Review of Energy Enhancement Protocol Wireless Sensor Networks

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ABSTRACT

Wireless sensor network (WSNs) comprises of base station and number of nodes. Sometimes remote sensors are used which are generally known as remote sensor actuator systems. WSN is a large network of sensor nodes and these nodes are directly interacting with the environment by sensing the physical and ecological parameters like temperature, weight and so on. The limited energy of the sensor nodes is the major bottle neck of wireless sensor network. By conserving the on board energy, the life span of wireless sensor network can be well extensive. Data communication being the leading energy devastating movement of wireless sensor network, data decrease can provide better in conserving the nodal energy. The basic aim of this paper is to study and evaluate the performance of various techniques that are used for the communication in WSNs. The various algorithms that are used to enhance the energy of sensor nodes in wireless sensor network are portrait

Keywords

Wireless sensor network, Heterogeneous WSNs, Homogeneous WSNs, Firefly Algorithm, Clustering, Simulated annealing, Energy consumption.

1. INTRODUCTION

A Wireless sensor network (WSNs) consist of base station and quantity of nodes. Sometimes remote control sensor is deployed which are generally known as remote control sensor actuator systems. WSNs are spatially distributed autonomously device using sensors to monitor physical and ecological conditions like temperature, weight and so on .Remote sensors are utilized as part of military, well being, natural, car and other business applications. Sensor nodes are frequently operated by short ability battery and are unattained. WSNs nodes are regularly stationary. Remote Sensor Networks basically consists of sensors. The critical attributes of WSNs Receptors are:

- Low control

- Limited memory

- Energy manipulations because of little size.

- Wireless systems can be conveying in excessive natural conditions and might be prostrate to attacker assaults.

- Although conveyed in a specially appointed way they need to act naturally established and self-mending and can confront perpetual re-star collection.

- No crude information is transmitted, to build the life of system.

Four basic component associated with sensor nodes.

- Sensing device

- Processing device

- Power unit

- Transceiever

Sensing unit is employed in order to accumulate the information in analog format. Analog to digital convertors are employed to convert data fetched from analog to digital form. Microcontrollers are part of processing unit.The main task of transceiver is to tie together the sensor nodes with the network. Power device contains the battery needed to operate all the other module of the network[15]
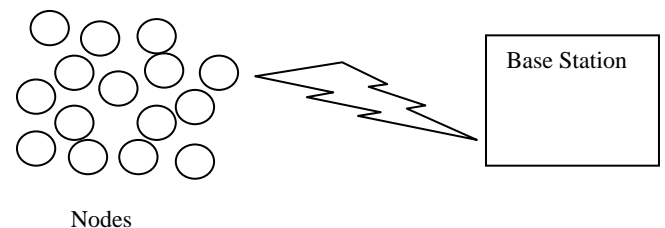

Nodes

Fig no.1 Wireless Sensor Networks

The Wireless Sensor Networks are broadly divided in two categories named as:

1.1 Homogeneous Wireless Sensor Network

All nodes are indistinguishable in terms of battery power &hardware difficulty.Homogeneous system have unadulterated static bunching. Sensors networks in which hub has same equipment, multifaceted nature & battery vitality in homogeneous sensor network.

In Homogeneous network of system utilized single system topology. In any case, the most imperative drawback of homogeneous sensor network and additionally part turn is that all system nodes will have the capability to go about as bunch heads, and therefore they must have required the ability to identify with equipment requirements.

1.2 Hetrogeneous Wireless Sensor Network

Heterogeneous remote sensor arrangements comprise of primarily two more hubs having diverse measure of vitality. In this sort of sensor system nodes with high measure of vitality went about as group head known as propelled nodes and nodes with less significant amount of energy called typical nodes. In Heterogeneous remote sensor systems weight based information transmission is utilized, hub having

high measure of vitality can utilized as they brought together point and total information got information and exchange to base station. Heterogeneous system are utilized with the idea of numerous trusting keeping in mind the end goal to achieve the cluster head, the hub which are nearer to group head having more vitality weight on account of handing-off. In Heterogeneous WSN distinctive topologies are utilized &it makes the system an extremely complex system. A Heterogeneous sensor accomplishes lowered equipment cost. Heterogeneous systems are utilizing the idea of numerous hops keeping in mind the end goal to achieve the group head, the nodes which are nearer to cluster head having the more vitality weight in view of transferring.
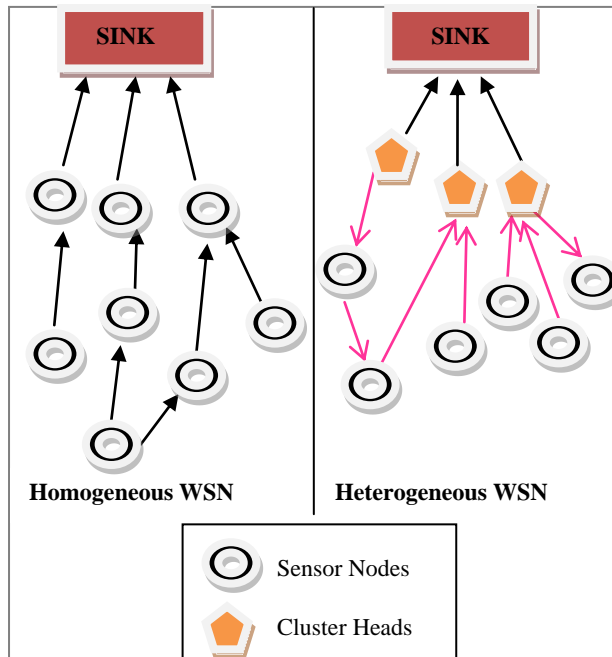

Fig no.2 Homogeneous vs. Heterogeneous WSNs

2. CLUSTERING

Clustering is strategy which is utilized as a part of WSNs to lessen the reduced utilization likewise decrease the no. of transmission to base station. Sensor nodes are partitioned into little gathering known as groups. Group head will gather the detected information from all nodes in that bunch. With the goal that hub will exchange their date to base station specifically. They just sense the information to CH of specific cluster.CH will sum up the information, wipe out repetitive information and transmit to the base station.

The nodes with most extreme fitness value will take as Cluster Head. The nodes under the correspondence will end up being an individual from Cluster Head and those nodes which has greatest vitality alongside Cluster Head is chosen as an Assistant of that group. The hub are supporting as Cluster Head that nodes will inspire opportunity to end up Cluster Head if Cluster Head dies.
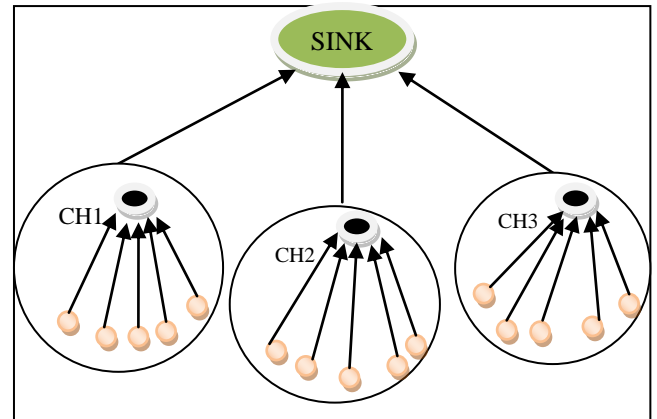
Advantages of Clustering

- Transmit entire information to the information sink.
- Diminish the quantity of hubs participating in transmission.
- Scalability for large number of hubs
- Reduces correspondence transparency for both single and multi-hop.

Topology control approach
Stack adjusting, arrange adaptability

Sorts of bunching

- Static: neighborhood topology organize
- Dynamic: altering system parameter
- Single hop and Multi - hop
- Homogeneous and Heterogeneous

3. FIREFLY ALGORITHM

The meta-heuristic calculation was proposed by Dr. Xin-She Yang at Cambridge University. The firefly Algorithm is proposed on the basis of conduct of fireflies. It finds the ideal molecule position. A firefly calculation in light of approach is suggested for vitality successful driving in Wireless sensor networks. Firefly insect generate flashes of small time through a strategy called bioluminescence. This method is evaluated after the activities of fireflies and their attraction towards different fireflies with higher power of light. Firefly Algorithm is widely used to solve reliability and redundancy problem.[12]

In firefly approach, two factors count on after light ability and appeal. Power of light is distinctly essential parameter for other firefly. This approach takes following rules:

- Firefly attracts to the other firefly on the premises of higher splendor.
- Attractiveness of fireflies on the assumption of light power straight corresponding to its higher shine.
- If distance between fireflies increments, it indicates light force is lowering.
- Objective capacity associated with brightness of firefly.

Appealing increments
The firefly algorithm is useful to improve the system lifespan &throughput of the system with determination of Cluster

Head on the basic of remaining vitality &nodes in bunch scope selected to go with on the premise of separation.

In firefly annealing approach, remaining vitality ideals assume real part as esteem shared between different hubs in the systems. Number of resending of every nodes and the separation between any nodes in group is assessed. On the support of this esteem and the estimation of remaining energy, another way is set up in the system from starting to sink. The nodes which have little vitality that esteem drawn toward the high vitality node and charm is figured.[12]

In firefly annealing approach, remaining energy values assumes significant part as esteem shared between different hubs in the systems. No. of resending of every hub and the separation between any hubs in bunch is measured. On the support on this esteem and the estimation of outstanding energy, other way is found in the system from beginning to drain. [12]

The strength of the blaze light which is likewise characterized as charm is contrarily relative with removal from the sunlight source. This demonstrates the appealing increments as the declines and the other way around [12].

Appeal and Light Intensity: The associated guidelines are utilized for group arrangement.[12]

In Firefly based approach, the remaining energy value performs a major role as the values are distributed among other nodes in the network. Range of retransmissions of every nodes and the distance value between any two nodes in the cluster is determined. Depending on these values and the values of recurring energy, a new path is found in the network from source to sink. The nodes which have low energy value are fascinated towards the high energy nodes and an elegance factor is calculated. [12

In Firefly Algorithm, light concentration and attractiveness are the two important variables. Firefly is concerned toward the other firefly that has lighter spark than itself. The attractiveness is dependent on the light strength [12].

4. SIMULATED ANNEALING

Simulated annealing is a probabilistic method purposed in Kirkpatrick, Gelett and Vecchi (1983) and Cerny (1985) for locating the global minimum amount of a cost function that may own several local minima. It works by emulating the physical process whereby a sound is slowly cooled so that when eventually their structure is "frozen", this happen at a minimal energy arrangement.[16]

Simulated annealing is method for solving unrestrained and bounded-constrained optimization problem. The process model involves the physical procedure for heating a objects and then slowly lowering the temperatures to decrease defect, thus minimizing the system energy.[16]

At each repetition of simulated annealing criteria, a new point is randomly generated. The length of the new point from the current point, and also the extent of the search, is based on a probability allocation with a scale proportion to the temperature. The algorithm allows all new point that lower the objective, the algorithm avoid being stuck in local minima at the beginning of time and is able to explore globally for better solution [16].

The traveling salesman problem is a good example: -The sales person is looking to visit a set of town in the order that minimize the total amount of miles they travel. As the quantity of cities gets large, it comes out to be computationally too intensive to evaluate every possible itinerary. At that point, need an algorithm.[16]

Simulated annealing is a generally appropriate and easy to execute probabilistic estimation algorithm that is actually able to produce good solution. The Simulated annealing algorithm can be looked at as a local search algorithm in which there are "upward" moves that leads to an amplify in the overall cost. One hope that such upward moves will help escape local minima. The SA algorithm contains a discrete- time homogeneous Markov chain. The concurrence simulated annealing is a reassuring property, but it is far enough for SA to be an useful criteria.[16]

In an extensive Study of SA, Johnson et al. (1990, 1991, 1992) discuss the performance of SA on four problem: Travelling salesman problem(TSP), Graph partition problem(GPP), Graph coloring problem(GCP) and number partitioning problem (NPP), Johnson et al. Apply Simulated annealing to these NP-hard problems by using a cooling schedule in which the temperature reduce geometrical[16]

For Graph coloring problem in Simulated annealing, SA produces final solution that are competitive with those obtained by a modified heuristic which is considered the best one in this difficulty. on the other hand calculation times for Simulated annealing are much longer than those of the specific heuristics.[16]

In addition SA are used in double in image and various alternative version based roughly on it have been used in statistical applications. Bohachevsky, Johnson and Stein (1986) suggested a "generalized" SA produce for continuous optimization problem and applied their method to an optimal design problem.[16]

5. RELATED WORK

Fateh boutekkouk et al. [7] proposed a hybrid approach to expand the lifetime of heterogeneous wireless sensor network. In this paper author proposed two meta-heuristics that are: firefly and simulated annealing to expand the life span of heterogeneous wireless sensor network through fixed base station by dropping the communication utilization. The proposed approach combines the clustering and the chain approaches. This optimization algorithm tries to find the optimal clustering over the network nodes using the firefly inside each cluster it try to find the best chain using simulated annealing.

M.S.MANSHAHIA et al. [11] purposed firefly based energy well-organized routing in wireless sensor network. The firefly algorithm rules is implement in this paper that relies on the attractiveness issues on the firefly for energy efficient routing in WSNs. The firefly algorithm result displays the enhancement in the network lifetime and throughput of the network.

N.Javaid et al. [2] purposed a novel clustering based routing technique: Enhanced Energy Efficient Clustering Scheme (EDDEEC) for heterogeneous WSNs. This technique is based on dynamical changes and with more efficient the cluster head (CH) selection possibility. EDDEEC is adaptive energy responsive protocol which vigorously changes the possibility of nodes to become a CH in a impartial and efficient way to allocate equal amount of energy among sensor nodes.

Nafaa Jabeur et al.[5] purposed recurrent problem of node idleness in heterogeneous wireless sensor network using bully strategy. In this paper, at the end author presented an analytical approach for the recognition and relocation of

redundant sensor of wireless networks. In this paper a bully approach is used for evaluations of overlapping between dissimilar sensing ranges.

Salah Abdel-Mageid et al. [11] purposed novel decentralizing approach enabled to consider the heterogeneous characteristics. The performance comparison is also introduced to study how to design the parameters affections. Simulation result show that purposed solution achieved high coverage performance in few rounds with minimum energy consumption and minimum computation.

Deepak R Dandekar et al. [1] in this paper have studied the problem of deploying additional relay node placement for multi-path connectivity in heterogeneous wireless sensor network. In this paper purposed that particle swarm intelligence algorithm in placing the relay nodes optimally. In this paper, in future would like to carry out same experiment to finding the optimal amount of heterogeneous wireless sensor relay nodes to be located for multipath connectivity in heterogeneous wireless network.

Ahmed Al-Saadi et a.[13] in this paper, a cognitive network framework for heterogeneous wireless networks is proposed, in which the network protocol stack is integrated with a semantic system. The proposed framework is used to provide on the basis for building smart network that observed the data from different layer in the network protocol stacks allowed to adding ontology to describe the data, searching the visualized data.

Ahmed M.Khedr et al. [8] purposed a new algorithm for finding the minimum connecting coverage of queried region by discovering the outmoded sensor for heterogeneous wireless sensor network, each with based on sensing range and is not responsive of its position or path of its neighbor. In the end of this paper simulation result shows that algorithm which is used that extend the lifetime of network. In future research, it will more work to focusing on distributing and localizing solution for practical deployment.

Chirihane Gherbi et.al.[16]purposed a load balancing and self adaption clustering for lifespan prolonging in huge scale in wireless sensor networks. In this paper, a new hierarchical approach called dispersed energy efficient adaptive clustering protocol with assemblage data is designed for wireless sensor network. In this paper purposed approach to range the following objective: decrease the overall network energy utilization, stability period of network, extend the lifetime of network ,the clustering should be efficient in difficulty of massage and time ,load balancing should be done well. In this paper purposed work is simulated by network simulator. The main objective of this paper is to design sleep control laws that decrease the expecting rate of cost function represent both energy utilization value and share costs for backlogging Packet.

Pratyay Kuila et .at.[18] In this paper, an Energy Efficient Load Balancing algorithm that addressed energy effectiveness as well as load balancing have been discussed. The simulation result show that efficiency of designed algorithm in term of load balancing, energy effectiveness ,implementation time, the number sensor nodes dead in the network lifetime

6. COMPARITIVE ANALYSIS

Table1 has shown the comparison between the surveyed papers that show which algorithms yields better results in enhancing the energy and lifespan of network. The various parameters like initial energy of networks, number of bits present for message passing, number of nodes of various techniques has been compared and shown in table 1.

Table 2 demonstrated the various techniques that are used in WSN presently. The comparisons on the behalf of various techniques based on network category, issue, benefits used to enhance the energy of network have been elaborated. It is also categorized that which technique is perform better than the available methods to recover the energy enhancement & life span of network in wireless sensor networks.

Table1. Comparison of Heterogeneous Vs Homogeneous Networks:

Sr. No	Authors/ Year	Network Category	Protocol	Clustering Scheme	Parameters Involved	No. of Nodes	Area Field	Initial energy of nodes	Stability period of network	Message No. of bits Present
1	Deepak R. Dandekar et.al[2] /2013	Heterogeneous	Not Mentioned	Not Mentioned	1.Number of sensor nodes	60	1000m*1000m	Not mentioned	Yes	Not Mentioned

2	Fatehboutekkoukel.lt[7]/2015	Heterogeneous	Not Mentioned	Clustering approach	1.Number of nodes 2.Cluster number 3.Field dimension 4.Base station position 5.Energy of all nodes 6.Initial temperature	100	500m*500m	0.1J	Yes	2000
3	Nafaa Jabeur el.al[5]/2016	Heterogeneous	Not Mentioned	Not Mentioned	1.Network field 2.Residual energy 3.Threshold redundancy 4.Maximum energy	Not Mentioned	Not Mentioned	Not Mentioned	Yes	Not Mentioned
4	Ahmed M.Khedr et.al[8]/2015	Heterogeneous	Not Mentioned	Not Mentioned	1.Network field 2.Coverage field	Not Mentioned	400m*400m	Not Mentioned	Yes	Not Mentioned
5	N.Javaid et.al[1]/2013	Heterogeneous	Not Mentioned	EDDEEC (Enhanced Developed Distributed Energy-Efficient Clustering)	1.Number of sensor nodes 2.Network field 3.Energy of norm nodes 4.Energy of an advanced nodes	100	100m*100m	0.5J	Yes	4000bits
6	M.S.Manshahia et.al[12]/2015	Heterogeneous	Not Mentioned	Not Mentioned	1.Number of nodes 2.Area of field 3.Message size 4.Simulation time	50	1000*1000m	Not Mentioned	Yes	Not Mentioned
7	Salah Abdel Mageid et.al[11]/2011	Heterogeneous	Not Mentioned	Not Mentioned	1.Number of sensor nodes 2.Area field	115,150,180 and 100,120,140	300*300m	Not Mentioned	Yes	Not Mentioned

8	Soichiro Yamanaka et.al[9]/ 2016	Heterogeneous	Not Mentioned	Not Mentioned	1.Number of sensor nodes 2.Simulation time 3.Coverage time	1000,3000,4500,6000,9000	Not Mentioned	Not mentioned	Yes	Not Mentioned
9	Salim EL Khediri et.al[13] /2015	Heterogeneous	O-LEACH	Not Mentioned	1.Simulation Area 2.Initial energy 3.Base Station 4.Number of nodes 5.Transmitter/Receiver electronics	100 and 300	100*100 m	0.5J	Yes	2000bits
10	Chirihane Gherbi et.al[17] /2015	Homogeneous	DEACP	Not mentioned	1.Area Field 2.Data packet size 3. Control packet size 4.Initial Energy 5.Base Station 6. Distance	100	1000*1000m	2J	Yes	4000bits
11	Pratyay kuila et.al[18] /2012	Homogeneous	Not Mentioned	EELBC (Energy Efficient Load balanced Clustering)	1.Number of sensor nodes 2.Electronic energy 3.Amplifier energy 4. Massage size 5.Threshold distance	100 to 500	1000*1000m	2J	Yes	Not Mentioned
12	Santar Pal Singh et.al[19] /2015	Homogeneous	Cluster based routing protocol(LEACH, HEED, etc)	Not Mentioned	Not Mentioned	Not Mentioned	Not Mentioned	Not mentioned	Yes	Not Mentioned
13	B.Manzoor et.al[20] /2013	Homogeneous	Q-LEACH	Not Mentioned	1.Number of nodes 2. Area field	100	100m*100m	0.5J	Yes	2000bits

| 14 | Gaurang Raval et.al[21] /2015 | Homogeneous | Centralized protocol(LEACH-centralized, KMeans-CP,FCM-CP,HSP protocol) Compared with realistic topologies | Not Mentioned | 1.Cofficient of variation 2.Number of nodes 3.Packet header size 4.Message size 5.BSlocation 6.Node distribution 7.Bandwidth of channel 8.Initial node energy 9.Simulation time 10.Energy consumed during data aggregation | 50,100 ,150,200 | Not Mentioned | 2J | Yes | 500bytes |
| 15 | Rohini Sharma/ 2015 | Homogeneous | LEACH | Not mentioned | 1.Theshold value 2.Area field 3.Initial energy per nodes 4.Radio electronics energy 5.Data size 6.Nodes 7.Radio amplifier energy for multipath fading | 100 | 100m*100m | 0.5J | Yes | 100bit |

This section provides comparison between the networks that are used to enhance the energy based on their parameters, initial energy of network. This comparison can be used for selection of optimal technique for future research.

Table2.Various techniques described through following comparison

Ref no.	Year	Techniques	Network Category	Issues	Benefits	Limitations
[2]	2013	Clustering routing technique	Heterogeneous	Energy consumption in WSNs	Better lifetime of network and stability period, enhancement of energy	Optimize to divide the sensor field among consistent number of clusters.

[7]	2015	Meta-heuristic used: firefly and simulated annealing	Heterogeneous	To reduce the energy utilization and improve the life span of network and find best cluster head ,best optimal path in the network	Extend the lifetime of network using firefly and simulated algorithm and enhancement of energy	Used proactive protocol
[5]	2016	Bully approach	Heterogeneous	Recurrent difficulty of node idleness in Heterogeneous WSNs	Improving relocating of redundancy of sensor	Complexity increase while solve the problem of redundancy
[8]	2015	Localization coverage determination	Heterogeneous	Extend the network lifetime using distributed algorithm	Integration of Heterogeneous WSNs with IP is backbone of 4G network	Handoff delay, packet loss, packet delay complicated to solve
[3]	2013	Mobility in heterogeneous wireless network	Heterogeneous	Coverage ratio & lifetime of network	Better lifetime of network& coverage ratio	ECRM protocol is highly Scalable but if the terrain is uneven extra region is added after the step of shifting the node it will be difficult to organize the network.
[4]	2012	Mobility technique	Heterogeneous	Mobility management with all IP in 4G network issue such context of network	Integration of heterogeneous network with 4G is backbone provider	Handoff delay, packet loss, packet delay complicated to solved.

[1]	2012	Particle swarm optimization technique	Heterogeneous	Deploying minimizing additional nodes	Using PSO algorithm deploying a minimum additional relay node to process multipath connectivity.	PSO algorithm difficult to discontinuous problem in variety of field
[12]	2015	Firefly and particle swarm intelligence algorithm	Heterogeneous	Network lifetime and throughput and find the best optimal path in network using cluster head at base station	Improve the lifespan and throughput of network	Difficult to improve the Stability period of network
[11]	2011	Adaptive relocation strategy	Heterogeneous	Increase lifetime and reliability network, without significantly increase the cost, energy consumption	Achieve high performance in few round with minimum energy consumption & minimum computation	Different operations are performed on the basis of characteristics of their strategies
[9]	2016	Efficient scheduling method based PCO model.	Heterogeneous	Collision due to hidden nodes.	Attain high rate of data gather with realistic coverage time in equally Heterogeneous and homogeneous network.	PCO MODEL has hidden node problem.
[13]	2015	Cognitive network framework	Heterogeneous	Increase traffic demand in network is expected to increase thousand fold.	Provide higher network capacity wider coverage high quality of service, analyzing search the visualization data	Framework is applicable in network layer with symmetric system.

7. CONCLUSION AND FUTURE WORK

In the application based WSNs location, energy and bandwidth of the sensors are appreciated resources and essential to consume capably. In this paper the energy enhancement of homogeneous and heterogamous wireless sensor networks have been surveyed and analyzed. Due to energy consumption the life span of the network would decrease; to enhance the energy and lifetime of the network. The review has shown that various algorithms which are used to improve energy enhancement of network, but still there are some issues left which decreases the network life time so to overcome these issues in near future.

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