Survey on Efficient Clustering with Energy Aware Routing in Wireless Sensor Networks

Anita Chavan[1], Simran Khiani[2]

[1]Student in I.T Dept, G.H.R.C.E.M., Wagholi Savitribai Phule Pune University, India

[2]Asst. Professor in I.T Dept, G.H.R.C.E.M., Wagholi Savitribai Phule Pune University, India

Abstract: *Wireless Sensor Networks (WSNs) are defined as dynamic, self-deployed, highly constrained structured network. The WSN is a special kind of network which consists of large number of sensors and minimum one base station. Main difference between the WSN and the traditional wireless networks is that sensors are extremely sensitive to energy consumption. Energy saving and load balancing are the crucial issue in designing the wireless sensor networks. Load balancing can be used to extend the lifetime of a sensor network by reducing energy consumption. Load balancing with clustering can increase network scalability and clustering can also used to achieve self organization, power saving, channel access, routing. The lifetime of network, depends on various parameters such as number of nodes, strength, range of area and connectivity of nodes in the network. Sensor nodes in wireless sensor network are depends on battery power they have limited transmission and reception range thus energy efficiency plays a vital role to minimize the overhead through which the Network Lifetime can be achieved. In this paper we are over viewing techniques which are used in wireless sensor network for load balancing and improving lifetime of network also we discussed the system which we are going to implement.*

Keywords: wireless sensor network, clustering, reliability, load balancing, overhead, network lifetime

1. Introduction

The WSN is a special kind of network which consists of large number of sensor nodes and minimum one base station. A wireless sensor network is kind of ad-hoc infrastructure of sensing, communicating elements that gives the ability of observing, reacting in specific environment such as information technology or a biological system. A Wireless Sensor Network is specialized network which is a collection of sensor nodes which are handling through the radio channels. Each node in the wireless sensor network has the capability of processing separately which contains large amount of memory, transceiver and power resources. Wireless Sensor Network are deployed in various areas where human involvement is not possible like environment monitoring, earthquake and woodland fire discovery etc. essential issues implicated in Wireless Sensor Networks are improving the lifetime of network and reducing battery or power.

In last few years, sensor networking has received significant interest from the research community. Sensor networks can increase the effectiveness of many military and civil applications such as combat field surveillance, security and disaster management where conventional approaches prove to be very costly and risky. Signal processing and communication activities are the main consumers of sensors energy. Since sensors are battery operated, keeping the sensor active all the time will limit the duration that the battery can last. The sensor nodes are generally small embedded systems, which have comparatively least processing capacity, storage capacity and communication ability, carry energy limited battery and not easy to replace or recharge.

To solve this problem, researchers have proposed many routing protocol to extend the life cycle of WSN.

Clustering has several advantages like routing table size is reduce, conserve communication bandwidth, increase network lifetime, decrease the redundancy of data packets, reduces the rate of energy consumption.

The rest of the paper is organized as, in the second section we discussed about distinct survey done by the researchers for the wireless sensor network with energy saves and load balancing. After that we discussed the comparison table of different literatures. In the next section discussing the generic architecture of the proposed topic discussed. The next section is about key challenges and motivation of the proposed technology. After that we discussed the expected outcome of the proposed system. Finally conclude the topic with the reference used for the paper.

2. Literature Survey

In [2] author proposed novel clustering based routing protocol LEACH (Low-Energy Adaptive Clustering Hierarchy) to reduce global energy usage by sharing the load and energy among all the sensor nodes at different points in time in the given network. Each node in cluster has the load of acquiring data from the nodes in the cluster, and then aggregate signals are obtain by combining the data, and transmitting this aggregate signal to the base station. LEACH does not require any control information from the base station as it is completely distributed in nature.

As LEACH is having distributed nature, so distributing the energy among the nodes in the network is effective in reducing energy dissipation from a universal perspective and due to this system lifetime is enhanced. To gain scalability and robustness for dynamic networks LEACH uses localized coordination and integrates data combination into the routing protocol which aims to reduce the amount of information that need to be

transmitted to the base station. Communication energy reduces using LEACH, providing such a low-energy, ad hoc, distributed protocol will help develop the new way for future micro sensor networks. They give a good first order approximation of the lifetime extension using LEACH.

In [3] author presented a novel approach for cluster head election in wireless sensor network. Base station has responsibility of nominating cluster head in each round by evaluating the opportunity each node has to become the cluster-head based on three fuzzy descriptors as energy, concentration and centrality. Proposed approach is more appropriate for electing cluster-heads for medium sized clusters.

More lifetime is accomplished when compared with LEACH as network size increases. A further enhancement in the network lifetime and energy consumption can be achieved by altering the shape of each fuzzy set accurately. Proposed protocol provide good performance as compare to other

The cluster heads closer to the base station are loaded with heavy traffic and tend to die early. In [4] author proposed the new an Energy Efficient Unequal Clustering (EEUC) mechanism in wireless sensor networks to solve this issue. To balance the energy utilization among cluster heads they presented an unequal clustering mechanism. They grab new idea that clusters near to the base station have smaller sizes than those far away from the base station. Due to this cluster heads near to the base station can conserve some energy for the purpose of inter-cluster data forwarding. Author also proposes new protocol for the inter-cluster communication called energy-aware multihop routing protocol.

An obvious improvement on the network lifetime and energy preservation among all sensor nodes is achieved using unequal clustering mechanism. According to Simulation results show that unequal clustering mechanism clearly improves the network lifetime over LEACH and HEED.

In [5] author extend a communication protocol named LEACH (Low-Energy Adaptive Clustering Hierarchy) to reduce the power utilization of wireless microsensor networks. Based on network configuration a network lifetime of micro sensor networks is increased by 30 percent.

Author introduced a new approach to define lifetime of micro sensor networks using three new metrics. These metrics are FND (First Node Dies), HNA (Half of the Nodes Alive), and LND (Last Node Dies).The nodes themselves identify whether they are eligible to become cluster-heads for this no need of communication with the base station. Due to this communication energy is preserved.

In [6] author presents a new clustering scheme for wireless sensor networks based on semantic properties as its basis. Signal strength and neighboring are the most used criterion

in the cluster formation and nodes inside a same cluster are ordered like a hyper tree where the cluster-head is act as root node of the tree.

Proposed approach is more efficient and achieved better energy than other clustering schemes. This hyper tree organization formed a layered data aggregation which leads to avoid the cluster head overload and energy dissipation, and makes the network more robust against links and nodes failures.

In [7], author proposed new energy efficient protocol, TEEN (Threshold sensitive Energy Efficient sensor Network protocol) for reactive networks. Proposed scheme is more suitable for time critical applications and also little bit efficient in terms of energy consumption and response time. Performance of proposed protocol evaluated on a simple temperature sensing application.

In this scheme, at every cluster change time, in addition to the attributes, the cluster-head transmits to its members. It is targeted at reactive networks and is the first protocol developed for reactive networks.

It also allows the user to control the energy consumption and accuracy to suit the application. This network can be used to examine machinery for fault detection and diagnosis. It can also be used to gather data about change in temperature over a particular area. Proposed protocol is applicable in many time critical applications such as intrusion detection, explosion detection.

In [8] proposed a class of flow augmentation algorithms and a flow redirection algorithm which balance the energy consumption rates among the nodes in proportion to the energy reserves. The limitation of this approach is that it requires the prior knowledge of the sets of origin and destination nodes and the information generation rates at the origin nodes; consequently, the topology and the traffic are fixed at least between consecutive computations.

3. Comparison Table

Table 1: Comparison Table

Reference Paper Name	Technique	Pros.	Cons.
Energy-efficient communication protocol for wireless microsensor networks	Author proposed novel clustering based routing protocol LEACH (Low-Energy Adaptive Clustering Hierarchy) to reduce global energy usage by sharing the load and energy among all the sensor nodes at different points in time in the given network.	Communication energy reduces using LEACH, providing such a low-energy, ad hoc, distributed protocol will help develop the new way for future microsensor networks.	Some data from the individual signals is lost, but this results in a substantial reduction of the overall energy dissipation of the system.
CHEF: Clusterhead election mechanism using fuzzy logic in wireless sensor networks	Author presented a novel approach for cluster head election in wireless sensor network	More lifetime is accomplished as compared to LEACH as increase in the network size. Proposed protocol provide good performance as compare to other	In this approach energy is spent to transmit the location information of all the nodes to the base station
An energy-efficient unequal clustering mechanism for wireless sensor networks	author proposed the new an Energy Efficient Unequal Clustering (EEUC) mechanism in wireless sensor networks to solve this issue	Unequal clustering mechanism balances the energy consumption well among all sensor nodes and achieves an obvious improvement on the network lifetime.	To verify the unequal clustering mechanism indeed extend the network time.
Low energy adaptive clustering hierarchy with deterministic cluster-head selection	Author introduced a new approach to define lifetime of microsensor networks using three new metrics FND, HNA and LND.	The nodes themselves identify whether they are eligible to become cluster-heads for this no need of communication with the base station. Due to this communication energy is preserved.	All nodes in the network are homogenous and energy-constrained.
A Semantic Clustering Routing Protocol for Wireless Sensor Networks	Author presents a new clustering scheme for wireless sensor networks based on semantic properties as its basis.	Proposed approach is more efficient and achieved better energy than other clustering schemes	
TEEN A Routing Protocol for Enhanced Efficiency in Wireless Sensor Networks	Author proposed new energy efficient protocol, TEEN (Threshold sensitive Energy Efficient sensor Network protocol) for reactive networks.	It also allows the user to control the energy consumption and accuracy to suit the application. This network can be used to examine machinery for fault detection and diagnosis.	Less efficient in terms of energy consumption and response time
On Improving The Lifetime Of Wireless Sensor Networks Using Virtual Scheduling Backbone Replacement	Studying Virtual Scheduling Backbone Replacement (VSBR) algorithm in which replacement of node based on energy for the improvement of life span of network.	Collision avoidance is achieved through proposed algorithm.	Loss of channel during sharing of channel information is avoided

4. Generic Model

In this section we discussed the system which we propose for overcome the disadvantage of the proposed system.

- Load balancing: new clustering protocol proposed for distributing energy equal amount of load among the sensor nodes in the network.
- Energy aware protocol: new protocol specifically designed for sensor networks with consideration energy awareness.
- Scalability: The number of sensor nodes deployed in the sensing area may be in the order of hundreds or thousands depending upon the routing algorithms as they should be scalable enough to respond to the events.
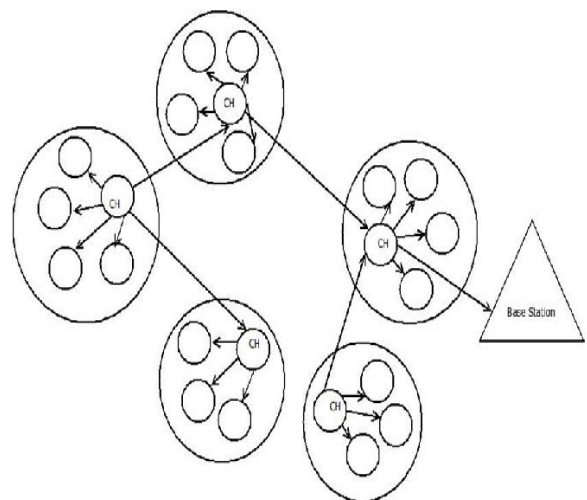
Figure 1: Generic Model

Paper ID: NOV152958

2117

5. Algorithm Used

1. Generate a network graph with n number of sensor nodes where; all nodes are stationary and randomly deployed in the target area.
2. Assign the fixed position to the base station.
3. Assign the same initial energy to all the nodes.
4. Divide the sensor nodes into the clusters according to their positions.
5. Calculate the initial energy, number of neighboring nodes an distance of each node from the base station.
6. From above calculations taking as a parameter calculate each node's probability to become as a cluster head.
7. Select the appropriate cluster head for each cluster.
8. Send the data from the cluster member's to the cluster head.
9. Evaluate the efficient path from cluster head to the Base Station.
10. All the Cluster Head Data should be delivered to the Base Station.

6. Conclusion

This paper presented an all-inclusive survey on the load balancing in wireless sensor network. The main features, the advantages and disadvantages of each technique are described. In this paper we are over viewing techniques which are used in wireless sensor network for load balancing and energy consumption.

As per survey, strong need to focus on energy consumption and also need to decrease overload of sensor network. In Propose work, we develop new protocol for load balancing and energy consumption.

References

[1] Qi-Ye Zhang,Ze-Ming Sun and Feng Zhang, "A Clustering Routing Protocol for Wireless Sensor Networks Based on Type-2 Fuzzy Logic and ACO", 2014 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)July 6-11, 2014, Beijing, China.
[2] W. Heizelman, A. Chandrakasan, H. Balakrishnan, "Energy-efficient communication protocol for wireless microsensor networks," in Proceeding of the 33rd Annual Hawaii Internation Conference on System Sciences(HICSS), Maui, HI, 2000, pp. 3005-3014.
[3] J. M. Kim, S. H. Park, Y. J. Han, and T. M. Chung, "CHEF: Clusterhead election mechanism using fuzzy logic in wireless sensor networks, "in Proceedings of the International Conference on Advanced Communication Technology (ICACT), 2008, pp. 654-659.
[4] C. Li, M. Ye, G. Chen, and J. Wu, "An energy-efficient unequal clustering mechanism for wireless sensor networks," in IEEE International Conference on Mobile Adhoc and Sensor Systems Conference (MAHSS),2005, pp. 597-604.
[5] M. Handy, M. Haase, D. Timmermann, "Low energy adaptive clustering hierarchy with deterministic cluster-head selection," in the 4th International Workshop on Mobile and Wireless Communications Network, Citeseer, pp. 368-372, 2002.
[6] F.Bouhafs, M. Merabti, and H. Mokhtar, "A Semantic Clustering Routing Protocol for Wireless Sensor Networks", IEEE Communications Society subject matter experts for publication in the IEEE CCNC 2006 proceedings.
[7] Adil Khan, "TEEN A Routing Protocol for Enhanced Efficiency in Wireless Sensor Networks", IEEE 2001.
[8] Jae-Hwan Chang and Leandros Tassiulas. Energy conserving routing in wireless ad-hoc networks, INFOCOM, 2000

Paper ID: NOV152958

2118