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# Exterior Bound Allotted Advanced Node Distribution for Energy Efficient Clustering (EBAN DEEC) Protocol in WSN

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***Abstract*-In recent years , numerous steering conventions have been proposed to enhance the lifetime, deployment of nodes, energy efficiency, latency, robustness, fault tolerance, and reliability of Wireless Sensor Networks (WSN). The vitality requirements and drawing out the lifetime of the WSN is imperative part of steering conventions. Diverse bunch based directing convention have proposed to enhance the customary conventions i.e. direct transmission, multi-jump steering, static bunching and least transmission-vitality. Among all group based conventions, DEEC is the most conspicuous WSN convention. In this undertaking, we have attempted to extend the DEEC by including diverse components in DEEC for homogeneous and heterogeneous situations. We have proposed Hand DEEC Phase-1 by presenting capable group head choice plan and distinctive transmitting force levels for DEEC in homogeneous environment. Be that as it may, vitality sparing plan of homogeneous environment is not suitable for heterogeneous environment. Stable Election Protocol (SEP) is the element heterogeneous steering convention. SEP depends on weighted decision probabilities of every hub to end up the bunch head as indicated by the remaining vitality in every hub. We propose Hand DEEC Phase-2 by applying diverse methods for correspondence (between CH to sink) for cutting edge and ordinary hubs. By demonstrating recreation, we demonstrate that Hand DEEC is more vitality proficient and has longer lifetime of system than DEEC in homogeneous and heterogeneous situations.**

***Keywords-- Data aggregation, Dynamic cluster head rotation, Heterogeneous system, DEEC Protocol, WSN.***

## 1. Introduction

DEEC, which is a WSN protocol for homogeneous systems, is not suitable for heterogeneous systems. Putting few heterogeneous nodes in a Wireless Sensor Network is an effective way to increase the network's stability and lifetime. The energy saving schemes used for homogeneous WSNs does not work efficiently when used for heterogeneous WSNs. Thus, a new energy efficient clustering protocol should be designed for them. Heterogeneous WSNs are very much useful in real deployments because they are more close to real life situations.

We can divide heterogeneous WSN system mainly in three parts. 1) Computational heterogeneity
2) Link heterogeneity
3) Energy heterogeneity

### 1.1. Computational heterogeneity:

In this type of system, some of the nodes have more energy than the other normal nodes. The heterogeneous nodes can provide some benefits such as complex data processing and long term storage with the use powerful computational resources. We are going to use this approach in EBAN DEEC Phase 2.

### 1.2 Link heterogeneity:

Here, some of the heterogeneous nodes have higher bandwidth and longer distance network transceiver than the normal nodes. It can provide more reliable data transmission.

### 1.3 Energy heterogeneity:

This system has some of the heterogeneous nodes that are line powered or their batteries are replaceable.
For our protocol, Computational heterogeneity is the best suitable. Because in EBAN DEEC, we are trying to increase the lifetime of the network. By distributing powerful calculations to advance nodes, we can increase the network lifetime. Link heterogeneity is dealing with the quality and reliability of packets whereas; Energy heterogeneity can be implemented in practical situations. We are not considering Link and Energy heterogeneity from the algorithm point of view.

## 2 Heterogeneous SEP Protocol:

EBAN DEEC Phase 2 is dependent on SEP (A Stable Election Protocol for clustered Heterogeneous WSNs) protocol. SEP is based on weighted election probabilities of each node to become cluster head according to the remaining energy in each node. SEP tries to maximize the stability of the network. Stability can be increased by increasing the time of last node death. Clearly, larger the

stable and unstable regions are, better is the reliability of the clustering process.
On the other hand, there is a trade off between reliability and the lifetime of the system. Until the death of the last node, we still can have some feedback about the sensor field even though this feedback may not reliable. The unreliability of the feedback stems from the fact that there is no guarantee that there is at least one cluster head per round during the last rounds of the operation. In our model, the absence of a cluster head prevents reporting about the cluster to the sink at all. The throughput quantity captures the amount of such data reporting to the sink. In a heterogeneous WSN, DEEC doesn't work well as it is very sensitive to the heterogeneity.

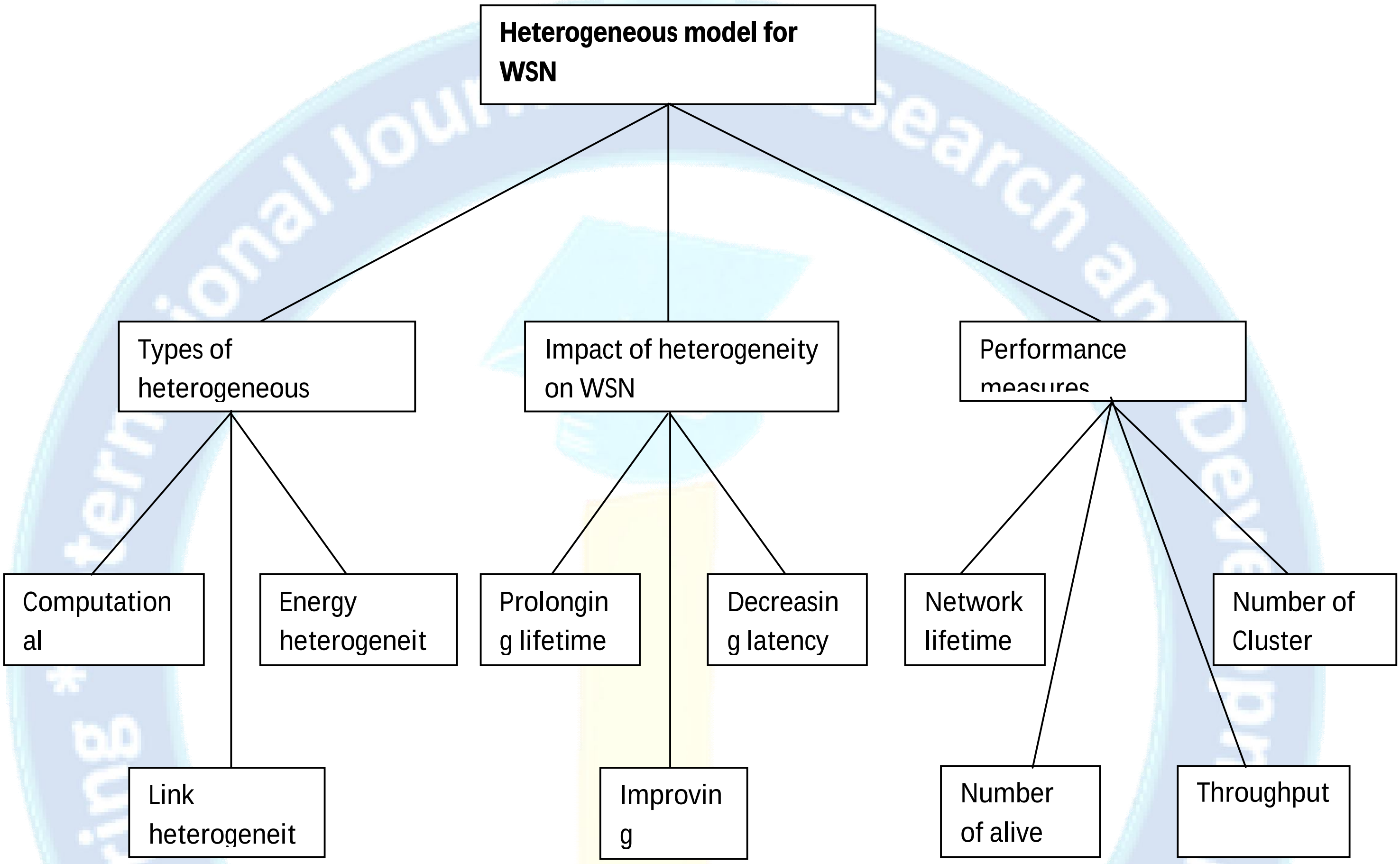


**Fig. 1. Heterogeneous model for Wireless Sensor Network**

### 3. Related Work:

**Li Qing et.al. (2006) [3],** The clustering Algorithm is a kind of key technique used to reduce energy consumption. It can increase the scalability and lifetime of the network. Energy-efficient clustering protocols should be designed for the characteristic of heterogeneous wireless sensor networks. We propose and evaluate a new distributed energy-efficient clustering scheme for heterogeneous wireless sensor networks, which is called DEEC. In DEEC, the cluster-heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network. The epochs of being cluster-heads for nodes are different according to their initial and residual energy. The nodes with high initial and residual energy will have more chances to be the cluster-heads than the nodes with low energy. Finally, the simulation results show that DEEC achieves longer lifetime and more effective messages than current important clustering protocols in heterogeneous environments.
They describe DEEC, an energy-aware adaptive clustering protocol used in heterogeneous wireless sensor networks. In DEEC, every sensor node independently elects itself as a cluster-head based on its initial energy and residual energy. To control the energy expenditure of nodes by means of adaptive approach, DEEC use the average energy of the network as the reference energy. Thus, DEEC does not require any global knowledge of energy at every election round. Unlike SEP and DEEC, DEEC can perform well in multi-level heterogeneous wireless sensor networks.

There are two kinds of clustering schemes. The clustering algorithms applied in homogeneous networks are called homogeneous schemes, and the clustering algorithms applied in heterogeneous networks are referred to as

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heterogeneous clustering schemes. It is difficult to devise an energy-efficient heterogeneous clustering scheme due to the complicated energy configure and network operation. Thus most of the current clustering algorithms are homogeneous schemes, such as DEEC [10], PEGASIS [11], and HEED [12].

The cluster-heads have to spend extra energy for aggregating data and performing long-range transmission to the distant base station. The DEEC protocol selects clusterheads periodically and drains energy uniformly by role rotation. Each node decides itself whether or not a cluster-head distributed by a probability. Under the homogeneous network, DEEC performs well, but its performance become badly in the heterogeneous network as shown by [9]. In PEGASIS, nodes will be organized to form a chain, which can be computed by each node or by the base station. The requirement of global knowledge of the network topology makes this method difficult to implement. HEED is a distributed clustering algorithm, which selects the cluster-heads stochastically. The election probability of each node is correlative to the residual energy. But in heterogeneous environments, the low-energy nodes could own larger election probability than the high-energy nodes in HEED. The heterogeneity of nodes in terms of their energy is considered in our DEEC, which is designed for heterogeneous networks. At the same time, DEEC keeps the merits of the distributed clustering algorithms.

**Estrin et al.** [5] discuss a hierarchical clustering method with emphasis on localized behavior and the need for asymmetric communication and energy conservation in sensor networks. They suggest using the remaining energy level of a node for cluster-head selection. In [10], it is proposed to elect the cluster-heads according to the energy left in each node. We call this clustering protocol DEEC-E.

The drawback of DEEC-E is that it requires the assistance of routing protocol, which should allow each node to know the total energy of network. SEP [9] is developed for the two-level heterogeneous networks, which include two types of nodes according to the initial energy, i.e., the advance nodes and normal nodes. The rotating epoch and election probability is directly correlated with the initial energy of nodes. SEP performs poorly in multi-level heterogeneous networks and when heterogeneity is a result of operation of the sensor network. Our DEEC protocol assigns different epoch of being a cluster-head to each node according to the initial and residual energy. In DEEC, a particular algorithm is used to estimate the network lifetime, thus avoiding the need of assistance by routing protocol.

Many DEEC-like algorithms are proposed to improve the performance of DEEC recently. In [13], the authors have studied multi-hop clustered networks, and use a randomized clustering scheme to organize the sensors. They provide methods to compute the optimal values of the algorithm parameters. Mhatre and Rosenberg [14] study the case of multi-hop routing within each cluster, which is called M-DEEC. In M-DEEC, only powerful nodes can become the cluster-heads. EECS [15] elects the cluster- heads with more residual energy through local radio communication. In cluster formation phase, EECS considers the tradeoff of energy expenditure between nodes to the cluster-heads and the cluster-heads to the base station. But on the other hand, it increases the requirement of global knowledge about the distances between the cluster-heads and the base station. In DEEC-B [16], a new adaptive strategy is proposed to choose cluster-heads and to vary their election frequency according to the dissipated energy. The simulation results show that the improvement obtained by DEEC-B is limited.

For homogeneous wireless sensor networks **Heinzelman, et. al.** [4] introduced a hierarchical clustering algorithm for sensor networks, called Low Energy Adaptive Clustering Hierarchy (DEEC). DEEC is a cluster-based protocol, which includes distributed cluster formation. DEEC randomly selects a few sensor nodes as cluster heads (CHs) and rotates this role to evenly distribute the energy load among the sensors in the network [1]. PEGASIS [11] is a chain based protocol which avoids cluster formation and uses only one node in a chain to transmit to the BS instead of using multiple nodes.

**Manjeshwar et. al.** proposed Threshold sensitive Energy Efficient sensor Network protocol (TEEN) [7]. TEEN pursues a hierarchical approach along with the use of a data-centric mechanism. the cluster head broadcasts two thresholds to the nodes. These thresholds are hard and soft thresholds for sensed attributes. TEEN is not good for applications where periodic reports are needed since the user may not get any data at all if the thresholds are not reached.

**Manjeshwar et. al.** The Adaptive Threshold sensitive Energy Efficient sensor Network protocol (APTEEN) [8] aims at both capturing periodic data collections and reacting to time-critical events. The architecture is same as in TEEN. The main drawbacks of TEEN and APTEEN are the overhead and complexity of forming clusters in multiple levels implementing threshold based functions and dealing with attribute-based naming of queries.

**Heinzelman, et. al.** [10] proposed DEEC centralized (DEEC-C), a protocol that uses a centralized clustering algorithm and the same steady state protocol as DEEC. SEP (Stable Election Protocol) [9] is proposed in which every sensor node in a heterogeneous two-level hierarchical network independently elects itself as a cluster head based on its initial energy relative to that of other nodes.

**Li Qing et. al.** proposed DEEC [6] (Distributed energy efficient Clustering) algorithm in which cluster head is selected on the basis of probability of ratio of residual energy and average energy of the network. Simulations show that its performance is better than other protocols.

**B. Elbhiri et al,** proposed SBDEEC (Stochastic and Balanced Developed Distributed Energy-Efficient Clustering (SBDEEC) [2] SBDEEC introduces a balanced and dynamic method where the cluster head election probability is more efficient. Moreover, it uses a stochastic scheme detection to extend the network lifetime. Simulation results show that this protocol performs better than the Stable Election Protocol (SEP) and the Distributed Energy-Efficient Clustering (DEEC) in terms of network lifetime. Our E-DEEC (Enhanced Distributed Energy Efficient Clustering) scheme is based on DEEC with addition of super nodes. We have extended the DEEC to three-level heterogeneity. Simulation results show that E-DEEC performs better than SEP which is too extended to three-level scheme.

**4. Methodologies:**

At the end of EBAN DEEC Phase 1, we assume that the nodes are placed randomly and with different amount of energies in all. So we can divide the nodes based on their energies: zone 0, Head zone 1, and Head zone 2.

We assume that the advance nodes are having fraction of more energy than the normal nodes. Total m numbers of nodes out of n are having α time more energy than normal nodes. We refer these nodes as advance nodes and *(1-m) ×n* are normal nodes.

Nodes in zone 0 have less energy and they are deployed near to the base station. These nodes will directly transmit the data to the sink. Nodes in Zone 1,2 have α times more energy than nodes in zone 0. Where o is Normal node, + is special energy activated node and x is BS

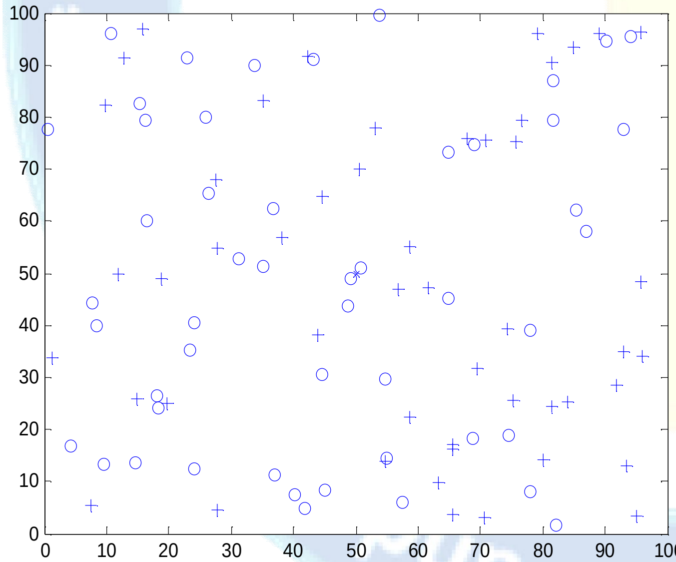


**Fig. 2. Setup for the Advanced and normal node for EBAN DEEC phase 2**

**4. Result and Discussion:**

In this project work we are developed an energy efficient wireless sensor network model having modified version of DEEC protocol having special energy activated sensor nodes called as EBAN DEEC. In this we have considered an area having randomly distributed wireless sensor network having equivalent initial energy some of the node having additional energy known as special node. We have taken m as the special node e. i m=0.1 then it mean that 10% node are special mode out of all the nodes the energy of these node is $E_s$=E(1+a).There $E_s$ is energy special node. If a=0.5 then $E_s$=(1.5*E) that is energy of special node is 1.5 times of the normal node. For various combination of m and a we have run our algorithm to generate the different number of dead nodes at different rounds.

(a) m= 0.15,a=0.5

(b) m= 0.15,a=1.0

The plot of the result as shown one by one and they are finally tabulated to described the performance of our purposed EBAN DEEC and compared with the normal DEEC algorithm.

**Case-a:** As described in previous section this case m=0.15 and a=0.5 we have generated plots for number of alive nodes of difference round shown in figure 1a. Where y axis represented the number of alive nodes and x axis represented the number of rounds.There are two lines green and blue colour where green colour normal DEEC and blue colour EBAN DEEC. We can observed that in the DEEC alive nodes start decreasing from round 999 while in EBAN DEEC alive nodes start decreasing from round 1524

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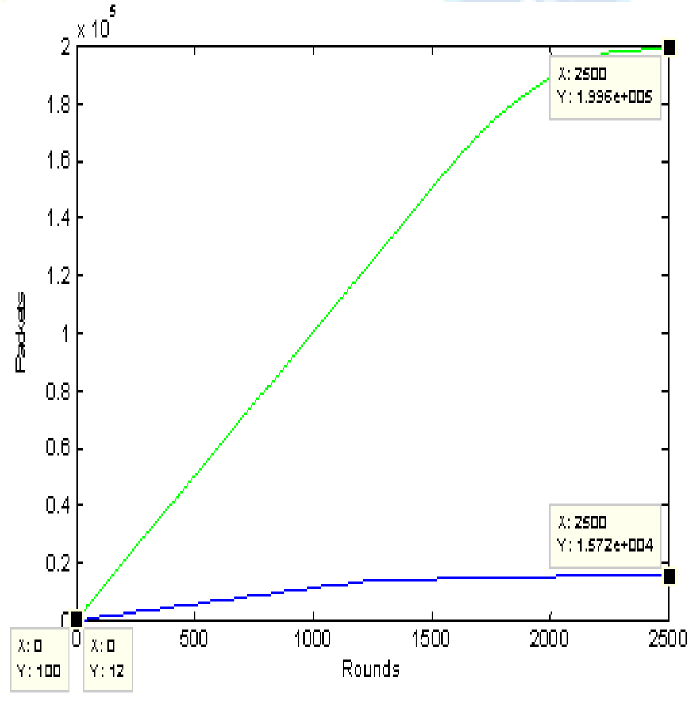


**Fig 3a:Number of Packets Sent at different rounds (Blue: DEEC, Green: EBAN DEEC).**

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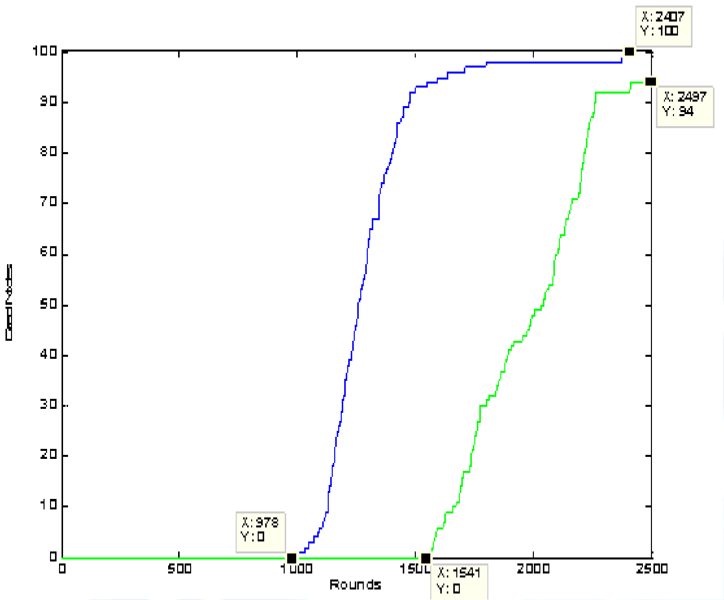


**Fig 3b:No. of dead nodes at different rounds (Blue: DEEC, Green: EBAN DEEC).**

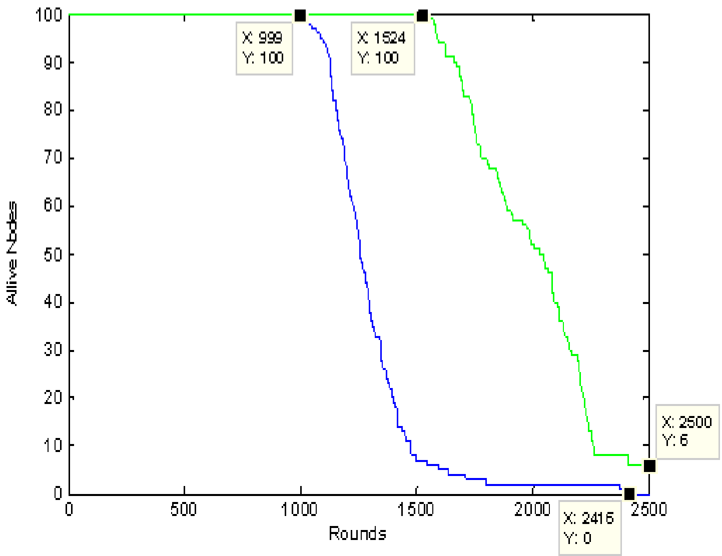


**Fig 3c:No. of alive nodes at different rounds (Blue: DEEC, Green: EBAN DEEC).**

**Case-b:** As described in previous section this case m=0.15 and a=1 we have generated plots for number of alive nodes of difference round shown in figure 1a. Where y axis represented the number of alive nodes and x axis represented the number of rounds. There are two lines green and blue colour where green colour normal DEEC and blue colour EBAN DEEC. We can observed that in the DEEC alive nodes start decreasing from round 971 while in EBAN DEEC alive nodes start decreasing from round 1550.

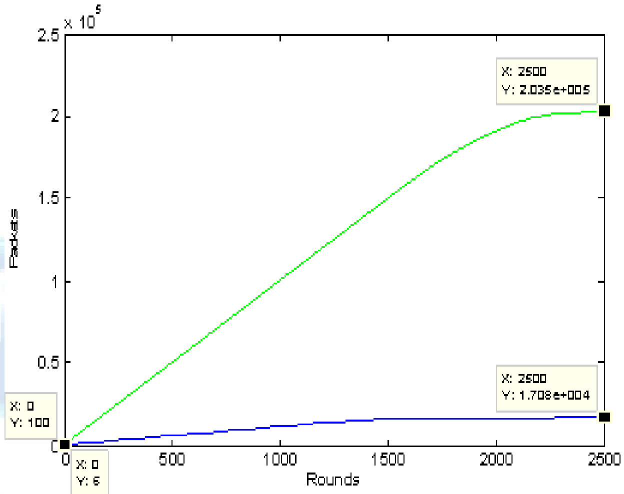


**Fig 4a:Number of Packets Sent at different rounds (Blue: DEEC, Green: EBAN DEEC).**

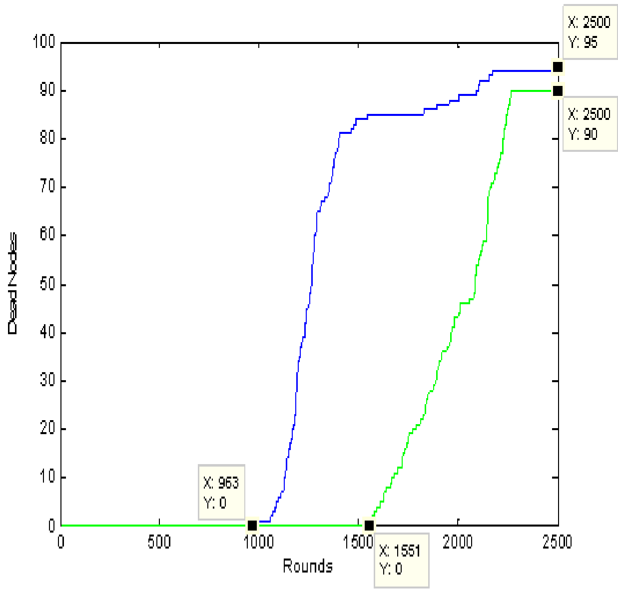


**Fig 4b:No. of dead nodes at different rounds (Blue: DEEC, Green: EBAN DEEC).**

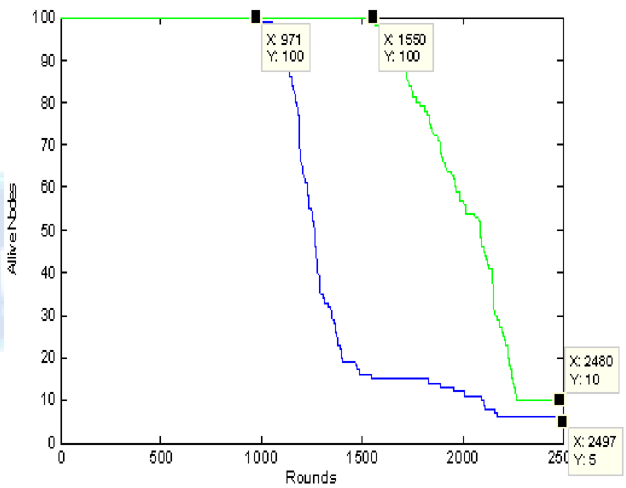


**Fig 4c: No. of alive nodes at different rounds (Blue: DEEC, Green: EBAN DEEC).**

## 5. Conclusion:

In our work we have briefly describe how cluster based routing protocol DEEC can be utilized in better way for homogeneous and heterogeneous environment. Our simulation shows EBAN DEEC gives better throughput of the system compare to DEEC. We can get better efficiency by including new CH replacement scheme and different transmission energy.

Results are generated for different number of special energy activated nodes out of total nodes for different probabilities of election of EBAN DEEC nodes as the cluster heads. It has been observed that in any combinations of m and a the EBAN DEEC sends higher number of packets as compared to normal DEEC. For minimum value of m=0.15 and a=1 the EBAN DEEC DEEC shows higher life time than the DEEC. Hence it can be concluded that even if we consider only 10 %cent nodes as EBAN DEEC nodes with energy 50% higher than other nodes we can significantly enhance the network life time and data transmission rate. Moreover, stability of EBAN DEEC can be improved by using two different transmission techniques direct transmission and CH to sink transmission in heterogeneous. In future, EBAN DEEC can be improved by adding more techniques for hierarchal transmissions between CH to Sink. Again it will be interesting to apply advanced node concept with Energy heterogeneity.

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