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A Study Of Multi Level Heterogeneous Routing Protocols In WSN

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Abstract: Wireless sensor networks (WSNs) are popular in real world applications. Because of the characteristics of the resource-constrained and battery-aware sensors; in WSNs energy used has establish to be a major interesting subject of research. WSNs compose battery-powered nodes which are connected with the base station to for definite action or task. As sensor nodes are battery-powered i.e. it has become dead subsequent to the consumption of the battery which is also called lifetime of WSNs. So utilizing the energy in well-organized way has results in prolonging the lifetime of the WSNs. The general aim has to get the drawbacks of the BEENISH i.e. well known multi-level heterogeneous energy aware protocol. In BEENISH ultra-super nodes are mostly elected as CH as compare to super, advance and normal nodes, and so, on. In this way energy inspired by all nodes is equally distributed. But BEENISH has neglected the utilization of intercluster data aggregation which has reason flooding. So to overcome this issue a new inter cluster data aggregation and neural network based BEENISH protocol has been proposed. Neural network has improved the cluster head selection of the BEENISH utilizing the various factors such as range of neighborhood of individual nodes, nodes waiting time etc. MATLAB tool will be used to design and implementing the performance of the given protocols.

Keywords: Wireless Sensor Network (WSN), BEENISH, Neural Network, Data Aggregation.

1. INTRODUCTION

A wireless sensor network is a collection of small randomly dispersed devices that provide three important functions; the ability to check physical and environmental conditions, often in real time, such as pressure, light and moisture; the ability to run devices such as motors or actuators that control those conditions; and the ability to give efficient, dependable communications via a wireless network. Wireless sensor Networks (WSNs) contain many sensor nodes having limited energy resource, which report sensed data to the Base Station (BS) that requires high energy usage. Routing protocols help to attained power efficiency in wireless sensor networks.
Wireless Sensor Network [1] consists of large number of low power, low cost, light weight small sensor nodes deployed in a field or very close to the physical fact to detect the events like temperature, pressure, movement etc. A sensor node consists of sensing component, processing component, communication component and power component. Each sensor node sense the event, process it and communicate it with the other nodes or Base Station through high frequency channel using single hop or multi-hop communication. Sensor nodes are provided with small batteries having limited energy, which limits the lifetime of the Sensor network. To extend the lifetime of the sensor network with limited battery power is the main challenge.

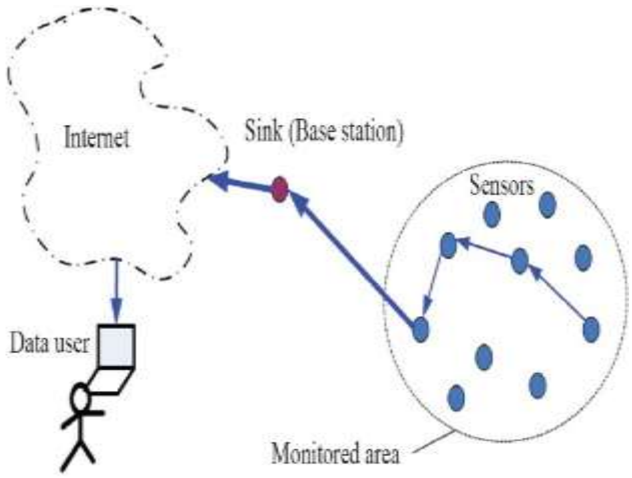

Figure1 wireless sensor network

All sensor nodes process data and transmit it to base station also called sink. In WSNs these sensor nodes are power constrained due to limited battery resource [2]. So using the battery in efficient way becomes critical issue. A number of protocols play an important role to reduce useful energy consumption [2].

There are five ways to save the energy :
1) Deployment of the sensor nodes
2) Energy Efficient Clustering
3) Energy Efficient Scheduling
4) Data Aggregation
5) Energy Efficient routing protocol

2. CLUSTERING

In order to reduce power utilization, clustering is used. In clustering, the sensor nodes select a cluster head and the nodes which fit in to the cluster send their information to the cluster head and data is aggregated at the cluster head and then transmitted to the base station. The clustering Algorithm is a type of technique used to decrease energy0 consumption.

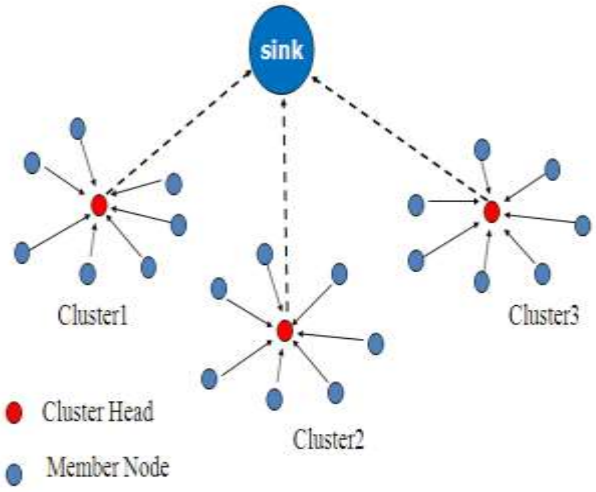

Fig 1.2: Clustering in WSN

WSNs are generally comprised of thousands of nodes that are fixed with limited energy resources. How to expand the lifetime of such a network is challenging. The major approach to increasing energy efficiency, clustering techniques provide a smart topology control scheme for WSNs. Clustering algorithms [2] can divide the sensors in a network into different clusters. A sensor in each cluster, selected as Cluster Header (CH), is responsible for creating a transmission schedule, gathering and fusing data and transmits data back to the Base Station (BS). Many techniques are used in recent clustering algorithms to attain longer lifetime. All the algorithms and data processing is done at the Cluster Head(CH) which consume large quantity of energy because energy utilization depends upon the length of the packet which is to be transmitted and the distance between nodes to CHs and CH to BS.

2.1 Classification of Clustering Attributes

In the classification of clustering attributes that can be used to categorize and make different clustering protocols of heterogeneous wireless sensor networks. The Comparison of heterogeneous clustering protocols is based on these attributes .

2.2 Cluster Properties

Cluster Count: Cluster heads are prearranged in some of the approaches. So, the numbers of clusters are fixed. Cluster head selection algorithms usually choose randomly cluster heads from the deployed sensors thus yields variable number of clusters.

Intra-cluster topology: A few clustering schemes are based on direct communication between a sensor and its selected cluster head, but sometimes multi-hop sensor-to-cluster head connectivity is necessary.

Connectivity of cluster head to base station: Cluster heads transmit the aggregated data to the base station directly or indirectly with help of other cluster head nodes. It means there exists a direct link or a multi-hop link.

2.3 Cluster Head Selection Criteria

Initial energy: To select the initial energy cluster head is an important parameter. When any algorithm starts it usually considers the initial energy.

Residual energy: once some of the rounds are completed, the cluster head selection should be based on the energy left behind in the sensors.

Average energy of the network: This energy is used as the reference energy for each node. It is the ideal energy that each node should own in current round to keep the network alive.

3. HETEROGENEOUS PROTOCOLS

A. Distributed Energy-Efficient Clustering(DEEC):

For dealing with sensor nodes of heterogeneous networks, DEEC is proposed by [22]. The initial and residual power levels of sensor nodes are used to select cluster head. Let the number of rounds for a sensor node μ_a to be a cluster head be δ_a. In the network, the optimum number of cluster heads during each and every round is $\alpha_{op} * M$. Nodes having more power will become cluster head more often than the nodes having low power. Consider the probability of a sensor node μ_a of becoming a cluster head be p_i, so high power nodes have larger ρ_a value in comparison with α_{op}.

Let the average power of network during P^{th} round is as follows [22]:

$$\bar{E}(P) = \frac{1}{M}\sum_{a=1}^{M} E_a(P) \quad (4)$$

Probability will be given by:

$$\rho_a = \alpha_{op}\left[1-\frac{\bar{E}(P)-E_a(P)}{\bar{E}(P)}\right] = \alpha_{op}\frac{E_a(P)}{\bar{E}(P)} \quad (5)$$

During each and every round, the average number of cluster heads is as [22]:

$$\sum_{a=1}^{M}\rho_a = \sum_{a=1}^{M}\alpha_{op}\frac{E_a(P)}{\bar{E}(P)} = \alpha_{op}\sum_{i=1}^{M}\frac{E_a(P)}{\bar{E}(P)} = M*\alpha_{op} \quad (6)$$

Assume G be a set of sensor nodes that are eligible to become cluster head at round t. Each sensor node selects a random number in [0,1]. If this number is less than the threshold value [22], then this node becomes cluster head in the present round.

$$C(\mu_a) = \begin{cases} \frac{\rho_a}{1-\rho_a\left(P \bmod \frac{1}{\rho_a}\right)}, & if\ \mu_a \in S \\ 0, & otherwise \end{cases} \quad (7)$$

In two level heterogeneous networks the value of α_{op} is given by [22]:

$$\rho_\delta = \frac{\alpha_{op}}{1+\beta d},\ \rho_i = \frac{\alpha_{op}(1+\beta)}{1+\beta d} \quad (8)$$

In equation (5), ρ_δ *and* ρ_i will be used for two level heterogeneous networks:

$$\rho_a = \begin{cases} \frac{\alpha_{op}E_a(P)}{(1+\beta d)\bar{E}(P)}, & if\ \mu_a\ is\ a\ normal\ node \\ \frac{\alpha_{op}(1+\beta)E_a(P)}{(1+\beta d)\bar{E}(P)}, & if\ \mu_a\ is\ an\ advanced\ node \end{cases} \quad (9)$$

This can be extended to multi-level network which is given as:

$$\rho_d = \frac{\alpha_{op}M(1+\beta)}{(M+\sum_{a=1}^{M}\beta_a)} \quad (10)$$

In equation (5), ρ_d will be used for two level heterogeneous networks:

$$\rho_a = \frac{\alpha_{op}M(1+\beta)E_a(P)}{(M+\sum_{a=1}^{M}\beta_a)\bar{E}(P)} \quad (11)$$

The average power for the round t of the network is given by:

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$\bar{E}(P) = \frac{1}{M} E_C \left(1 - \frac{P}{A}\right)$(12)

Where A represents the total number of rounds of the lifetime of the network and is given by:

$A = \frac{E_C}{E_b}$(13)

Where E_b = total power dissipated in the entire network during a round [22].

B. Developed Distributed Energy-Efficient Clustering (DDEEC):

DDEEC is proposed by [19]. The same strategy as that of DEEC is implemented by DDEEC in order to estimate average power of the network and the algorithm for selecting cluster head that is based on residual power.

The total power dissipated in the network during a round is given by [23]:

$E_b = k\left(2ME_\gamma + ME_{ad} + \alpha \epsilon_{dp}\ \theta_{toBS}^4 + M \epsilon_{fs}\ \theta_{toCH}^2\right)$(14)

Where α = number of clusters,

k = number of bits,

E_γ = power dissipated per bit in order to run the transmitterE_{TX} or receiverE_{RX},

E_{ad} = cost of data aggregation per bit per signal,

θ_{toBS}^4= distance between the cluster head and base station.

θ_{toCH}^2 = distance between cluster head and cluster members, and

ϵ_{dp}andϵ_{fs} depend on the model used on the basis of distance between sender and receiver.

If $d < d_o$, where $d_o = \sqrt{\frac{\epsilon_{fs}}{\epsilon_{mp}}}$, then the free space ($d^2$ energy loss) model is used.

If $d \geq d_o$, then the multi path (d^4 energy loss) model is used.

Assume that all the sensor nodes are uniformly distributed, then

$d_{toCH} = \frac{M}{\sqrt{2k\pi}}$, $d_{toCH} = 0.765\frac{M}{2}$ (15)

Now the optimum number of clusters is given by:

$k_{op} = \frac{M}{d_{toBS}^2}\frac{\sqrt{N}}{\sqrt{2\pi}}\frac{\sqrt{\epsilon_{fs}}}{\sqrt{\epsilon_{mp}}}$(16)

Since in DEEC, the advanced nodes having high power will become cluster head more often as compared to normal nodes with low energy, so advanced nodes die more quickly than other ones. So, at each and every iteration the residual power is decreased by [23]:

$E_{disAN} = l(E_{TX} + E_{mp}\ (d_{toBS}^4) + (E_{RX} + E_{DA})n/k_{op})$(17)

Where E_{disAN} = the power dissipated by an advanced node during round.

Possible number of iterations for a cluster head with an initial power $(1+\alpha)E_o$ will be given by:

$Nb_{CH} = (1+\alpha)E_o/E_{disAN}$(18)

In each round the power dissipated by a normal node $E_{disNN}$is[23]:

$E_{disNN} = l(E_{TX} + \epsilon_{fs}\ (d_{toCH}^2))$(19)

Possible number of iterations for a normal node with an initial power E_o will be given by:

$Nb_{NN} = E_o/E_{disNN}$(20)

Some changes are made in equation (9) by DDEEC for saving advanced nodes. Threshold residual power is introduced by DEEC [23] that is given by:

$Th_R = E_o\left(1 + \frac{\alpha E_{disNN}}{E_{disNN} - E_{disAN}}\right)$(21)

The probability in this case will be given by:

$$p_i = \begin{cases} \frac{k_{op}E_i(t)}{(1+\alpha m)\bar{E}(t)} & for\ normal\ nodes, E_i(t) > Th_R \\ \frac{k_{op}(1+\alpha)E_i(t)}{(1+\alpha m)\bar{E}(t)} & for\ advanced\ nodes, E_i(t) > Th_R \\ c\frac{k_{op}(1+\alpha)E_i(t)}{(1+\alpha m)\bar{E}(t)} & for\ advanced, normal\ nodes, E_i(t) \leq Th_R \end{cases}$$

(22)

C. Enhanced Distributed Energy-Efficient Clustering (EDEEC):

EDEEC is proposed by [24]. The concept of three level heterogeneous network is used. The value of probability p_i to select cluster head is given by:

$$p_i = \begin{cases} \frac{k_{op}E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & if\ u_i\ is\ the\ normal\ node \\ \frac{k_{op}(1+\alpha)E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & if\ u_i\ is\ the\ advanced\ node \\ \frac{k_{op}(1+b)E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & if\ u_i\ is\ the\ super\ node \end{cases} \quad (23)$$

The threshold to select cluster head for all types of sensor nodes will be given by [24]:

$$T(u_i) = \begin{cases} \frac{p_i}{1-p_i(t\ mod\frac{1}{p_i})}, if\ p_i \in G' \\ \frac{p_i}{1-p_i(t\ mod\frac{1}{p_i})}, if\ p_i \in G'' \\ \frac{p_i}{1-p_i(t\ mod\frac{1}{p_i})}, if\ p_i \in G''' \\ 0, otherwise \end{cases} \quad (24)$$

Where G' = set of normal nodes which have not been cluster heads in the last $1/p_i$ rounds of the epoch.

G''=set of advanced nodes which have not been cluster heads in the last $1/p_i$ rounds of the epoch.

G'''=set of super nodes which have not been cluster heads in the last $1/p_i$ rounds of the epoch.

The same idea as that of DEEC is implemented by EDEEC in order to estimate average power of the network and the algorithm for selecting cluster head that is based on residual power.

D. Enhanced Developed Distributed Energy-Efficient Clustering (EDDEEC):

EDDEEC is proposed by [25]. The concept of three level heterogeneous networks is used like EDEEC. It uses the same strategy like DEEC to compute the residual power of nodes, average power of network and the cluster head selection algorithm. The value of probability p_i to select cluster head is given by [25]:

$$p_i = \begin{cases} \frac{k_{op}E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & for\ normal\ \ if E_i(t) > T(u_i) \\ \frac{k_{op}(1+\alpha)E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & for\ advanced\ \ if E_i(t) > T(u_i) \\ \frac{k_{op}(1+b)E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & for\ super\ \ if E_i(t) > T(u_i) \\ c\frac{k_{op}(1+b)E_i(t)}{(1+m(\alpha+m_0 b))\bar{E}(t)} & for\ ALL\ nodes\ if E_i(t) \leq T(u_i) \end{cases} \quad (25)$$

The threshold $T(u_i)$ is given by:

$T(u_i) = zE_o$(26)

Where z belongs to (0,1). If the value of z=0, then there will be EDEEC. The advanced and super nodes may have not been a cluster head in rounds t actually, it is also probable that some nodes some nodes become cluster head and same is the case with the normal nodes. So the accurate value of z is in doubt. On the other hand, the closest value of z is estimated through various simulations by varying it for best result on first dead node in the network and best result for z equal to 0.7 is found. Thus, $T(u_i)$=(0.7)E_o.

4. BEENISH

BEENISH implements the same concept as in DEEC, in terms of selecting CH which is based on residual energy level of the nodes with respect to average energy of network. However, DEEC is based on two types of nodes; normal and advance nodes. BEENISH uses the concept of four types of nodes; normal, advance, super and ultra-super nodes.

Let$n_i$shows the rounds for a node $s_i$to become CH, we refer it as rotating epoch. CH has to consumemore energy as compare to member nodes. In homogeneous networks, to ensure average $p_{opt}N$ CHs ineach round, LEACH let every node s_i(i = 1, 2, ...N) to become CH once in every n_i= 1rounds. During operation of WSN all the nodes does not own the same remaining energy. So, if the epoch $n_i$is kept equalfor all nodes as in LEACH then energy is not efficiently distributed and nodes having low energy die before high energy nodes. BEENISH choose different epoch $n_i$for different nodes with respect to their remaining energy $E_i(r)$. High energy nodes are more often elected as CH as compare to low energy nodes. So, highenergy nodes have smaller epoch $n_i$as compare to high energy nodes. In BEENISH ultra-super nodesare largely elected as CH as compare to super, advance and normal nodes, and so, on. In this way energy consumed by all nodes is equally distributed.

Let $p_{i=\frac{1}{n_i}}$ is probability of node to become CH during epoch $n_i$rounds. When all the nodes have sameevery level at each epoch, selecting the average probability $p_i$to be p_{out}can ensure that there are $p_{out}N$ CHs every round and approximately all nodes die at the same time. If nodes are having different energy then nodes with more energy hasp_i larger thanp_{out}.

In BEENISH, average energy of rthround can be obtained as follows and as supposed in DEEC:

$$E(r) = \frac{1}{N}E_{total}\left(1-\frac{r}{R}\right) \text{..................}(6)$$

R is showing total rounds from the start of network to the all nodes die and can be estimated as in DEECand given as under:

$$R = \frac{E_{total}}{E_{round}} \text{.........................} (7)$$

$E_{total}$is the energy dissipated in a network during single round. To achieve the optimal number of CH at start of each round, node s_i decides whether to become a CH or not based on probability threshold calculated by expression in the following equation, and as supposed in [6].

$$T(s_i) = \begin{cases} \frac{p_i}{1-p_i\left(r \bmod \frac{1}{p_i}\right)}, & if\ s_i \in G \\ 0 & ,otherwise \end{cases} \text{........} (8)$$

where$G$ is the set of nodes eligible to become CH. If a node $s_i$has not been CH in the most recent $n_i$then it belongs to set G. Random number between 0 and 1 is selected by nodes belonging to set G. If the number is less than threshold $T(s_i)$, the node $s_i$will be CH for that current round. In real scenarios, WSNs have more greater than two or three energy levels of nodes. In WSN due to random CH selection, large range of energy levels are created. So, as much more energy levels we quantize and define different probability for every energy level will lead to as much better results and lead to energy efficiency. In BEENISH, we first time use concept of four level heterogeneous network having normal, advance, super and ultra-super nodes. The probabilities for four types of nodes are given below:

$$p_i = \begin{cases} \frac{p_{opt}E_i(r)}{(1+m(a+m_o(-a+b+m_i(-b+u))))E(r)} s_i\ is\ the\ normal\ node \\ \frac{p_{opt}(1+a)E_i(r)}{(1+m(a+m_o(-a+b+m_i(-b+u))))E(r)} s_i\ is\ the\ advanced\ node \\ \frac{p_{opt}(1+b)E_i(r)}{(1+m(a+m_o(-a+b+m_i(-b+u))))E(r)} s_i\ is\ the\ super\ node \\ p_{opt}(1+u)E_i(r) s_i\ is\ the\ ultra\ super\ node \end{cases}$$

Threshold is calculated for CH selection of normal, advanced, super and ultra-super nodes by puttingabove values in equation (26).

5. RELATED WORK

D. Kumar et al. [6] have studied the impact of heterogeneity of nodes in terms of their energy in wireless sensor networks that are hierarchically clustered. They assumed that a percentage of the population of sensor nodes is equipped with the additional energy resources. They also assume that the sensor nodes are randomly distributed and are not mobile, the coordinates of the sink and the dimensions of the sensor field are known. Homogeneous clustering protocols assume that all the sensor nodes are equipped with the same amount of energy and as a result, they cannot take the advantage of the presence of node heterogeneity. Adapting this approach, they introduced an energy efficient heterogeneous clustered scheme for wireless sensor networks based on weighted election probabilities of each node to become a cluster head according to the residual energy in each node. Finally, the simulation results demonstrated that proposed heterogeneous clustering approach is more effective in prolonging the network lifetime compared with LEACH. Saini, Parul et al. [7] have described the enhanced distributed energy efficient clustering scheme for heterogeneous networks. It contains three types of sensor nodes in order to improve the stability of the wireless sensor network and to make longer the network lifetime. Sensor nodes are introduced that have extra energy as compared to normal and advanced nodes. So, the heterogeneity and energy level of the entire network is increased. The result showsthat the performance of EDEEC is better as compared to SEP.Katiyar, Vivek et al. [8] have described the impact of heterogeneity and study different clustering algorithms for heterogeneous WSNs highlighting their objectives, features, complexity, etc. To expand the lifetime of a sensor network by reducing energy utilization clustering technique is used. It can also increase network scalability. Clustering is a good technique to decrease energy utilization and to provide stability of network in wireless sensor networks. This paper surveyed some of the research protocols in this region. Most of them are based on clustering. They are classified according to energy efficiency and stability of network. Finally conclude that for real life applications the heterogeneous wireless sensor networks are more suitable as compared to the homogeneous counterpart.Basma M. Mohammad El-Basioni et al. [9] have studied the QoS of an energy-efficient cluster-based routing protocol called Energy-Aware routing Protocol (EAP) in terms of lifetime, delay, loss percentage, and throughput, and proposed some modifications on it to enhance its performance. The modified protocol offers better characteristics in terms of packets loss, delay, and throughput, but slightly affects lifetime negatively. Simulation results showed that the modified protocol significantly outperforms EAP in terms of packet loss percentage by on average 93.4%. Sheikhpour, Razieh et al. [10] surveys different energy efficient clustering protocols for heterogeneous wireless sensor networks and compares these protocols on various points like, location awareness, clustering method, heterogeneity level and clustering Attributes. To provide stability in wireless sensor networks clustering is a good technique to decrease energy utilization. The clustering algorithms in saving energy for heterogeneous wireless sensor networks the performance of energy efficient clustering protocols for heterogeneous wireless sensor network has better than energy efficient clustering protocols for homogeneous wireless sensor network in prolonging the network lifetime. Finally, for real life applications heterogeneous wireless sensor networks are more suitable as compared to the homogeneous equivalent.Mohammad El-Basioni et al. [11] have described the QoS of an energy-efficient cluster-based routing protocol called Energy-Aware routing Protocol (EAP) in terms of lifetime, delay, loss percentage, and throughput, and proposes some modifications on it to improve its performance. The modified protocol offers better characteristics in terms of packets loss, delay, and throughput, but a little affects lifetime negatively energy, and using an aggregation technique decreases delay and packet losses. Simulation results showed that the modified protocol significantly outperforms EAP in terms of packet loss percentage by on average 93.4%.M.J. Shamani et al. [12], authors have considered heterogeneous multi-domain sensor networks in this paper. It means that different networks belong to different domains and sensors are deployed at the same physical location and their topology is heterogonous. Apparently, domains life time can be increased by means of cooperation in packet forwarding; however selfishness is inevitable from rational perspective. They have investigated this problem to find out cooperation of authorities while their sensors are energy aware. When sensors are energy aware, spontaneous cooperation cannot take place. Therefore they presented the Adaptive Energy Aware strategy, a novel algorithm that is based on TIT-FOR-TAT, starts with generosity and ends up with conservative behaviour. Our simulation results showed that this algorithm could prolong its network lifetime in competition with other networks. T. N. Qureshi et al. [13] by analyzing communication energy consumption of the clusters and large range of energy levels in heterogenous WSN, they have proposed BEENISH (Balanced Energy Efficient Network Integrated Super Heterogenous)Protocol. It assumes WSN containing four energy levels of nodes. Here, Cluster Heads (CHs) are elected on the basesof residual energy level of nodes. Simulation results showed that it performs better than existing clustering protocolsin heterogeneous WSNs. Their protocol achieved longer stability, lifetime and more effective messages than DistributedEnergy Efficient Clustering (DEEC), Developed DEEC (DDEEC) and Enhanced DEEC (EDEEC). Khan, M. Y. et al. [14] proposed as energy aware adaptive clustering protocols for heterogeneous WSNs. This is a Cluster based (hybrid) distributed scheme for efficient energy utilization in WSNs. By using multi- hoping selected cluster head communicate the Base station (BS) through beta elected nodes in H-DEEC. On the basis of initial and residual energy the network is divided into two parts .The normal nodes with high initial and residual energy will be highly probable to be CHs than the nodes with lesser energy. Hybrid-DEEC is a cluster based (hybrid) distributed scheme for efficient energy utilization in WSNs. From the results, it is observed that the rotated beta nodes chain making scenario in each round, helps H-DEEC to do better than DEEC and SEP in terms of stability time, throughput and energy utilization.Tripathi, R. K. et al. [15] have described a clustering for non-uniform deployed nodes, also calculating the required number of cluster heads in small sub-fields of the WSN. Sensor nodes allocation in a topology influence the energy utilization of individual nodes as well as the wireless sensor network because the nodes at different locations will have different energy loss due to different distance from the base station. Results shows that there is balanced energy utilization in the proposed non-uniform clustering as there are enough amounts of cluster heads are allocated depending on the number of nodes in the annular region compared to the uniform clustering where an equal number of cluster heads are allocated in each annular band.Iqbal, Adeel, et al. [16] have described and estimate Advanced Low-Energy Adaptive Clustering Hierarchy (Ad-LEACH) which is static clustering based heterogeneous routing protocol. The complete network field is first divided into static clusters and then in each cluster separate Ad-LEACH protocol is applied. In this proposed scheme, CH choice mechanism is inherited from DEEC whereas; protocol architecture is adopted from LEACH protocol. To confirm the performance effectiveness of our proposed scheme, simulations are performed in MATLAB. The selected performance metrics are: throughput, energy consumption, number of dead and alive nodes. The results confirm the performance efficiency of Ad-LEACH in the case of two level heterogeneous networks, as compared to LEACH and DEEC. Sharma, Nishi et al. [17] have proposed protocol, which is heterogeneous in energy. To examine the basic distributed clustering routing protocol LEACH (Low Energy Adaptive Clustering Hierarchy), which is a homogeneous system, and then we study the impact of heterogeneity in energy of nodes to prolong the life time of WSN. The result using MATLAB shows that the proposed Leach-heterogeneous system significantly reduces energy utilization and increase the total lifetime of the wireless sensor network. It can be concluded that Leach HeterogeneousSystem provides better performance in energy effectivenessand increasing level in lifetime of the wireless sensornetworks.Aseri, T. C. et al. [18] have described, routing protocols of heterogeneous WSN are discussed. The network lifetime can be increased with the introduction of the heterogeneity in sensor nodes. Several heterogeneous routing algorithms in WSN are proposed. This paper, analyzed the performance of distributed energy efficient clustering algorithm (DEEC), developed distributed energy-efficient clustering algorithm (DDEEC), and energy efficient heterogeneous clustered scheme for WSN (EEHC) in terms of network lifetime and number of messages expected by base station.Hoang, Van-Trinh et al. [19] have described a novel cluster-head selection approach to expand network lifetime and reliability by taking obstacle-aware criteria into consideration. In this approach they selected the most suitable sensor node to become cluster head. The results show significant results by reducing 93% the number of lost packets in the network, thus improving the network throughput up to 53%. In addition, our solution extends the network lifetime to 11%.Kumar, S. et al. [20] have described the MEEP (multihop energy efficient protocol for heterogeneous sensor network) is proposed. This protocol is anextension of SEP and it takes the full advantage of heterogeneity. It improves the network lifetime, stable area and throughput of the network. MEEP introduces a multihop architecture for normal cluster heads for taking the full advantage of heterogeneity. Advanced nodes further takes over the data transmission load of normal cluster head to save network energy, prolong the constant region, network lifetime and throughput of the system. Simulation result shows that the proposedscheme is better than other two level heterogeneous sensornetwork protocol like SEP in energy effectiveness and network life.Kaur, Manpreet et al. [21] have described Distributed energy efficient clustering algorithm and its variants. DEEC is energy aware adaptive technique to use the energy of sensor nodes efficiently. Variants of DEEC illustrate new concepts and techniques which improve reliability, lifetime and throughput. Improvement is also possible in many aspects like sensor nodes electronics, sensor nodes deployment management, effective and energy efficient routing protocols selection for WSNs according to requirements of application. Objective of our work is to analyze that how these extended routing protocols work in order to optimize network lifetime and how routing protocols are improved.

6. LIMITAITONS OF THE EARLIER WORK

1. The use of inter cluster data aggregation has been neglected by the most of the existing researchers.
2. Most of the work is either on the homogeneous WSNs or heterogeneity is limited to three level of nodes.
3. The effect of node scalability has been neglected by most of the researchers.
4. The use of neural network to select the neighborhood range has been neglected in the most of the existing research.

Clustering Approach	Hetero geneity Level	CH Selection is based on			
		Initial Energy	Average Initial Energy	Residua l Energy	Average Energy
DEEC	**Two/ Multi**	-	-	**Yes**	**Yes**
DDEEC	**Two**	**Yes**	-	**Yes**	-
EDEEC	**Three**	-	-	**Yes**	-
EDDEEC	**Three**	**Yes**	-	**Yes**	**Yes**
BEENISH	**Four**	-	-	**Yes**	**Yes**

7. CONCLUSION

Wireless Sensor Network consists of huge number of low power, low cost, light weight small sensor nodes deployed in a field or very close to the physical fact to detect the events like temperature, pressure, movement etc. Because of the characteristics of the resource-constrained and battery-aware sensors; in WSNs energy used has establish to be a major interesting subject of research. WSNs compose battery-powered nodes which are connected with the base station to for definite action or task. As sensor nodes are battery-powered i.e. it has become dead subsequent to the consumption of the battery which is also called lifetime of WSNs. So utilizing the energy in well-organized way has results in prolonging the lifetime of the WSNs. The general aim has to get the drawbacks of the BEENISH i.e. well known multi-level heterogeneous energy aware protocol. In BEENISH ultra-super nodes are mostly elected as CH as compare to super, advance and normal nodes, and so, on. In this way energy inspired by all nodes is equally distributed. But BEENISH has neglected the utilization of intercluster data aggregation which has reason flooding. So to overcome this issue a new inter cluster data aggregation and neural network based BEENISH protocol has been proposed. Neural network has improved the cluster head selection of the BEENISH utilizing the various factors such as range of neighborhood of individual nodes, nodes waiting time etc. MATLAB tool has be used to design and implementing the performance of the given protocols.

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