E-SDEEC: Enhanced Sonic Distributed Energy Efficient Clustering Scheme for Heterogeneous WSN

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Abstract- **In a heterogeneous WSN higher energy nodes can become cluster heads more times than the nodes with low energies. When cluster head is selected and assigned to task them then it can be greatly contribute to energy efficiency which result in increasing in set of connection existence. In recent year many protocols had proposed for clustering structure. In this paper, we proposed four types of nodes in ESDEEC for prolonging the existence and stableness of the set of connection. Hence it increases the energy level of set of connection. Result shows that ESDEEC performs better than LEACH, SEP with more stableness.**

Keywords- **Wireless Sensor Set of connection (WSN); Cluster; Multi objective; Energy Efficiency; Stableness**

I. INTRODUCTION

WSN is the set of connection which consists of various tiny sensors nodes which senses the physical environment in terms of temperature, light, sound, humidity etc.

Clustering technique enables the sensor set of connection to work more efficiently but in dense nature of this sensor create the situation when the unnecessary information is transmitted to BS along with this the energy of nodes is also dissipated.

For the homogeneous set of connection some clustering protocols are PEGASIS and HEED whereas SEP and EDEEC deal with heterogeneous set of connection.

To overcome from these problem various clustering algorithm were proposed. The whole set of connection of nodesis divided into a number of cluster the data aggregation is performs within cluster and then transmitted to base station.SEP is two types of nodes in which advancenodes have more energy than normal ones. In this paper ESDEEC follows the thoughts of EDEEC and adds another type of node called sonic nodes to increase the heterogeneity.

II. RELATED WORK

The researchers have classified routing protocols for aset of connection and for heterogeneous wireless sensor set of connection hierarchical clustering algorithm called (LEACH).

LEACH is a cluster formation. A random selection node can become the cluster head for the current round if its value is less than the threshold T (n) where T (n) is given by-

$$T(n)= \begin{cases} \dfrac{P}{1-P(r \bmod 1/P)} & \text{if } S \epsilon G \\ 0 & \text{otherwise} \end{cases} \qquad (1)$$

SEP stable election protocols was an improvement over LEACH is the way that it took into account the heterogeneity of set of connection. In SEP, some node with high energy are referred to as advance nodes and probabilities of advance nodes to become CHs are more as comparison to that of non-advance nodes.

EDEEC for heterogeneous WSNs is a routing protocol where CH selection based on probability ratio of residual energy and average energy of the set of connection. In these nodes having more energy, chances to be a CH it prolong the existence of the set of connection. ESDEEC follows the same principle of EDEEC and add another type of nodes called sonic node.

EEHC is energy efficient heterogeneous hierarchical clustered scheme. EEHC takes into

account residual energy of each node and its weighted probability to become CH. Here, not only consumption of energy resources of the sensor set of connection enhanced, but also the process of CH election improved due to heterogeneity.

ERP takes routing problem in clustered WSN. It improves the unwanted performances of the evolutionary algorithm. It combines two clustering aspects namely cohesion and separation error. The fitness of the function depends upon the transmission. In ERP, a non-cluster node is part of the cluster if it satisfies minimum distance in the previous round.

III. SET OF CONNECTION MODEL

Fig.1. illustrates the set of connection model where many nodes deployed randomly in the area NXN.

There are sensor nodes which are of four types and they are normal, advance, super, sonic nodes. The total nodes let be the fraction of 'm' which are equipped with c times more energy than the normal nodes called sonic nodes.

The rest N.m.(1-mo) nodes are equipped with a times more energy than normal nodes, called advance nodes, N. (1-m) as normal nodes and remaining N.m.mo.(1-m) as sonic nodes.
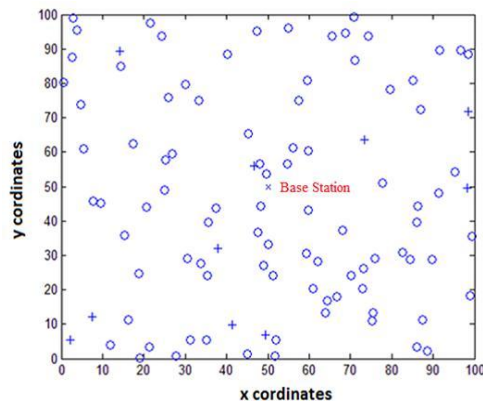

Fig.1. Wireless sensor set of connection

E_{total}=N.(1-m).E_0+N.m.(1-mo).(1+a).E_0+N.m.m_0.E_o(1+b)+N.m.m_0.(1-m).(1+c).E_0 (2)

Therefore four level of heterogeneous set of connection have more energy is increase.

IV. CLUSTER HEAD SELECTION METHODS

Traditionally as per LEACH cluster head algorithm is broken into rounds. At each rounds node decide a CH on threshold calculation of cluster heads for the set of connection and the number of times the node has been cluster head so far.

The probabilities of normal, advance, super, sonic nodes are-

$$P_i = \begin{cases} \dfrac{P_{opt}E_i(r)}{(1+m(a+m_0.b)).E(r)} \\[2ex] \dfrac{P_{opt}(1+a)\,E_i(r)}{(1+m(a+m_0.b)).E(r)} \\[2ex] \dfrac{P_{opt}(1+b)\,E_i(r)}{(1+m(a+m_0.b)).E(r)} \\[2ex] \dfrac{P_{opt}(1+c)E_i(r)}{(1+m(a+m_0.b)).E(r)} \end{cases} \quad (3)$$

In the four levels heterogeneous set of connection there are four types of node normal node, advance node, super node, sonic nodes and the references value of p is different for these types of nodes.

Threshold for CH selection is calculated for normal node, advance node, super node,sonic node by putting above value in equation (1)-

$$T(Si) = \begin{cases} \dfrac{P_i \text{ if } P_i \epsilon G'}{1-P_i(r \bmod 1/P_i)} \\[2ex] \dfrac{P_i \text{ if } P_i \epsilon G''}{1-P_i(r \bmod 1/P_i)} \\[2ex] \dfrac{P_i \text{ if } P_i \epsilon G'''}{1-P_i(r \bmod 1/P_i)} \\[2ex] \dfrac{P_i \text{ if } P_i \epsilon G''''}{1-P_i(r \bmod 1/P_i) \text{if } P_i\, G''''} \\[2ex] 0 \quad \text{otherwise} \end{cases} \quad (4)$$

Where G is the set of normal nodes that have not become CH within the last 1/Pi rounds of epoch where Si is normal, advance, super and sonic nodeand G', G'',G''',G'''' is the set of normal advanced, super and sonic node that have not become CH.

ESDEEC implements the same strategy for estimating the energy in the set of connection as proposed is EDEEC.

Since the probabilities of the average energy at each rounds r, hence this is to be calculated. This average energy is calculated as-

E(r) = 1/N E_{total}(1-r/R)   (5)

Where, R denotes the total rounds of the set of connectionexistences. R can be calculated as-

$$R = E_{total} / E_{rounds} \quad (6)$$

$E_{rounds}$is the dissipated energy in the set of connectionin rounds. The total dissipated energyE_{rounds} is equal to,

$$E_{rounds}=L(2NE_{elec}+NE_{DA}+kE_{amp}d^4_{toBS}+NE_{fs}d^2_{toCH})(7)$$

Where k is number of cluster d_{toBS} is the average distance between cluster head and the BS and d_{toCH} is the average distance between CM and CH.

Now,

$$d_{toCH}=M/\sqrt{2\pi}k , d_{toBS} = 0.765M/2 \quad (8)$$

By calculating the derivation of Eround with respect to k to zero we get optimal number of cluster as-

$$K=\sqrt{N/2\pi}.M/d^2_{toBS}.\sqrt{E_{fs}/E_{amp}} \quad (9)$$

Hence, we can find the dissipated energy per rounds by substituting equation (8) & (9) in (7).

Due to the heterogeneity factor R is taken as 1.5R(since E(r) will be too large as end from equation (6) some will not die finally).

V. SIMULATION AND RESULT

In this section the results presented for LEACH, SEP and ESDEEC using MATLAB. We have comparisonESDEEC with LEACH and SEP which is too extended to four levels on the same approach. It clearly shows that by introducing sonic nodes existence increases. Stableness period and existence of ESDEEC is longer as comparison to LEACH and SEP.

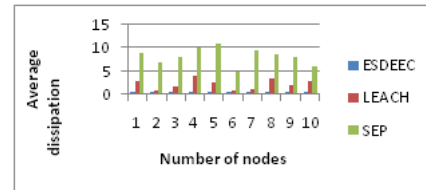| Parameters	Values
Area (x,y)	100,100m
Protocols	LEACH,SEP,ESDEEC
No. of nodes	100
Probability	0.1
Initial Energy	0.5J
Transmitter energy	50nJ/bit
Receiver energy	50nJ/bit
Free Space Energy(amplifier)	10nJ/bit/m^2
Multipath Energy(amplifier)	0.0013PJ/bit/m^4
Number of rounds	3000
C(energy factor between normal nodes and sonic nodes)	4

A. AVERAGE ENERGY DISSIPATION

Fig.2. Average energy dissipation

AED is the energy mean utilization of the energy per node. Fig.2 shows the average energy dissipation. AED of SEP is more than the ESDEEC and LEACH in senarios due to hierarchical clustering. This saving of energy extends the lifespan of the set of connection and illustrates the effectiveness Of ESDEEC. The results further shows thatESDEEC has lower average energy dissipation.
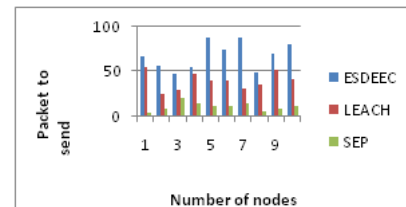
B. PACKET TO SEND

Fig.3.Packet to send

Packet to send is the correlation among the total number of packet received by the sink as against the total number of packet send by the senders from all the nodes. Fig.3 demonstrates the packet to sendof LEACH, SEP and ESDEEC. In ESDEEC packet to send is higher because of the best route is chosen correctly and quickly as it provides the multi-objective solution that simultaneously optimizes reaction times.
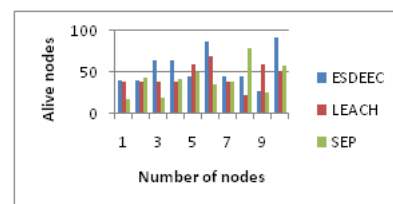
C. ALLIVE NODES

Fig.4.Allive node

The number of allive nodes per rounds of the set of connection show that the ESDEEC gives the best result but the SEP and LEACH protocols is not better than ESDEEC. This shows that the more number of nodes allive for longer period of the time which is shown in fig.4.

VI. CONCLUSION

WSN is a wireless combination communication and the set of connection should be energyefficient withlongerexistence and stableness. This manuscript proposed S-EDEEC adds heterogeneity

in the set of connection by introducing the sonic nodes having energy more than normal nodes and advance nodes & their respective probabilities. Results shows that ESDEEC has perform better as comparison to LEACH and SEP in terms of parameter used.

VII. REFERENCES

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