Implementation of throughput Improvement Algorithm for Wireless Sensor Networks

Ramesh Patil[1] Dr. Vinayadatt V Kohir[2]
[1]Department of Computer Science & Engineering [2]Department of Electronics & Communication Engineering
[1]Guru Nanak Dev Engineering College, Bidar [2]PDA Engineering College, Kalaburagi

Abstract— In this 21st century there is tremendous increase in the usage of Wireless distributed sensor systems, these systems enable the most reliable monitoring techniques for any desired environments it may be real time or non-real time applications, like any civil or military applications. In this paper, we present traditional method of communication protocols used for WSN's and study its impact on the overall energy dissipation. Further we compare the existing method of data aggregation with our proposed energy efficient algorithm based on clustering technique.

Key words: WSN, LEACH, Data Aggregation, CH, Energy

I. INTRODUCTION

Most of the communication protocols are defined for direct transmission, minimum-transmission-energy, multihop routing, and static clustering may not be optimal for sensor networks, In year 2000, a group of researchers namely Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan of Massachusetts Institute of Technology proposed LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network. LEACH uses localized coordination to enable scalability and robustness for dynamic networks, and incorporates data fusion into the routing protocol to reduce the amount of information that must be transmitted to the base station. Simulations show that LEACH can achieve as much as a factor of 8 reductions in energy dissipation compared with conventional routing protocols. In addition, LEACH is able to distribute energy dissipation evenly throughout the sensors, doubling the useful system lifetime for the networks[1].

LEACH algorithm is based on hierarchical routing, where all nodes organise themselves into different groups, either individual clusters or zones. Nodes present within cluster will work together in order to distribute workload between them, if no workload exists then all nodes act as redundant nodes for each other. Typically, the nodes in each cluster elect a clusterhead, which acts as an data aggregation source for every nodes of that cluster.[2].

It must be remembered that Cluster heads were chosen based on their remaining energy and on the energy required by ordinary nodes to communicate with the cluster heads.

Overall routing generally occurs in either of two ways:

1) All communication from a individual node travels through particular cluster head after being data aggregated from neighbouring nodes of that cluster.
2) For every cluster there must be gateway nodes which should enable inter communication between multiple clusters. Whatever information/ data are aggregated within cluster by the cluster head must forwarded through a sequence of clusters by use of gateway nodes until the data arrives at the sink.

II. DATA AGGREGATION PROCESS

Most of the sensor networks contain too much of data/information for an end-user to process. So it is necessary to define automated methods/ algorithms of combining or aggregating the data into a small set of meaningful information.[3][4]. In order to avoid information overload, data aggregation, we use data fusion technique, which allows us to enhance and combine any unreliable data measurements in order to produce a more accurate signal and also helps in minimizing the uncorrelated noise.

The proposed data aggregation process for our cluster based WSN algorithm is shown in flowchart Fig.1. Whenever the monitoring node sends an status order to inquire about the state, then this status order is transmitted to the coordinator. Now the cluster head broadcasts information towards all member nodes in order to activate the existing dormant nodes to carry out all data communication within cluster. After receiving all the data collected and sent by the member nodes, the cluster head CH integrates and further exchanges the data to the central monitoring host along the original path. If any of the target network coordinator is not found or disconnected, the order will be reverted and returned back to earlier monitoring node. We must see to that all unused nodes in the network must to be in dormant state in order to save energy and extend the overall lifetime of the network.

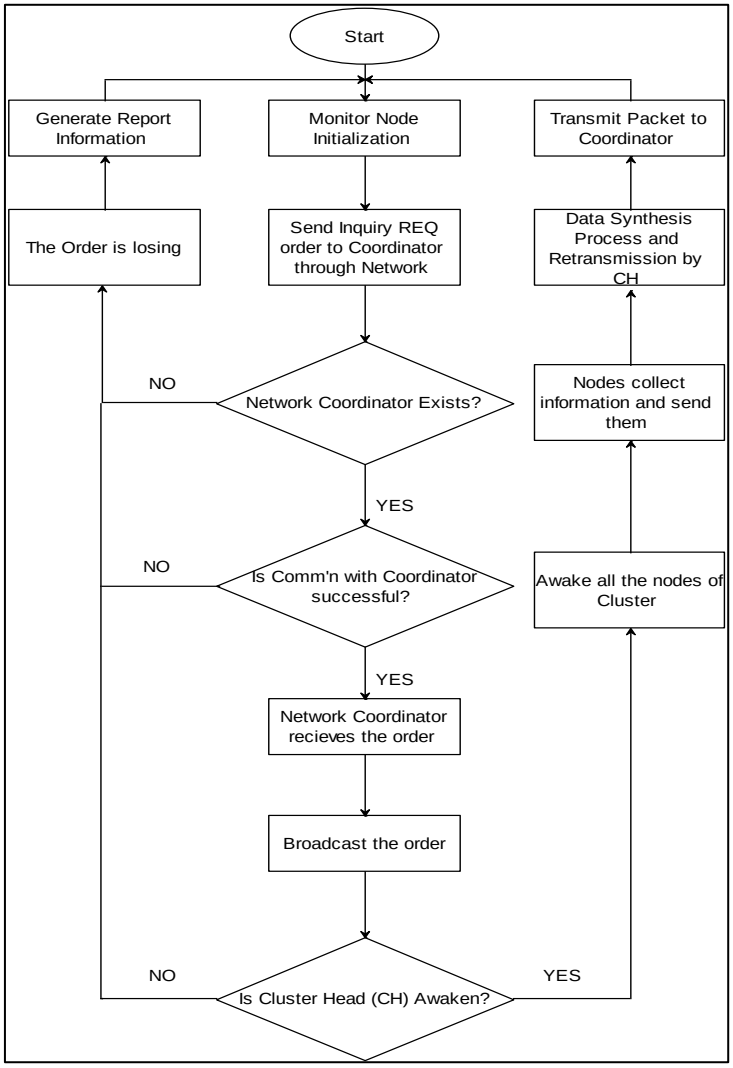

Fig. 1: Data Aggregation Process.

– The overall method of performing data aggregation / the classification algorithm is application-specific.

III. RESULTS & DISCUSSIONS

The Proposed energy efficient algorithm and communication protocol is simulated under OPNET tool. We have considered two scenarios for simulations, one scenario simulated without cluster head (CH) and other with cluster head (CH). In each scenario we have taken two clusters, each cluster consisting of 4 member nodes a shown in fig.2. Further we simulated these scenarios by enabling inter communication between this clusters by use of gateway node across each cluster end.

A. Proposed Scenario

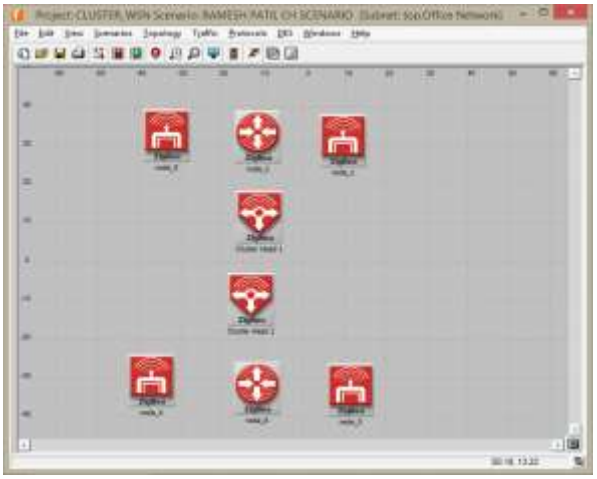

Fig. 2: Proposed Scenario with Cluster Head

In our scenario all the member nodes transmit data to cluster heads, here node_0, node_1, node_2 are members of Cluster Head 1, whereas node_4, node_5, node_6 are members of Cluster Head 2.The overall simulation period was for 20.mins (1200 secs).

Dimension of Topography	100*100
Number of Retransmission Attempts	5
Minimum Back Off Exponent	3
Maximum Number of Back Offs	4
Transmission Bands	2450MHz

Table 1: Simulation Parameters

Our obtained results outperforms earlier proposed static clustering algorithm, the simulated results show very high throughput for clusters consisting of cluster head, in which data fusion/ data aggregation is enabled. The overall throughput obtained with cluster head was three times higher than throughput obtained without cluster head can be seen in fig.5.

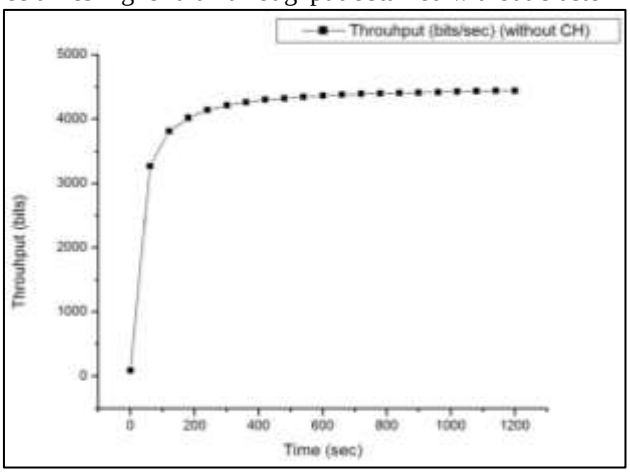

Fig. 3: Throughput for Scenario simulated without Cluster Head (CH)

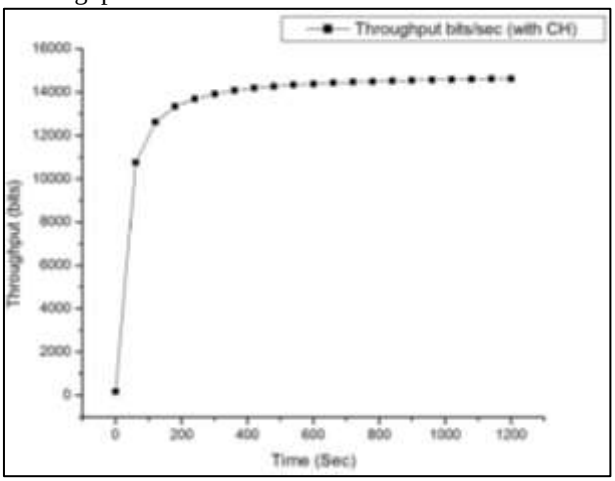

Fig. 4: Throughput for Scenario simulated with Cluster Head (CH)

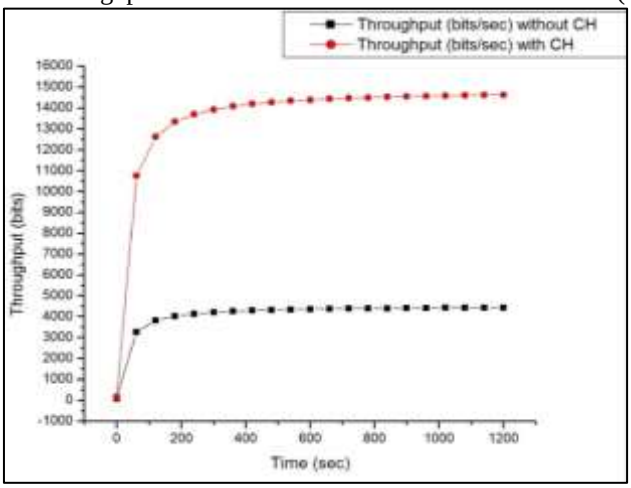

Fig. 5: Comparison of Throughput for both simulated Scenario's (with & without CH)

IV. CONCLUSION

Our obtained results outperforms earlier proposed static clustering algorithm, the overall throughput obtained with cluster head was three times higher than throughput obtained without cluster head as shown in fig.3, fig.4 and fig.5. By this throughput performance we can clearly say that the energy consumption will be very less because of less delay and less network load. Hence the proposed algorithm can be considered as energy efficient and clustering concept enables high data aggregation within network hence this technique can be implemented in Wireless Sensor Networks.

REFERENCES

[1] Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan, “Energy-Efficient Communication Protocol forWireless Microsensor Networks”, Proceedings of the 33rd Hawaii International Conference on System Sciences - 2000.
[2] Alan W. F. Boyd, “Node Reliance: An Approach to Extending the Lifetime of Wireless Sensor Networks”, A thesis to be submitted to the UNIVERSITY OF ST ANDREWS June 2010.
[3] D. Hall. Mathematical Techniques in Multisensor Data Fusion. Artech House, Boston, MA, 1992.
[4] L. Klein. Sensor and Data Fusion Concepts and Applications. SPIE Optical Engr Press, WA, 1993.
[5] Mumtaz M.Ali AL-Mukhtar, Teeb Hussein Hadi, "Diagnosis of Failures in Zigbee Based Wireless Sensor Networks", IJCSET, Vol 3, Issue 3, 104-108, ISSN:2231-0711, March 2013.
[6] P. Medagliani, M. Martalo, G. Ferrari, "Clustered Zigbee networks with data fusion: Characterization and performance analysis", ELSEVIER Ad Hoc Networks 9 (2011) 1083–1103.