RESEARCH ARTICLE OPEN ACCESS

Review Paper on Energy Efficient Protocol in Wireless Sensor Network

Sheetal Watkar*, Prof. B.G.Hogade**,Prof.Hemangi Satam***
*(Department of Electronics and Telecommunications, Mumbai University, India)
** (Department of Electronics and Telecommunications, Mumbai University, India)
*** (Department of Electronics and Telecommunications, Mumbai University, India)

ABSTRACT
Wireless sensor network (WSN) is a system composed of a large number of low-cost micro-sensors. This network is used to collect and send various kinds of messages to a base station (BS). WSN consists of low-cost nodes with limited battery power, and the battery replacement is not easy for WSN with thousands of physically embedded nodes, which means energy efficient routing protocol should be employed to offer a long network life time. The lifetime of Wireless Sensor Networks (WSN) is crucial. To achieve the aim, we need not only to minimize total energy consumption but also to balance WSN load. Hence, this paper aims to study different energy balance routing protocols of WSNs. In this paper, we have compared different protocols of WSN, ensuring maximum network lifetime by balancing the load as equally as possible

Keywords **-** Energy-balance, network lifetime, routing protocol, wireless sensor network

I INTRODUCTION

WITH the advances in Micro-Electro-Mechanical Systems (MEMS)-based sensor technology, low-power digital electronics and low-power wireless communication [1],[2],[3], it is now possible to produce wireless sensor nodes in quantity at low cost. Although these sensor nodes are not as powerful or accurate as their expensive macro-sensor counter parts, we are able to build a high quality, fault-tolerant sensor network by making thousands of sensor nodes work together. Through the cooperation of wireless sensor nodes, WSN collects large amounts of information and sends them to the Base Station (BS). WSN has a wide range of potential application including military surveillance, disaster prediction, environment monitoring, etc. Thus it has become one of the most important research fields and has aroused extensive research interest. Generally, wireless sensor nodes are deployed randomly and densely in a target region, especially where the physical environment is so harsh that the macro-sensor counterparts cannot be deployed. After deployment, the network cannot work properly unless there is sufficient battery power. In general, WSN may produce quite a substantial amount of data, so if data fusion could be used, the throughput could be reduced. Because sensor nodes are deployed densely, WSN might generate redundant data from multiple nodes, and the redundant data can be combined to reduce transmission.

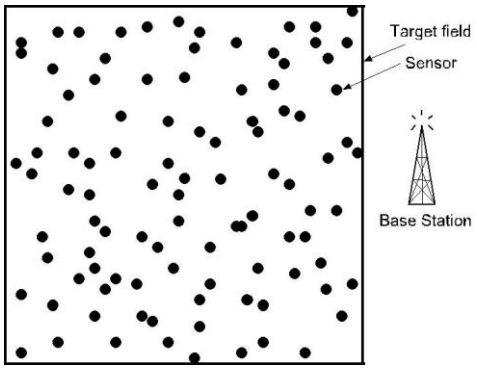

Fig.1 A system model of WSNs

This paper primarily consists comparative study of various energy balance routing protocols of WSNs. Each Protocol has its own advantages and disadvantages under specific working environment. To compare and evaluate the effectiveness of each protocol, this paper focus on namely how many no of nodes dies after certain rounds. In comparative discussion of performance of different existing protocols of WSNs, table shows the comparison summary of the performance evaluation of different protocols. In this paper we are comparing LEACH, PEGASIS [14], HEED [8], TREEPSI [12], TBC [13] and GSTEB [9].

II. REVIEW OF LITERATURE

Researchers have proposed many protocols such as LEACH, HEED, PEGASIS, TBC and PEDAP, GSTEB.In order to explore about the energy efficient protocol technology, we had gone through different online and offline resources in addition to different research papers. Few of them are given

below:

Zhao Han, Jie Wu, Member, IEEE, Jie Zhang, Liefeng Liu, and Kaiyun Tian (2014): Proposed a General Self-Organized Tree-Based Energy-Balance routing protocol (GSTEB) which builds a routing tree using a process where, for each round, BS assigns a root node and broadcasts this selection to all sensor nodes. Subsequently, each node selects its parent by considering only itself and its neighbors' information, thus making GSTEB a dynamic protocol. [9]

K. T. Kim and H. Y. Youn, (2010): Proposed a Tree-Based Clustering TBC in which all the deployed sensors construct a logical tree. Data are passed from a leaf node to its parent nodes. [13]

Ossama Younis, Student Member, IEEE, and Sonia Fahmy, Member, IEEE (2004): Present a protocol, HEED (Hybrid Energy-Efficient Distributed clustering), that periodically selects cluster heads according to a hybrid of the node residual energy and a secondary parameter, such as node proximity to its neighbours or node degree [8]

H. O. Tan and I. Korpeoglu (2003): Propose PEDAP prolongs the lifetime of the last node in the system while providing a good lifetime for the first node, whereas its power-aware version provides near optimal lifetime for the first node although slightly decreasing the lifetime of the last node. [7]

S. Lindsey and C. Raghavendra (2002): Propose PEGASIS, every node in chain senses the data, receives data from its predecessor, and fuses with received predecessor's data and transmits to next node in chain. [14]

W. B. Heinzelman, A. Chandrakasan, and H. Balakrishanan (2000): 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. [5]

III. RESULT ANALYSIS

TABLE1.Comparison between Hierarchical Protocols

AUTHORS	PROTOCOS	ADVANTAGES
Chunyao FU, Zhifassng JIANG, Wei WEI and Ang WEI	LEACH	It is a clustering based technique and the cluster head in network directly communicates with the base station in single hop. It has two phases, set-up and steady state phase.
Stephanie Lindsey Cauligi S. Raghavendra	PEGASIS	It is a tree based technique; it has low consumption of energy compared to LEASE. It has two phases, Chain formation phase, Broadcasting phase. Life time of PEGASIS is more if we compared it with LEACH
Ossama Younis, and Sonia Fahmy	HEED	It is a clustering based technique; This is suitable for heterogeneousWSN It has three phases, Initialization phase, Set-up phase and Steady phase. Life time of HEED is more compared to PEGASIS.
S.S.Satapathy and N. Sarma	TREEPSI	The length of path form end, leaf node to root/chain node in TREEPSI is shorter compared to PEGASIS. The data will not send data for a long path. For In TREEPSI power consumption is less if we compared it with PEGASIS

K. T. Kim and H. Y. Youn	TBC	Nodes in a cluster form a tree with the root as the cluster-head, while the height of the tree is decided based on the distance of the member nodes to the cluster-head
Jie Zhang, Liefeng Liu, and Kaiyun Tian	GSTEB	A General Self-Organized Tree-Based Energy-Balance routing protocol is used to achieve a longer network lifetime. Each round BS assigns a root node and broadcasts this selection to all sensor nodes. each node selects its parent by considering only itself and its neighbors details thus making a dynamic protocol

TABLE 2 .Network Lifetimes Of Different Schemes

Energy (J/node)	Protocol	The round a node begins to die	The round all the nodes are dead
0.25	LEACH	118	243
	PEGASIS	246	568
	TREEPSI	267	611
	TBC	328	629
	GSTEB	389	677
0.5	LEACH	209	435
	PEGASIS	485	1067
	TREEPSI	532	1123
	TBC	589	1165
	GSTEB	730	1330

Above table gives a MATLAB simulation results of protocols in terms of number of rounds, when nodes begins to die and when all the nodes in the network are completely dead. We can find that GSTEB performs better than all other protocols [9]

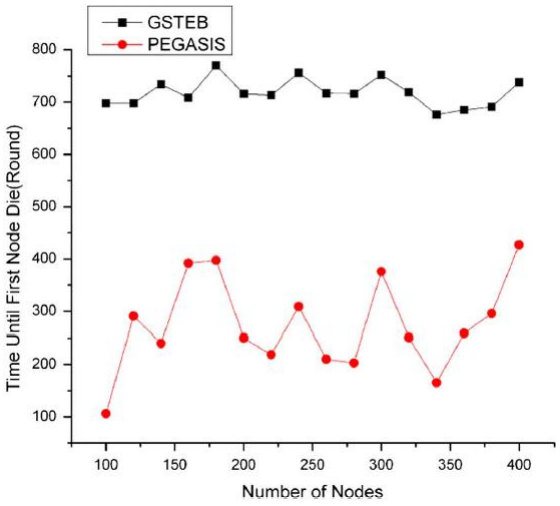

Fig.2 Comparing the time when first node dies for GSTEB and PEGASIS for the number of nodes from 100 to 400 in the square area, the net-work working in round makes Round be the time measurement unit

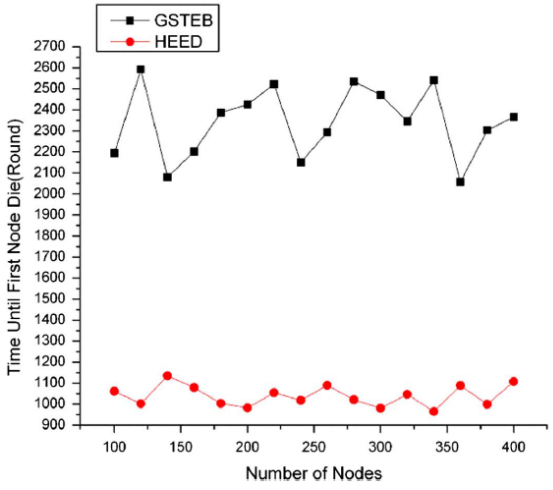

Fig.3 Comparing the time when first node dies for GSTEB and HEED for the number of nodes from 100 to 400 in the square area, the network working in round makes Round be the time measurement unit

IV.CONCLUSION

GSTEB outperforms compared with above mentioned protocol. In LEACH protocol cluster head is selected randomly and it reduces the energy level due to their distances to base station are far, because of the heavy energy burden and these cluster heads will soon die. In case of PEGASIS, nodes take turns to transmit the fused data to the base station to balance the energy depletion in the network and preserves robustness as the sensor nodes die at random locations. HEED distribution of energy extends the lifetime of the nodes within the network thus stabilizing the neighboring node .At the end of each TDMA; each node is either a cluster head or an

ordinary node that belongs to exactly one cluster. In GSTEB, the cluster head is selected based on energy and a tree is constructed to transfer the information. Thus GSTEB prolongs the network lifetime compared to other protocols in the network.

.

REFERENCES

[1] K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks," *Elsevier Ad Hoc Network J.*, vol. 3/3, pp. 325–349, 2005.

[2] I. F. Akyildiz *et al.*, "Wireless sensor networks: A survey," *Computer Netw.*, vol. 38, pp. 393–422, Mar. 2002.

[3] Sohrabi *et al.*,Protocols for self-organization of a wireless sensor network,*IEEE Personal Commun.*, vol. 7, no. 5, pp. 16–27, Oct. 2000.

[4] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, Wireless sensor networks: A survey, *Computer Netw.s*, vol. 38, no. 4, pp. 393–422, 2002

[5] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, Energy efficient communication protocols for wireless micro sensor networks, in *Proc. 33rd Hawaii Int. Conf. System Sci., Jan. 2000, pp. 3005–3014.*

[6] Quazi Mamun, A Qualitative Comparison of Different Logical Topologies for Wireless Sensor Networks, *Sensors 2012, 12, 14887-14913.*

[7] H. O. Tan and I. Korpeoglu, Power efficient data gathering and aggregation in wireless sensor networks, *SIGMOD Rec., vol. 32, no. 4, pp.* 66–71, 2003.

[8] O.Younis and S. Fahmy, HEED A hybrid energy-efficient, distributed clustering approach for ad hoc sensor networks, *IEEE Trans. Mobile Computing, vol. 3, no. 4, pp. 660–669, 2004.*

[9] Zhao Han, Jie Wu, Jie Zhang, Liefeng Liu, and Kaiyun Tian,A General Self-Organized Tree-Based Energy-Balance Routing Protocol for Wireless Sensor Network, *IEEE Transactions On Nuclear Science, Vol. 61, No. 2, April 2014*

[10] Kevin L. Mills, A brief survey of self-organization in wireless sensor networks, Wireless Communications and Mobile Computing, *Wirel. Commun. Mob. Comput. 2007; **7:823–834** Published online 10 May 2007 in Wiley InterScience DOI: 10.1002/wcm.499*

[11] *G.Asha*, S.Durgadevi, Mr.K.Shankar ,The comparison between routing protocols based onlifetime of wireless sensor networks**,** *International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726,Volume 3 Issue 11 , November 2014 , PP.20-26*

[12] S. S. Satapathy and N. Sarma, TREEPSI: Tree based energy efficient protocol for sensor information, in *Proc. IFIP Int. Conf.*, Apr. 2006, pp. 11–13

[13] K. T. Kim and H. Y. Youn, Tree-Based Clustering (TBC) for energy efficient wireless sensor networks, in *Proc. AINA 2010*, 2010, pp. 680–685

[14] S. Lindsey and C. Raghavendra, Pegasis: Power-efficient gathering in sensor information systems,in *Proc. IEEE Aerospace Conf.*, 2002 vol. 3, pp. 1125–1130