International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 5 153 – 157

Linking of Global Energy Balance to Wireless Sensor Networks

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***Abstract*—**Extending network lifetime and sensor functionality is crucial for the successful utilization of wireless sensor networks (WSNs) in applications where replacing or charging energy storage units is impractical or not cost effective. In the previous work, the system of WSN was used for reducing the power consumption in the network .This allowed the network to improve its lifetime by using cluster head based algorithm .In cluster head based algorithm the system selects the nodes with the highest energy in the network and sends data via this node only .This allow the network to perform multiple communication in a given period of time and the lifetime is automatically improved. We propose a cluster of cluster head based algorithm where we will be selecting at least two nodes from each cluster to become the cluster and perform all communication via this cluster head. The main advantage of this protocol over the existing protocol is that this protocol has a backup of cluster head which when the current cluster head has lost enough energy, thereby further improving the lifetime of the network

Keywords- *Energy balance, wireless sensor networks, cluster head based algorithm, clustering, energy efficient clustering, LEACH, network lifetime, energy efficient algorithms, energy efficient routing.*

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I. INTRODUCTION

Wireless sensor network is a popular area for research now days, due to vast potential usage of sensor networks in different areas. A sensor network is a comprised of sensing, processing, communication ability which helps to observe, instrument react to events and phenomena in a specified environment. This kind of network enables to connect the physical world to environment. By networking tiny sensor nodes, it becomes easy to obtain the data about physical phenomena which was very much difficult with conventional ways. Wireless sensor network typically consist of tens to thousands of nodes. These nodes collect, process and cooperatively pass this collected information to a central location.WSNs have unique characteristics such as low duty cycle, power constraints and limited battery life, redundant data acquisition, heterogeneity of sensor nodes, mobility of nodes, and dynamic network topology, etc. In recent years, wireless communication technology and the rapid development of the miniaturization and low cost of the sensor nodes, that has accelerated the development of the wireless sensor network. Wireless sensor network is a large number of static or mobile sensor nodes which form the wireless network using self-organization and multi-hop method, its purpose is to collaborate detection, processing and transmitting the data. In wireless sensor network, sensors or nodes are generally battery powered devices. These nodes have limited amount of initial energy that are consumed at different rates, depending on the power level. For maximizing the lifetime of these nodes most routing algorithm in wireless sensor networks uses the energy efficient path. These energy efficient routing algorithms select a best path for data transmission and consume less energy. But a single best path puts extra load to a specific node causing lower lifetime.

II. PURPOSE

The purpose of this project is to find the method which is more energy efficient and less power consuming. Wireless sensor networks are battery operated. Sensor nodes collect the data and pass them on to the network for further use. This passing and receiving of data utilizes most of the energy of the network. So for better operation and increase the lifetime of the network, energy consumption must be the major factor of concern. In this project new method for clustering the sensor network is proposed in which lifetime is improved by using Cluster Head Based Algorithm .In cluster head based algorithm, the system selects the nodes with the highest energy in the network and sends data via this node only .This allow the network to perform multiple communication in a given period of time and the lifetime is automatically improved. Proposed cluster of cluster head based algorithm selects at least two nodes from each cluster to become the cluster and perform all communication via this cluster head.

III. METHODOLOGY

A. Concept of global energy balance

We proposed global energy balanced concept. In this concept, energy required to perform communication between two nodes gets reduced and also lifetime of system gets improved. If the network is formed by using random number of nodes. To communication between two nodes (say node A and node B) which are some distance apart. If node A communicates with node B, the required energy will be more. But using global energy balanced concept, node A does not communicate with node B directly instead, first it will select nearer node and communicate with it. That nearer node select new node which is nearer to it. Then, this process continues till final nodes does not selected. This reduces the energy

consumption in the system thereby further increasing the lifetime of the systems.

B. LEACH Protocol [Low Energy Adaptive Clustering Hierarchy]:

LEACH protocol organizes the nodes by themselves. LEACH Protocol is a typical representative of hierarchical routing protocols. It is self-adaptive and self-organized. LEACH protocol uses round as unit, each round is made up of cluster set-up stage and steady-state stage, for the purpose of reducing unnecessary energy costs, the steady state stage must be much longer than the set-up stage. The process of it is shown in Figure 1.Each node should select a random number between the interval 0 &1. If the generated random number is less than threshold then the node becomes a CH for current round. Threshold is obtained by using the following formula:

$$t(n) = \begin{cases} \dfrac{p}{1 - p * (r \bmod \frac{1}{p})} & if\ n \in G \\ 0 & if\ n \notin G \end{cases}$$

Where, P is the desired percentage of clusters;
r: denotes the current round;
G denotes set of nodes that have not been CHs in the last 1/P rounds.
Cluster Head Selection, Cluster Formation and Data Communication are taken place at a time instant is known as rounds. Each round has two phases:
1. Set-up Phase &
2. Steady State Phase.

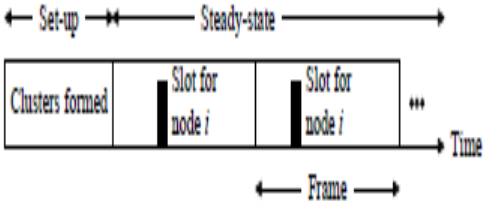

Fig 1.Hierarchal Leach Protocol

C. AODV (Adhoc On Demand Distance Vector Routing Protocol):

Routing is the act of moving information across an inter-network from a source to a destination. Function of AODV is to send request to various nodes and the node which accepts the request first and responds, the data is send to that node.

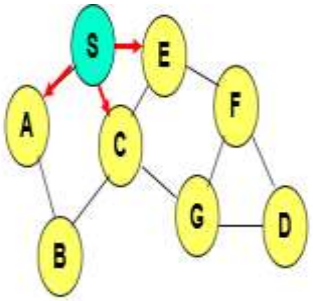

Fig 2.AODV Route Request

First of all the source floods route request in the network, the nodes hears the request and responds to the one which transmits the request. After hearing the request reverse paths are formed when a node hears a route request. Each node forwards the request only once (pure flooding).

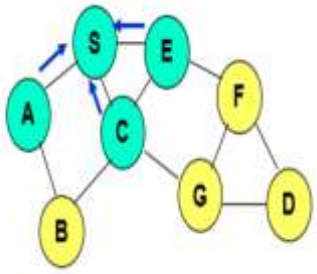

Fig. 3AODV route reply

Route reply is forwarded via the reverse path thus forming the forward path. The forward path is used to route data packets

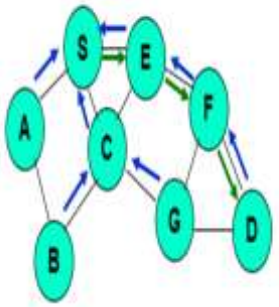

Fig.4 AODV route forward path

IV. RESULTS AND SIMULATIONS

In this section, comparison of performance of our proposed system with existing system is given in detail. We have implemented our project on network simulation tools i.e. NS2. Comparison of parameters like delay, jitter, throughput and energy, routing load of our proposed work and existing technique is given. Fig. 4.1 shows comparison of delay of proposed energy balanced concept and without energy balanced concept. Table 4.1 gives the value of delay of both technique.

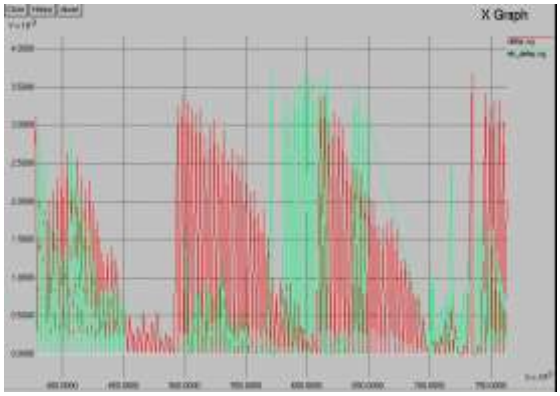

Fig. 4.1 Result of Delay of Proposed Work AndExisting Work

Table4.1
Result of Delay of Proposed Concept and Existing Concept

X axis	Simulation time
Y axis	Parameters
Delay Values without energy balance	1.8msec
Delay Values with energy balance	1.4msec

Figure 4.2 shows the result of packet delivery ratio of energy balanced and without energy balanced. From results, it is concluded PDR of both algorithm is almost same and we will slightly improve PDR .Figure 4.2 shows graph of PDR of algorithm implemented in network security tool. Value of PDR is tabulated in table4.2.

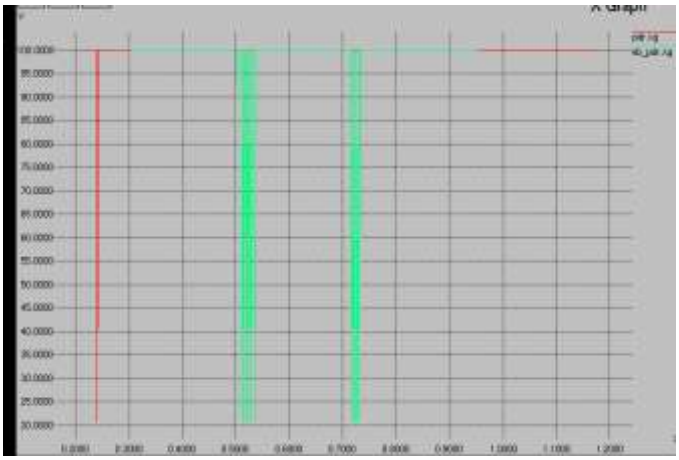

Fig. 4.2 Result of Packet Delivery Ratio of Proposed Algorithm and Existing Technique.

Table 4.2
Result of PDR of Proposed Concept and Existing Concept.

PDR without energy balance		PDR with energy balance	
Time(ms)	PDR value	Time(ms)	PDR value
0.21	100	0.30	100
0.24	20.86	0.317	20.86
0.31	100	0.32	100
0.33	100	0.33	20.86

Figure 4.3 shows the result of jitter of energy balanced and without energy balanced. From results, it is concluded jitter of proposed algorithm is improved as compared to existing technique. Figure 4.3 shows graph of jitter of algorithm implemented in network simulation tool. Value of jitter of energy balanced and existing technique is tabulated in table 4.3.

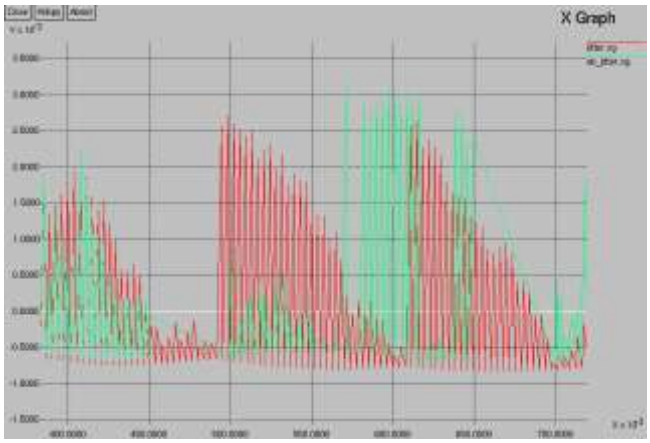

Fig.4 .3 Result of Jitter of Proposed and Existing Technique

Table 4.3
Results of Jitter of Proposed and Existing Concept

Jitter without energy balance		Jitter with energy balance	
Time(ms)	Jitter value	Time(ms)	Jitter value
0.30	0.000704	0.30	0.00744
0.50	0.0026	0.50	0.0031
0.75	0.0024	0.75	0.0027
0.94	-0.00105	0.94	0.00116

Figure 4.4 shows the result of energy of energy balanced and without energy balanced. From results, it is concluded energy of proposed algorithm is improved as compared to existing technique. Figure 4.4 shows graph of energy load of algorithm implemented in network security tool. Value of energy of energy balanced and existing technique is tabulated in table 4. 4.

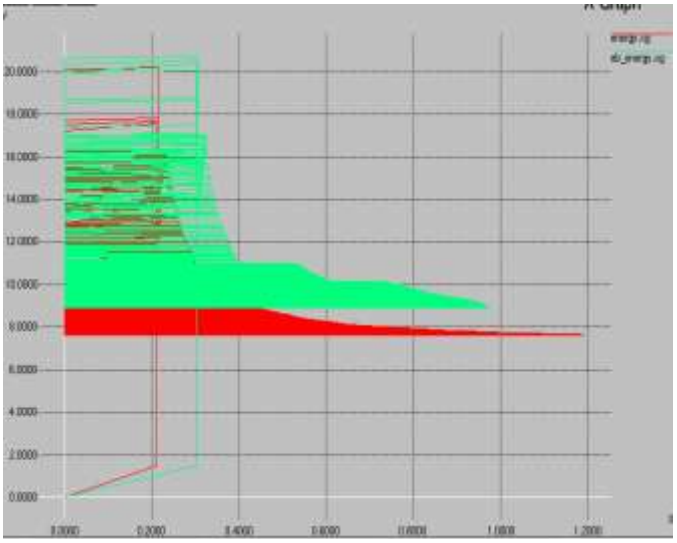

Fig. 4.4 Result of Energy of Proposed Method and Existing Technique

Table 4.4
Result of Energy of Proposed and Existing Concept

Energy without proposed method		Energy with proposed method	
Time(ms)	Energy(mJ)	Time(ms)	Energy(mJ)
0.12	1.50	0.12	1.30
0.20	1.76	0.20	1.50
0.21	2.00	0.21	1.75
0.22	2.50	0.22	2.00

Figure 4.5 shows the result of throughput of energy balanced and without energy balanced. From results, it is concluded throughput of proposed algorithm is improved as compared to existing technique. Figure 4.5 shows graph of throughput of algorithm implemented in network simulation tool. Value of throughput of energy balanced and existing technique is tabulated in table 4.5.

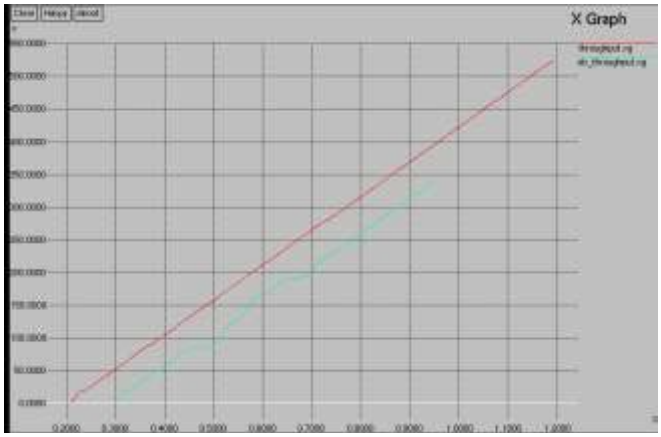

Fig 4.5 Result of Throughput of Proposed Method and Existing Technique

Table 4.5
Result of Throughput of Proposed Concept and Existing Concept.

Throughput without energy balance		Throughput with energy balance	
Time(ms)	Throughput	Time(ms)	Throughput
0.3	52.299	0.3	2
0.35	80.299	0.35	35.13
0.40	105.299	0.40	62.13
0.50	160.299	0.50	96.14

Figure 4.6 shows the result of routing load of energy balanced and without energy balanced. From results, it is concluded routing load of proposed algorithm is improved as compared to existing technique. Figure 4.6 shows graph of routing load of algorithm implemented in network simulation tool. Value of routing of energy balanced an existing technique is tabulated in table 4.6.

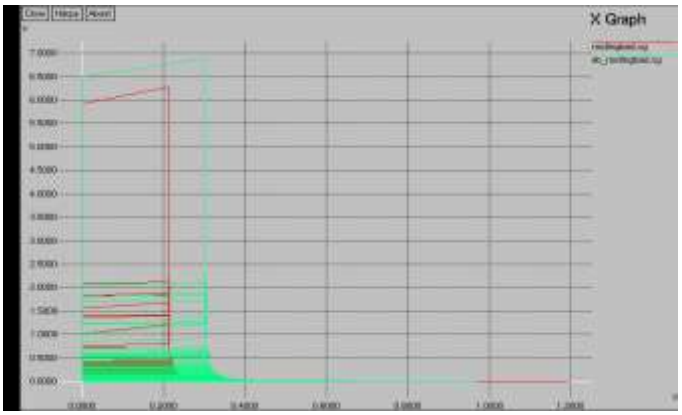

Fig 4.6. Result of Routing Load of Proposed Method and Existing Technique

Table 4.6
Result of Routing Load of Proposed and Existing Technique

Routing load without energy balance		Routing load with energy balance	
Time(ms)	Routing load	Time(ms)	Routing load
0.211	6.28	0.30	8.55
0	1.55	0	4.29
0.213	1.845	0.54	0.013
0.217	0.565	0.58	0.015

V. CONCLUSION

We examined the need of clustering in wireless sensor network. We introduced LEACH algorithm in literature survey but the major disadvantage of LEACH is, it considers homogeneous distribution of nodes in the network. So, LEACH with cluster of cluster head algorithm is used which is the best programming model for large data sets to parallel the task. We tried to use this functionality of LEACH with cluster of cluster head algorithm. LEACH with cluster of cluster head algorithm is widely used for clustering in data mining, but it is best suitable for smaller data sets. The Lager data setoff sensor network becomes the smaller data set of LEACH with cluster of cluster head algorithm. And for it the LEACH with cluster of cluster head algorithm works best.

Our proposed scheme does not need the homogeneous distribution of the nodes over the grid. In cluster of cluster head phase we are assigning the cluster heads to sensor nodes. In LEACH with cluster of cluster head algorithm phase we tried to optimize the clusters by checking two conditions. In first one we checked the energy of the CH; it is below some threshold new CH will be assigned to the sensor nodes. It helps to minimize the dropped nodes in the network. In second condition, if the energy of the common node is falling below some threshold it tries to find out new CH. It will also help to minimize the dropped nodes. We have considered and placed the CHs in the sensor network such that minimum distance is maintained among them. Our algorithm tries to change the cluster head of the nodes if the CH is running out of the energy, it helps to minimize the dropped packets. Also the

proposed scheme gives the better performance in terms of throughput. Our scheme basically considers the energy of the node as well as the position of the node, it helps to produce best cluster.

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