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An application and architecture of Low Energy Adaptive Clustering Hierarchy Protocol in Wireless Microsensor Network

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Abstract:
The collection of hundreds or thousands of wireless micro sensor nodes form the networking that provides the users to proper and accurate monitor a remote environment by intelligently combining the data from the individual nodes. These networks require robust wireless communication protocols hat are energy efficient and provide low latency. In this paper, we analyze the low-energy adaptive clustering hierarchy (LEACH) protocol architecture for wireless Microsensor networks that merge the thinking of energy-efficient cluster-based routing and media access control protocol together with application-specific data aggregation to achieve good performance in terms of system lifetime, latency, and application-perceived quality. Wireless sensor networks (WSNs) are merged the many low power, low cost devices with sensing, local processing and wireless communication capabilities. Recent advances in wireless networks have led to many new protocols specifically designed for WSNs where energy awareness is an essential consideration. Main important thing that is routing protocol that it is differ depending on the network architecture and application. With the growth of different design goals and application requirements, wireless sensor networks (WSNs) have been increasingly popular for a wide variety of purposes, e.g., image formation of a target field, intrusion detection, surveillance and environmental monitoring. A multi-hop heterogeneous cluster-based optimization algorithm (MHCOA) is proposed for the wireless sensor networks.

***Index terms*:** *protocol architecture, wireless Microsensor networks. Data aggregation*

Introduction:

Advancement in sensor technology, low-power radio frequency (RF) and low-power electronics, design have enabled the development of small, relatively inexpensive and low-power sensors, called *Microsensors* that can be connected via a wireless network. These types of wireless Microsensor networks that represent a new paradigm for collect the data from the environment and enable the reliable monitoring of a variety of environments for applications that include surveillance, machine failure diagnosis, and chemical/biological detection. An important challenge in the design of these networks is that two key resources communication bandwidth and energy are significantly more limited than in a tethered network environment. These constraints require innovative design techniques to use the available bandwidth. The vast advancements in technology in general and in wireless communications have specifically given us the ability to mass-produce small, low-cost sensors that can connect to each other wirelessly. The sensors once deployed, whether in a random or a pre-engineered way will connect to each other and form a wireless sensor network (WSN).

WSNs are made of a large number of sensors deployed in a certain area. The sensors would transform physical data into a form that would make it easier for the user to understand. WSN technology is growing rapidly and becoming cheaper and easier to afford, allowing different kinds of application usage of such networks. Wireless sensor networks are used to at a very large applications dealing with monitoring (health environments, seismic, etc.), control (object detection and tracking), and surveillance (battlefield surveillance), perimeter and topology discovery and energy efficiently In WSNs, the sensor nodes are often grouped into individual disjoint sets called clusters. The collection of base station is known as Clustering, that is used in WSNs this technique provides network scalability, resource sharing and efficient use of constrained resources that gives network topology stability and energy saving attributes. Clustering schemes that is used to reduced the communication overheads and provide the efficient resource allocation thus decreasing the overall energy consumption and reducing the interferences among sensor nodes. The basic thing of clustering routing protocol [9–11] is to use the information aggregation mechanism in the cluster head (CH) to reduce the amount of data transmission and energy dissipation in the communication system, to achieve the purpose of saving energy of the sensor nodes. In the clustering routing algorithms for wireless networks, LEACH [12, 13] is considered as the most popular routing protocol that use cluster based routing in order to minimize the energy consumption. LEACH was one of the first major improvements on conventional clustering approaches such as minimum-transmission-energy (MTE) or direct transmission which do not lead to even energy consumption throughout a network in WSNs. In LEACH, the function of the CH is the collection of data received from member sensor nodes and forwards the information directly to the BS. And if the CH is far away from the BS then it requires more energy to transfer the information to the BS and therefore it will die soon and so LEACH has the lowest network lifetime. While LEACH helps the sensors within their cluster dissipate their energy slowly, the CHs consume a larger amount of energy when they are located farther away from the BS. The LEACH protocol is provided the clustering technique that is used to terminates in a finite number of iterations, but does not guarantee good CH distribution and assumes uniform energy consumption for CHs. Most of LEACH improvements concerned with the way of electing CHs not how to achieve balancing inside the clusters during round operation which is our contribution in this paper. The main goal of the proposed protocol is to evenly distribute energy consumption over all sensor nodes by dividing the work among the CHs and its cluster members (CMs) which reduces energy consumption of CH. Each non- CH uses power control to set the amount of transmit power based on the received strength of the CH advertisement.

$$\mathbf{E(CH)} = \sum_{i=1}^{N} \mathbf{p(t)} * 1$$

Where E is the energy of node and P_i is the probability of ith node, E_{total} is the total energy of the node and k is the parameter.

Application:

There are following applications of wireless sensor network

- It use in Home security system
- Machine failure diagnosis
- Chemical/biological detection

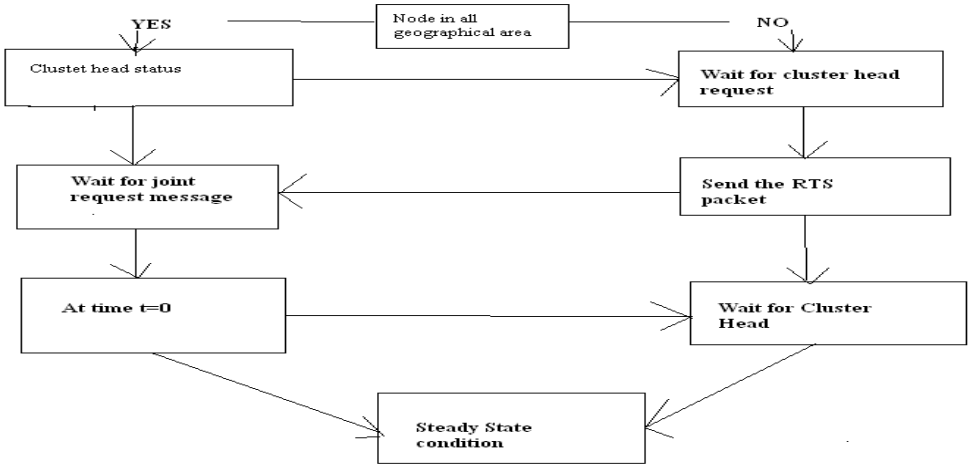

Fig.1 Flowchart of the cluster formation algorithm for LEACH

Related Work:

In the wireless sensor networks routing process has the very important role and very big challenge due to several characteristics that distinguish them from contemporary communication and wireless ad hoc networks [14–16]. The routing protocols are used to mainly due to the energy constrained nature or saving energy of such type of networks [17]. There is following example of routing protocol that is flooding technique in which a given node broadcasts data and controls packets that it has received to the rest of the nodes in the network. This process is applied until when the destination node is reached at final position.. Note that this technique does not take into account the energy constraint imposed by WSNs. As a result, when used for data routing in WSNs, it leads to problems such as implosion and overlap [18, 19]. There is following technique that is, flooding is a blind technique, duplicated packets may keep circulate in the network, and hence sensors will receive those duplicated packets, causing an implosion problem. Two sensors elements when sense the same sector and broadcast their sensed data at the same time, their neighbors will receive duplicated packets. To overcome the shortcomings of flooding, another technique known as gossiping can be applied [20]. When we talk about the receiving a packet, a sensor would select randomly one of its neighbors and send the packet to it. The same process repeats until all sensors receive this packet. Using gossiping, a given sensor would receive only one copy of a packet being sent. Gossiping tackles have a problem in WSNs that is implosion problem; there is a significant delay for a packet to reach all sensors in a network. These types of inconveniences are highlighted when the number of nodes in the network increases. The limited energy resources of sensor nodes pose challenging issues on the development of routing protocols for WSN. Introducing clustering into the network's topology reduces the number of transmissions in the network. The collection of base station or we can say clustering technique provides the energy efficiency as CHs aggregate the data's from its CMs, thereby reduce duplication of transmission and enhance the network lifetime. Many research area related to WSNs last few years have explored hierarchical clustering in WSN from different perspectives. There are many protocols have been proposed for prolonging the life of WSN and for routing the correct data to the BS. Each protocol has advantages and disadvantages. Battery power has the very important role for individual sensor nodes is a precious resource in the WSN [21, 22]. Some of the hierarchical protocols are LEACH, PEGASIS, TEEN, and APTEEN. LEACH (low energy adaptive clustering hierarchy) protocol is the very important and [12, 13] the first and most popular energy-efficient

hierarchical clustering algorithm for WSNs that was proposed for reducing power consumption. The key features of LEACH are: (1) randomized rotation of the CH and corresponding clusters, (2) local compression to reduce global communication, and (3) localized coordination and control for cluster set-up and operation. LEACH reduces energy consumption by minimizing the communication cost between sensors and their CHs and turning off non-head nodes as much as possible [23]

Result and Simulation:

To analysis the Low Energy Adaptive Clustering Hierarchy Protocol (LEACH) to increase performance of Wireless Microsensors Network, I have used the MATLAB software for increase the performance of the system in the terms of latency, system life time, quality performance and ease of deployment all these parameters are based upon the dead and alive nodes continuously. The figure 1 shows the all dead and alive nodes in complete geographical region. Figure 2 shows the energy per round of the nodes with all iteration and figure 3 shows the alive nodes only per round with all iteration.

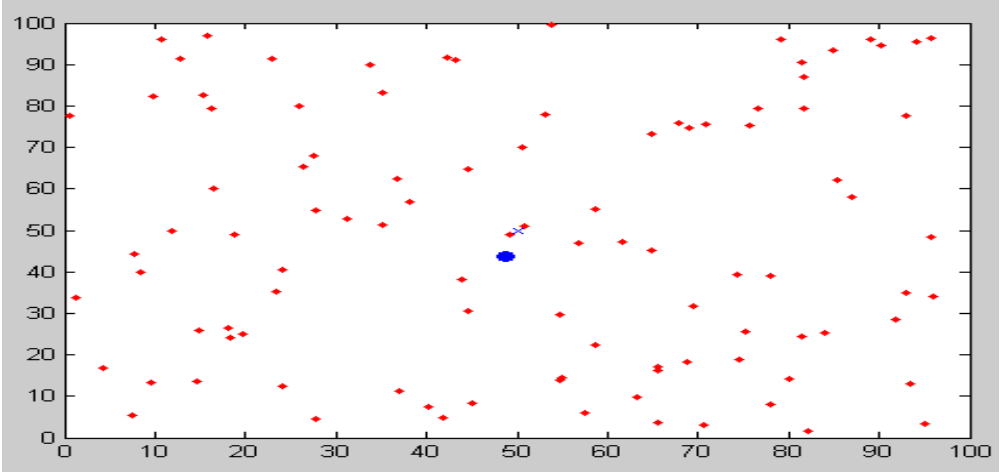

Fig.2 Dead and Alive nodes in all geographical area

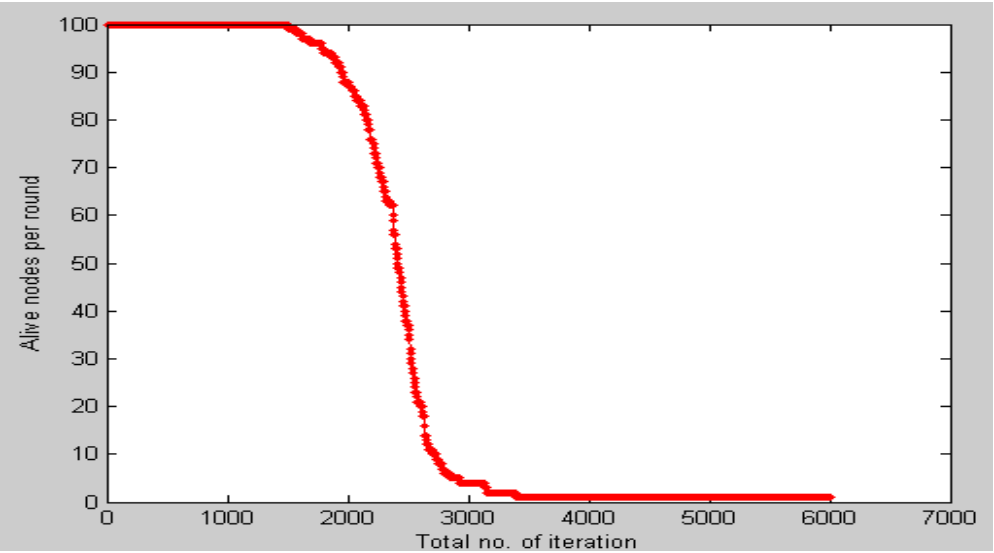

Fig.3 Energy per round with the total iteration for LEACH

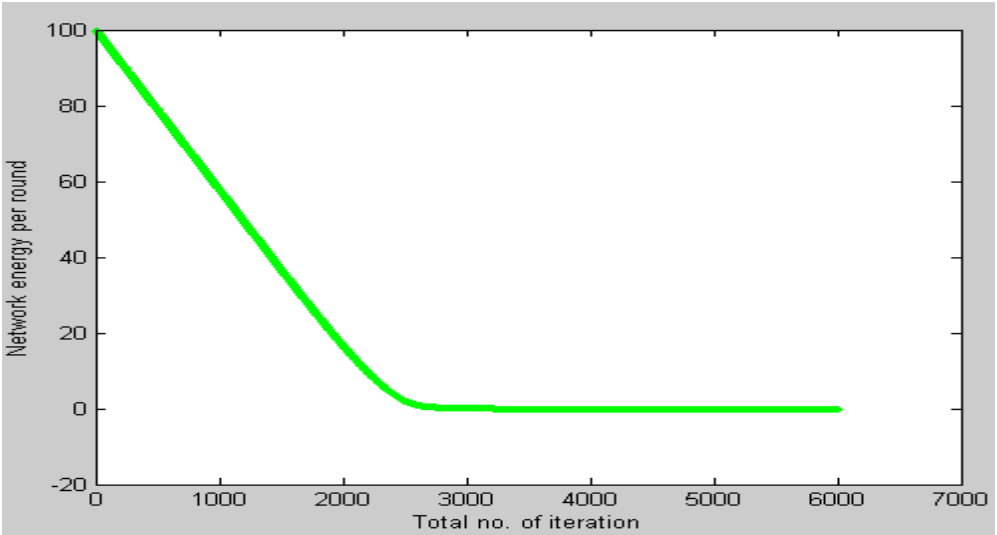

Fig.4 Alive nodes per round with the total iteration for LEACH

Conclusion:

In this paper, we have proposed a routing protocol form improving LEACH by introducing IBLEACH which is balanced energy consumption protocol for WSNs. Through distributing the cluster load overhead over the CMs, the life time of the entire network extended compared with LEACH protocol. Our simulation results show that IBLEACH outperforms LEACH and its improvements in terms of the network lifetime and balanced energy consumption.

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