets and perform routing, though they are not specialized hardware and may suffer from limited performance. The routing process usually directs forwarding on the basis of routing tables which maintain a record of the routes to various network destinations. Thus, constructing routing tables, which are held in the router's memory, is very important for efficient routing. Most routing algorithms use only one network path at a time, but multipath routing techniques enable the use of multiple alternative paths. Routing, in a more narrow sense of the term, is often contrasted with bridging in its assumption that network addresses are structured and that similar addresses imply proximity within the network. Because structured addresses allow a single routing table entry to represent the route to a group of devices, structured addressing (routing, in the narrow sense) outperforms unstructured addressing (bridging) in large

networks, and has become the dominant form of addressing on the Internet, though bridging is still widely used within localized environments.

II. LITERATURE SURVEY

Mohammad Javad Hajikhani and Bahman Abolhassani [1] presented a paper named “An Energy Efficient Algorithm for Cluster-Head Selection in WSNs” The work was regarding overcome energy problem of nodes. There are several different approaches to overcome this problem. LEACH (Low-Energy Adaptive Clustering Hierarchy) is a well known algorithm whose best advantage is that each node makes its decision about whether to be a cluster-head independently, but it cannot guarantee an even energy load distribution. To overcome this problem, we should consider the remaining energy of each node and the average residual energy of its neighboring nodes. S. Deng, J. Li and L. Shen [2] published a paper named “Mobility-based clustering protocol for wireless sensor networks with mobile node”. The purpose of this study was to propose a mobility-based clustering (MBC) protocol for wireless sensor networks with mobile nodes. In the proposed clustering protocol, a sensor node elects itself as a cluster-head based on its residual energy and mobility. A non-cluster-head node aims at its link stability with a cluster head during clustering according to the estimated connection time. Joohwan Kim, Xiaojun Lin, Ness B. Shroff, and Prasun Sinha [3] A paper named “Minimizing Delay and Maximizing Lifetime for Wireless Sensor Networks with AnyCast” was presented by these. The paper work was belongs to minimizing the delay and maximizing the lifetime of event-driven wireless sensor networks for which events occur infrequently. In such systems, most of the energy is consumed when the radios are on, waiting for a packet to arrive. Sleep–wake scheduling is an effective mechanism to prolong the lifetime of these energy-constrained wireless sensor networks. However, sleep–wake scheduling could result in substantial delays because a transmitting node needs to wait for its next-hop relay node to wake up. Based on this result, they provided a solution to the joint control problem of how to optimally control the system parameters of the sleep–wake scheduling protocol and the any cast packet-forwarding protocol to maximize the network lifetime, subject to a constraint on the expected end-to-end packet-delivery delay. Li Xunbo, Li Na, Chen Liang, Shen Yan, Wang Zhen and Zhu Zhibin [4] A paper named “An Improved LEACH for Clustering Protocols in Wireless Sensor Networks” was published by them. The cluster head is selected by the random number generated by nodes in the hierarchical routing protocol which is implementing Low Hao Wang, Pu Tu, Ping Wang and Jian Yang [5] published a paper named “Redundant and Energy-Efficient Cluster head Selection Protocol for Wireless Sensor Network” The purpose of this paper was selection of cluster head on the base of energy. Cluster-based routing protocol is currently a hot research in wireless sensor network. In this paper, they proposed an improved method RECHS (Redundant and Energy-efficient Cluster head Selection) for LEACH protocol to balance network load and to extend the network life. In order to selecting reasonable cluster heads, our scheme first selects initial cluster heads and initial redundant Cluster heads. Haosong Gou and Younghwan Yoo [6] Both of them presented work on “An Energy Balancing LEACH Algorithm for Wireless Sensor Networks” Wireless sensor networks (WSNs) have been considered as a promising method for reliably monitoring both civil and military environments under hazardous or dangerous conditions. Due to such environments, the power supplies for sensors in the network are not usually rechargeable or replaceable. Therefore, the energy efficiency is critical for the lifetime and cost of WSN. Khoa T. Phan, Rongfei Fan, Hai Jiang, Sergiy A. Vorobyov and Chintha Tellambura [7] They all presented a paper titled “Network Lifetime Maximization with Node Admission in Wireless Multimedia Sensor Networks” Wireless multimedia sensor networks (WMSN) are expected to support multimedia services such as delivery of video and audio streams. Yifeng He, Ivan Lee, and Ling Guan [8] presented work named as “Distributed Algorithms for Network Lifetime Maximization in Wireless Visual Sensor Networks” in 2009. In this paper they explained that network lifetime maximization is a critical issue in wireless sensor networks since each sensor has a limited energy supply. In contrast with conventional sensor networks, video sensor nodes compress the video before transmission. Zhong Zhou, Shengli Zhou, Shuguang Cui and Jun-Hong Cui [9] presented a paper named “Energy-Efficient Cooperative Communication in a Clustered Wireless Sensor Network” In this paper, they considered a clustered wireless sensor network where sensors within each cluster relay data packets to nearby clusters using cooperative communications. They propose a cooperative transmission scheme based on distributed space-time block coding and conduct a systematic analysis on the resulting energy consumption. Compared with existing work, their distinctions were two fold: 1) Only sensors that can correctly decode received packets participate in the cooperative transmission, where the number of cooperating nodes depends on both channel and noise realizations; and 2) packet-error-rate-based analysis was used rather than symbol-error-rate-based analysis. Xueyan Tang and Jianliang Xu [10] presented work titled as “Optimizing Lifetime for Continuous Data Distribution with Precision Guarantees in Wireless Sensor Networks” Paper exploits the tradeoff between data quality and energy consumption to extend the lifetime of wireless sensor networks. To obtain an aggregate form of sensor data with precision guarantees, the precision constraint is partitioned and allocated to individual sensor nodes in a coordinated fashion.

III. PROPOSED WORK

LEACH protocol is basically used in case of multicast or broadcast network. It gives the concept of data distribution. It means instead of performing n paths for n packet deliveries it gives the concept of Cluster based routing where the nodes are interconnected in the form of Cluster and perform the communication respectively. In each round of this data-gathering application, all data from all nodes need to be collected and transmitted to the BS, where the end-user can access the data. In some sensor network applications, data collection may be needed only from a region and, therefore, a subset of nodes will be used. A simple approach to accomplishing this data gathering task is for each node to transmit its data directly to the BS. Since the BS is typically located far away, the cost to transmit to the BS from any node is high so nodes will die very quickly. Therefore, an improved approach is to use as few transmissions as possible to the BS and reduce the amount of data that must be transmitted to the BS in order to reduce energy. Further, if all nodes in the network deplete their energy levels uniformly, then the network can operate without losing any nodes for a long time. In sensor networks, data fusion helps to reduce the amount of data transmitted between sensor nodes and the BS. Data fusion combines one or more data packets from different sensor measurements to produce a single packet. For example, sensors may collect temperature, pressure, humidity, and signal data from the field. We would be interested in finding the maximum or minimum values of such parameters.

The proposed work is the improvement in LEACH protocol in terms to decide the next node in the Cluster. It will check the ratio of residual energy along with distance to perform the initial decision it not eligible the second level decision is taken by checking the response time. The work proposed here is the try to increase the network life time as well to increase the throughput over the network.

The basic parameters considered here to improve the protocol are

1. *Distance: The distance vector is also defined in range.*
2. *Energy Consumed: The energy consumed depends on distance vector, if the distance is within range energy(i) will be consumed and after the range some other energy will be consumed.*
3. *Response Time: It basically includes the case of congestion. If the node is congested it will not response on equal interval. The node responding well will be selected for next cluster head.*

The base methodology of defined work is given as

1. *Define the Weightage to the distance respective to energy consumed.*
2. *While Selection of Next Node find*
 - a. *Distance*Ei depending on Range*
 - b. *Check Energy-Distance*Ei > Threshold*
 - c. *Check For Loop Back.*
3. *If LookBack(True)*
 - a. *Then*
 - Discard that node*
4. *If Energy-distance*Ei < Threshold*
 - a. *Then*
 - Discard that Node*
5. *Find the Node having*
 - a. *Minimum Emery Consumption respective to Distance*
 - b. *Will Have Max Energy After Transmission*
 - c. *Not performing the loop.*
6. *Move to Next Node Respective to Above Parameters*

As the presented approach will perform the parametric changes in the work performed by earlier LEACH protocol. These changes are given as under.

IV. CONCLUSION

The presented work is the improvement of network life in case of multicasting or in case of data distribution. To perform this work the parametric changes in earlier LEACH protocol are suggested.

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