



# PERFORMANCE ANALYSIS AND ITS CHARACTERISTIC RESPONSES FOR LEACH AND DEEC PROTOCOLS FOR WIRELESS SENSOR NETWORKS

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## ABSTRACT:

*Remote Sensor Network is the system of intensity constrained detecting gadgets called sensors. Remote sensor arrange is vary from different systems regarding improvement of measure of vitality since when these sensors sense and transmit information to different sensors exhibit in the system, significant measure of vitality is disseminated. Different steering calculations are proposed to restrict the forces utilized by the remote sensors. Various leveled steering conventions with the idea of bunching like LEACH and SEP and DEEC are as of now best known for keeping up vitality productivity. The three conventions of the parcel and the favorable position and their drawbacks are examined, vitality dispersal and number of hubs alive and soundness period and we will examine the favorable position and drawback of these conventions under different conditions.*

## INTRODUCTION:

Remote Sensor Network (WSN) is a framework made out of remote sensors sent in an area to detect different sorts of physical data from the surroundings [1]. The data detected by these sensors (or hubs) is then handled and has been sent to Base Station (BS) for evaluation. WSNs are utilized for different applications like natural surroundings observing, military observations, forest fire recognitions, transport checking, and so on. Since the hubs are remote and small, these can be conveyed easily, even in remote zones and sloping territories. Anyway since the hubs are thick and observing of these hubs is extremely entangled, Particularly in the situations when the hubs are appropriated in the areas where the physical intercede of

the individual isn't conceivable .The system once settled, continues detecting the data and the vitality of the hubs continue dispersing at whatever point, they get some data and send it further to different hubs or BS. A number of steering conventions have been proposed to make hubs more vitality proficient. Thick nature of this sensor make the circumstance when the excess data is exchanged to the base station, alongside this the vitality of the hubs is additionally disseminated. To defeat from these issues different bunching calculations were proposed. The entire system of hubs is separated into various bunches; the information accumulation is performed inside the group and after that transmitted to the BS. Bunching helps in decrease of repetition and change over the lifetime of the system [2]. The LEACH [4] and SEP [5] and DEEC [3] are such bunching conventions. The rest of the paper is organized as follows: In section 2, we review the related works in this field. Section 3 will depict the energy model that could be used by the sensors. Section 4 contains simulation results to compare all the three under various performance measure matrices. Finally, in section 5, we present the conclusion.

## SURVEY OF CLUSTERING ALGORITHMS FOR WIRELESS SENSOR NETWORK

1. Filter (Low Energy Adaptive Clustering Hierarchy) LEACH [4] is a standout amongst the most well known grouping

calculations. The principle thought behind drain is to frame groups in light of the flag quality of the sensors. A portion of the hubs are arbitrarily picked as the bunch heads(CH) and a hub is doled out to the CH in light of the flag quality got by that hub from the CH. CHs need to complete significantly more work than the ordinary hubs, consequently they scatter significantly more vitality and may kick the bucket rapidly. So as to keep up a steady system, CHs continue pivoting, in each round. Thus, a hub which had moved toward becoming CH may not get a chance to end up CH again before a set interim of time. A hub can turn into the bunch set out toward the current round if its esteem is not as much as the limit  $T(n)$  where  $T(n)$  is given by –

$$T(n) = \begin{cases} \frac{P}{1 - P * (r \bmod \frac{1}{P})} & \text{if } n \in G \\ 0 & \text{otherwise} \end{cases}$$

$P$  is the percentage of cluster heads,  $r$  is the  $r$ th round,  $G$  is the set of nodes which are not cluster heads in the last  $1/P$  rounds.

Advantages:

- LEACH is completely distributed. LEACH does not require the control information from the base station, and the nodes do not require knowledge of the global network in order for LEACH to operate.
- LEACH reduces communication energy by 8 times as compare to direct transmission and minimum transmission energy routing.

## 2. SEP (Stable Election Protocol)

SEP [5] was a change over LEACH in the way that it considered the heterogeneity of systems. In SEP, a portion of the high vitality hubs are alluded to as cutting edge hubs and the likelihood of cutting edge

hubs to wind up CHs is more when contrasted with that of non-propelled hubs.

Preferred standpoint:

- SEP does not require any worldwide information of vitality at each decision round.

Impediments:

- The downside SEP technique is that the decision of the bunch heads among the two kind of hubs isn't dynamic, which comes about that the hubs that are far from the intense hubs will kick the bucket first.

## 3. DEEC (Distributed Energy Efficient Clustering)

In DEEC [3] convention all hubs utilize the underlying and leftover vitality level to characterize the group heads. DEEC appraise the perfect estimation of system lifetime to figure the reference vitality that every hub ought to consume amid each round. In a two-level heterogeneous system, where we have two classes of nodes,  $m.N$  propelled hubs with beginning vitality equivalent to  $E_o.(1+a)$  and  $(1 - m).N$  ordinary hubs, where the underlying vitality is equivalent to  $E_o$ . Where  $a$  and  $m$  are two variable which control the hubs rate composes (progressed or ordinary) and the aggregate starting vitality in the system  $E_{total}$ .

- The value of Total Energy is given as

$$E_{total} = N. (1-m).E_o + N.m.E_o.(1+a) \quad (1)$$

- The average energy of  $r$ th round is set as follows

$$E(r) = \frac{1}{R} E_{total} (1 - R) \quad (2)$$

$R$  denotes the total rounds of the network lifetime and is defined as

$$E_{total} R = E_{Round} \quad (3)$$

• ERound is the total energy dissipated in the network during a round, is equal to:

$$E_{\text{Round}} = L(2NE_{\text{elec}} + NEDA + kEmpd4 \text{ toBS} + NE_{\text{fs}}d2 \text{ toCH}) \quad (4)$$

k: number of clusters    EDA: data aggregation cost expended in the cluster heads  
 dtoBS : average distance between the cluster head and the base station  
 dtoCH: average distance between the cluster members and the cluster head.

• Because we are assuming that the nodes are uniformly distributed, we can get:  
 $dtoCH = M \sqrt{2k\pi} \text{ dtoBS} = 0.765 * M / 2$

Advantages: • DEEC does not require any global knowledge of energy at every election round. • Unlike SEP and LEACH DEEC can perform well in multi-level Heterogeneous wireless network.

Limitations: • Advanced nodes always penalize in the DEEC, particularly when their residual energy reduced and become in the range of the normal nodes. In this position, the advanced nodes die rapidly than the others.

The energy model used in LEACH-like protocols assumes that transmission energy is composed of a constant amount of energy consumed by the electronics and a propagation energy proportional to the transmitter – receiver separation distance raised to a power of 2 or 4, depending on whether the distance is larger or smaller than the crossover distance [5]. The transmission energy depends on the number of bits transmitted.

The energy required to transmit an l-bit message is

$$E_{\text{tx}} = lE_{\text{elect}} + l\mu d^n$$

where l is the number of bits;  $E_{\text{elect}}$  is the energy consumed per bit by the

electronics;  $\mu d^n$  is the propagation energy per bit. (The factor  $\mu$  is a constant that depends on the propagation loss) ; d is the distance of transmission; n is the propagation loss exponent. For distances smaller than  $d_0$ , the value of P is based on the Friis free-space equation. The propagation energy is therefore

$$E_{\text{tx}} = lE_{\text{elect}} + l\epsilon_{\text{fs}}d^2 \quad \text{for } d \leq d_0$$

where  $\epsilon_{\text{fs}} = \mu$  is the free space factor.

For distances smaller than  $d_0$ , the Friis free space equation is used for the transmission power

$$P_t(d) = \frac{P_r(4\pi d)^2 L}{G_t G_r \lambda^2}$$

where  $P_r$  is the minimum receive power;

$G_t$  and  $G_r$  are the gains of the transmitting and receiving antennas respectively;

$\lambda$  is the wavelength of the carrier;

d is the receiver-transmitter separation distance;

L is a system loss factor.

For distances greater than the crossover distance, the two-ray model, which uses a path loss exponent of 4, is used

$$P_t(d) = \frac{P_r d^4}{G_t G_r h_t^2 h_r^2}$$

where  $h_t$  and  $h_r$  are the heights of the transmitting and receiving antennas above ground respectively. At the crossover distance, (3) and (4) yield the same value. The LEACH model derives the crossover distance based on this observation. The value of  $\epsilon_{\text{fs}} = \mu$  is determined by observing that the transmission power is equal to bit rate times the propagation energy per bit:

$$P_t(d) = R_b \epsilon_{fs} d^2$$

where  $R_b$  is the bit rate. An expression for  $\epsilon_{fs}$  is found by equating (3) and (5):

$$\epsilon_{fs} = \frac{\Pr(4\pi)^2 L}{\lambda^2 G_t G_r R_b}$$

The energy equations and the value of  $\mu$  for distances greater than  $d_0$  are found using a similar derivation. The value of  $\mu$  is called the multi-path factor,  $\epsilon_{mp}$ . Therefore

$$E_{rx2} = lE_{elect} + l\epsilon_{mp}d^4$$

$$P_t(d) = R_b \epsilon_{mp} d^4$$

and an expression for  $\epsilon_{mp}$  is found by equating (4) and (8):

$$\epsilon_{mp} = \frac{P_r}{R_b G_t G_r h_t^2 h_r^2}$$

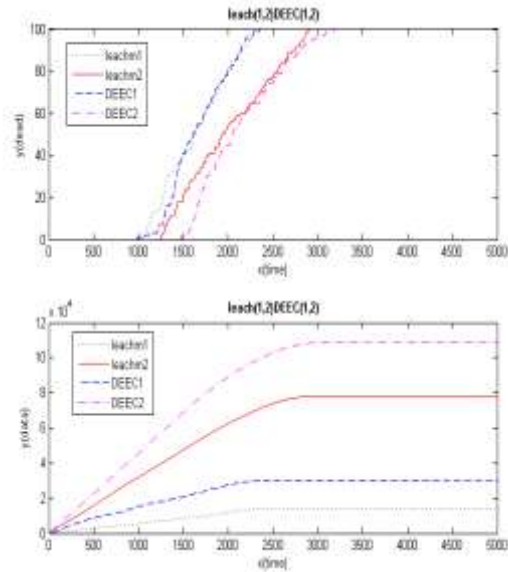
The crossover distance,  $d_0$ , is found by equating (5) and (8)

$$d_0 = \sqrt{\frac{\epsilon_{fs}}{\epsilon_{mp}}}$$

**PERFORMANCE TABLE:**

performance criteria	LEACH	SEP	DEEC
Heterogeneity level	Not present	Two	Multilevel
Cluster Stability	Lower than SEP and DEEC	Moderate	High
Energy Efficient	Low as compare to SEP and DEEC	Moderate	High
Cluster head Selection criterion	Based on Initial and Residual Energy	Based on Initial and Residual Energy	Based on Initial , Residual and Average Energy of the network
Network Lifetime	Lower than SEP and DEEC	Moderate	Prolong Network Lifetime than SEP and LEACH

**RESULTS:**



**CONCLUSIONS:**

We had analyze the LEACH SEP and DEEC convention under different exhibitions metric through reenactment. The execution of the three conventions are judged under the different execution metric .Simulation comes about demonstrates that DEEC beats the two .The table(1) demonstrates the examination of three conventions under different execution measurements.

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