International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05 | May 2021 www.irjet.net p-ISSN: 2395-0072

Amplifying Energy Efficiency of Wireless Sensor Networks by Optimizing DEC Protocol

Shivangi Gautam[1], Pallavi Garg[2], Avni Sharma[3]

[1]*Student, Dept. of Computer Science Engineering, HPTU, H.P, India*
[2]*Head of Department, Dept. of Computer Science Engineering, Sirda Institute of Engineering & Technology, H.P*
[3]*Assistant Professor, Dept. of Computer Science Engineering, HPTU, H.P, India*

Abstract–*In today's world, wireless sensor networks (WSN's) play a significant revolutionizing role by observing and collection of physical conditions of the surroundings and coverage it to the central location [1].These networks are extremely resource and power forced. During this analysis, a strictly increased settled model has been developed that utilizes agglomeration to arrange the nodes in the network which is known as enhanced deterministic energy efficient clustering(E-DEC) protocol which is dynamic, distributive, self-organizing and well-tried to be a lot of energy economical than existing probabilistic protocols[2]. The performance of our planned E-DEC protocol was strictly tested on basis of energy consumption, network period of time and outturn. The search results were analyzed, compared and benchmarked against some well-known protocols like LEACH, SEP and SEP-E. In this, a number of agglomeration approaches like single-level agglomeration and multi-level agglomeration also are mentioned that covers each theoretical and experimental analysis of our technique [3]. MATLAB is employed to implement the simulations of 5 protocols: LEACH, SEP, SEP-E, DEC and E-DEC. The results square measure then compared to search out the facts. E-DEC protocol has achieved the goal of a well-balanced energy consumption pattern across the nodes in spite of the energy hierarchies within the network system [4].*

Key Words: **Revolutionizing, Resource and power forced E-DEC, Energy Economical, MATLAB, Well-Balanced Energy Consumption and Probabilistic Protocols.**

1. INTRODUCTION

Sensor nodes are low-size and low-complex devices that sense the environment or surroundings and gather the knowledge from the observance field and communicate through wireless links, then the information collected is forwarded via multiple hops to the sink (controller or monitor) that may use it domestically, or is connected to other network. With the help of sensors, we can avoid catastrophic infrastructure failures, conserve precious natural resources, boost productivity, improve security, and upgrade new applications such as context-aware systems and smart home technologies[5].

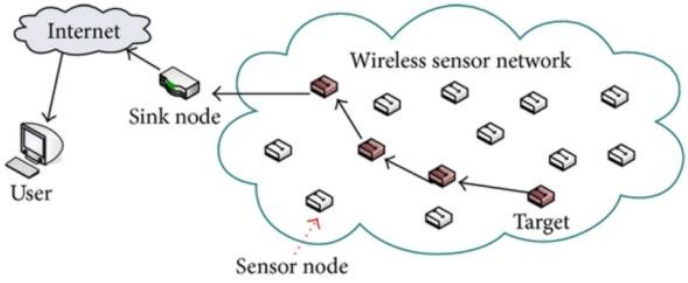

Figure 1: Architecture of a typical WSN

1.1 PURPOSE OF CLUSTERING IN WSN's

Energy potency is that the most important and difficult constraint in wireless sensor networks. Sensor nodes are operated with the assistance of batteries that don't seem to be recharable in harsh environments therefore these are energy forced. Therefore, it becomes necessary that specialized energy-aware routing and knowledge gathering protocols giving high measurability ought to be applied in order that network life is preserved in such environments. Therefore naturally, grouping nodes into clusters has been wide adopted to satisfy the higher than measurability drawback and conjointly to attain high energy potency and prolong the period of networks. Within the ranked network structure every cluster includes a leader, that is additionally known as the cluster head (CH) and frequently performs the special tasks referred higher than (fusion and aggregation), and several other common sensor nodes (SN) as members. The CH nodes mixture the information (thus decreasing the whole variety of relayed packets) and transmit them to the bottom station (BS) either directly or through the intermediate communication with alternative CH nodes. However, as a result of the CH nodes send all the time knowledge to higher distances than the common (member) nodes, they naturally pay energy at higher rates. A typical answer so as to balance the energy consumption among all the network nodes is to sporadically re-elect new CHs (thus

rotating the CH role among all the nodes over time) in every cluster. The BS is that the processing purpose for the information received from the sensor nodes, and wherever the information is accessed by the top user. BS is typically thought of mounted and at a so much distance from the sensor nodes[6].

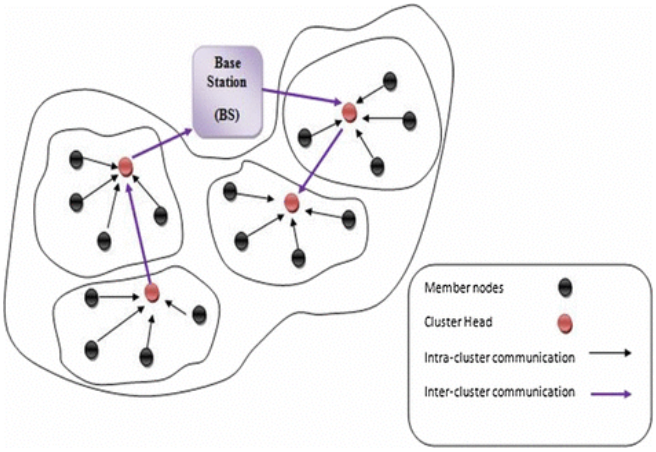

Figure 2: Data communication in a clustered network

1.2 COMPARISON BETWEEN TRADITIONAL WIRELESS NETWORKS AND WIRELESS SENSOR NETWORKS

Many existing protocols, techniques and ideas are gift associated with ancient wire-less networks, like cellular network, mobile ad-hoc network, wireless native space network and Bluetooth that are applicable and still utilized in wireless sensor networks. However there are also several necessities that result in the requirement of recent protocols and techniques. Range of nodes gift in wireless sensor network is way more than the standard wireless network. Sensor networks don't seem to be address-centric; instead they're data-centric network. Broadcast communication paradigms are utilized in wireless networks, whereas most unplanned networks are on point-to-point communication. Sensor nodes are less expensive than nodes in ad-hoc networks. Sensor networks are chiefly accustomed collect information whereas MANETS (Mobile Ad-hoc Networks) are designed for distributed computing instead of military operation. Thus, in contrast to in ancient networks, wherever we tend to specialize in maximizing channel output or minimizing node preparation, the main thought in a very sensor network is to increase the system stability, time period and in addition the system security[7].

2. NEED OF WORK

In WSN's, the protocols that are designed earlier are chiefly supported the chance of energies and are unremarkably referred to as Probabilistic models. However the potency of those protocols don't seem to be high as a result of they are not coping well with the heterogeneity which implies nodes die earlier as they willy-nilly choose the cluster heads on the idea of the chance. So to beat the issues of probabilistic models, there's another approach adopted that is deterministic model that typically elects the cluster head (CH) by evaluating the residual energies of every node within the cluster. This approach is predicated on the settled model that is thought as E-DEC. So during this protocol solely high energy nodes or say that the foremost powerful nodes can become the cluster-heads instead of low energy nodes like non appointive within the probabilistic model. There's abundant stability in determined models as compared to probabilistic models as a result of in probabilistic models initial node dies out quicker as compared to settled one. Stability amount (first node death) is that the interval wherever the primary node within the network field depletes all of its energy. E-DEC outperforms the probabilistic-based models by guaranteeing that a set range of cluster-heads are non-appointive per spherical. E-DEC determines CH election supported the residual energy of every node and proves to be additional strong and stable than that of the probabilistic-based models.

2.1 OBJECTIVES OF THE RESEARCH WORK

1. To investigate the remaining network energy.

2. To improve energy efficiency in networks.

3. To improve the throughput.

4. To calculate number of alive and dead nodes per round.

5. To compare the performance of the proposed scheme with the existing schemes under both setups i.e. homogenous and heterogeneous[8].

3. PROPOSED IDEA OF OPTIMIZED NETWORK PROTOCOL

There are situation wherever the network reaches its lifetime whereas some nodes area unit still high in residual energy. Coming up with a protocol that's capable of the same energy consumption and/or distribution within the network is non-trivial. Thus E-DEC protocol is planned, that determines cluster-head (CH) election strictly supported the

residual energy (RE) of every node. To meet this objective, E-DEC is designed to offer the followings:

1. The CH election ought to be domestically set supported every node's residual energy. Every spherical ought to be freelance of the next spherical not like the strategy in LEACH, SEP and SEP-E.

2. E-DEC ought to guarantee each node an opportunity of election as long as its residual energy is over its neighbors.

3. E-DEC ought to guarantee an extended life and stability as compared to LEACH, SEP and SEP-E, DEC in each unvaried and heterogeneous setups[9].

3.1 E-DEC ALGORITHM: CLUSTER FORMATION AND CLUSTER HEAD SELECTION

The key idea is that the sensor nodes should perform election of cluster-heads with respect to their energy levels autonomously.

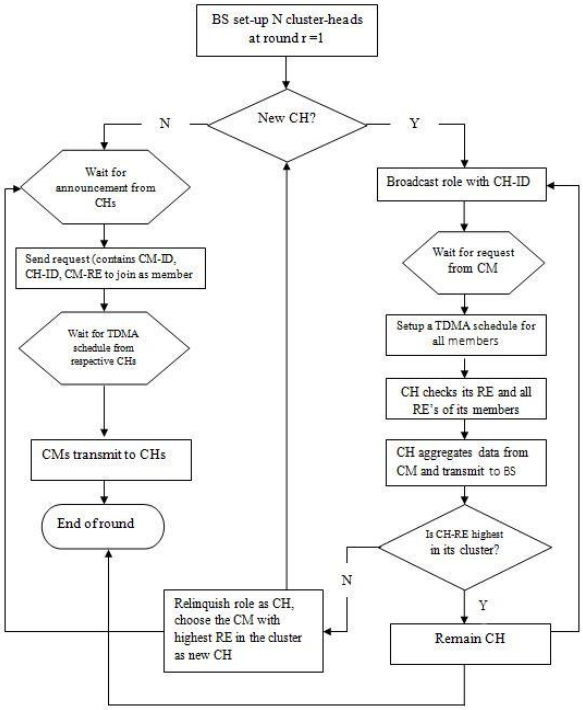

Figure 3: Flowchart of cluster head formation of E-DEC algorithm

E-DEC Cluster Formation Process: In below figure, the inexperienced coloured node has the best residual energy and hence is the new CH for consequent spherical, note the data exchange is carried-out employing a unicast packet-type shown with the curve arrow. Once this call is formed for the new CHs and every one the information from this spherical is communicated to the sink, this spherical (r = s) ends (an excellent synchronization is assumed, even as in LEACH). Consequent spherical r = s + one begins; however since the new CHs have already been chosen within the previous spherical, they broadcast their role within the new spherical and cluster members (CMs) be part of their cluster as antecedently explained on top of. The steady part begins once more. This method continues in every spherical till the last node dies within the network[10].

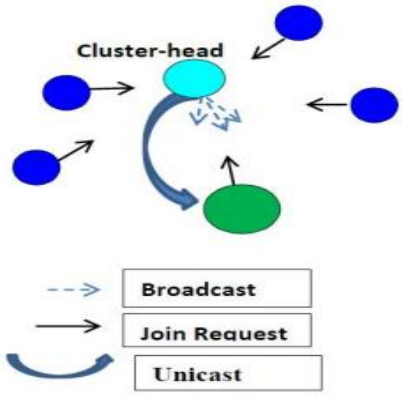

Figure 4: E-DEC cluster formation process.

4 PERFORMANCE COMPARISON BETWEEN E-DEC AND LEACH PROTOCOL UNDER HOMOGENOUS SCHEME

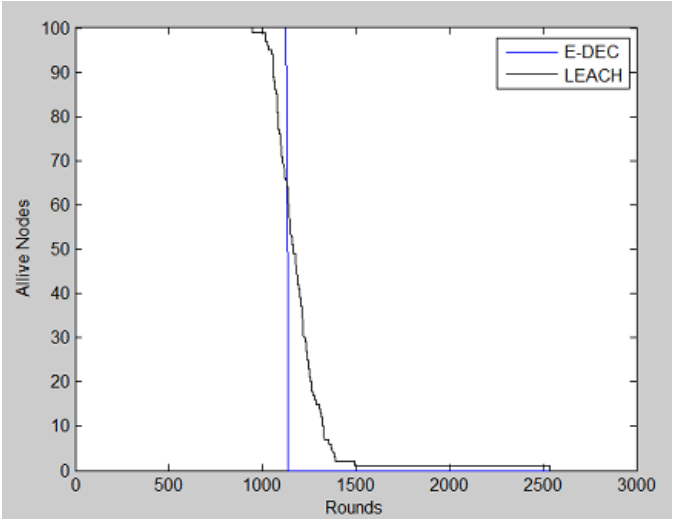

Chart 1: Performance of the protocols showing dead nodes with respect to rounds

E-DEC is more suitable as compared to the leach protocol in homogenous condition also. The performance of LEACH is additionally acceptable, however, for a critical application

that needs about 80-100% full monitoring requirements, E-DEC proves to be more suitable.

4.1 PERFORMANCE COMPARISON BETWEEN E-DEC AND OTHER EXISTING PROTOCOLS

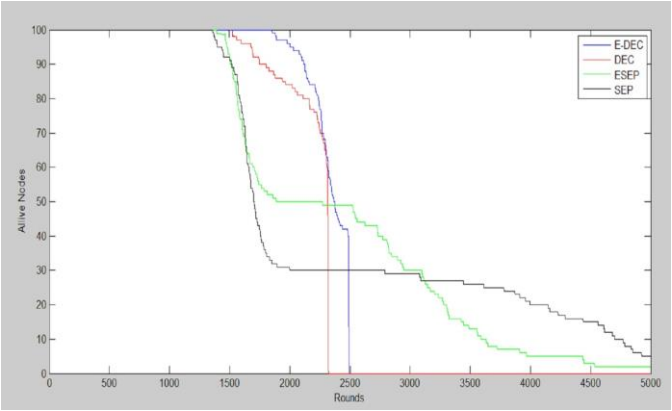

Chart 2: Performance of the protocols using heterogenous setup, with the proposed optimal parameters. Comparison with existing schemes

Chart 2, shows the behavior of SEP, SEP-E, DEC and DEC-E protocols with reference to energy heterogeneity. E-DEC proves to be superior up to when 50% of the nodes are alive. The curve of SEP-E, SEP and DEC descends slowly until the top of the network because these protocols cope slowly with heterogeneity. However, supported experiments shows E-DEC outperformed both the SEP-E and SEP protocol. Only those applications that require minimal observance can use LEACH, SEP and SEP-E.

Protocols	FND	LND
E-DEC	1952	2500
SEP	1358	5050
SEP-E	1391	5002
DEC	1660	2282

Table 1: Network lifetime of the sensors with total energy of 102.5J, when the base station is located inside the sensing region.

Here, FND= First Node Dies, conjointly called stability period And LND= Last Node Dies

The summary in Table 1 shows some significant leads to favor of the E-DEC protocol. When the energy gap in SEP becomes considerably large between the advanced nodes and therefore the normal nodes, the instability of SEP is additionally increased, as shown in above table. If the advanced nodes are far more powerful than the traditional nodes then there's a high tendency of all normal nodes dying out faster than expected, without the death of any advanced nodes. Hence, because the network evolves, this leaves the bulk of the advanced nodes with high residual energy. The adverse effect of this is often a high instability region of SEP-E and SEP. One among the benefits of the E-DEC protocol is that it elects the cluster-heads supported their respective residual energies; hence, it's ready to cope well with the matter of energy gaps. Overall, E-DEC improves the WSN's lifetime compared with DEC, SEP and SEP-E. E-DEC protocol has achieved the goal of a well-balanced energy consumption pattern across the nodes regardless of the energy hierarchies in the network system.

4.2 PERFORMANCE COMPARISON BETWEEN E-DEC AND DEC PROTOCOL

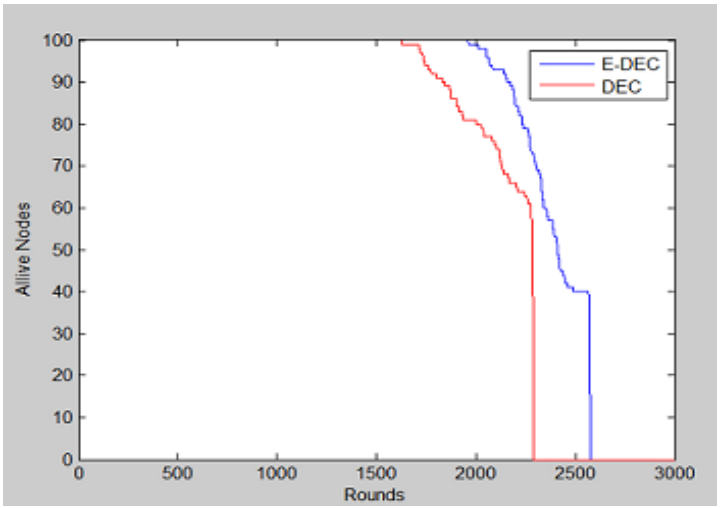

Chart 3: Comparison of E-DEC and DEC showing alive nodes vs. rounds

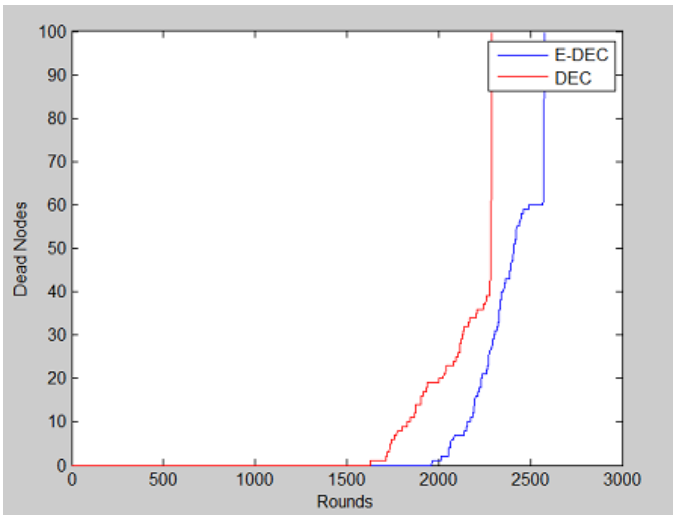

Chart 4: Comparison of E-DEC and DEC depicting dead nodes vs. rounds

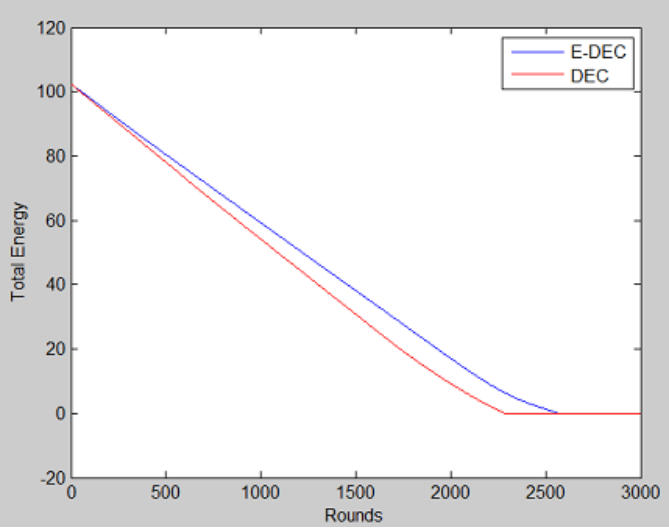

Chart 5: Comparison of E-DEC and DEC depicting Total Energy vs. rounds

In this section, the comparison between the E-DEC protocol and DEC protocol has been shown. Therefore we can see from above results that E-DEC protocol outperforms the DEC protocol in all the cases which are discussed above.

5. CONCLUSION AND SUGGESTIONS

Based on the experimental study, we will conclude that E-DEC improves the time period of wireless sensor networks considerably in comparison with LEACH, SEP, DEC and SEP-E. E-DEC takes advantage of the native data i.e., the residual energy of every node to optimize the energy consumption in each unvaried and heterogeneous situations. It's a strictly deterministic-based protocol that gives higher utilization of the energy resource for low-energy detector nodes. E-DEC is extended to the four level of hierarchy by introducing new quite nodes specifically as super nodes that area unit the foremost powerful nodes within the network. E-DEC has successfully extended the stable region and network time period by being tuned in to heterogeneity and assignment of cluster-head role to a lot of capable nodes. E-DEC offers a secured performance and shut to a perfect resolution of an even energy unfold across the network. Hence, the nodes die out nearly at constant time. From the results, it's clear that energy heterogeneity are often associated in nursing improvement to network time period of WSNs if it's properly exploited. Some suggestions during this analysis area unit as given below:

1. E-DEC protocol is often extended to a multi-level system wherever communication methodology is multi-hop or dual-hop rather than a single- hop.
2. Amplifying techniques such as PSO, GA etc. can also be applied which increases the optimality in order to select the cluster heads so as to increase the proficiency of the protocol.
3. Security technique may also be utilized in order to shield knowledge or data from attacks.

REFERENCES

[1] Wiley, [2010] Fundamentals of Wireless Sensor Networks - Theory and Practice.
[2] W. Heinzelman, A. Chandrakasan and H. Balakrishnan. 2000. Energy-Efficient Communication Protocol for Wireless Microsensor Networks. Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS '00).
[3] S. Lindsey, C. Raghavendra. 2002. PEGASIS: Power Efficient Gathering in Sensor Information Systems. IEEE Aerospace Conference Proceedings, Vol. 3, 9-16 pp. 11251130.
[4] Haase, M. and Timmermann, D. (2002). Low energy adaptive clustering hierarchy with deterministic cluster-head selection. In Proceedings of IEEE Conference on Mobile and Wireless Communications Networks, (MWCN), '02, 368{372. IEEE.
[5] Harneet Kour and Ajay K. Sharma, "Hybrid Energy Efficient Distributed Protocol for Heterogeneous Wireless Sensor Network", International Journal of Computer Applications (0975 – 8887) Volume 4 – No.6, July 2010.
[6] W. Heinzelman, A. Chandrakasan and H. Balakrishnan. 2000. Energy-Efficient Communication Protocol for Wireless Microsensor Networks. Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS '00).
[7] Vijay Garg b M.S. Meitei c S. Raman c A. Kumar c N. Tewari R.K. Ghosh a,*. Ad hoc networks. pages 168{185, 2006.} W. Heinzelman, A. Chandrakasan and H. Balakrishnan. 2000. Energy-Efficient Communication Protocol for Wireless Microsensor Networks. Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS '00).
[8] A.P. Chandrakasan W.R. Heinzelman and H. Balakrishnan. An application-specific protocol architecture for wireless microsensor networks. IEEE Transaction on Wireless Communication, 1(4):660–670, 2000.
[9] Gamwarige, S. and Kulasekere, C. (2005). An algorithm for energy driven cluster head rotation in a distributed wireless sensor network. In Proceeding of the International Conference on Information and Automation, 354{359}.
[10] Gamwarige, S. and Kulasekere, C. (2005). An algorithm for energy driven cluster head rotation in a distributed wireless sensor network. In Proceeding of the International Conference on Information and Automation, 354{359}.