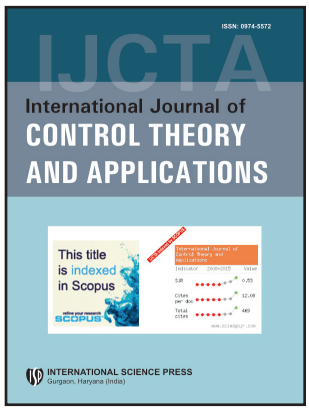

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MRPSO based Modified Algorithm for Enhancing Energy Efficiency in WSN

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Abstract: In wireless sensor network the sensor nodes are used for the communication. Efficiency of the network depends on the sensor nodes present in the network, various energy efficient protocols have been designed to enhance the efficiency of the system. By decreasing the energy consumption the life time of the network is increased and thus the efficiency of the system also increases. In this paper the modified PSO is used for the selection of the Clusterhead, along with this the energy efficient sleep awake aware concept is introduced. In Energy Efficient Sleep Awake nodes switches between sleep and active modes in order to minimize energy consumption. Form the results obtained it is concluded that the proposed method is efficient and better than the traditional methods.

Keywords: WSN; Modified PSO; Energy efficient Awake/sleep aware; Energy efficiency.

1. INTRODUCTION

The process of finding the data transmission route is termed as routing. In wireless sensor network large amount of nodes are present that are used for the sensing, transmitting, receiving of the data between the nodes present in the network. The efficiency of the network also depends on the selection of the path the as it effects network life time, energy consumption etc. [1] Various routing algorithms have been designed for the efficient routing process. The wireless sensor networks are reliable, accurate, cost effective and easily deployed. The life time of the network is defined by the energy consumed by the sensor nodes. So various routing mechanism have been developed that will help in increasing the life time of the network by consuming less amount of energy. The network efficiency depends on the energy consumed for transmitting the data by the nodes. [3]

Uses of WSN are increasing day by day without any kind of limitations. Different type of applications have different type of network bearing constraints and features but still most of the issues are common or same which makes them comparable.[22] The positions of the sensor node become most sensitive point while the process of deployment of nodes. But sometimes coverage area of networks creates an issue because it also directly depends upon the positions of the nodes. In sniper systems, a sensor network is placed to secure an area from the snipers.

The network is designed according to the urban areas where snipers can easily hide and sound sensors are also installed in the network to detect the sound generated by the bullet. [23] By fetching data collected by all these sensors, the location of the sniper can be estimated after applying space temporal data in an efficient manner. In some cases complete terrain coverage is must where the situations are critical so that the sensors can detect the bullet trajectory no matter what this trajectory is. But in some areas like biomedical sensors the coverage of the terrain is not important but in this situation interface with the patient or the system's safety become of a critical. [3]There is two other important Concerns, In the first the WSN is deployed in a battlefield where the support and maintenance of WSN is not possible or a longer period of lifetime.

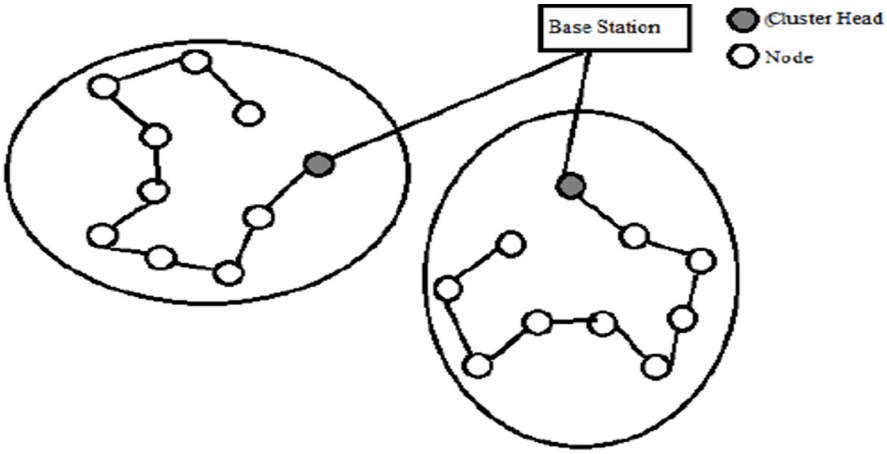

Figure 1: Routing in wireless sensor network [6]

2. TECHNIQUES

Various clustering techniques for energy efficient WSN is as follows:

- LEACH
- HEED
- TEEN
- DEEC
- PEGASIS

LEACH

LEACH means Low Energy Adaptive Clustering Hierarchy. It is a clustering protocol. It distributes the energy load equally among all the sensors in a network. Leach is a self-organized and adaptive protocol for networks. [21] In LEACH, all the nodes contained in a local cluster and a single node among all of the nodes behaves like a cluster-head or base station. If the cluster heads were chosen a fixed throughout the system life time, as in conventional clustering algorithms, it is easy to see that the sensors selected for cluster-heads would die quickly, ending the useful lifetime of all nodes belonging to those clusters.[7]

Therefore LEACH has a high energy cluster which is random so that it can move or rotate among all sensor nodes to drain the battery of single sensor.[21] Due to the advantages of LEACH such as reduced control messages, bandwidth reusability, enhanced resource allocation, improved power control and lest wastage of energy it is proved efficient for Autonomic Sensor Network which has mobile battery power nodes.

HEED

HEED stands for Hybrid Energy-Efficient Distributed Clustering. HEED does not contain any communication overhead so it did not facilitate the efficient distribution of cluster head nodes over the network.[1] LEACH-C protocol is use to overcome this problem, it is a centralized approach but scalable to limited number of sensors only. Many clustering algorithms are available which creates more uniform clusters at the expense of overhead in cluster formation. [6] One of the approaches is HEED which uses distributed algorithms which are easy and quick to convert. HEED uses a cluster formation algorithm, in which each node is assigned with a cluster head probability which is the function of their residual energy and also communication cost which is the function of neighbor proximity. Cluster head probability is used to decide that whether the sensor node is candidate for cluster head for this round or not.[17]

The advantage of HEED is that there is no need to have the global knowledge regarding the nodes in a network, it terminates the processing at O(1) round or iteration, it considers that each node is part of a an single cluster, cluster heads the distributed in a proper manner.[1]

TEEN

TEEN stands for Threshold sensitive Energy Efficient sensor Network protocol. It is used for reactive networks. It is an application which senses the temperature.[7] It is more energy efficient protocol as compare to the conventional protocols. To overcome the limitations of LEACH protocol the TEEN protocol is developed. It enhanced version of LEACH protocol. TEEN is not suitable for large scale networks because it lacks:

- Randomly choosing cluster-heads before the events happened. It makes the sensors out of the event region gathering into clusters and transmitting data, causing unnecessary energy consumption and unbalance clusters.
- Choosing the cluster-heads without considering their residual energy. It may choose the sensors with less energy as the cluster-heads and then cause them premature death.
- The cluster-heads transmit data to the sink node directly. Thus one-hop transmission mode may result in the cluster-heads far away from the sink node quickly dead.

DEEC

DEEC stands for distributed energy efficient clustering. It is used for heterogeneous wireless sensor network. In this protocol the ratio between the remaining energy on each node and average energy on the network is calculated and its probability ratio is used to select the cluster-heads.[2] The number of rotation on each node varies along with the variations in initial and remaining energy i.e. DEEC transforms the rotation on each node into energy. The nodes which have high amount of residual energy and high initial energy is much suitable for cluster head candidate node as compare to the nodes with low energy.[16] Therefore DEEC can extend the lifetime of the network by using heterogeneous aware clustering algorithms. DEEC can gain more effective messages as compare to the classical clustering algorithms. DEEC is more suitable for Multi-level heterogeneous networks.

PEGASIS

PEGASIS stands for Power-Efficient Gathering in Sensor Information Systems.[5] It is a chain-based power effective algorithm. It is based on following two parameters:

- Chaining
- Data fusion

It works similarly LEACH. In PEGASIS, each node can act as a leader of the chain and chain is also constructed with the help of greedy algorithm and can install by the sensor nodes. PEGASIS is based on following assumptions:

- Sensor nodes have global knowledge of the network
- All the nodes are stationary
- Nodes have knowledge about the location of all other nodes.

PEGASIS also face some problems as LEACH suffers. One of the main disadvantages of PEGASIS is that it is not scalable so it cannot be used in case of wireless sensor networks due to the lack of knowledge regarding the nodes because of large number of nodes. [17]

3. LITERATURE REVIEW

R. Rajeshwari, et. al., [1], In this paper author conveys that Sensor networks are combination of many sensor nodes. These sensor nodes sense the data from its surroundings and send that collected data to the base stations in the form of data packets. Because the lifetime of sensor node is based on the energy of battery, so it is mandatory to utilize the energy consumption by these nodes. And to reduce the battery consumption it is mandatory to reduce the traffic on each and every node along with the minimized number of transmitted data to the Base station. By using clustering approach scalability, reduced energy consumption and better performance of network can be obtained. In Clustering approach whole network is divided into small clusters and each cluster has its cluster head which is selected from the clusters itself. Cluster heads generate the aggregate form of data sensed by sensors locally. This technique reduces the size of the data by generation compressed form of data and this compressed data is forward to the base station for a proper sink of the network.

Parul Saini et. al., [2], In this author defines that there are many routing techniques which are used to enhanced the lifetime and efficiency of the system. These protocols are helpful to increasing the fault tolerance and robustness of the system. In this author used a technique EDEEC which is the modification in traditional DDEEC technique. The results or simulation of EDEEC shows that the proposed technique much reliable to enhance the lifespan of the WSN as compares to traditional DEEC.

R. Renuga Devi et. al., [3], In this author conveys that the recent advancements in integrated circuit technology, micro-ele ctro mechanical system technology, Ad hoc network routing protocol, distributed signal processing and embedded systems have enabled the development of low cost, and low power, network enabled or multifunctional wireless sensor network environment. The major concern of all efficient WSN is optimal power consumption and maximum. Earlier WSN was used for monitoring and reporting events only but now it has variety of applications. As every application has distinct requirement single Routing protocol is inefficient. In this author defines the energy efficient routing protocols into three main schemes as data centric, hierarchical or location based routing. The comparison shows the important design issues that need to be taken into consideration at the time when designing and evaluating network protocol is performed.

Georgios Smaragdakis Ibrahim et. al., [4], In this paper the author explains the effect of heterogeneity of hubs, as far as their vitality, in remote sensor arranges that are progressively bunched. In these systems a portion of the hubs get to be group heads, total the information of their bunch individuals and transmit it to the sink. The author accept that a rate of the number of inhabitants in sensor hubs is outfitted with extra vitality assets—this is a wellspring of heterogeneity which may come about because of the underlying setting or as the operation of the system develops. The likewise accept that the sensors are arbitrarily (consistently) conveyed and are not portable, the directions of the sink and the measurements of the sensor field are known. The author demonstrates

that the conduct of such sensor systems turns out to be exceptionally flimsy once the primary hub passes on, particularly in the nearness of hub heterogeneity. Established bunching conventions accept that all the nodes are outfitted with the same measure of vitality and thus, they cannot exploit the nearness of hub heterogeneity. The author propose SEP, a heterogeneous-mindful convention to delay the time interim before the passing of the main hub (we allude to as security period), which is essential for some applications where the input from the sensor system must be dependable. SEP depends on weighted race probabilities of every hub to wind up cluster head as indicated by the remaining vitality in every hub. The author appears by recreation that SEP dependably drags out the dependability period contrasted with (and that the normal throughput is more prominent than) the one got utilizing current grouping conventions. The author closes by considering the affectability of our SEP convention to heterogeneity parameters catching vitality awkwardness in the system. The author found that SEP yields longer security locale for higher estimations of additional vitality brought by all the more capable hubs.

Sunita Rani, et. al., [5], International journal of computing and corporate research, Vol. 2, 2012, In this author defines that Wireless sensor network is an ad hoc network. In WSN each senor node has limited amount of energy to consume each sensor is defined with limited energy. These wireless sensors sense and monitor the data from its surroundings physical or environmental condition such as temperature, sound, vibration at different location. And ten this collected data is transferred to the base station. In the process of transmission of data node consumes some amount of energy. The lifetime of the network depends upon the amount of energy consumed by the nodes. The protocols are used to minimize the delay in data transmission along with the reduced power consumption and extended lifetime of the network. Example is PEGASIS. PEGASIS follows a chain structure, every chain consist of only one cluster head, it is used *t* corresponding to every node's receiving and sending messages who belong to this chain, the cluster head consumes more energy and the times of every round increasing. In PEGASIS, saves the energy for WSN and increase the lifespan of the network. In proposed work author proves that to select the next neighboring node is much reliable. For considers the some parameters like Distance, Residual Energy and Response time. As result simulates that PEGASIS leads to the reduction in energy consumption and extended lifetime of the network.

Harneet Kour et. al., [6], In this author represents the HEED for increasing the lifetime of the system along with increased efficiency of the system. HEED is a Hybrid Energy Efficient Distributed Protocol. It is a protocol which enhances the lifetime or efficiency of the system. The efficiency of the protocol is proved after getting the results which are much reliable as compare to traditional techniques.

Leena Y. Bara et. al., [7], In this author defines the LEACH protocol to increase the efficiency of the system. LEACH is an energy efficient protocol which is used to enhance the lifetime of the network. In LEACH nodes are categorized into clusters and cluster consist of related nodes only. Then from clusters a cluster head is selected which is used to transfer the data from clusters to Sink node. The communication link between cluster heads and sink nodes will be aborted when cluster head dies due to the insufficiency of energy or when communication is completed. Various parameters like PDR i.e. Packet Delivery Ratio, Delay or lifetime etc are used for evaluating the performance of the system. After evaluation it is observed that the proposed technique is much better than existing techniques.

Supriya Dhauta et. al., [8], In this author describes that various clustering techniques are used in WSN and many surveys and research are conducted regarding this topic. WSN is a sensor network which runs on the basis of battery life i.e. nodes in this system operates through battery, in this way lifetime of the network does effected because nodes consumes more power. In earlier homogeneous systems the nodes are allotted with the equal amount of energy so that the lifetime of the system can be enhanced. But in case of heterogeneous networks different amount of energy is allotted to the nodes to increase the lifetime of the system. In this author defines clustering algorithm for both homogeneous and heterogeneous networks.

4. LIMITATION OF THE TRADITIONAL APPROACHES

The design of energy efficient protocols is done to improve the quality of service parameters of the system like to improve its lifetime, to reduce the energy dissipation of nodes. The protocols work by first the formation of the clusters and then selecting the cluster head for each cluster that communicates with the sink to ease the process of communication. The parameters like energy and distance were considered for selecting cluster head or sometimes probability equation was used for deciding the cluster head among nodes. Further, both parameters of energy and distance were considered while selecting the cluster head in a network. This improved the efficiency of the network but only up to certain extent. The energy efficiency needed to be improved more so that it could work better. A new approach for the selection of cluster head need to introduced in the work.

Furthermore, in the conventional protocols each node actively participated in the data transmission, which dissipated energy of the nodes. Consumption of energy of nodes leads to the decreased lifetime of the system that also needs to be improved in the future work. A new protocol needs to be designed so that only those nodes participate in the communication that was required for transmission of data. This will reduce energy consumption that will improve the efficiency and the lifetime of the network.

5. PROPOSED METHOD

In the traditional approaches various energy efficient protocols have been used for the efficient communication. All so in this proposed work the work is done in enhancing the Clusterhead selection method. The energy and the lifetime of the network are the two main factors on which the efficiency of the system depends. Various approaches have been proposed for efficient routing so that the energy consumption is less and the lifetime of network is more but still the results obtained were not as efficient as required. So in this work the traditionally the GSA algorithm that was used for the Clusterhead selection method is replaced by the modified PSO work. By using modified PSO the more optimize results are obtained for the selection of the Clusterhead. Along with this the sleep \ awake concept is introduced that will minimize the energy consumption of the node by switching between the active and sleep mode of the node. The main aim of the proposed work is to minimize the energy consumption of the network in order to increase its life time and efficiency.

6. METHODOLOGY

In the proposed work the MPSO technique is used for the Clusterhead selection. After that the concept of sleep/awake nodes is applied for the communication. The network lifetime is significantly improved by applying the proposed protocol and the energy efficiency of the network is also improved. The methodology of the propose method is defined below

Step I: Initialize Network Parameters as Area of network, Energy of network, number and location of nodes to be placed in network etc.

Step II: Next step is to split the network into multiple layers for cluster formation.

Step III: Now apply modified PSO technique over the traditional techniques to select cluster heads and accordingly update the fitness function.

Step IV: After applying modified PSO we get optimized cluster heads. Now perform the data communication between cluster heads.

Step V: Now apply sleep/awake scenario for normal nodes to communicate.

Step VI: If sensed values are greater than the Threshold values then start Communication otherwise again apply sleep/awake scenario.

Step VII: After Communication calculation of the performance parameters are done and also comparison with the traditional technique.

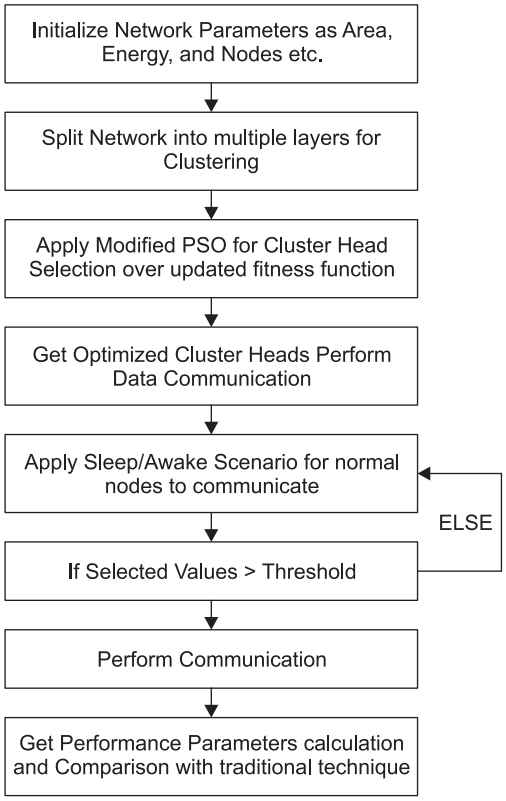

Figure 2: Flow diagram of the proposed algorithm

7. RESULTS AND DISCUSSION

In this section there is discussion about the results of proposed method of routing in the wireless sensor network. In this paper Modified PSO is used. By using the Modified PSO the optimize route is obtained. The graph given below depicts the comparisons between the proposed and the traditional algorithm. The proposed technique is considered to be efficient than the traditional as the energy utilization is less and the lifetime of the network is more.

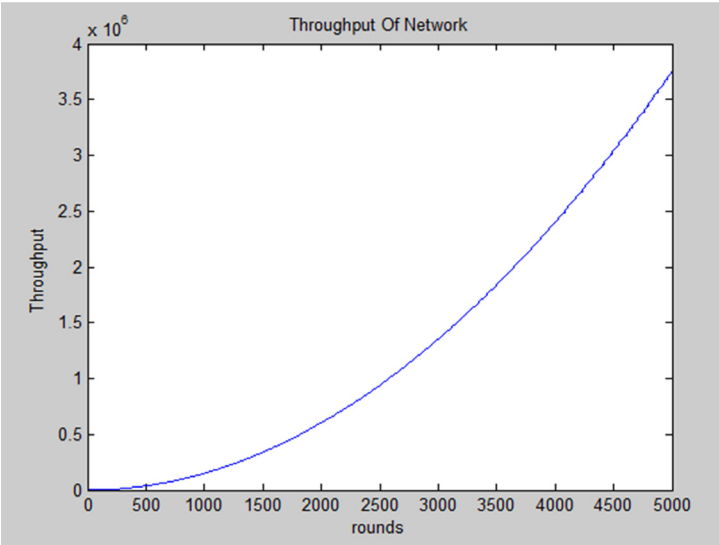

Figure 3: represents the throughput of the network

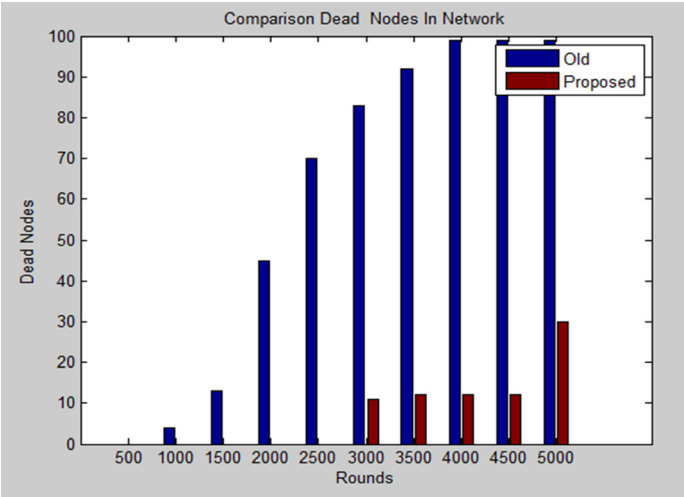

Figure 4: Comparison graph on the basis of the dead nodes in the network

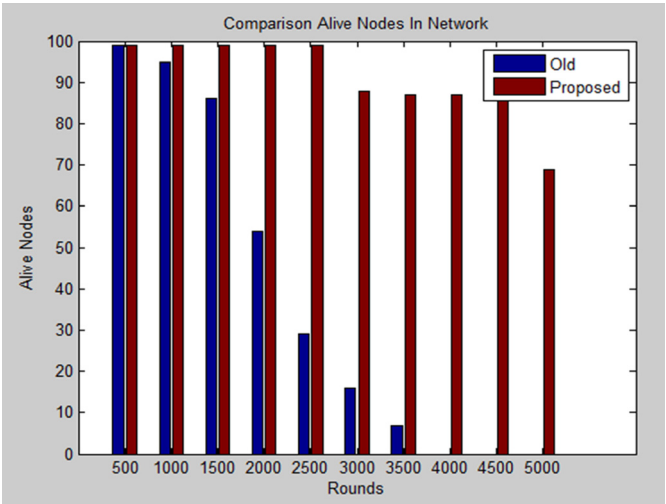

Figure 5: Comparison graph on the basis of the alive nodes in the network

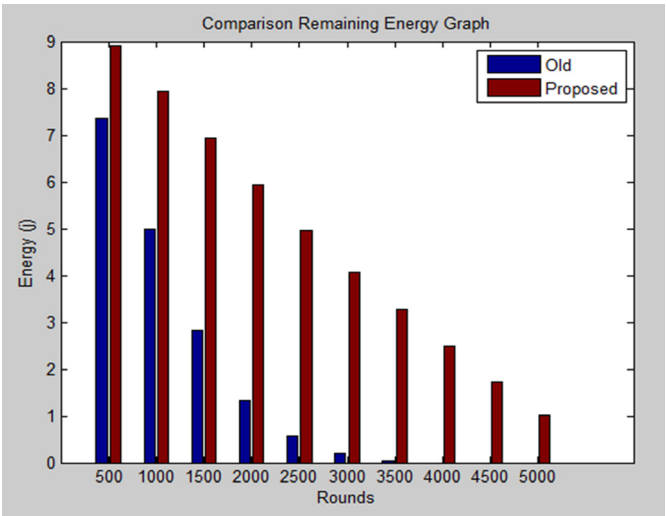

Figure 6: Comparison graph on the basis of the energy of nodes in the network

8. CONCLUSION AND FUTURE SCOPE

In wireless sensor network the energy utilization of the sensors nodes is tone of the major challenge. The energy efficiency of the network is examined with the help of this work .In this Modified particle Swarm optimization (MPSO) is used for the cluster head selection that will help in obtaining the optimized route. The energy utilization of the network is reduced and thus the life time of the network increases by using this algorithm. Along with this Concept of the Awake/Sleep aware is used that is used for minimizing the energy consumption and will enhance the stability period and the lifetime of the network. Along with this the Cluster head selection method is also enhanced. So this proposed method is better and efficient than the traditional method.

Form the result obtained it is concluded that proposed method is better the traditional method. By using optimization algorithm the results obtained are efficient thus the life time of the network is improved. In future this approach can be further enhanced by using some trending soft computing technique.

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