International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 12 01 – 04

Analysis of Load Balancing Technique using Clustering Approach by PSO Algorithm

Reshami Pathekar
M. Tech. Dept. of E&TC
Priyadarshini College of Engineering
Nagpur, India
reshmi.pathekar01@gmail.com

Prof. A. B. Jirapure
Dept. of E&TC
Priyadarshini College of Engineering
Nagpur, India
Ashish_ji2014@rediffmail.com

***Abstract*--**Wireless sensor Networks made up of nodes, where each node is connected to one or more number of sensors. WSN consists of a large number of low-cost, low-power, multifunctional sensor nodes. The life of sensors depends on their energy. When sensors in the network communicate with each other their energy get lowered and after some time they may die and because of that the network fails. Therefore our aim is to reduce the energy consumption and increase the sensor network lifetime. As the energy available in the sensor nodes used in WSN is limited, therefore we are trying to propose the technique to maximize lifetime of WSN by PSO algorithm. In this paper the selection of cluster head is done via PSO algorithm. Particle Swarm Optimization (PSO) is the technique used for placing the sink node. The sink node is at optimal position. The cluster head is selected on the basis of energy of the clusters and connectivity among the clusters. The cluster head then communicate with the Base Station (BS).

Index Terms: *WSN, PSO, BS, AN.*

*****

I. INTRODUCTION

In WSN to detect the changes in the environment such as temperature and the movement vibration etc. the coverage area is needed for wireless sensor networking. The wireless sensors are very significant due to the various resource constraints. The resource constraints such as the detection range of sensors, the number of sensors and the environmental condition. The optical deployment of wireless sensors and radars is done on the above constraints. Due to these constraints, it is very important to design an energy-efficient scheme. An energy-efficient scheme that consumes energy uniformly across the sensing field to increase the network lifetime. The agriculture, target tracking, health care monitoring system etc. are the various application of WSN. In WSN the sensors

are of low costand also has a low power. When sensors loses their energy there is no guarantee of connectivity of network and the coverage in wireless sensor network. When the battery of the sensor get reduced, it's not easy to change or to replace the battery of the sensor. In the critical applications such as forest, border surveillance applications, etc. it's not easy to replace the batteries. One major problem in a WSN is to produce low cost sensors and the size of the sensor nodes should be small. WSNs may be useful in various environments, such as remote and hostile regions on large scale. In WSN, the ad hoc communications are a key component. Energy and Power Consumption should be minimized which is useful for sensing device. Sensor nodes should be energy efficient. Limited energy resource determines the lifetime if the sensors. The data collected from wireless sensor networks is usually stored in the form of numerical data. Data is stored in a central base station. WSN has a wide range of applications which are useful to industry, science, transportation, civil infrastructure, and security. In WSN the nodes can communicate with each other or with the cluster head. While communicating with each other the energy of the sensors get lowered. When the energy of sensors get lowered, they may die and the network fails. So it is important to increase the lifetime of WSN.

In this paper, we propose the method for maximize the lifetime of WSN using clustering approach via PSO algorithm. The cluster head is selected by the PSO algorithm. PSO algorithm is used to find out the optimal position of the sink node. Then cluster head is selected by usingthe sink node position.Clustering is useful to reduce the collisions between the sensors. It is also useful in balancing load among the sensors. By selecting the cluster head via PSO algorithm, the network lifetime increases as the communication is done between the cluster head and the base station. Cluster head collects the data fromthesensors within the cluster and then transfer it to the base station.

II. LITERATURE REVIEW

Particle swarm optimization (PSO) is an algorithm depends upon swarm of particles. The Application Node (AN) position is assumed in traditional approach and uses PSO algorithm to find out the optimal position of the sink node. The positions of ANare not pre-determined in a real

time therefore this approach is ineffective. The positions of the Application node are manually determined. PSO algorithm used for optimal placement of base station. The paper is proposed by B. Paul et al. [4]. It states that PSO is used to reduce the power consumption and maximize the network lifetime of two tired wireless sensor network. PSO algorithm is used to find out optimal position of sink node. A cluster formation scheme which is named as "LEACH" is proposed by Heinzelmanet al. [5] this protocol gives the smallest number of clusters this scheme assumes that the energy consumption of cluster head should be uniform and it does not guarantee the good cluster head distribution. Younis and Fahmy proposed "HEED" protocol [6]. In this scheme the cluster head selection is depend upon the residual energy of the sensors and cost of the sensors. The properly distributed cluster head are produced by this scheme. It also produced the compact cluster. In lossy wireless sensor network Gong et al. [7] proposed energy efficient clustering scheme which is based on link quality.

III. PROPOSED WORK

In the Proposed approach application node selection is made dynamic during the simulation of PSO algorithm. Particle swarm optimization (PSO) is a optimization technique which is population based. It is inspired by social behavior of bird flocking or fish schooling. These particles are moved around in the search-space. The improved position guide the swarm movement. It is known as the entire swarm's best known position. The process is repeated. As compared to other methods PSO gets better results. Sensor node clustering is the techniques that can expand the lifespan of the whole network at the cluster head through data aggregation. In this paper, the clustering is done using particle swarm optimization (PSO) algorithm for wireless sensor networks. This maximizes the lifetime of the network. The application node position plays an important role in deciding the efficiency of Particle Swarm Optimization. The PSO algorithm is used for optimized BS locations to reduce power consumption and maximize the life time of WSN. After finding optimized location for sink node, The Sink node transfer data to application node (AN) and AN to regular nodes. Regular nodes are attached to AN. Those nodes which have same values send response to the application node via sink node. The initial energy of the nodes are set randomly and the sink is assumed to have infinite energy. The transmission and reception of data by the nodes is assumed to be Omni-directional.

Basically the selection of cluster head is the essential operation in clustering. To increase the lifetime of network the cluster head selection is on the basis of higher residual energy. For clustering the first priority is the percentage of residual energy of each sensor. There must be one cluster head inside each cluster. If there is no neighbor within the range of the sensor then the sensor itself is the cluster head [1]. Otherwise the selection of cluster head depends on the percentage of residual energy. The sensors are sorted on the basis of residual energy and the connectivity among the other neighbors. Then the cluster head is selected. When the energy of cluster head get reduced the iteration takes place and sensors updates their local information.

Only one cluster head can be selected in each cluster by using PSO algorithm. Cluster head is selected on the basis of range, connectivity among the clusters and the residual energy. Then the cluster head will communicate with the other clusters within the range and then communicate with the base station. When the energy of Cluster head reduces, then again run the PSO algorithm and find the cluster head.

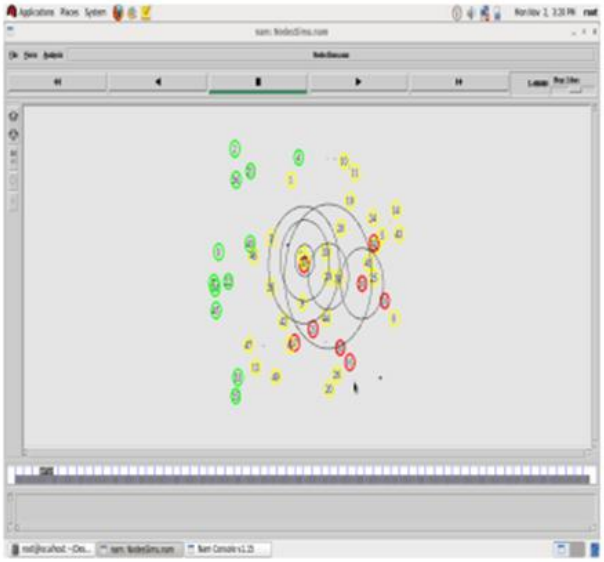

Fig. 1 Sensor communicating and dropping their energy

From fig.1 as the energy level decreases the color of nodes changes from Green to Yellow. Again when the energy level decreases the color of nodes changes from Yellow to Red. The Red color of nodes indicates that the node is dead.Selection of the CH is done on the basis of connectivity among the clusters. Range of the CH is defined for the communication in the cluster.

CH sends request to all the sensor nodes within the cluster range.The other nodes send their current energy status. Higher residual energy nodes will be identified. The cluster members communicate with the CH and send a data. The nodes which are not within the cluster head range can communicate through the other nodes. CH will collect the data from all the nodes within the cluster. CH will transmit the collected data to the base station. If the residual energy of the CH is low or the load on the CH increases, the new

CH is selected. The load is shifted to the new CH. The new CH collects the information from the other nodes and send it to the base station. The old CH will act as the general node.

IV. PSO ALGORITHM

- Input the number of nodes.
- Calculate the position of the nodes.
- Calculate the probability of CH is to be selected.
- Evaluate the fitness value for each node.
- Calculate the best fitness value.
- Calculate the particle velocity.
- Find the range of the sensor node.
- Run the PSO algorithm.
- Update velocity of the particle.
- Update the position of the particle.

LOAD BALANCING ALGORITHM

- Initialise the global variables.
- Initialise the nodes as Set now [$ns now]
- Calculate the position of the nodesusing the rand function.
- Calculate the node 1 velocity
- Calculate the node 2 velocity
- Compare the velocity of both the nodes
  If { node 1 = node 2 }
- Then Load is shifted from node 1 to node 2

V. SOFTWARE BEING USED

Network Simulator (NS2) is used for the simulation of proposed method.

VI. SIMULATION RESULTS

The comparative analysis of clustering approach using PSO algorithm with load balancing and clustering approach using PSO algorithm without load balancing technique is given below.

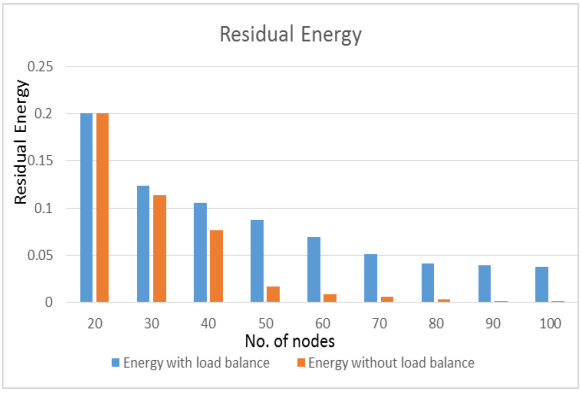

Fig. 2 Residual Energy of clustering with load balancing andclustering without load balancing in Joules

The residual energy of the clustering with PSO and load balancing technique and without load balancing is calculated on the NS2 simulation. During the simulation in NS2 every time we need to change the no. of nodes and evaluate the respective residual energy level. Hence from the figure it is observed that initially the residual energy using the load balancing approach is 0.2J and then it is decreases to 0.04J. In without load balancing approach initially it is 0.2J and then it is nearly equal to zero. As we can see from the graph the residual energy decreases because as the no. of nodes increases, the communication between the nodes require more energy. Residual energy in load balancing is more than without load balancing. Therefore we can say that load balancing technique is efficient to maximize the life time of WSN.

During the simulation in NS2 every time we need to change the no. of nodes and evaluate the respective throughput. Hence from the figure it is observed that initially the throughput using the load balancing approach is 30 bits/sec and then it is increases 120 bits/sec. In without load balancing approach initially it is 28 bits/sec and then it is 102 bits/sec

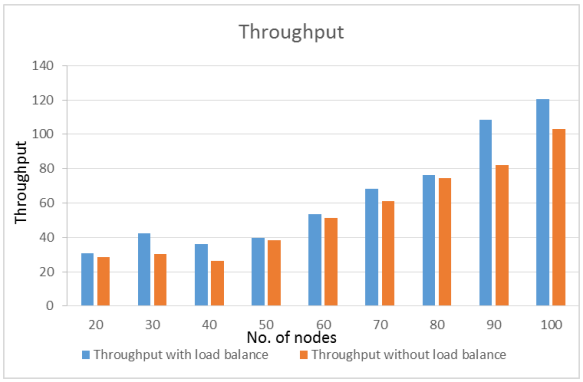

Fig. 3 Throughput of clustering with load balancing andclustering without load balancing in Bits/Sec

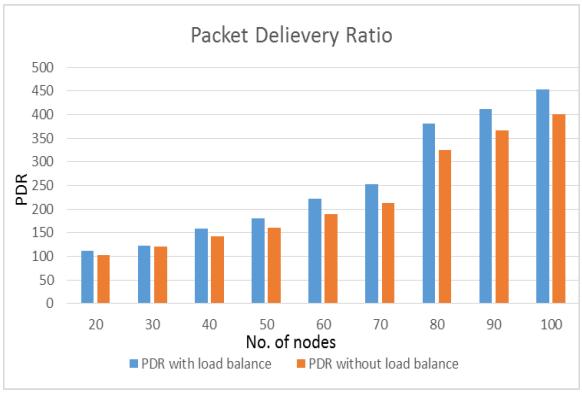

Fig. 4 PDR of clustering with load balancing andclustering without load balancing

From the figure it is observed that initially PDR using the load balancing approach is 110 and then it is increases 450. In without load balancing approach initially it is 100 and then it is 400.

VII. CONCLUSION

There are many ways to extend the life time of the WSN application. One such method is particle swarm optimization. In this paper, existing solutionsfor finding out optimized location for sink node using PSO is further used to find out the cluster head. The PSO algorithm is used to achieve good scalability, to reduce the energy consumption and increase network lifetime. It is useful to shorten data transmission.

REFERENCES

[1] Miao Zhao, Yuanyuan Yang and Cong Wang, "Mobile data gathering with load balance clustering and dual data uploading in wireless sensor networks," IEEE Trans. Mobile Comput., vol. 14, no. 4, April 2015.

[2] R. Alageswaran, R. Usha, R. Gayathridevi and G. Kiruthika "Design and Implementation of Dynamic Sink Node Placement Using Particle Swarm Optimization For Life Time Maximization of WSN Applications," IEEE-Internationa Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 2012.

[3] Alfieri, A., Bianco, A., Brandimarte, P., and Chiasserini, C.F. "Maximizing system Lifetime in wireless sensor Networks", European Journal of Operational Research, 2007.

[4] B. Paul, M. A. Martin, M.1. Showkat, and Z. Rehman,"Optimal placement of base stations in a two tiered wireless sensor network", WSEAS Transactions on Communications, vol. 1, 2010.

[5] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "An application-specific protocol architecture for wireless micro sensor networks," IEEE Trans. Wireless Commun., vol. 1, no. 4, pp. 660–660, Oct. 2002.

[6] O. Younis and S. Fahmy, "Distributed clustering in ad-hoc sensor networks: A hybrid, energy-efficient approach," in IEEE Conf. Comput. Commun., pp. 366–379, 2004.

[7] D. Gong, Y. Yang, and Z. Pan, "Energy-efficient clustering in lossy wireless sensor networks," J. Parallel Distrib. Comput., vol. 73, no. 9, pp. 1323–1336, Sep. 2013.