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Improvement in Cluster Head Selection Method by Considering Residual Energy and Distance between Nodes to Base Station in WSN

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***Abstract*—** Wireless Sensor Network(WSN) performs energy extensive tasks and it is essential to rotate the roll of cluster head to make it efficient. Hierarchical routing having cluster based topology is a very efficient approach for improving throughput. In this paper we aim to improve network life time by using LEACH based protocol by considering residual energy and distance of nodes in WSN. In our proposed approach we adopt dynamic clustering with dynamic selection of cluster heads in first round and static clustering with dynamic selection of cluster heads from second round. The protocol has been simulated in NS2 and results show improvement in energy efficiency, throughput, less packet drops and packet delivery ratio when compared to LEACH**.**

Keywords- *Wireless Sensor Network; sensor nodes; Throughput; clusters, cluster-head, NS2*

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I. INTRODUCTION

Wireless Sensor Network(WSN) itself organizing network consisting of many small devices called sensor nodes. These nodes consists of components like -sensing, data processing, communication, aggregation and base station. Wireless sensor networks includes various -based, and location based routing protocols. In this paper we concentrate on hierarchical protocol called LEACH. This protocol is mainly used to increase the life time of the network. The other types of hierarchical protocols include Hybrid, Energy Efficient Distributed [HEED], Threshold-sensitive Energy Efficient sensor Network (TE applications such as monitoring, manufacturing and logistics, environmental observation and forecast systems, military applications, health, home and office application and a variety of intelligent and smart systems.

The nodes in a network are distributed randomly. The sensor node are used to collect data from neighboring nodes and forward it to the sink, and from sink to the base station. Data collected at base station is further processed and analyzed.

There are three types of routing protocols-Proactive, Reactive, and hybrid protocols. In WSN the routing protocols are classified as flat-based, hierarchical EN), Power-Efficient Gathering in Sensor Information System (PEGASIS).

The concept hierarchical protocol is to divide the network in hierarchy of nodes. In this the network is divided into three layers. The level 0 consists of sensor nodes, which are used to sense data. Level 1 consists of cluster head, the sensed data from sensor nodes is forwarded to cluster head. Level 2 consists of base station, the data from of cluster head is forwarded to base station.

II. RELATED WORK

TL-LEACH(Two-Level Hierarchy LEACH) [3] is a proposed extension to the LEACH algorithm. It has two levels of cluster heads (primary and secondary) instead of a single one. Here, the primary cluster head in each cluster communicates with the secondary's, and the corresponding secondary's in turn communicate with the nodes in their sub-cluster. Data fusion can also be performed here as in LEACH. In addition to it, communication within a cluster is still scheduled using TDMA time-slots. The organization of a round will consist of first selecting the primary and secondary cluster heads using the same mechanism as LEACH, with the a priori probability of being elevated to a primary cluster head less than that of a secondary node. Communication of data from source node to sink is achieved in two steps: Secondary nodes collect data from nodes in their respective clusters. Data fusion can be performed at this level. Primary nodes collect data from their respective secondary clusters. Data-fusion can also be implemented at the primary cluster head level. The two-level structure of TLLEACH reduces the amount of nodes that need to transmit to the base station, effectively reducing the total energy usage.

LCTS(Local Clustering and Threshold Sensitive) [4]: It combines the advantages of LEACH and TEEN in terms of short transmission delay and threshold based data gathering. Cluster-head selection is done by the base station.

LS-LEACH(Lightweight Secure LEACH) [11] is improved secure and more energy efficient routing protocol Authentication algorithm is integrated to assure data integrity, authenticity and availability. Furthermore, it shows the improvement over LEACH protocol that makes it secure and how to make it more energy efficient to reduce the effect of the overhead energy consumption from the added security measures. It provide security measures to LEACH protocol after indicating the source and limitation of nodes. Also, we develop security measures to protect wireless sensors and the communications from possible attacks without compromising the network performance. For instance, securing LEACH protocol against denial of service attacks while maintaining its performance. Furthermore, the protocol assures that only the authenticated nodes are allowed to join and communicated in the network. At the other hand, we mitigate the overhead cost from the security

measures applied to avoid compromising the network performance.

Sec-LEACH-Sec-LEACH [12] proposes some creative modifications to LEACH protocol. It shows how to invest the key pre-distribution scheme to secure node-to-CH communications. The main idea is to generate a large pool of keys and their IDs at the time the network is deployed, and then each node is assigned a group of these keys randomly. Also each node is assigned with a pair-wise key which shares with the BS; these keys are used during node-node and node-B.S. communications. This algorithm provides authenticity, confidentiality, and freshness for node-to-node communication. The security level is not impacted by the number of nodes; actually it depends on the size of the key group assigned for each node according to the total size of the key pool [12].

III. LEACH PROTOCOL

Low-Energy Adaptive Clustering Hierarchy(LEACH) is one of the clustering based hierarchical routing protocol. It is used to collect data from wireless network. In the network, hundreds and thousands of wireless sensors are dispersed that collects and transmit data. In these sensor nodes the cluster head's are elected. Because sensor nodes of low energy level and nodes cannot be replaced, the chances of node death scenario is more. So we require LEACH protocol to increase the life time of network.

LEACH protocol uses random selection cluster head selection and cluster formation. Here the energy is evenly distributed by rotating the cluster head in every round. LEACH protocol is divided into 2 phases:
1)Set-Up phase: Set-up phase includes cluster head selection and cluster formation.
- **Cluster head selection algorithm**: In this phase, the nodes are randomly dispersed in a network. Each node takes a self governing decision whether to become a cluster head for current round or not. Here every node will generate a random number between 0 and 1. If the number is less than threshold value, then node is cluster head for the current round. Threshold is given by

$$T(n) = \frac{p}{1-p(r \bmod \frac{1}{p})} \quad if \ nEG \qquad (1)$$

T(n)=p/1-p(r mod 1/p) if n€G (1)
p- optimal percentage of CH's in each round.
r-current round
G-is set of nodes which have not been elected as CH in (1/p)rounds

- **Cluster formation**: After cluster head selection, each node broad casts advertisement (ADV) message using (CSMA/CA) MAC protocol. The near-by nodes send join request to cluster head. It follows a TDMA schedule to set-up and transmission and to assign separate time slots to each of its cluster members.

2)Steady-state phase: This phase consists of transmitting data from cluster members to cluster head during allotted time slots. The cluster head aggregates data and forwards to base station.

IV. PROPOSED APPROACH

A. Network Model
The network architecture for proposed approach is based on the following assumption:

1) Base station is located at the centre of sensor field.
2) Sensor nodes are energy-constrained and have same initial energy.
3) All nodes are capable of becoming cluster head.
4) All sensor nodes are aware of the base station location.
5) Sensor nodes are static.

B. Proposed Algorithm

The proposed algorithm consists of two phases:
1)Set-up phase
-cluster head selection
-cluster formation

2)steady state phase
-Data transmission
-Present Cluster head status

1)Set-up phase **:**
-Cluster head selection: In first round the cluster head is selected using random generation number. Here every node will generate a random value using random function. The node with highest random value is selected as cluster head.

-Cluster formation:
The cluster head sends (ADV) messages to all the nodes. Based on (RSSI) received signal strength the cluster members send JOIN_REQ. The CHs create a TDMA schedule by which each member will get particular time to broadcast.

2)Steady state phase**:**
-Data transmission
Here all CMs sense data and transmit it CHs. Next other information's such as residual energy, distance to Base station etc. Then the CHs will aggregate the data and calculates the energy.

-Present Cluster head status
Here we proceed with second round of cluster head selection. In second round the cluster head is selected based on the residual energy and distance to the base station. For calculating the difference,
Calculate diff=receiving timestamp-sending timestamp.
The distance is calculated using standard Euclid distance formula.

The residual energy is measured after the 1st round. Residual energy is calculated using formula.

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E_res= current energy after 1st round
Initial energy of the cluster

Using these two parameters i.e distance and residual energy next cluster head is selected. Integrating these two formulas we get

Y= E_res*MAX_BS
D_iBS

Where E_res= residual energy
MAX_BS= maximum distance of nodes to the base station.
D_iBS= distance between each cluster.

V. SIMULATIONAND ANALYSIS

A. Simulation environment :

To analyze the performance of the LEACH with improved LEACH, we evaluate in NS2 simulator. The proposed algorithm is compared with LEACH and Results show increase in throughput.

B. Result Analysis:

1) Throughput: Throughput is how much data is received by receiver in bits/sec. The throughput of proposed approach is more compared to LEACH and LCTS protocol as shown in figure (1).
2) Energy: The Improved leach consumes less energy compared to LEACH and LCTS protocol as shown in figure (2).
3) Packet drops: Packet drops is difference between number of packets sent and packets received. The packet drops of proposed approach are less than LEACH and LCTS protocol as shown in figure (3).
4) Packet delivery ratio (PDR): it is the ratio of number of packets sent and number of packets received by the receiver. The PDR of proposed approach is higher than LEACH and LCTS protocol as shown in figure (4).

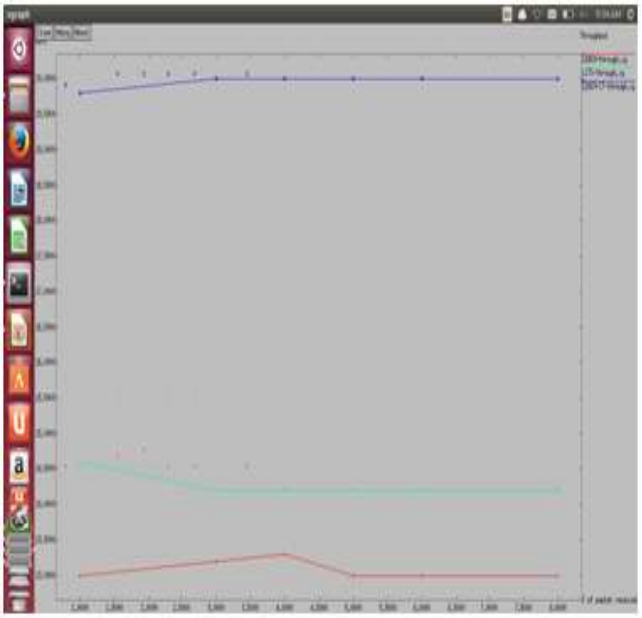

Figure 1. Throughput at sink node

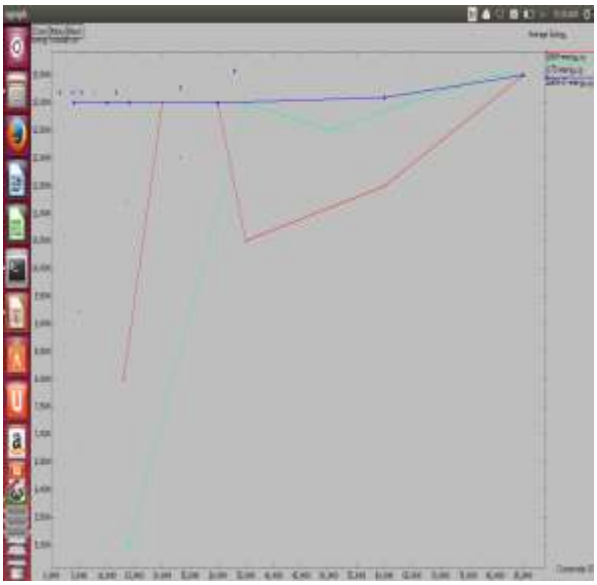

Figure 2: Average energy consumption against the cluster head

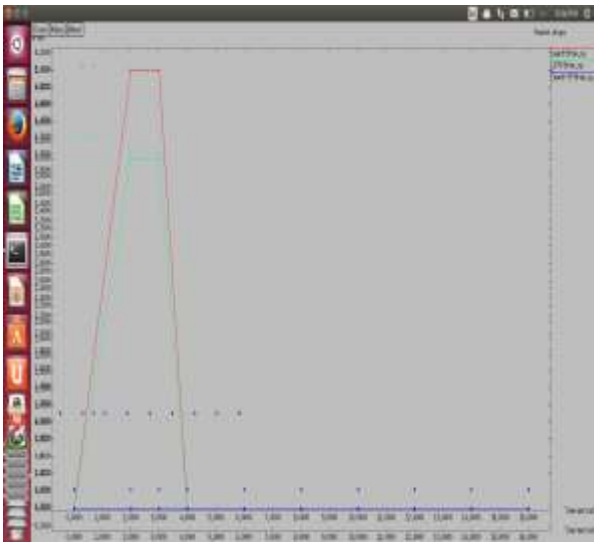

Figure 3. Packet drops

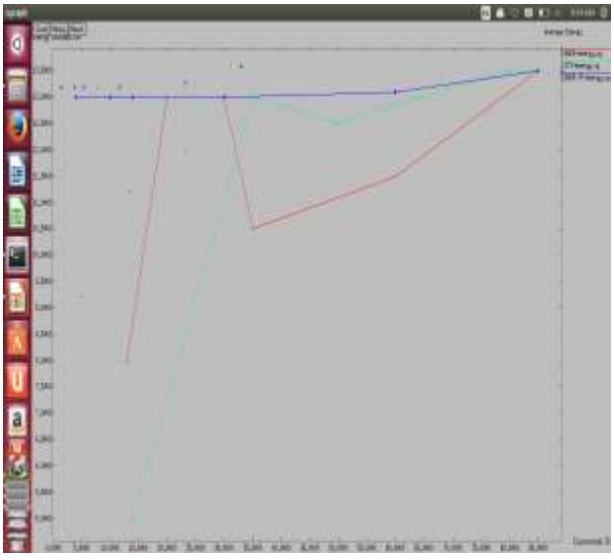

Figure 4: Packet delivery ratio

VI. CONCLUSION

The results of this paper show improvement in energy efficiency, throughput, less packet drops and packet delivery ratio when compared to LEACH.. This paper is compared with other two protocols LEACH and LCTS. The proposed hierarchical routing protocol increases the number of packets received at the sink by adapting the technique of dynamic clustering with dynamic selection of cluster-heads at first round and static clustering with dynamic selection of cluster heads from second round. The cluster-head selected in consequent rounds is decided based on the residual energy and distance to the base station. Simulation results show that our algorithm is much more efficient then other algorithms.

VII. REFERENCES

[1] Rajeshwar Singh, Singh D.K. and Lalan Kumar, "A review on security issues in wireless sensor network" Journal of Information Systems and Communication, ISSN: 0976-8742 & E-ISSN: 0976-8750, Vol. 1, Issue 1, 2010, PP-01-07.

[2] Parth M Dave, Purvang D Dalal, "Simulation & Performance Evaluation of Routing Protocols in Wireless Sensor Network" International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 3, March 2013.

[3] Ankita Joshi , Lakshmi Priya.M, "A Survey of Hierarchical Routing Protocols in Wireless Sensor Network" A Survey of Hierarchical Routing Protocols in Wireless Sensor Network pp 67 – 71.

[4] Tripti Singh, Neha Gupta and Jasmine Minj, "Hierarchical Cluster Based Routing Protocol with High Throughput for Wireless Sensor Networks", Department of Computer Science & Engineering Motilal Nehru National Institute of Technology Allahabad Allahabad, India.

[5] A. Manjeshwar and D. P. Agrawal, *TEEN: A Protocol for Enhanced Efficiency in Wireless Sensor Networks*, Proc. of the 1st Int. Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, 2001.

[6] Mian Ahmad Jan, Priyadarsi Nanda, Xiangjian He, Ren Ping Liu, "Enhancing Lifetime and Quality of Data in Cluster-based Hierarchical Routing Protocol for Wireless Sensor Network", 2013 IEEE International Conference on High Performance Computing and Communications & 2013 IEEE International Conference on Embedded and Ubiquitous Computing.

[7] P. R. Gundalwar, Dr. V. N. Chavan, "Analysis Of Wireless Sensor Networks (Wsns) And Routing Issues" , International Journal of Engineering Research & Technology (IJERT) Vol. 1 Issue 8, October – 2012.

[8] Nitin D.Alety, Kiran H. Hole, Dinesh B. Parmar, K.R.Akhil, Prof. Soumitra S.Das, " Routing & Performance Optimization Using LEACH Protocol in WSN, International Journal of Scientific & Engineering Research, Volume 4, Issue 5, May-2013.

[9] S. Lindsey, C. S. Raghavendra, PEGASIS: Power-Efficient Gathering in Sensor Information Systems, IEEE Aerospace Conference Proceedings, vol. 3, pp. 1125-1130, 2002.

[10] O. Younis and S. Fahmy, HEED: A Hybrid, Energy Efficient, Distributed Clustering Approach for Ad Hoc Sensor Networks, IEEE Transaction on Mobile Computing, vol. 3, No. 4, pp. 366-379, 2004.

[11] Muneer Alshowkan, Khaled Elleithy, Hussain AlHassan, "LS-LEACH: A New Secure and Energy Efficient Routing Protocol for Wireless Sensor Networks" , Department of Computer Science and Engineering University of Bridgeport Bridgeport, USA.

[12] Mohammed A. Abuhelaleh and Khaled M. Elleithy, "SECURITY IN WIRELESS SENSOR NETWORKS: KEY MANAGEMENT MODULE IN SOOAWSN, International Journal of network security & its applications (IJNSA), vol.2,no.4, october2010.