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Protocols of Wireless Sensor Network: A Comparative Review

Neetu Mehta[1], Arvind Kumar[2]
[1]*SRM University, Computer Science and Engineering Department, Delhi - NCR. Sonepat, Haryana*
Email id: neetu.verma29@yahoo.com
[2]*SRM University, Computer Science and Engineering Department Delhi, - NCR. Sonepat, Haryana*
Email id:k.arvind33@gmail.com

Abstract: Wireless sensor network has been one among the most researched area. The main objective of the present paper is to understand the previous work that has taken place on the protocols of WSN. The review is divided into two parts. The first part of the review segment try to find out the different protocols suggested by different scholars for the WSN and second part analyses the existing protocol. Multiple Protocols have been found during the survey and mostly worked with improvising the energy efficiency which means to enhance the network stability period. This research will result into the gaps in the existing literature and this will open avenues for further research.
Keywords: Protocol, WSN, Energy Efficiency, Network Lifetime

1. INTRODUCTION

Wireless Sensor Network (WSN) has been widely accepted as a leading area of research among the scholars in last decades. One can call a sensor as a device which identifies and reacts some type of input from both the physical or environmental conditions, and results in the form of electrical signal that is transmitted to a controller for further processing. A Wireless sensor network, whereas, is a network of devices which transfer the data collected from a monitored field using the wireless links. It is the multiple nodes that forward the data, and with a gateway, the data is linked to other networks like wireless Ethernet. Hence WSN can be understood as a remote system that comprises of base stations (sink) and quantities of nodes (remote sensors).Figure 1 shows the model of Wireless sensor network. These systems are utilized to screen physical or ecological conditions like sound, temperature and pass information through the system to the principal location. It has various applications across different spheres of life like in the field of observing air pollution, military surveillance, monitoring waste water, movement across international borders etc. 1-9[1-2]Among the major issues in WSNs is conservation of energy and extending network lifetime [3-5][2-4]. Clustering techniques have been widely used to resolve the issue of energy conservation where in among the multiple nodes few nodes are being made the cluster head to manage the whole system.

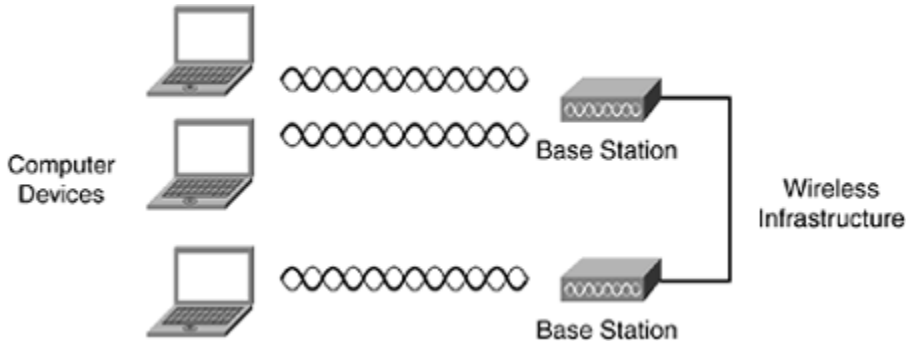

Figure 1: Wireless sensor network

The cluster head is one among the nodes which is in charge of looking after cluster, gathering information from nodes and transferring it to sink. By utilizing clustering system it has been watched that there is a huge amount of energy that has been saved.

2. CLUSTERING

Clustering [2][4] [6-7], refers to the ability of several nodes to connect to a single database (cluster head) to reduce the energy consumption .The fundamental role of cluster head is proficient information correspondence between sensor hubs and the base station. So the cluster head ought to have high vitality when contrasted with different nodes. Cluster head totals information and sends collected information to the base station where the end-client can get to the information. Cluster formation has been shown in Figure 2 and Figure 3 shows the LEACH Clustering Hierarchy

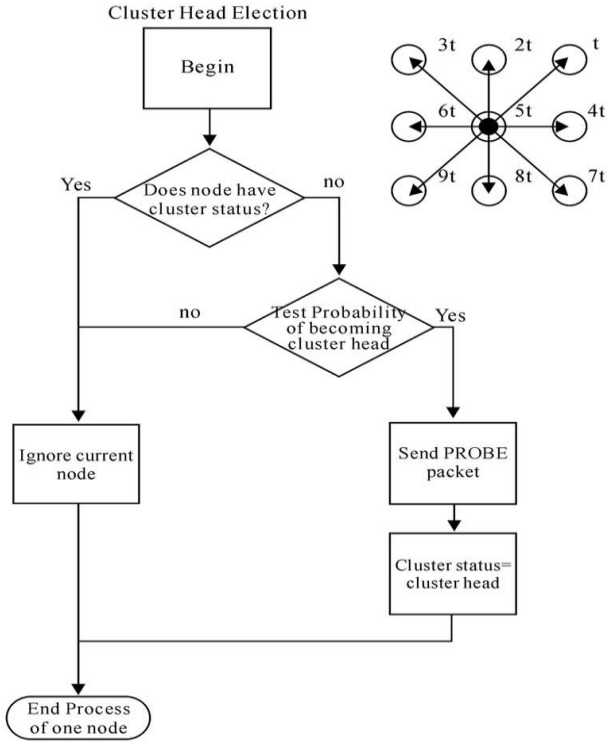

Figure 2: Cluster formation in WSN [8]

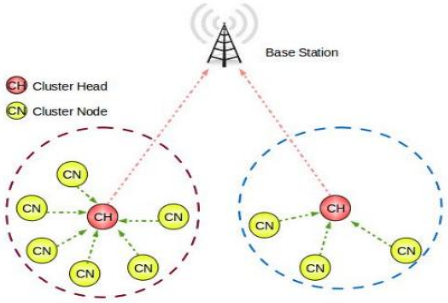

Figure 3: LEACH Clustering Hierarchy

Broadly clustering can be done in two types of networks. The first one is homogeneous and second is heterogeneous. A homogeneous sensor network consists of identical nodes, while a heterogeneous sensor network consists of two or more types of nodes (organized into hierarchical clusters). When clustering technique is used in sensor networks of homogeneous types it is called homogeneous clustering and when the techniques is applied in heterogeneous network it is known as heterogeneous clustering.

3. LITERATURE SURVEY ON TYPES OF PROTOCOLS

Heinzelman et al. [4] has proposed Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol which can have significant impact on the overall energy dissipation of these networks. Simulations show the 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 simulated .Manjeshwar et al. [5] introduced TEEN (Threshold sensitive Energy Efficient sensor Network protocol) as a protocol which was expected to be energy efficient. They found, while evaluating the performance that TEEN outperforms the existing conventional sensor networks. Lindsey et al. [8] propose PEGASIS (power-efficient gathering in sensor information systems), a near optimal chain-based protocol which they considered as an improvement over LEACH. Simulation results show that PEGASIS performs better than LEACH by about 100 to 300% when 1%, 20%, 50%, and 100% of nodes die for different network sizes and topologies. Youniset al. [2] 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. HEED terminates in O (1) iterations, incurs low message overhead, and achieves fairly uniform cluster head distribution across the network. They claimed that HEED can asymptotically almost surely guarantee connectivity of clustered networks. Another protocol being suggested was Stable Election Protocol (SEP) Smaragdakis et al. (2004) [10]. This protocol meant for two-level heterogeneous networks which use to have two types of sensor nodes. It is equally probable for both of the node to become the cluster head. One major advantage of this protocol was that it improved the time period prior to first node getting dead i.e. improvement in stability time. Distributed energy-efficient clustering (DEEC) was the next protocol proposed by Qing et al. [11] which was again meant for heterogeneous wireless sensor network. It is the ratio among the energy left with each of the node and average energy of Wireless sensor network that decided the cluster head. To improve the load balancing problem and improve the energy efficiency Israr et al. [12] proposed the improvised Multi-hop LEACH protocol. In this protocol cluster head receives the data from the sensor nodes during the inter cluster transmission. Ali et al. [13] then came with another protocol and said it ALEACH i.e. advanced low-energy adaptive clustering hierarchy protocol. It relies upon both the present status likelihood and general likelihood that empowers choosing admirably appropriate node for cluster head and pivoting cluster head positions to equally convey the energy load among every one of the nodes. Stochastic Distributed Energy Efficient Clustering (SDEEC) in the year of 2009 and Developed Distributed Energy- Efficient Clustering (DDEEC) in the year of 2010 were being proposed by Elbhiri et.al [14] and Elbhiri et al. [15] respectively. It has been asserted that SDEEC streamlined the intra-clusters correspondence to prolong network lifetime and give preferable execution over the SEP and DEEC. In case of SDEEC, when the outstanding energy of nodes diminishes and is changed over into the arrangement of the ordinary sensor nodes, protocol constantly chose the propelled nodes. It advanced the cluster head decision by following their residual energy and it performed superior to DEEC. To improve the lifespan and permanency of the WSNs, Saini et al [16] talked about Enhanced Distributed Energy Efficient Clustering (EDEEC).It has three sensor nodes which helps in increasing the lifespan, heterogeneity, and receives additional data packets at BS than SEP. A new protocol is being suggested by Alla et al.[17] which is known as Balanced and Centralized Distributed Energy Efficient Clustering (BCDEEC).Here, BS ensures that the high energy nodes get the first passage for cluster heads to show signs of improvement in lifetime of WSN. It spares normal energy and gives the preferred execution over SEP and DEEC. Kashaf et al. [18] talked about a reactive protocol utilizing three levels of heterogeneity and is known as Threshold Sensitive Stable Election Protocol (TSEP). It is found that protocol beats concerning lifetime of sensing nodes utilized.

3.1 Review on Analysis of existing protocols.

While dissecting the execution of LEACH, DEEC and SEP, Miao et al. [19], found that the execution of LEACH isn't up to mark in the heterogeneous condition as is the situation with SEP which is made out of two types of nodes. They infer that since DEEC use to have high starting and remaining energy, nodes will have more likelihood to be CH than bring down energy nodes and consequently DEEC can enhance the solidness time frame and Lifetime of WSNs. Around the same time, Qureshi et al. (2012) [20] tried the execution of Distributed Energy-Efficient Clustering, Enhanced DEEC, Developed DEEC and Threshold DEEC under various diverse condition hold abnormal state heterogeneity to low-level heterogeneity. DEEC and DDEEC performed well in three level heterogeneous system. EDEEC and TDEEC performed well in all heterogeneous state containing low energy level variety among nodes. Bhattacharyya et al. [21] grouped the routing method as proactive, reactive and hybrid on their method of capacity and sort of target applications. They additionally discovered eight conventions to be specific LEACH, TEEN, APTEEN, PEGASIS, SPIN, DD, RR, and GEAR. They reason that since the sensor systems are application based, one can't state a specific protocol is superior to other. Vivek et.al [22] suggested a multi -hop variant of LEACH (M-LEACH) which also showed better results with regard to energy efficiency.

4. CONCLUSION

Review of the literature has shown that increasing the energy efficiency remained the major objective to suggest new protocols. All the new protocols like Low-Energy Adaptive Clustering Hierarchy (LEACH), TEEN (Threshold sensitive Energy Efficient sensor Network protocol),PEGASIS (power-efficient gathering in sensor information systems), HEED (Hybrid Energy-Efficient Distributed clustering), Stable Election Protocol (SEP),Distributed energy-efficient clustering (DEEC), Multi-hop LEACH protocol ALEACH, Stochastic Distributed Energy Efficient Clustering (SDEEC), Developed Distributed Energy- Efficient Clustering (DDEEC), Enhanced Distributed Energy Efficient Clustering (EDEEC), Balanced and Centralized Distributed Energy Efficient Clustering (BCDEEC), Threshold Sensitive Stable Election Protocol (TSEP) have shown an improvement in the life span of network. There are some areas which was rarely found in the literature was the negligence of cluster head selection on the basis of Fuzzy or the bringing the distance between sensor node and base station while deciding the cluster head which may help the future researchers to opt as research area.

References

[1]A.Kashaf et al., "TSEP: Threshold-sensitive StableElection Protocol for WSNs", 10th InternationalConference on Frontiers of Information Technology(FIT), 2012, pp.164-168.

[2] O. Younis and S. Fahmy, "HEED: A hybrid, energyefficient,distributed clustering approach for ad hocsensor networks", IEEE Transaction on MobileComputing, vol.3, no.4, pp .366 -379, 2004.

[3] M. Alshowkan et al., "LS-LEACH: A New Secure andEnergy Efficient Routing Protocol for Wireless SensorNetworks", 17th International Symposium onDistributed Simulation and Real Time Applications(DS-RT), 2013, pp. 215-220.

[4] W.R. Heinzelman et al., "Energy-efficientcommunication protocol for wireless microsensornetworks", in Proc. 33rd Hawaii IEEE InternationalConference on System Sciences, 2000, pp.1-10

[5] A. Manjeshwar and D. P. Agrawal., " TEEN: A RoutingProtocol for Enhanced Efficiency in Wireless SensorNetworks", 1st International Workshop on Parallel andDistributed Computing Issues in Wireless Networks andMobile Computing, 2001, pp.1-7.

[6] W. Heinzelman, A. Chandrakasan, and H. Balakrishnan,"An Application-Specific Protocol Architecture forWireless Microsensor Networks," IEEE Transaction onWireless Comm., vol. 1, no. 4, pp. 660- 670, 2002.

[7]N.Javaid et al., "EDDEEC: Enhanced DevelopedDistributed Energy-Efficient Clustering forHeterogeneous Wireless Sensor Networks.",International Workshop on Body Area SensorNetworks, 2013, pp.914-919.

[8] Loh, P. K., & Pan, Y. (2009). An energy-aware clustering approach for wireless sensor networks. International Journal of Communications, Network and System Sciences, 2(02), 131

[9] S. Lindsey and C. S. Raghavendra, "PEGASIS: Powerefficientgathering in sensor information systems", InAerospace conference proceedings, 2002, pp. 1125-1130.

[10] G. Smaragdakis, et al., "SEP: A Stable ElectionProtocol for clustered heterogeneous wireless sensornetwork", In Second International Workshop on Sensorand Actor Network Protocols and Applications(SANPA), 2004, pp.1-10.

[11] L.Qing et al., "Design of a distributed energy-efficientclustering algorithm for heterogeneous wireless sensornetworks", Computer communications, vol. 29, no. 12,pp. 2230-2237, 2006.

[12] N.Israr and I.Awan, "Multihop clustering algorithm forload balancing in wireless sensor networks",International Journal of Simulation Systems, Scienceand Technology, vol. 8, no. 1, pp. 13-25, 2007.

[13] Md. Solaiman Ali et al., "ALEACH: Advanced LEACHrouting protocol for wireless microsensor networks", In5th International Conference on Electrical andComputer Engineering (ICECE), 2008, pp. 909-914.

[14] B.elbhiri et al., "Stochastic Distributed Energy-EfficientClustering (SDEEC) for heterogeneous wireless sensornetworks", ICGST-CNIR Journal, Vol.9, Dec, pp.11-17,2009.

[15] B.Elbhiri et al., “Developed Distributed Energy-Efficient Clustering (DDEEC) for heterogeneouswireless sensor networks”, 5th International Symposiumon Communications and Mobile Network, 2010, pp.1-4.

[16] P.Saini and A.K.Sharma, “E-DEEC- EnhancedDistributed Energy Efficient Clustering Scheme forheterogeneous WSN”, 1st International Conference onParallel, Distributed and Grid Computing (PDGC),2010, pp. 205-210

[17] S.B.ALLA at al., "Balanced and Centralized DistributedEnergy Efficient Clustering for heterogeneous wirelesssensor networks", 3rd International Conference on NextGeneration Networks and Services, 2011, pp.39-44.

[18] Kashaf, Aasia, Nadeem Javaid, Zahoor Ali Khan, andImran Ali Khan. "TSEP: threshold-sensitive stableelection protocol for WSNs." arXiv preprintarXiv:1212.4092 (2012).(FOR ESEP)

[19] Y.Miao et al., "Performance Study of RoutingMechanisms in Heterogeneous WSNs”, International Conference on Computer Science & Service System(CSSS), 2012, pp. 971-974.

[20] T.N. Qureshi et al., “On Performance Evaluation ofVariants of DEEC in WSNs”,7th InternationalConference on Broadband, Wireless Computing,Communication and Applications (BWCCA), 2012,pp.162-169.

[21] Bhattacharyya, D., Kim, T. H., & Pal, S. (2010). A comparative study of wireless sensor networks and their routing protocols. Sensors, 10(12), 10506-10523.

[22] Mhatre, Vivek, and Catherine Rosenberg."Homogeneous vs heterogeneous clustered sensornetworks: a comparative study." In Communications,2004 IEEE International Conference on, vol. 6, pp.3646-3651. IEEE, 2004