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Energy Conservation in Wireless Sensor Network using Data Aggregation and Controlling Transmission Range

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Abstract: The main aim of Wireless Sensor Network is to collect the important real time information or data from coordinating sensor node. In this WSN, Energy Conservation has always been the main problem/issue, because replacement or recharging of battery is not possible. There are many solutions provided for energy conservation in WSN. Clustering and implementing Cluster Head have been successful for solving this issue to an extent. In proposed algorithm the data aggregation, controlling the transmission range in wireless sensor node, and using Cluster Head and T – node the better results are expecting, when compared to LEACH (low energy adaptive clustering hierarchy) algorithm in battery usage. The another thing that can consider in the proposed algorithm is by using the CH (cluster head) and T – node (Transfer node), it is possible to reduce the stress in the Cluster Head node, reducing the Transmission range in sensor nodes the level of energy consumption of batteries can be saved and by using High Bandwidth data is going to send to the sink node, from this fast transfer of the data can be achieved. These are Static based Wireless Sensor Network; the nodes are fixed in some particular areas. This proposed system can be used mainly in the defense and in forest to detect the movement of animals, with this they can deploy in remote areas.

Keyword: Cluster Head (CH), Transfer Node (TN), Wireless Sensor Network (WSN).

I. INTRODUCTION

Wireless Sensor Networks are mainly used to gather the important real time data from coordinating sensor node in the environment. Each sensor node in WSN is equipped with Sensors, Transceiver, Memory, Microcontroller, and an energy source (battery) [1]. Energy Conservation has always been the main issue for wireless Sensor Network, because replacement or recharging of Battery is not possible.

This paper is mainly concentrated on the energy (battery) conservation in the wireless sensor network. The Static node placing technique is used in it.

In existing systems, the sensed data from sensor nodes are directly transferred to the sink node or the base station. In this method we have some of the drawback as delay in the transfer of data, early node failure and more importantly node consumes more energy.

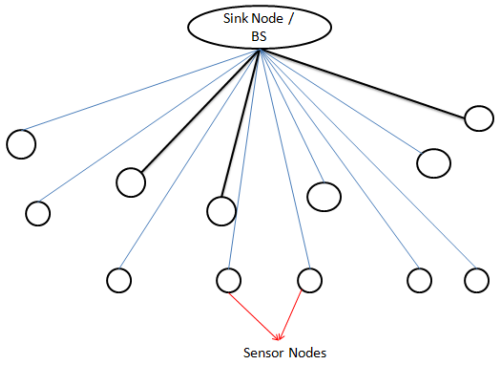

Fig: Data transmission in existing system

These are the main problems facing by the sensor nodes in WSN for data transfer. To overcome by this problem LEACH (Low Energy Adaptive Clustering Hierarchy) algorithm introduced the clustering and cluster head (CH) concept. This algorithm was successful in transferring the data to reducing the time delay problem.

LEACH (Low Energy Adaptive Clustering Hierarchy) algorithm is a self-organized clustering protocol. This tells that each and every node in the wireless Sensor Network have the capacity to become cluster head(CH)[2]. It contains random election of cluster head method and uses shortest path concept for the sensed data transfer. LEACH had been a good approach towards saving the energy level but nodes which have less energy and less efficiency towards the approach of data transfer faced difficult in transferring the data to the destination.

In this proposed system, it is possible to reduce 50% of the transmission range in all wireless sensor nodes and also set the transmission and receiving range in cluster head (CH). Here T-node (transmission node) is used to transfer the data from cluster head (CH) to sink node and by using cluster formation it is possible to save approximately 50% of the battery power compared to the existing system. Data aggregation concept is used for the faster transfer of the data to the sink node from the sensor nodes. The main advantage in this project is to provide stronger signal bond between wireless sensor nodes and sink node. In our real life this proposed system can be used in the static nodes design, it can be helpful in army, traffic management,

detection for indication of traffic details and can used by forest officers for the animal movement in the forest.

II. RELATED WORK

Energy conservation in wireless sensor network is the base for the device to work for longer time. Many researchers are worked and concentrated on power saving in WSN and the work is still moving on with different ideas. Some of the existing cluster based routing protocols are discussed below.

A. Low Energy Adaptive Clustering Hierarchy (LEACH)

LEACH is a self-organized clustering protocol. It contains random election of cluster head technique and uses shortest path concept for the sensed data transfer [3]. LEACH is a good approach towards saving the energy level but nodes which have less energy and less efficiency towards the approach of data transfer faced difficulty in transferring the data to the destination [1]. This leads towards early node failure, data loss and node consumes more energy.

B. Multiple Mobile Sink

The data is collected by the base station from all the clusters or directly from wireless sensor nodes in the wireless sensor network [2]. In this protocol, base station moves towards the cluster or nodes to collect the information. Advantage from mobile sink technique is to save all the energy in all the nodes utilizes more energy in base station and if base station node fails then all the data collection going to be failed.

C. Geographic Routing in Clustering

The members in the cluster divided equally and shortest path technique is used to conserve energy in wireless sensor network [3]. The main advantages from Geographic Routing are it reduces the time delay in transferring the packets and less energy consumption in wireless sensor nodes.

D. Optimized Energy Efficient Routing Protocol (OEERP)

OEERP is a cluster based routing protocol works under uniform battery Resource conservation [5]. In this protocol the normal cluster formation going to take place but during the cluster formation some nodes may be left out without being a member in any of clusters in particular cluster formation [4, 5,and 1]. This may lead to a) Early node failure, b) Data loss and c) Node consumes more energy.

E. PSO Based Clustering

The PSO clustering is made to overcome by the problems of OEERP protocol. It uses Cluster Head for the formation of the cluster node and it introduces assistant Cluster Head for the formation of clustering [5]. In this PSO cluster formation the cluster formation is done with the help of cluster head (CH) at the time some of the nodes are left out without being a member in any of the cluster, with the help of assistant Cluster Head the left out nodes going to become member in some cluster [7]. The process won't start until all the nodes become a member in one or other clusters. From the PSO topology all the nodes in the wireless sensor network become members in some cluster by this it is going to conserve energy in individual nodes. Proposed system consumes less energy in wireless sensor node when compared to existing system.

III. PROPOSED ALGORITHM

Consider a wireless sensor network consisting of limited nodes and this is not dynamic node allocation. This is a static based wireless sensor node allocation for the transfer of data to the S-node (sink node). Proposed system introduces CH and T-node for the collection and transfer of the data to the sink node. The basic assumptions that are made for network scenario and for sensor nodes are:

A. S-node (sink node) is located far from the sensor nodes and the data transfer bridge or link between sensor node and S-node is done with the help of CH and T-node.
B. Recent information from the sensor nodes are sent to the sink node after aggregation.
C. Each node has unique identifier (ID) and is identical with respect to energy and ability.
D. Here it is possible to reduce the transmission range in all the nodes.
E. Each node can find the distance of another node by receiving the signal strength.
F. Setting the receiving and transmission range is done in both CH and T-node.

The cluster head (CH) receives the data from the members and aggregates the data before sending to T-node. Once the data aggregation is done in CH, data is sent to T-node. Then T-node will send the received data directly to the sink node (S-node) by using higher bandwidth for the fast transmission of data.

For each **Node1** in WSN
Begin
    Node1 transmits **Energy_ level**
    For each **Node2** in WSN
    Begin
        If **Node1** = **Node2**
        Skip
        Else
    Store**Energy_level** of **Node1** in **Node2.energy table**.
        End
    End
End
For each **Node** in WSN
Begin
    If **Node.Energy_ level** is highest in **Node.energy table**
        Node selected as CH
    Else if Node Energy_ level is second highest in **Node.energy table**
        Node selected as T-Node
    Else
        Node will become normal WSN node
    End
End

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Algorithm: Algorithm to set CH and T-node

Algorithm

1) Place sensor nodes.
2) Clusters are set based on physical alignment of node and with its sensing signal range.
3) For Each node Broadcast the energy level in the system and node energy is recorded in Node.energy table.
4) From the broadcasted details highest energy level node is elected as (CH) Cluster Head.
5) The Second Highest energy node is elected as (T-Node) Transfer Node.
6) The nodes are not dynamically arranged, these are static nodes. Remaining nodes are connected to Cluster Head in each Cluster.
7) Transmission Range is set to each and every Sensor nodes, it is possible to reduce the transmission range in the Cluster Node and increase the Receiving Range of the cluster node.
8) In T-node, will reduce the receiving range and will increase the transmission range so that all the aggregated data are transmitted with HIGH BANDWIDTH to BS/Sink Node.
9) Network operation starts and Energy saving is calculated.

STAGES

1. Nodes are going to be placed
2. Clusters Formation.

Nodes broadcast their energy level and

3. CH and T-node will be elected.
4. Remaining all nodes act as normal sensor nodes and send the sensed data to the C-node (cluster node).

Figure2: main stages in proposed system

1. Nodes are going to be placed and broadcast their energy level

In the beginning, all sensor nodes are sent and each node broadcast the energy level in the system and node energy is recorded in Node.energy table. In this, each node going to know the neighbour node energy level based on signal strength and that are recorded in Node.energy table. It is possible to reduce 50% transmission range in all nodes; from this it may have the chance of getting more cluster formation. This is done in the sensor node to have strong signal strength between the nodes.

2. Clusters Formation

Clusters are set based on physical alignment of node and with its sensing signal range. Nodes are set and the default energy level has set once the signal strength is set the nodes which have the stranger signal strength are formed as group of nodes those group of nodes are called clusters.

3. CH and T-node will be elected

On the basis of energy level of the nodes in Node.enery table, the highest energy node is elected as Cluster Head (CH) and the second highest node is set as Transfer node (T-node). The members in the cluster will send the sensed data to CH. In CH, set the higher receiving range and low transmission range, then data from the CH will be transformed to T-node. T-node is linked with CH and S-node (sink node). At T-node set low receiving range and higher transmission range. T-node is linked to S-node with higher bandwidth.The aggregated data from CH transferred to T-node. T-node will send the received data to the S-node.

4. Remaining all nodes act as normal sensor nodes and send the sensed data to the CH (cluster Head)

The remaining nodes act as members in some cluster and those nodes will sense the data and send the sensed data to CH.

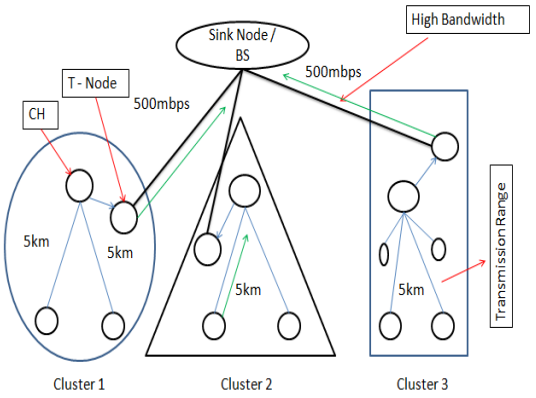

Figure3: Design and Architecture of Energy Conservation

By using the CH (cluster Head) and T – node (Transfer node) it is possible to reduce the stress in the Cluster Head node, by using Transmission range it is possible to reduce the energy consumption in battery and by using High Bandwidth data is going to be send to the sink node, by this fast transfer of the data can be achieved.

Proposed System estimates the energy consumption of Nodes approximately 50% less when compared to existing system.

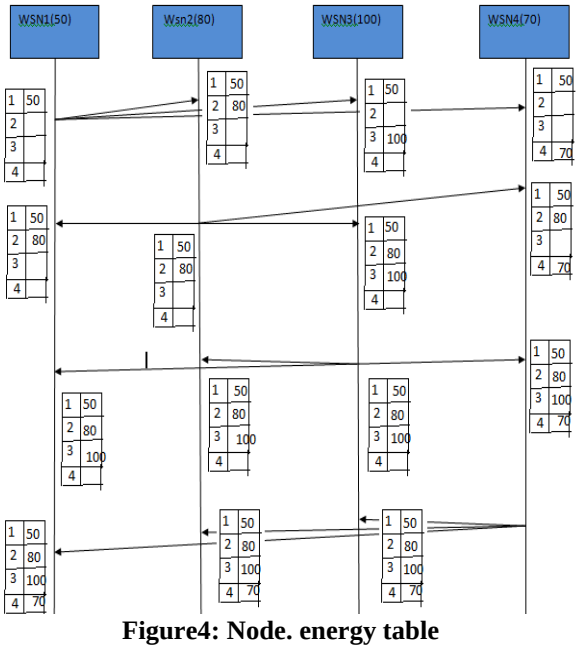

Figure4: Node. energy table

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Few key features of proposed system are:

- Since the Transmission range is set, expecting strong frequency signal strength.
- No data loss.
- Faster transfer of the data to the Sink node (Base Station).
- Conserving the battery life for longer days compared to Existing system.
- Protect early node failure.

IV. MATHEMATICAL ANALYSIS

Mathematical Model provides perfect perspicuous evidence of Wireless Sensor Network systems. With the equal distribution of node in cluster and energy saving in the node are calculated.

A. Energy Consumed in Existing System [ECES].
By using the average energy spent in each node for the transfer of data (packets) to base station (Sink node) will show the energy consumed by existing system. The below formula is to calculate the energy level in existing system.

ECES = nN * E (avg) joulesPerUnitTime
E (avg) = (energy utilized in node1 + energy utilized in node2 + ……. + energy utilized in node n) / nN
ECES =Energy Consumed in Existing System.
nN = Number of Nodes.
E (avg) = Average Energy Used.
ECES = nN*E(avg) joules Per 3.5sec (simulation time)
ECES = nN * E (avg) joules Per UnitTime
ECES = 10 * 1.01 = 10.01joulesPer 3.5sec

B. Energy Consumed in Proposed System [ECPS].
The below formula is to calculate the energy level in proposed system.

ECPS = nNC * nC * E(avg) joules Per UnitTime
E (avg) = (energy utilized in node1 + energy utilized in node2 + ……. + energy utilized in node n) / nN
ECPS = Energy Consumed in Proposed System.
nN = Number of Nodes.
E (avg) = Average Energy Used.
ECPS = nNC * nC * E(avg) joules Per 3.5sec (simulation time)
ECPS = 5 * 2 * 0.5 = 5 joulesPer 3.5sec

V. SIMULATION RESULTS

This sectiondescribes that the proposed system energy conservation is better from the existing system. The simulation is done for 3.5sec as taken as unit time for both Existing and proposed system to show the difference between Existing and Proposed System energy Consumed. The simulation is done for both existing and proposed system, both Simulation consist of 11 nodes including the base station. Firstly (Figure 5) the simulation of existing system is done and energy consumed is recorded as output. After this, the simulation of proposed system (Figure 6) is carried out and the output is recorded. Then by both (Figure 7) the simulation outputs, it help to show proposed system consumes less energy compared to existing system and the project is successful in conserving less energy compared to existing system.

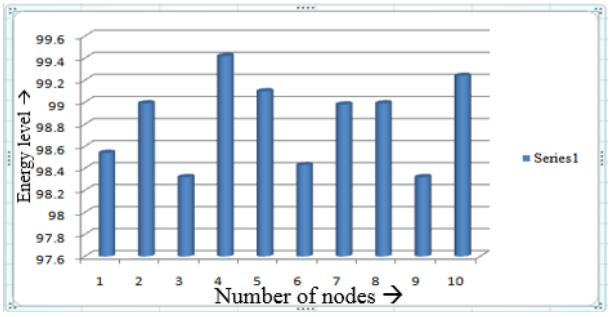

Figure5: Simulation result of Existing System

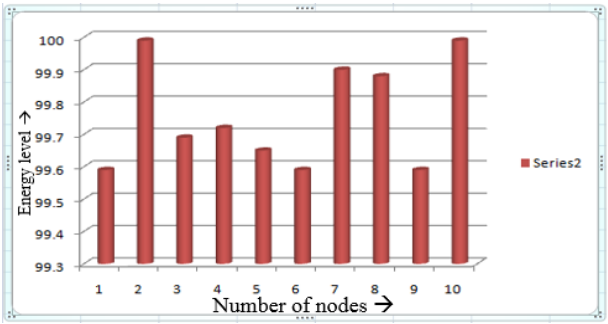

Figure6: Simulation result of Proposed System

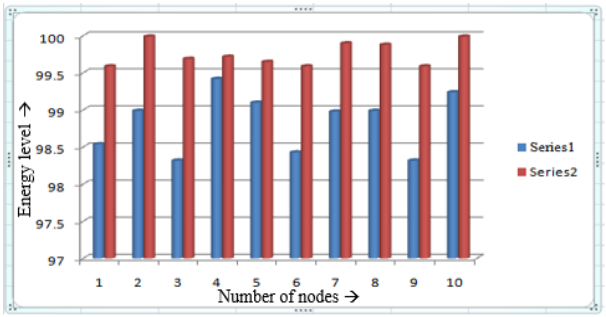

Figure 7: Comparison of Existing and Proposed System

VI. CONCLUSION

From this proposed system it is possible to estimate approximately 50% less energy usage, compared to Existing system. Using proposed system it is going to give the strong Frequency range between clusters, so no data loss and also protect from early node failure. And in the real time, sensed data going to be transmitted to sink node without any delay and this can be used in forest to protect the people from wild animals. It's a very good concept from the point of energy saving and by saving the people by wild animals attack.

REFERENCES

1. "Particle Swarm Optimization – Based Clustering by Preventing Residual Node in wireless sensor Network". : J. Rejina Parvin and C. Vasanthanayaki .
2. "Energy Efficiency Cluster based Approach for Data Collection in Wireless Sensor Networks with Multiple Mobile Sink": Mrs.T. Nagamalar and Dr. T.R Rangaswamy.

3. "Geographic Routing in Clustered Wireless Sensor Networks Among Obstacles": Hari Prabhat Gupta, S.V. Rao, Amit kumar Yadav and Tanima Dutta.
4. "A Survey on Energy Efficient Protocols for Wireless Sensor Networks" Baranidharan. BB. Shanthi.
5. "Energy Optimization of Wireless Sensor Network with Node Density in Multi Hop Hexagonal Clustering for Large Structure", Rajeev Kumar, Ashraf Hossain,and RatishchandraHuidrom.
6. "Energy Efficient Routing Techniques in Wireless Sensor Network Focusing On Hierarchical network Routing Protocols", Zain ulAbidinJaffri, SundasRauf.
7. "Energy Efficient Routing Protocol for Wireless Sensor Networks", Pallavi S. Katkar, Prof. (Dr.) Vijay R. Ghopade.
8. "Bandwidth efficient cluster based data aggregation for wireless sensor" Dnyaneshwar S. Mantri, NeeliRashmi,Prasad, Ramjeeprasad, Elsevier, Computers and Electrical Engineering network", 2014.
9. "A survey on Mobility and Mobility aware MAC protocol in wireless sensor networks",IEEE communication survey and tutorials", Qian Dong, WaltenegusDargie, February 2013.
10. "Survey of extended LEACH-Based clustering routing protocols for wireless sensor networks." High Performance Computing and communication, 2012 IEEE 9th International Conference on Embedded Software and Systems(HPCC-ICESS), 2012 14th International conference on IEEE, 2012. By Aslam, M., et al.
11. "Energy efficient mobility adaptive distributed clustering algotitham for mobile ad hoc network."16th International Conference on IEEE, 2008 "Chinara, Suchismita, and SantanukumarRath".
12. "Real-Time Implementation of harmony search algorithm-based clustering protocol for wireless sensor network",IEEE, Trans . Ind. Information.., Feb 2014, D.C Hoang. P. Yadav, R. Kumar.
13. "Transmission Efficiency clustering method for wireless sensor network using compressive sensing", IEEE Trans. March-2014, "R.Xie and X.Jia.
14. "The Architectural Organization of a Mobile Radio Network via a Distributed Algorithm" IEEE Transaction," "D.J. Baker and A. Ephremides," 2013,.
15. "Energy efficient cooperative LEACH protocol wireless sensor network and communication"journal 2010". Hyung Yun-2010.