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*Article*

# Energy Efficient Clustering Protocol to Enhance Performance of Heterogeneous Wireless Sensor Network: EECPEP-HWSN

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**Abstract:** As Heterogeneous Wireless Sensor Network (HWSN) fulfill the requirements of researchers in the design of real life application to resolve the issues of unattended problem. But, the main constraint face by researchers is energy source available with sensor nodes. To prolong the life of sensor nodes and hence HWSN, it is necessary to design energy efficient operational schemes. One of the most suitable routing scheme is clustering approach, which improves stability and hence enhances performance parameters of HWSN. A novel solution proposed in this article is to design energy efficient clustering protocol for HWSN, to enhance performance parameters by EECPEP-HWSN. Propose protocol is designed with three level nodes namely normal, advance and super node respectively. In clustering process, for selection of cluster head we consider three parameters available with sensor node at run time, i.e., initial energy, hop count and residual energy. This protocol enhance the energy efficiency of HWSN, it improves performance parameters in the form of enhance energy remain in the network, force to enhance stability period, prolong lifetime and hence higher throughput. It is been found that proposed protocol outperforms than LEACH, DEEC and SEP with about 188, 150 and 141 percent respectively.

**Keywords:** cluster head; dead node; random; vicinity; modulation; index; survival; overhead

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## 1. Introduction

As remote event sensing is possible by wireless sensor network, which is composed with certain number of small size sensor nodes with capabilities such as advanced processing, support for communication protocol, transceivers and sensor with better sensitivity. As wireless sensor nodes or network is easy to deploy and manage, deployment may be uniform, linear or random based on objectives. To record a real time picture large number of sensor nodes needs to be arrange systematically, such that information collection is possible for low intense and large threshold event for longer span of time. This indicates that wireless sensor network (WSN) is cost effective in information sensing for completing different tasks such as collection, aggregation and communication over the air in the coverage radius or in sensing region, but the main problem faced by WSN or wireless sensor node is in limitations of resources facilitated in development of tiny or small size node. Normally resource facilities available are low storage, less processing power compared to complex instruction set computer, antenna system with limited gain, low energy backup or battery and low bandwidth for communication. Depend on the application area, WSN for particular application has their own respective constraints than the low battery energy. Some of the popular applications design and developed by researchers are in surveillance, forestry, weather forecasting, in habitat monitoring, volcano, military, in machine health updating and for inventory system update, in biomedical applications such as for human health record and to convey doctor in certain premises areas [1-3]. Very differently classified applications of WSN are in geoinformatics and Intelligent Transport System (ITS) [3]. Finally in research for hypothesis model verification for different scenario. With this list of applications, applications can be categorized as social, industrial, medical, GIS and in research field. As WSN not only composed of wireless sensor nodes, but one most important element used by WSN is base station (BS) or sink node. After collecting information or sense data, data need send it to the BS through wireless channel. But, the main difficulty faced by researchers in using WSN is energy supply available, which shrinks the life and all performance parameters. Systematic energy utilization and enhancing performance parameters is the main goal of the researchers. Design and implementation of energy efficient scheme is commonly suggested solution by researchers in the form of local energy saving and global energy saving like sleep and wake-up strategy, data aggregation, overload reduction, single hop communication, multi-hop communication and transmission power control inside network operation. Different working approaches proposed by authors for data updating at BS like query, threshold and time based approach [1-4]. Clustering based routing is most suitable scheme to support for load balancing, fault tolerance and reliable communication and hence to prolong performance parameters of WSN. Clustering scheme have three elements as cluster head (CH) node or head of clustered node department works as an intermediate node to transfer concise report of activity inside the network in the form of aggregated data to head of system or controller i.e. BS, sensor nodes or cluster member (CM) the followers to collect and report the event information to head regularly or based on certain rule. Indirectly CH manages all CM locally and utilizes the available resources systematically. CH also contribute for different responsibility towards cluster as allocation of channel, intimation of power control, as well as reformed the cluster, control the activity of routing based on distance from BS or CM. Finally clustering scheme is the well-organized routing framework in sensory system for the sake of energy conservation by distributing responsibility to each and every member of WSN. There are the different approaches suggested by researchers to work with clustering scheme as mentioned in [1-2]. All those approaches have their respective merits and demerits. However clustering scheme provides better energy conservation with Wireless Sensor Network (WSN). But, at run time there is variation in energy level at sensor nodes of WSN, hence network with different energy level node is formed. This type of network behavior is referred as Heterogeneous WSN and longer support to traditional designed clustering protocol, which is based on assumption of sensor nodes available in the network have equal energy capability node (Homogeneous WSN). Hence researchers turn their focus on the design and development of clustering HWSN. Main components of HWSN are same as WSN like sensor nodes and BS, but in this sensor node have different capability as varied battery level, varied antenna system, high processing and link capability. On the outset high energy capability nodes is the best choice of all the varied features, as battery energy level controls all the varied features of sensor node. Ideal consideration is to have high energy node in WSN is good practice to prolong the lifetime. Adding heterogeneity in WSN (HWSN) termed as HWSN, which have better performance parameters than homogeneous WSN. HWSN with clustering approach additionally improve performance parameter of the network [1-2]. WSN may be homogeneous or heterogeneous, node whose energy level reach zero during operation termed as dead node. In real time application node whose battery energy level lower than energy require for sensing accurately or processing is termed as dead. Thus energy optimization scheme is demanded that minimize the death of nodes from WSN. Meta-heuristic approach is the preferable optimization scheme to enhance performance parameter. As heuristics approach support full benefit to specific issue, and are in greedy in nature in the solution that trapped in local saving and fails for global optimum [5]. However, meta-heuristics approach is full proof solution for energy efficiency and finding the best for global. Author follow the approach of Meta-heuristics for selecting cluster head for HWSN with three different energy level nodes as normal, advance and super node with reference to [6-7]. In this work, we present a distributed clustering approach that considers a hybrid of energy and communication cost. A novel protocol named EECPEP-HWSN (Energy Efficient Clustering Protocol to Enhance Performance of HWSN) is proposed here with different objectives such as: (i) Select best possible node to be CH by considering the real time information, (ii) Enhance stability period and lifetime by reducing energy consumption in the form of reducing internal overhead and cost of processing energy. In the proposed clustering protocol there is an assumption of random deployment or distribution of nodes, with the considerations that nodes in remote applications are randomly deployed. All nodes have their location awareness in advance or at the time of deployment. The issue we highlighted here is for the sake of load balancing and minimizing energy consumption of the network by dividing the network initially in four subsections called as zones based on population [8]. All the nodes have to work for the role inside the network may be as CH or CM, but only one at particular cluster round. A certain amount of clusters and hence CH generated inside the network at a time and there location is also known to the other member of network. In the proposed network model everybody gets an opportunity to work as CH or intermediate CH other than role of cluster member. Sensor node or member node can transfer their collected information to CH, which is in coverage range. It is well assured that selected temporary CH and final CH is less likely in the or on the vicinity of network. Proposed work is presented here in the following subsections as, second section presents literature survey, third section offers network details acquired for the proposed work, proposed work in the form of explanation of mathematical base is presented in the form of proposed protocol in fourth section, proposed protocol implementation and its validations with existing protocol is presented in fifth section of this article and efforts in the form of outcome is presented in final section of this article.

## 2. Literature Survey

Though the design and implementation of energy efficient clustering protocol is demanded, there are number of issues raised during real time working. Design energy efficient routing that support heterogeneity, scalability and hierarchical topology is the main goal of researchers in the area of wireless sensor network for longer span of time [1-2]. There is high need to design energy efficient clustering protocol such that it balance the load among the available nodes and must keep routing table minimum. Any node death must be recorded and overhead need to be reduced. To prolong lifetime of WSN or Heterogeneous WSN researchers efforts a lot to design clustering scheme based on hierarchical clustering protocol as proposed in [2]. Single hop scheme of cluster routing for homogeneous WSN with the goal of load balancing such that every node get chance to become CH once during lifetime of network as proposed by author in [8]. Node which is elected as CH for particular round never be CH again in next 1/p round with probability of cluster head is p. The base of CH election is random number generated by node within range 0 to 1. The node whose values is less than the threshold T (n) is been elected as cluster head for particular round. Once node is elected as CH, then it publishes its identity and parameter associated in the form of advertise ADV message towards other member in the coverage zone. CM replied on the receipt of ADV with associated parameters like time slot acquired, energy level available, hop count etc. CH prepares TDMA from the reply of all the nodes in its coverage and publishes it by air. With this everybody comes to know the time slot on which to participate for communication. Other than this slot period particular node can be in sleep state, to save energy available. Merits suggested by LEACH protocols are CH role is rotated such that load balancing is achieved. With single hop approach considerable energy is saved. But, there are higher number of demerits to compensate for merits as no basis of residual energy is considered, as role of CH is rotation impose possibility that node elected as CH is on the vicinity of network or in the vicinity. This mechanism increases control overhead and its processing energy, which is not suitable for scalable network. Like this other protocols suggested as [7, 10] etc. are also focused on energy efficient clustering. But all those are somehow are less faithful to really enhance energy efficiency of WSN without their considering criteria of CH selection and network model support. Stable Elections Protocol (SEP) is introduce, to enhance stability and lifetime of heterogeneous WSN by author of [11]. Two level energy nodes are introduced in this protocol namely normal and advance nodes. Basically in HWSN, nodes those are heterogenite in resources are less in percentage fraction. In this advanced node have higher battery energy level than its follower normal node. Probability of node to be CH is different for both type of node, but mostly advanced node have more chance to get select as CH than normal node. In this by increasing percentage factor of advance nodes and hence probability of CH selection improves performance in the form of stability and lifetime, which also improves throughput of the network. Demerits identified in this is advanced node get punished badly as they have more chance to get selected as CH. Reduce the survival time of network with added parameter of probability function for CH selection. DEEC (Distributed Energy Efficient Clustering) is another HWSN clustering protocol having different approach of selecting CH as proposed in [12]. In DEEC, CH selection is based on ratio of residual energy to average energy of the network. By varying epoch period we can have CH selection for different types of node. The node whose energy level, initial or residual energy is higher gets more chance to become CH than the node with low energy level. But, DEEC have the constraints as network lifetime is recorded while protocol in action for cluster round activity. DEEC have the same problem as SEP protocol as to punish advanced node badly and global knowledge of network. Hence to design and implement energy efficient clustering with heterogeneous WSN a novel approach to select CH such that energy utilization of the network get enhanced.

### *2.1. Motivation*

All aforementioned protocol HWSN clustering such as [9, 11, 12]. There is the CH selection criteria indirectly linked with probabilistic approach or connected to threshold T(n) with probabilistic approach. By varying the CH selection criteria to select most promising node, increases internal overhead. Some of the time node selected as CH is at the vicinity or off the vicinity. If node is at or on the vicinity, it increases the energy consumption in the network and hence reduces the stability and lifetime of the network. So node with this position is not suitable for the role of CH. Hence node must have better internal parameter and better connectivity with nodes and mainly situated in the premises of network. Hence best suitable node is selected for the role of CH, improves energy remain in the network, stability, lifetime and throughput of the network for respective cluster round.

### *2.2. Energy Consumption Model*

In communicating data between sensor nodes wirelessly some energy is dissipated due to internal electronics circuits operation. Other source of energy dissipation is sometimes node may have GPS system installed to update the location information. But, energy dissipation is mainly depending on the distance between sender and target receiver. It means some of the energy consumed at the time of process in sender and at transmission, at the same time energy is consumed in reception successfully and again to process for record. This energy consumption scene is presented mathematically as given below with reference to [13]. Where the parameter involved have their respective significance as $E_{elec}$ presents energy consumed by transmitting and receiving electronics circuitry to process single bit information. $E_{tx}$ and $E_{rx}$ is the energy required by transmitting and receiving section to process complete data packet of length L, This is directly depend digital coding or spreading of the bit and indirectly to digital modulation scheme used. $E_{fs}$ and $E_{mp}$ are the amount of transmitter amplifier expenses in the form of energy for free space loss and multipath fading loss, $d_0$ is the safe distance or threshold distance or crossover distance between sender and receiver. Main classified information about amplifier (power amplifier) is to control the setting of power such that if communication distance d between sender and receiver is less than $d_0$ then free space power loss model is to consider in the form of:

$$E_{tx}(L, d) = LE_{elec} + LE_{fs}d^2 \qquad d \ll d_0 \qquad (1)$$

If the distance is greater than threshold $d_0$ then multipath fading power loss model as:

$$E_{tx}(L, d) = LE_{elec} + LE_{mp}d^4 \qquad d \gg d_0 \qquad (2)$$

Where L is length of data packet in number of bit for communication. Calculation of $d_0$ is:

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$$d_0 = \frac{\sqrt{E_{fs}}}{\sqrt{E_{mp}}} \quad (3)$$

*2.3. Network Model*

In the proposed network model, there are n numbers of randomly deployed sensor nodes with the network layout of M X M. After deployment all nodes are assumed to be fix or immobile. Network layout is divided in four zone based on population and BS is at the center of network field. Every node has the capability to aggregate the data. Each and every node has the location information in advanced. All nodes have symmetric communication channel. It is prime considerations that node always have data to send. Networks have combination of different energy level nodes in certain percentage. Nodes are namely normal, advance and super nodes in increasing order of energy level as presented in [6-7]. For our simulation we are using increasing energy factor as 2. In the proposed work we are using three level energy heterogeneity as $E_0$, $E_{Adv}$ and $E_{Super}$. Nodes with percentage population factor a with n nodes for advanced node, which is equipped with energy factor greater than m times than normal node. Super nodes are equipped with increase energy factor as m0, with percentage population factor $a_0$ with respect to n nodes. Now we are presenting individual details in the form of equation as: Initial energy $E_0$ is the energy available for normal nodes whose density found as n (1-a-$a_0$), Hence advance and super node populations are, na and $na_0$ respectively. Energy presented by each individual node type is as follows:

Energy due to normal node is;

$$E_{normal} = nE_0 (1-a- a_0) \quad (4)$$

$$E_{Adv} = nE_0 (1+m) a \quad (5)$$

$$E_{Super}= nE_0 (1+m_0) a_0 \quad (6)$$

Equation 4, 5 and 6 presents available energy with all three types of nodes. Total initial energy proposed in the network model is calculated as $E_{Tot}$;

$$E_{Tot} = E_{normal}+ E_{Adv}+ E_{Super} \quad (7)$$

$$E_{Tot} = nE_0 - naE_0- na_0E_0+ naE_0 + nE_0\, ma+ na_0E_0 + na_0m_0E_0 \quad (8)$$

In equation (8) it is found that the second and fourth term is of equal magnitude and is out of phase, and terms third and sixth is of the same magnitude and is out of phase. Hence equation (8) is rewritten as;

$$E_{Tot} = nE_0 + nE_0\, ma+ na_0m_0E_0 = n\, E_0 (1+ma+m_0a_0) \quad (9)$$

Hence from equation (9) we are hereby conclude that if we add heterogeneity level up to level 2 available energy increased by factor (1+ma) and if it increased by level 3, then energy present at beginning is increased by factor (1+ma+$m_0a_0$). If we would like to improve heterogeneity level greater than 2 then equation is modified as given below:

$$E_{Tot} = nE_0( 1+ma +\sum_{i=0}^{N}(m_i a_i)); \quad i=0.........N \quad (10)$$

Where, N can be any integer number.

## 3. Proposed Protocol

We are presenting here a novel energy efficient clustering protocol to enhance performance metrics of HWSN in all the way better than the formerly available protocol. Initially all the nodes are deployed randomly in the network, network is divided in four equal zone based on location information such as zone A, Zone B, zone C and zone D as per [7].

Total network area is= Area (A+B+C+D) (11)

Which reduce the internal overhead inside the network during network management, this improves the energy remain in the network at run time. In most of the existing clustering protocol, cluster size is arbitrary some of the time cluster head or CH is located on the border or towards the border of the network, due this energy depletes at faster rate and degrades the network performance. In the proposed work, we are having a very different approach of selecting cluster head based on real time parameter available with the sensor node in the form of Node Quality Index ($Q_{ni}$). Node Quality Index is the devised parameter based on initial energy, residual energy and the hop count required by the particular node with respect to base station. As initial energy required being higher in normal selection of cluster head, residual energy need to be higher at run time for the assurance of longer life of node and finally node must be moderately or nearly situated from the base station. Hence finally arranging all these in the form of linear equation gives us a better value of $Q_{ni}$ for the role of cluster head. There is the index modeling used from data modeling approach for $Q_{ni}$ calculation.

### *3.1. Protocol Explanation*

In this propose work, we are presenting a new approach of CH selection by introducing a very new factor named as Node Quality Index ($Q_{ni}$). Node Quality Index is the fusion of initial energy of the node, current available energy at run time and hop count with respect to base station. Once selection of CH is started with available parameter from each zone. Node who have better value of index and satisfying the boundary condition criteria, as given below in CH solution. Node with better value of node index from each zone is selected as temporary CH for that zone. Every zone has the information of selected temporary CH and it is conveyed to all nodes available from the zone. Each and every zone submit the information of temporary CH, finally averaging of all the temporary CH Node Index is performed and the CH whose value greater than average value of CH is selected as final CH from the network for data transaction. All temporary CH have the updation of final CH and transfer aggregated data depends on requirement. But, at the time of data transmission temporary CH have to check relative distance between final CH and with BS. If distance between BS and the CH is lower than the final CH, transfer collected data to BS directly. Initially it is found that most of the nodes have equal value of node index, so it is very necessary to have appropriate approach of data collection such that load balancing is achieved. For this short span of time we are using LEACH scheme for CH selection. The proposed protocol is most suitable in surveillances, weather forecasting, home automation, traffic management, habitat monitoring, in machine health analysis and inventory management.

The fundamental CH solution for apply in proposed work is:

$$CH_i = \begin{cases} Q_{ni} > Avg_i; & \text{for } i > 50 \\ Q_{ni} \dfrac{P_i}{1-P_i\left(r \bmod \frac{1}{P_i}\right)} & \text{for } i = 0 \text{ to } 50 \end{cases} \quad (12)$$

Where, $Avg_i = \dfrac{\sum_{i=0}^{n} Q_{ni}}{|Q_{ni}|}$

Boundary = Boundary of network layout ± 10%

$$CH_i = [\text{Boundary} \cap (Q_{ni} > Avg_i)] \quad (13)$$

## 4. Simulation and Results

This section highlights the achievements of proposed work in the form of enhanced performance parameters than the existing well known clustering protocols such as HWSN, like LEACH, SEP and DEEC. Some of the performance parameters are explained in short as follows:

- **Stability Period:** The time period before the death of very first node from available sensor nodes from deployed HWSN.
- **Number of alive node per cluster round:** Number of node alive available inside the network for every cluster round, which indirectly presents the available energy remain in the network.
- **Number of dead nodes per cluster round:** Number of nodes dead per cluster round during the survival against changing energy level inside the network. This factor indirectly presents death rate of nodes over cluster cycle. Which indicate network survival time before complete death.
- **Throughput:** Number of data packets sent from the sensor nodes towards base station over the cluster round present's amount of throughput. Amounts of throughput signify efficiency of network. Throughput presents quality of the network.

## 5. Result discussion

With reference to table 1 given below in the form of parameter set, we randomly deploy the network in 200 m X 200 m form. Divide the network in four equal zones based on population, place the BS at the center of the network with position (100 X 100). Total node population is 200, with percentage fraction factor as a=0.2 and $a_0$=0.1. With advance node energy value about to double the normal node energy. Super node energy value is about twice the advanced node.

Table 1. Simulation Parameter.

| Sr. No. | *Parameter symbol* | *Name* | *Value* |
|---|---|---|---|
| 1 | M X M | Network area | 200m X 200m |
| 2 | N | Number of nodes | 200 |
| 3 | E0 | Initial energy of nodes | 0.5–1.5J |
| 4 | L | Data packet size | 4000bits |
| 5 | $E_{elec}$ | Radio electronics energy | 50 nJ/bit |
| 6 | $E_{\varepsilon fs}$ | Free space energy | 10 pJ/bit/m$^2$ |
| 7 | $E_{mp}$ | Amplification energy | 0.0013 pJ/bit/m$^4$ |
| 8 | $E_{DA}$ | Data aggregation energy | 5 nJ/bit/signal |
| 9 | $d_0$ | Threshold distance | 87-87.7 m |
| 10 | BS | Sink node | (100, 100) |

### *5.1. Validation with LEACH protocol*

As we know LEACH strategy is best suitable for improving lifetime of WSN by offering an equal opportunity everybody to become a CH and balance the energy consumption as proposed in [8]. But it's a random selection of CH, no reference of residual energy available and about hop count. Hence our protocol outperforms than the LEACH with this aspect in the form of stability period and lifetime presented in figure 1(a) and 1(b). Colour used for presentation is blue for proposed protocol and red colour is used for former protocol. As per LEACH, there is less guarantee that selected node is inside the network premises and not on the verge of vicinity or in the vicinity. This improves energy consumption inside the network. Propose protocol solve this issue with reduction in internal overhead packets, hence energy remain in the network is better than LEACH protocol as shown in figure 1(c). Finally available energy is utilized efficiently and systematically for longer span of time improves throughput from the network shown in figure 1(d).

Figure 1. (a) No. of Alive nodes versus no. of cluster rounds

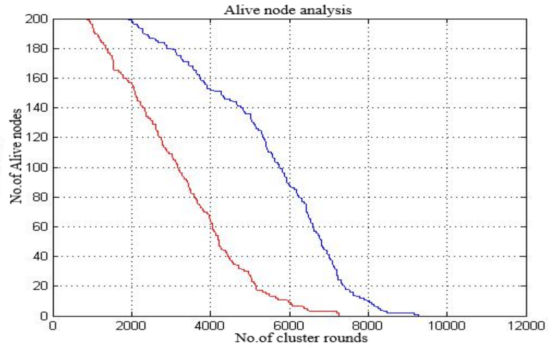



Figure 1 (b) No. of Dead nodes versus no. of cluster rounds

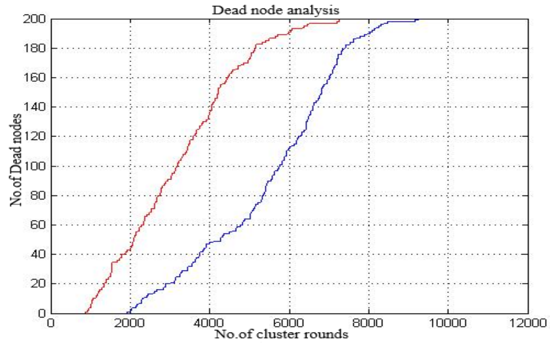



Figure 1 (c) Energy remain in the network versus no. of cluster rounds

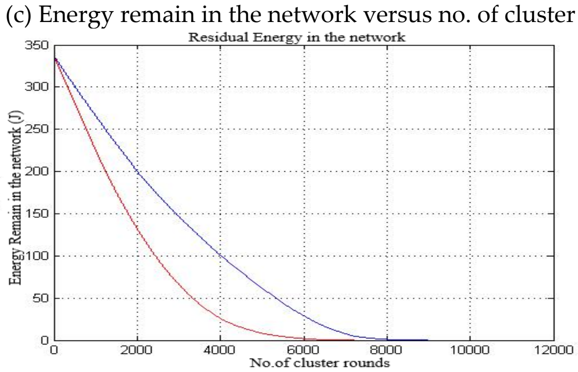
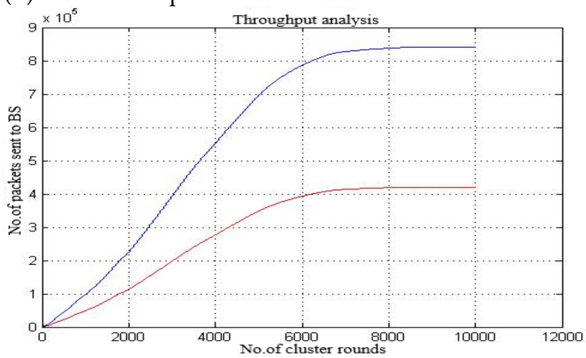



Figure 1 (d) No. of Data packets sent to BS versus no. of cluster rounds




*5.2. Validation with SEP protocol*

Basically SEP is proposed to introduce energy heterogeneity in WSN i.e. in the form of advanced nodes other than normal node as per [11]. But, in SEP protocol there is two level of probability function to differentiate between advanced and normal node for the role of CH. Which

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vary the energy level excursion and deplete the energy. It normally punishes the high energy node and results in early death, which reduce the stability period and lifetime. As shown in figure 2(a), lifetime 2(b) and energy remain in the network 2(c) compared with proposed protocol. Graph presented with two colour as red for former protocol and blue colour is used for proposed protocol. As proposed protocol is free from the varying probability function and changing energy level utilization. Finally with improved energy remain or residual energy in the network enhance the lifetime and hence number of data packets sent towards base station in the form of figure 2(d) as throughput over lifetime.

Figure 2 (a) No. of Alive nodes versus no. of cluster rounds

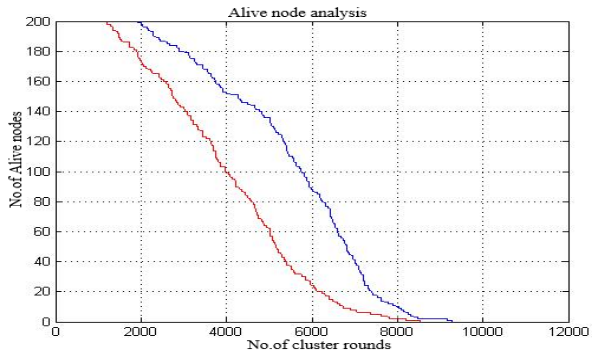


Figure 2 (b) No. of Dead nodes versus no. of cluster rounds

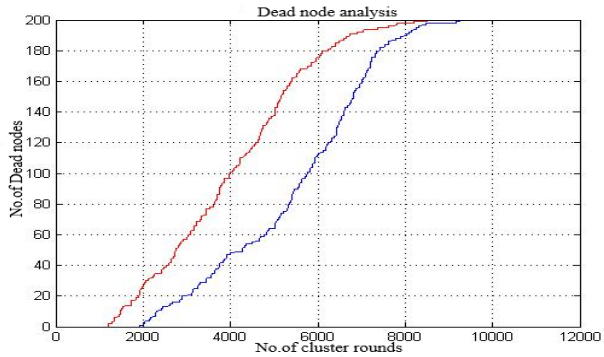


Figure 2 (c) Energy remain in the network versus no. of cluster rounds

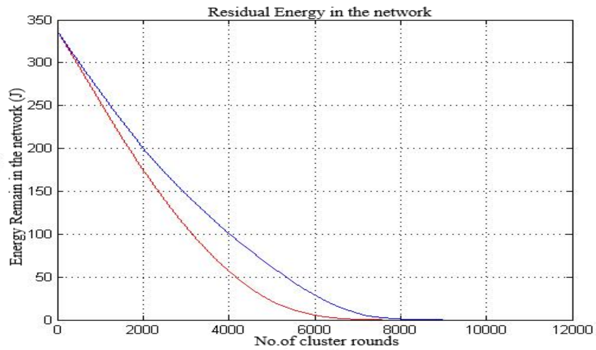


Figure 2 (d) No. of Data packets sent to BS versus no. of cluster rounds

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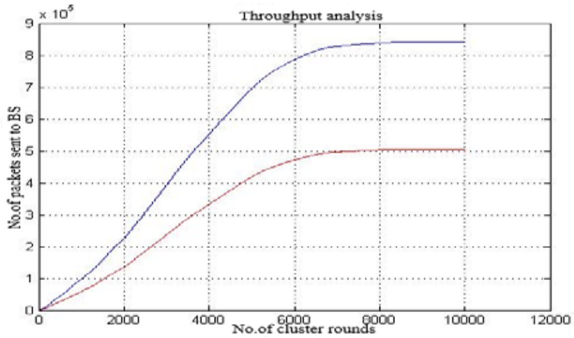


*5.3. Validation with DEEC protocol*

DEEC protocol proposed by author with the approach of average energy in the network and initial lifetime calculations in the form of number of round as given in [12]. In this protocol global knowledge of network needs to be updated regularly at end of each round and probability threshold function also playing an important role for CH selection based on varying probability function. Which affect the energy balancing inside the cluster and hence in network. Which reduce the lifetime of sensor network as depicted in figure 3(a) and 3(b) in the form of blue and red colour. Energy unbalancing of DEEC depicted in the form of energy remain in the network as in figure 3(c). Throughput of the former protocol is also getting reduced, presented in figure 3(d). Because proposed protocol does not have any varying probability function and criteria for CH selection is deterministic. Hence proposed protocol outperforms than the former.

Figure 3 (a) No. of Alive nodes versus no. of cluster rounds

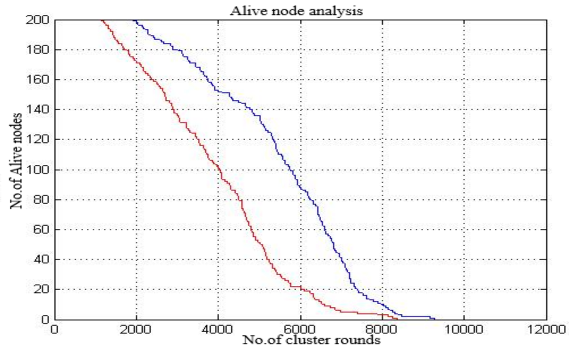


Figure 3 (b) No. of Dead nodes versus no. of cluster rounds

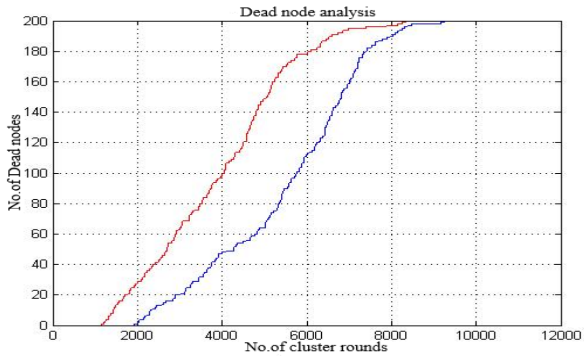


Figure 3 (c) No. of Alive nodes versus no. of cluster rounds

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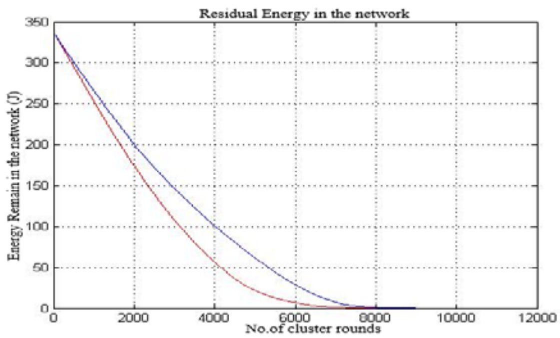
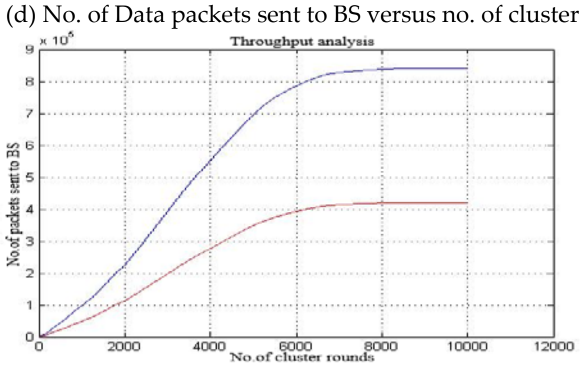



Figure 3 (d) No. of Data packets sent to BS versus no. of cluster rounds




Finally proposed simulation works shows better performance parameters than the existing protocols. Hence our proposed clustering protocol is well balanced energy efficient clustering protocol than the former. Performance validation is given below in table 2.

Table 2. Performance validation table

| Sr. | Name of the protocol to be simulated | | | | | % Enhancement on | | |
|---|---|---|---|---|---|---|---|---|
| No. | Performance parameter | LEACH | SEP | DEEC | Proposed | LEACH | SEP | DEEC |
| 1 | First node death (Stability) | 874 | 1206 | 1136 | 1931 | 221 | 160 | 170 |
| 2 | Tenth node death | 1345 | 1903 | 1710 | 2896 | 215 | 152 | 170 |
| 3 | All node death (Lifetime) | 7254 | 8199 | 8375 | 9284 | 128 | 113 | 110 |
| Overall performance parameter improvement with proposed protocol is: | | | | | | 188 | 141 | 150 |

## 6. Conclusion

In the proposed clustering protocol of HWSN, selection of CH is depend on current available energy, initial energy, hop count from the base station. Node selected for the role of temporary CH of each region is situated off the vicinity. Node which has better value of Node Index than temporary selected CH and off the vicinity can be final CH, which enhances energy efficiency of the network. Other achievement with proposed approach is internal overheads getting reduced to greater extent with the initial division of network than the arbitrary clustering network. This improves energy efficiency, force to enhance stability period, lifetime, improves residual energy of the network and hence throughput is also enhanced than existing protocol.

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