ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 5, Issue 12, June 2016

Error Rate Optimization and improved WSN Lifetime

Sharada K A
PhD scholar, Department of CSE, JJT University, Rajasthan, India
Dr. Siddaraju
Professor and Head, Department of CSE, Dr. AIT, VTU, Karnataka, India

Abstract*—Wireless Sensor Network design for various purposes like military operation, environment monitoring, fire monitoring etc. As sensor nodes are small in size and deployment of nodes are also easy and it is very useful in different operation so growth of sensor network is very rapid. As size of sensor network is large consumption of the energy is also increased compare to before and sensor nodes are powered by small battery, which is also not re-chargeable which lead to early death of sensor node. Lifetime of the network is decreased and it affects the overall system performance. For the improvement of the network lifetime in the wireless sensor network clustering is a technique which is used. A new multi-objective adaptive swarm optimization (MASO) method for clustering is proposed in this paper and maximum number of cluster will be calculated, which is best suited for the network. Cluster head and cluster member is given to each cluster and the local information extraction task is performed. Cluster head collect all the extracted information from the member node after then it will be sent to the base station, the global information extraction from all the cluster head nodes is performed by the base station and generate some useful result. Error probability is considered in transmission of data packets in one hop communication is considered by author. Obtained result is compared with "Energy Aware Swarm Optimization with Inter cluster Search for Wireless Sensor Network" author Shanmugasundaram Thilagavathi in terms of network lifetime, drop rate and average throughput is observed by author.

***Keywords*—Error, Packet,Cluster.**

I. INTRODUCTION

Wireless sensor network is used for gathering the real time sensitive data which is very useful in analysis of upcoming critical situation and we can ready for that situation. Sensor nodes are monitor the target region and it keep the record of whatever things is going on and store that details analyze it and send it back to the base station. In WSN sensor nodes are very small in size and densely deployed in WSN area. Sensor nodes are powered by battery which is not rechargeable and sometime not replaceable which is a major challenge in WSN. How to reduce the energy consumption and improve the network lifetime is our main objective for this paper. At the time of transmission sensor nodes in the network is grouped in to number of cluster, cluster making is a techniques in which cluster has cluster member and cluster head. Cluster head communicate with cluster member and base station or other cluster head. Here author considered the hop by hop recovering in the routing process to improve the error and energy utilization. Consumption of energy in each packet transmission is considered and per bit error or failure in packet transmission is also considered. Throughput of the system is dependent on the number of successful transmission or less error occurred during the transmission. Here author considered the event where they need to identify a scenario where in packet transmission failure of packet may occur due to noisy channel. Identifying error hop by hop and if transmission is loss request it to cluster head to send it back again.

We consider a scenario where sensors need to identify whether a given event has occurred based on its periodic, noisy, and observations of a given signal. Such information about the signal needs to be sent to a fusion center that decides about the actual state at that specific observation time. The communication links-single-or multi-hop-are modeled as binary symmetric channels, which may have different error probabilities Study for the WSN is considered in [1] where network is very dense and there are organized in a cluster and connected with each other. There are communicating with cluster head through multiple hop communication which takes lots of energy, because in long distance communication path loss occur and again retransmission takes time and creates communication gap [2]. For selection of the cluster head lots of clustering approaches is given, like based on lowest cluster ID, maximum number of connectivity in a group [3], load balancing approach because if load is not balanced latency is increased in the communication. But all these approach is not suitable for finding error or failure of packet at the time of transmission. In the LEACH approach cluster head selection is done periodically, but it has suffered from network overhead due to re-clustering [4]. Implementation of particle swarm optimization is easy, it also has low computational cost, and it also require very less hardware. It also solved the very global optimization problems [5], but it suffers from slow rates of convergence problem. Here [6] author proposed a new model for energy saving called LEACH-C, cluster head selection is done by base station and id of various cluster head's is broadcasted to the network. Base station keeps track the record of residual energy of all nodes and based on energy level, base station choose the network. For increasing network lifetime multi-node clustering protocol is given in WSN for data gathering process [7]{8]][9].

Rest of the paper organized as follow in section 2 proposed model for WSN network is given where packet failure probability is calculated. In section 3 result is explained in the last section 4 conclusion is given.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 5, Issue 12, June 2016

II. PROPOSED WORK

In WSN network sensor nodes are deployed in the network where sensor nodes collect the information and transferred it to the remote nodes or base station by multiple hops. Here suppose number of cluster organization in the WSN network is and cluster head is denoted by . For sort distance communication within the cluster path loss is assumed as a squared power due to Additive white Gaussian noise. Initially cluster head broadcast a message to the cluster members, then after encoding of message is done by the cluster members and again send it back to the cluster head. is the number of hop in the communication, r is the distance between Cluster head and member. Number of nodes in each hop communication is denoted by L. OFDM modulation techniques is used due to its efficiency, Bandwidth of the channel is denoted by B.

Creation of Cluster-cluster node itself elected as a cluster head based on their energy label, each node receive that broadcast message compare energy with their own value and if the value of signal strength more than that threshold value it select that node as a cluster head and join their cluster and record ID of that nodes as cluster head. Cluster head assign time slots to the cluster member for communication

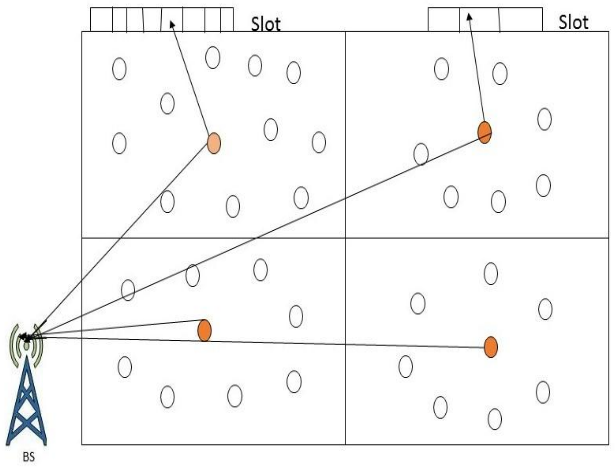

Image 1: Network Design

A. Energy Utilization

In a sensor network, consumption of energy by the nodes in transmission or encoding the data packet or at the time of receiving or decoding the packet in hop by hop communication. Now here considering information bits encoded as symbol bits of of linear block code as $(m, i$. Encoded symbol is denoted as a packet from this now size of packet is bits.

Energy Consumption in the packet transmission in one hop communication where number of intermediate node is and distance between nodes is considered as in local cluster. BW is the bandwidth utilized, , is the energy consumption by the transmitter and receiver. Total Energy utilized in per packet transmission in the hop communication .

$$E_{ch}(l) = E_{bs} + E_0(r_o, L) + E_1(P_b, r_{id}, L) \quad (1)$$

is the energy utilized by the base band signal in encoding and decoding the signal.

Where $E_0(r_o$ and $E_1(P_b, r_{id}$ can be defined as

$$E_0(r_o, L) = ndr_0^2 + nP_{tc}/B + nLP_{cr}/nL \quad (2)$$

Now finding the consumption of energy in transmission the packet in between cluster number of symbol in block code is defined as now for block size one intermediate hop with, bit error rate in terms of performance is given by

$$E_1(P_b, r_{id}, L) = \frac{nN}{N - L_N}\left(\frac{LN_0}{P_b^{\frac{1}{L}}} SG(r_{id}, x) + \frac{LP_{\text{t}}}{}\right. \quad (3)$$

In the above equation is the inter cluster distance of l hop. $SG(r_{id}$ is the power of antenna gain, is the error probability in per hop transmission. can be defined as in terms of mean time and failure of packet

$$SG = \frac{1 - PE_{wd}(P_b)}{t_{mean}} \quad (4)$$

Energy utilized in overall communication or transmission of packet, average transmission in per packet transmission time in a single hop. For this purpose probability of error in block code $(m, i$ computed as

$$PE_{wd}(P_b) = \sum_{j=t+1}^{m} \binom{m}{j} P_b^j (1 - P_b)^{m-j} \quad (5)$$

Time for transmission the packet in one hop communication can be given as

$$T_{avg} = \frac{1}{1 - PE_{wd}(P_b)} \quad (6)$$

Now we can give the overall energy consumption in per packet transmission

$$E_{overall} = K\left\{H[E_{bs} + E_0(r_o, L)] + \sum_{l=1}^{K} E_1(\right. \quad (7)$$

Where is the number of hops, impacts on both transmission time and energy consumption.

Variable used in the above equation summarized below in table 1

Table 1: Variables used

H	Number of cluster
H_c	Cluster head
(m, i)	information bit encoded as bit so packet size is bit

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 5, Issue 12, June 2016

L	Intermediate node
r	Distance between node in local cluster
,	Energy consumption transmitter and receiver
r_{id}	Inter cluster distance
E_0	Intra-cluster energy consumption
E_1	Inter-cluster energy consumption
P_b	error probability in per hop transmission
$SG(r_{id}, x)$	Antenna power gain
x	Path loss
BW	bandwidth utilize
PE_{wd}	Word error probability
P_{bk}	packet failure at the kth node
L	intermediate hop
N	Symbol in block code
P_{bj}	Packet failure probability at th node

B. Optimization Phase Using MASO

MASO is the evolutionary techniques, where number of object is generated, number of iteration is computed for the better solution. This technique is used in swarm optimization for finding the best feasible position solution. It uses the previous position details and has experience for finding the new global fit position solution. In this method each object is initialized for finding the global fit solution for a target problem. Some fixed threshold value is provided for a particular solution and substance repeatedly iterate till that particular threshold is not found. Object is initialized with few parameters initially and try to find the fitness value for the matched threshold S.

At the time of transmission, information about the topology is maintained by the sink node, and probability of packet failure at the jth node is . value of link is useful for determine the throughput value. Cluster head calculate and record the value of of the neighbor nodes. At the time of routing optimal distance is determined by the CH to the neighbor node. Sink or base station utilized the MASO algorithm to determine the best value of on the neighbor nodes. Once sink or base station determine the optimal sink send this message to the cluster head.

III. SIMULATION RESULT

System requirement are windows 8.1 enterprises 64-bit operating system with 4GB RAM. We have used Sensoria simulator which is based on C# programming and used dot net framework 4.0 visual studios 2010. Size of network is considered as 30*30m, network base station size as 1*1m, bandwidth is considered as 5000 bits/sec rate of transmission is 100 bits/sec, delay is considered as 0.1 ms. Here number of nodes deploy is considered as 600,1200,1800, noise is considered in a network is 15dB. As large network size is considered our proposed work shows it's robust for large network. Communication between cluster head and cluster member based on assign TDMA slot to the cluster member by the cluster head is done.

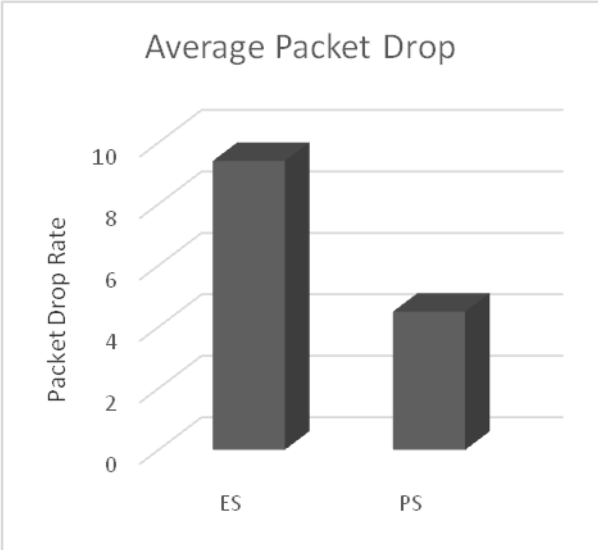

Fig 1: Packet Drop Rate

In figure 1, packet drop rate is given for that existing and proposed system drop rate is measured less in case of proposed system in which we are considering the recovering packet failure hop by hop. Hence percentage packet failure is 52% less than that of existing system. Network lifetime analysis for 600, 1200, 1800 nodes and here proposed system performed better at the time of 30% node death existing system nodes die early and proposed system nodes alive for more time. Throughput achieved for both existing and proposed system is shown in the above fig 3 where proposed system is 52.3% better than existing system. Decay rate is measure for both existing and proposed system in fig 4 where decay rate measured for existing system is more than proposed system.

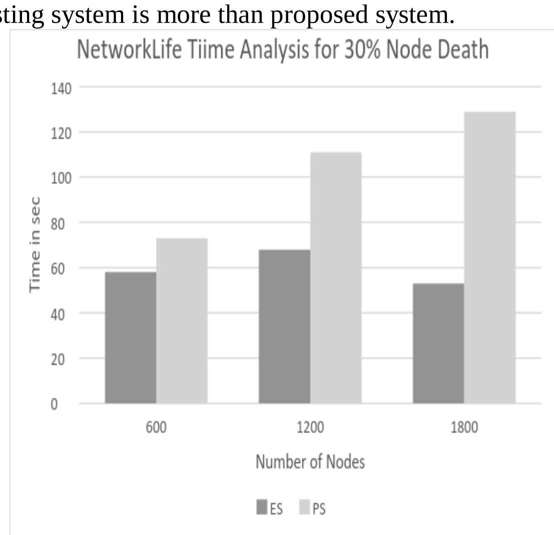

Fig 2: Network Life Time Analysis

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 5, Issue 12, June 2016

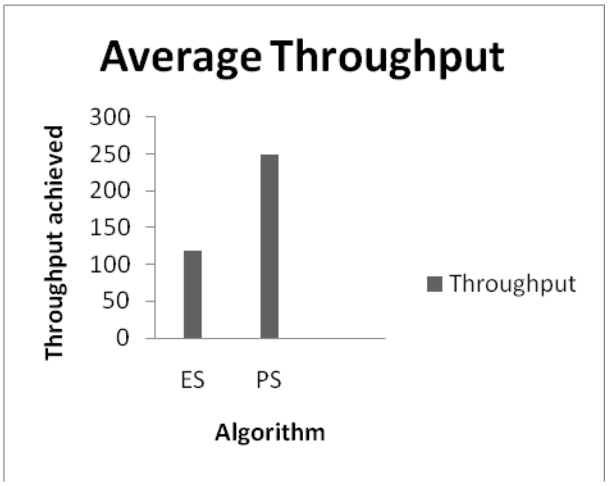

Fig 2: Average Throughput Analysis

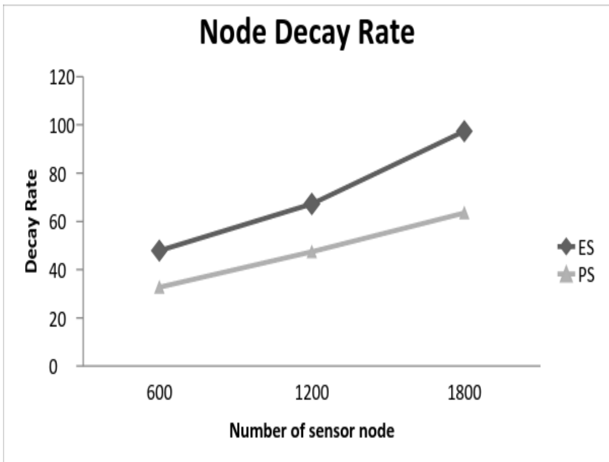

Fig 4: Node Decay Rate

IV. CONCLUSION

In WSN consumption of energy and packet failure in data transmission is the important issues. Here author focused on these two issues for that calculating failure of packet and recover it hop by hop to requesting the data to the cluster head if any failure has occurred and for optimization in the network energy and finding best position of nodes author used adaptive substance swarm optimization concept. Here network efficiency is measured in terms of network lifetime, packet drop rate, delay in transmission and average throughput, and system performance is measured better for proposed system. In future we will be worked for large network and try to optimize our worked more accurately for inter cluster communication.

REFERENCES

[1] F. Wang and J. Liu, "Networked wireless sensor data collection: Issues, challenges, and approaches," IEEE Communications Survey and Tutorials, vol. 13, pp. 673–687, 2011.

[2] L. He, J. Tao, J. Pan, and P. Xu, "Adaptive mobi UAVs assisted data collection in wireless sensor networks," in IEEE Wireless Communications and Signal Processing (WCSP), 2011.

[3] Yunyi Zhang, Deyun Zhang, and Chongzheng Huang "On the construction and Maintenance of Virtual Backbone for Wireless Sensor Networks", ICCIT 2007, pp. 18131817.

[4] W. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy efficient Routing Protocols for Wireless Micro sensor Networks", IEEE Trans. On Wireless Comm, 2002 pp. 660670.

[5] J Ibriq, I Mahgoub. Cluster-Based routing in wireless sensor networks: Issues and challenges. Performance Evaluation of Computer Telecommunication System. 2004; Jan: 759-766.

[6] W.B. Heinzelman, A.P. Chandrakasan, and H. Balakrishnan. Application-specific protocol architecture for wireless micro sensor networks. IEEE Transactions on Wireless Communications, 1(4):660 –670, 2002.

[7] A. A. Abbasi and M. youniis, "A survey of clustering algorithm for wireless sensor networks, "Elsevier Computer Communication, vol. 30, no. 14-15, pp. 2826-2841, 2007.

[8] Prerna and S. Kumar, "Energy efficient clustering algorithm for WSN," Signal Processing and Integrated Networks (SPIN), 2015 2nd International Conference on, Noida, 2015, pp. 990-993.

[9] T. Irkhede and P. Jaini, "Cluster and traffic distribution protocol for energy consumption in wireless sensor network," Engineering and Systems (SCES), 2013 Students Conference on, Allahabad, 2013, pp. 1-5.