

Enhance the Lifetime of Wireless Sensor Network Using A Novel Approach Based On Neural Network

Saurabh Kwar Research Scholar Deptt. Of Computer Science Monad University

ABSTRACT

Wireless sensor network consist of tiny and small device, named wireless sensor nodes and works towards a goal. Wireless sensor nodes have some storage capacity and computation power to complete their task. Because it is small and cheap, it can be deployed easily in a hostile and unattended environment. Wireless sensor networks have mainly two issues one is limited life time of node and second is power conception of sensor node of the network. Among various types of techniques clustering is the most efficient technique to reduce energy consumption of network. In this work, LEACH protocol has been used for clustering in which cluster heads are selected on the basis of distance and energy. The LEACH protocol is been implemented in simulated environment and analyze their performance graphically. The LEACH protocol is energy efficient protocol to reduce their energy consumption different modes is applied on the sensor nodes. These modes are sleep, Active and ready mode.

In this work, further enhancement will be proposed in RFID protocol for clock synchronization. In the proposed improvement the clocks of the sensor nodes will be synchronized on the basis of time lay technique. When the time of the cluster head gets mismatched then the cluster head will adjust its clock according to the sink node timing and sensor nodes. The proposed technique has been implemented in simulated environmental conditions. The graphical results show that proposed technique performs better than previous protocol in terms of throughput, delay, overhead, energy consumption and packet loss in the network.

Keywords : WSN, RFID, EEHC, HEED

Wireless Sensor Network

The recent enhancements made in the technology involving wireless sensor networks has provided great innovations within the applications that involve it such as the mechanical monitoring, traffic monitoring, cropping, etc. advance creative and productive thoughts are to be generated within this area such that their usage can be more helpful. In the information routing, compression as well as network aggregation, various analyzed methods have been introduced in the recent years.

Therefore, the major concern within the WSNs is the usage of battery within them. This also affects the overall lifetime of the nodes and thus the deployment of the network. The sizes of various constraints such as battery size, processors, information-storing memory and so on are important within these networks. The

consumption of energy is required to be advanced within the networks with the help of various optimization algorithms. Various time constraints are present within the detected and routing information sent across the WSNs. Before any alterations, the network can utilize the information. The monitoring of sensor is done for examining the environmental conditions surrounding the nodes of the network. The information gathered is helpful for applications of various fields such as industries, commercials, and public as well as consumer applications.

Sensor Network Architecture

There are large numbers of sensor nodes present within the architectural design of the sensor networks. The communication of sensor nodes is done through the sensor field across which the information related to their surroundings is transferred to each other. The sensor nodes are closed once they are not of any use within the network. The capacities of sensor nodes are advanced in cases where more applications are to be involved. The applications involve sensor nodes, which have advanced properties that are not present in other methods. The communication is done towards the powerful base station present within the sensor nodes. Internet is used for linking the base station with the internet.

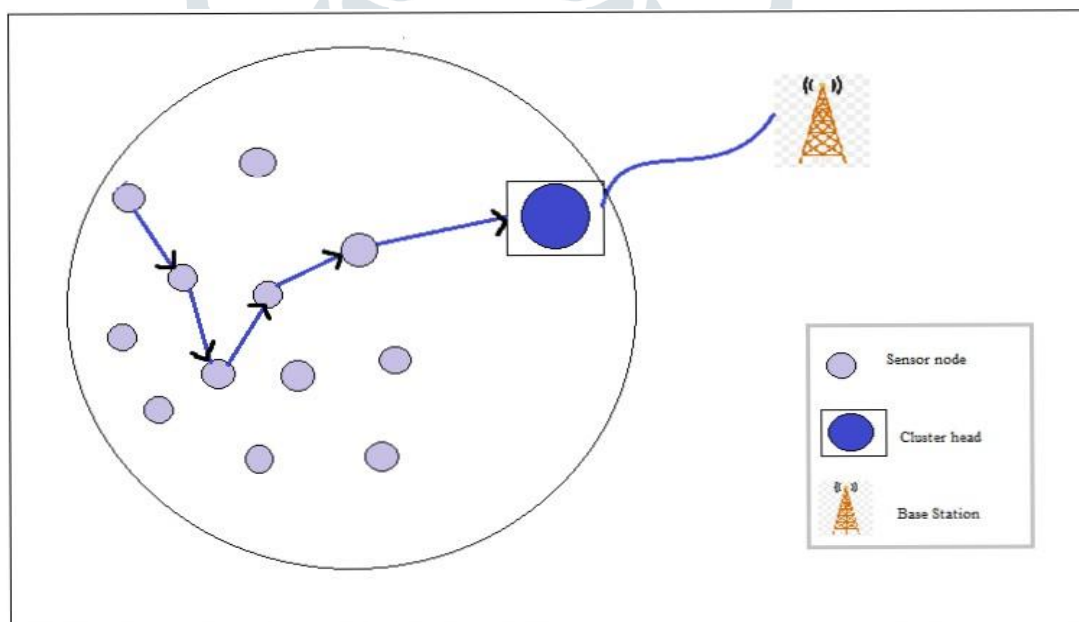


Figure 1: A wireless sensor network

The control manager handles the information gathered by the sensor nodes. The direct communication of sensor nodes to the base station is not possible by all the nodes. The connection of nodes with each other is helpful in providing new forms of communication. Due to restricted communication, the sensor nodes are not within the range of the base station. Various applications provide different facilities for nodes present at different ranges from the base station or the gateway. Within the sensor node, the base station is more efficient.

Structure of a Wireless Sensor Node

The figure below shows the architecture of a sensor node which comprises of:

- Power management unit
- Sensing unit
- Processing unit
- Storage and synchronization
- Transceiver
- Medium access

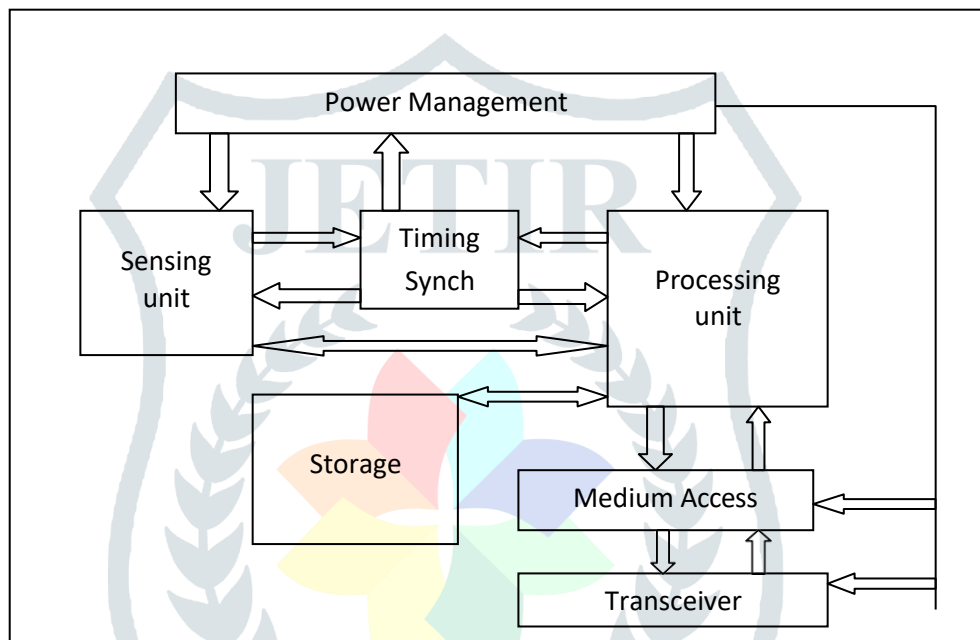


Figure 2: Schematic Diagram of a Sensor Node

RESEARCH METHODOLOGY

The wireless sensor nodes are the part of the microelectronic device in which there is limited energy. It is not possible to replace energy resources all the time as its recharge and replacement procedure is not easy in some application area. Hence, the lifetime of the sensor node is solely dependent on the lifetime of battery.

Clustering is one of the techniques proposed specifically for energy saving. With the help of this clustering, the clusters are formed by taking various sensor nodes in a single cluster. The selection of the clusters is done periodically so that it becomes easy for clusters members to communicate with their cluster-heads.

The data is transferred by the all the cluster members to the cluster head and after which it is forwarded to other clusters by cluster head until the data do not reach it's destination. There is fixed path between the cluster head within the whole network. There is no change in the path until the battery of sensor nodes exhaust or die.

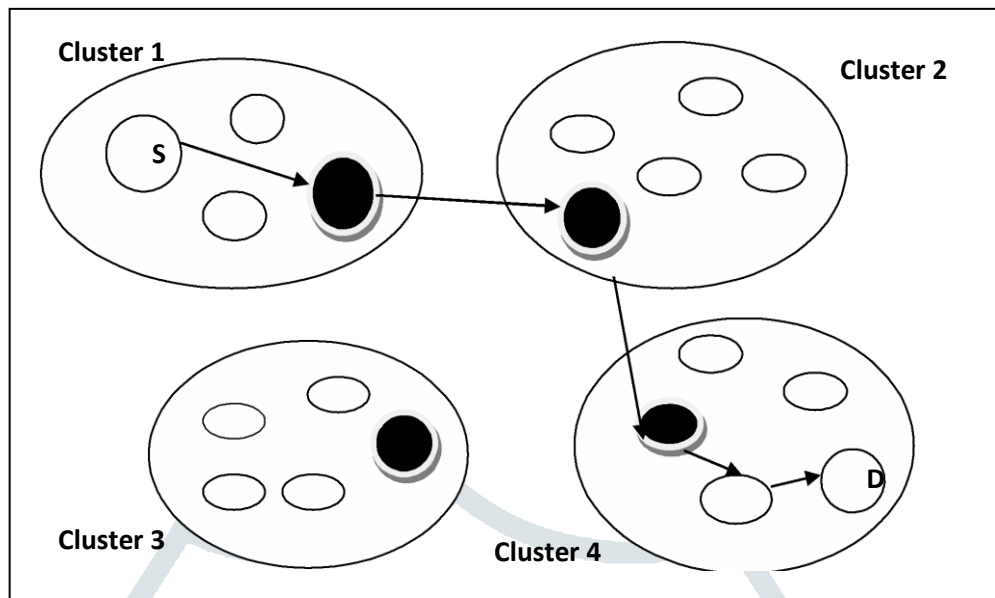


Figure 3: Simple network with pre-established path

The cluster head 2 goes down as the data is not received by it from clusters head 1 due to the finish of life time or battery shown in figure shows.

Energy Consumption Issues in WSN

The major issue that arises within the wireless sensor networks is the limited amount of lifetime of a battery of nodes present within the network. There are very limited constraints of size of battery, processors, and memory present within the sensor nodes of the network due to their small sizes. Thus, the major concern here is to upgrade the amount of energy being consumed by these networks. In order to provide solution to this problem, regular time constraints are provided within the network such that the data that is gathered can be transmitted to the destination such that it can be utilized prior to any hazard. There is higher consumption of power due to the communication of data within these networks in comparison the processing occurring in these networks. Thus, there is a need to address such issue.

Node failure can occur due to the absence of power within these networks. A reliable service is to be provided within this network by keeping in mind the objective, which is to be achieved. With the help of making adjustment, the network can act naturally as well here. From time to time, various adaptable properties are to be provided within this network.

There is restricted lifetime of a battery provided within the normal nodes. They cannot be replaced easily as well, due to which many problems arise. The scaling up of any number of sensor nodes within the network can be done on the basis of architecture and protocol utilized within these networks. In case there is a method identified which can help in minimizing the measure of communication, the lifetime of the battery can be extended here. By using low power components within the sensing subsystems, the energy

consumption can also be minimized. Within these systems, the lifetime of a battery present can be maximized through the minimization of current or power of turning it off when it is not being utilized at all.

Clustering of Sensor nodes

The clustering method is used in order to save the energy available within the sensor nodes. Each of the nodes present within the network can be divided into several smaller groups, which are known as clusters with the help of productive network organization. A cluster head is present within each cluster along with all other individual nodes. [20]

A two-level order is provided within the clustering method. The cluster heads shape accommodates the higher level here. The second part involves the nodes of these networks. The nodes are grouped into clusters through the clustering process. The cluster head is chosen here periodically in such a manner that all the other nodes can communicate with it as per their requirement. The data that is gathered from the numerous nodes by the cluster head which is further passed to the base station by it.

The network throughput is however increased here when there is heavy load present in the network. The network lifetime of the network is enhanced with the help of clustering. The execution of the networks can be accessed with the help of presence of enough lifetimes. Within the wireless networks, the clustering technique cannot be applied directly. This is due to the fact that there is one kind of deployment and operation qualities present within all these networks. There are large numbers of nodes present within the wireless sensor networks. There is no knowledge of locations within the nodes of ad hoc network. [21]

On the basis of power of battery that has constrained energy, the sensor nodes of the wireless networks work on battery power. Re-clustering is important due to some sudden failure of nodes in the network. Here, the remaining energy, and node degree might be required in such cases which can be provided by this method known as dynamic clustering. Various static parameters such as separation amongst the nodes are required in order to prepare the data. The reliability of the nodes is considered to be present here. In order to spare the energy of battery, the clustering mechanism is required.

The workload present on the cluster head is considered to be larger than the non-cluster heads when clustering is utilized within these networks. In order to circulate the workload and energy consumption, the cluster heads of the clusters are changed which help in increasing the lifetime of the network.

- *In heterogeneous sensor networks:* The sensor networks include within them two different types of sensors which are the ones that have higher processing capabilities and the others include complex hardware within them.
- *In homogeneous sensor networks:* With the help of distributed cluster head election method the flexibility and quick execution convergence of the quantity of nodes can be done within the homogeneous sensor networks. This further helps in forming cluster within the appropriate method. In order to handle the

substantial scale WSN applications, these techniques are normally not appropriate. There is a need to have connectivity and partitioning of the network in order to provide reasonable scaled applications.

Clustering parameters:

In wireless sensor networks, there is need to fulfill all clustering conditions by used algorithm before forming a cluster. In WSNs clustering processor, some important parameters need to be discussed that gives more detail for forming a cluster. Some of existing parameters are given below:

- *Number of clusters:* A variable number of clusters come by formation of election process of cluster head using existing randomized and probabilistic clustering algorithms [24]. In most of the techniques number of clusters is present and cluster head is predefined. The number of present cluster in a network plays a main role in total routing protocol efficiency.
- *Intra-cluster communication:* A direct communication is take place in sensor nodes and cluster head by using one hop communication in initial techniques of clustering. There is need of multi-hop intra cluster communication between cluster head and sensor nodes as number of used sensor nodes, range of communication is limited. So, number of cluster head is bounded in a network.
- *Nodes and cluster head mobility:* The inter and intra cluster network management has been facilitated with stable cluster by assuming cluster head, sensor nodes as stationary. The available cluster head and other cluster members will be movable if sensor nodes and cluster heads are not stationary. In a cluster positions of both of them get changed dynamically so it is required to maintain it continuously.
- *Nodes types and roles:* The capabilities of other existing nodes are less than cluster head as it gives more computation and communication resources in heterogeneous environment. The all present nodes capabilities are same as of cluster head in case of homogeneous environment.
- *Cluster formation methodology:* In distributed manner, the process of clustering is performed without coordination and cluster heads are considered to be as regular sensor nodes. In this primary design criterion considered is efficiency of time. The whole network off line position and cluster members control in centralized approach used a one or more existing sensor nodes as coordinator nodes [25].
- *Cluster-head selection:* In the cluster used leader nodes are pre-defined for heterogeneous environments that become a cluster head. The deployed set of nodes is used to select cluster head in homogeneous environments or it can be selected randomly or other specific criterion can also be used.
- *Algorithm complexity:* In most recent algorithms fast termination of executed protocol is considered as primary design goal. The number of hops, cluster heads or constant coverage rate and time complexity has been considered while forming cluster using proposed method. In a network total number of sensors is the factor on which complexity of time depends in existing protocols.
- *Overlapping:* The better routing efficiency, execution of faster cluster formation protocol are some of the reasons for overlapping of sensor nodes take place within different clusters that makes it very important

parameter of clustering.

Classification of Clustering Techniques

The utilized cluster head and cluster formation are two principle criteria for classifications that have been utilized by different clustering algorithm to select cluster head in wireless sensor networks.

- Probabilistic (random or hybrid) clustering algorithms: Low Energy Adaptive Clustering Hierarchy (LEACH), Energy-Efficient Hierarchical Clustering (EEHC), Hybrid Energy-Efficient Distributed Clustering (HEED), etc.
- A cluster head is elected by grouping nodes involve in a clusters exist in WSNs clustering such as:
 - The cluster head (CH) and cluster members can directly communicate with each other.
 - The existing CHs can be used to forward aggregated data to central base station by cluster head.
- The LEACH, and many more improved forms of LEACH like E-LEACH, LEACH- SM, multi-hop-LEACH, ENCM, etc are different techniques that are used in clustering. There are two phases involved in LEACH protocol given below:

1. **Cluster set-up phase:** In this phase of LEACH protocol every node portrays without considering the current round need to wind up a cluster head. The decision is made by picking a random 0 or 1 number by every nodes present in a network. The node quality is compared with threshold that has been setup and if its quality is less than that of threshold quality then that node will be considered as cluster head.
2. **Steady phase:** The TDMA mode is utilized by taking network in steady stage in case of cluster head dole out from time slots. The data is sent to cluster head by nodes when steady stage is isolated into frame and only one frame can be sent through a appointed transmission slot [27].

The some deficiencies are there in electing cluster head node in LEACH such as:

- At single time available clusters can be very small or big in size.
- When different energy is involved in nodes then cluster head selection is unreasonable.
- When cluster head die allocated energy is depleted by cluster member nodes.
- The nodes location is not considered in this algorithm.

- Not give importance to remaining energy, geographic location and extra information, which may easily lead to failure of cluster head.

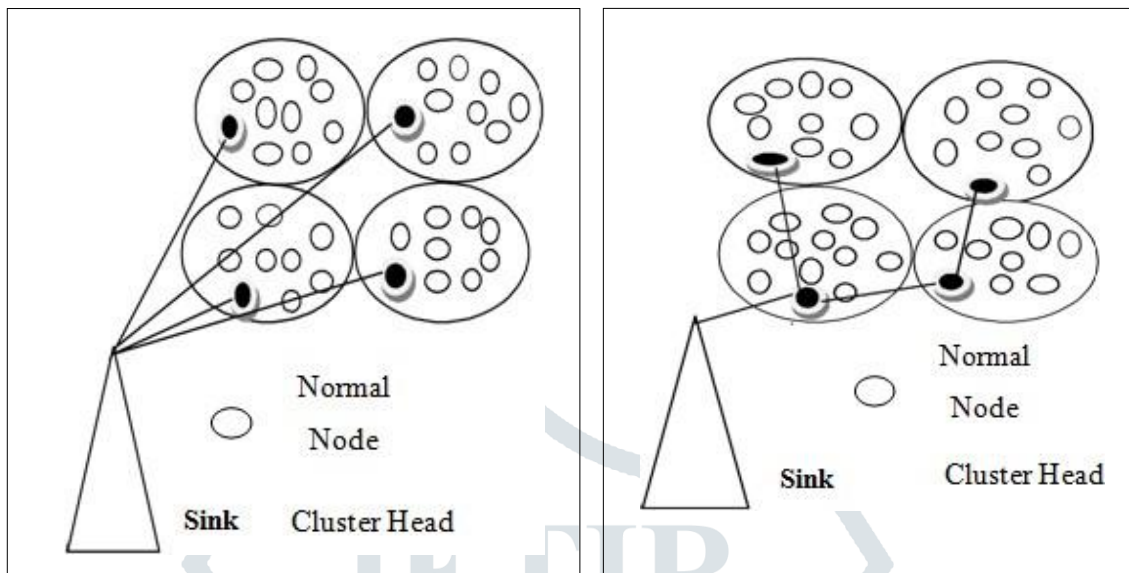


Figure 4: Single hop with clustering

Figure 5: Multi hop with clustering

The above figure 2.3 and figure 2.4 shows a clustering formation in which multi hop with clustering is shown in figure 2.4 and single hop with clustering is shown in figure 2.3. The LEACH is divided into three different clusters as shown in figure 2.4 and 2.3. The present nodes are not cluster head they are just members of cluster and any cluster protocol can be used to changes the cluster head randomly [28]. The network load distribution is involved in changing cluster head between each present cluster nodes.

Conclusion

Sensor node are very small device and these small devices have very low power and sometimes it is not possible to replace the battery of these devices and this will take more energy in Processing or sensing the data. It will take more energy in sensing data in the network and then Transferring this data to the base station leads to decrease the lifetime of the network. Main issue in the wireless sensor network is of energy consumption and limited battery power. Then three different modes are applied on the LEACH. These are sleep, active and ready. When a node is sending the request and communicating with sink node or cluster head than it will be in ready mode. If it is only sending the requesting, than waiting for its turn than it is in active mode otherwise, node is in sleep mode, in proposed work, a clock synchronization technique is applied which match the timing of every node with each other. Cluster head match their timings with each other and to the base station. In this way, synchronization achieved. Then, process is implemented in NS2 and results are compared based on the factors such as throughput, packet loss, delay, and energy consumption, overhead.

Reference

- [1] Jie Huang, "Research on Balanced Energy Consumption of Wireless Sensor Network Nodes Based on Clustering Algorithm", International Conference on Computer Network, Electronic and Automation, 2017
- [2] H.Oudani, S.Krit, M. Kabrane , K. Karimi, M. Elaskri, K. Bendaoud, H. El Bousty, L. Elmaimouni, "Minimize Energy Consumption in Wireless Sensor Network Using hierarchical Protocols", ICEMIS, 2017
- [3] M. Benaddy, B. El Habil, M. El Ouali, O. El Meslouhi, S. Krit, "A mutlipath routing algorithm for wireless sensor networks under distance and energy consumption constraints for reliable data transmission", IEEE, 2017
- [4] SarathPattathil and Jayakrishnan Nair, "Optimal distributed scheduling for single hop wireless networks", IEEE2017, vol. 43, pp 42-49
- [5] Sheikh Tahir Bakhsh" Adaptive Sleep Efficient Hybrid Medium Access Control algorithm for next generation wireless sensor networks", EURASIP journal on wireless communications and networking, 2017.
- [6] Dayong ye, Minijie Zhang, " A Self Adaptive Sleep/ Wake Up Scheduling Approach for Wireless Sensor Networks", IEEE Transactions on Cybernatics, 2017
- [7] K. Praghsh, R. Ravi, "Energy Consumption Architecture for Wireless Sensor Networks With Different Clusters", Third International Conference on Science Technology Engineering & Management (ICONSTEM), 2017
- [8] M. Karthihadevi, S. Pavalarajan, " Sleep Scheduling Strategies in Wireless Sensor Networks", Advances in natural and Applied Sciences, May 2017
- [9] PallaviYarde, Sumit Srivastava, Kumkum Garg, "A modified energy efficient protocol for optimization of dead nodes and energy consumption in wireless sensor networks", Eleventh International Conference on Sensing Technology (ICST), IEEE, 2017
- [10] Yao Lu , Pierre Kuonen, Beat Hirsbrunner, Mingwei Lin, "Benefits of data aggregation on energy consumption in wireless sensor networks", IET Communications, 2017Vol. 11,Iss. 8, pp. 1216-1223
- [11] Dr. ZainabTawfeeq Alisa, Hussein A. Nassrullah, "Minimizing Energy Consumption in Wireless Sensor Networks using Modified Genetic Algorithm and an Energy Balance Filter", International Conference on Multidisciplinary in IT and Communication Science and Applications (AIC-MITCSA), IEEE 2016
- [12] D. Shrestha, Zhibo Pang, Dacfeyzung, "Precise clock synchronization in high performance wireless

communication for time sensitive networking”, IEEE, 2016, vol.4

[13] P. Neamatollahi, M. Naghibzadeh, S. Abrishami, M. Yaghmaee,” Distributed Clusterinf- task Scheduling for Wireless Sensor Networks Using Dynamic Hyper Round Policy”, IEEE Transactions on mobile computing, 2016

[14] Than Dinh, Younghan Kim, Tao Gu, Athanasios V. Vasilakos,”L-MAC : A wake- up Time Self-Learning MAC Protocol for Wireless Sensor networks”, Computer Networks, 2016

[15] Tuan-Duc Nguyen, “Energy efficient wireless sensor network and low power consumption station design for an urban water level monitoring system”, 3rd National Foundation for Science and Technology Development Conference on Information and Computer Science, 2016

[16] Neha V. Deshmukh, Prof. A. V. Deorankar, “Minimizing Energy Consumption in Transmission Efficient Wireless Sensor Network”, International Conference on Advances in Electrical, Electronics, Information, Communication and Bio-Informatics (AEEICB16), 2016

