ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

Cluster Based Improved Piggybacking Routing Strategy for Wireless Sensor Network

G.Divyalakshmi[*1], B. Santhana Krishnan[2], Dr. M. Ramaswamy[3]

M.E Student (Communication System), Department of Electrical Engineering, Annamalai University, Tamil Nadu, India [1],

Assistant Professor, Department of Electrical Engineering, Annamalai University, Tamil Nadu, India[2],

Professor, Department of Electrical Engineering, Annamalai University, Tamil Nadu, India[3]

ABSTRACT: Wireless sensor networks have developed into popular domain owing to their extensive variety of applications. Many aspects are decisive the survivability and lifetime of the wireless sensor networks. Energy consumption is one of the biggest restraints of the wireless sensor node and these limitations besides a characteristic operation of greatest number of nodes added several tasks to the design management of wireless sensor networks. The existing mechanism say that, the only way through which the energy can be saved efficiently is by clustering and cluster head election. It is proposed to develop a cluster based improved piggybacking routing strategy for multi-hopping environment. The proposed algorithm avoids the node to node transmission there by reducing the energy consumption through improved piggybacking. Network Simulation has been conducted to evaluate the performance of proposed algorithm against some existing algorithms. The results are obtained in terms of the performance indices with a modified clustering algorithm. The new algorithm shows that the proposed modifications result in an extended network stability.

KEYWORDS: Dynamic Clustering Algorithm;Energy Efficient; Network Lifetime; Piggybacking; Random LinearNetwork Coding.

I. INTRODUCTION

Wireless sensor network (WSN) is constructs by various amounts of node. Sensor node is able to execute sensing information from its area and communicating with each other nodes in the system. Nodes are usually projected to function based on battery lifetime. It is very complicated to renovate batteries of sensor node in the region, nodes are expensive, and energy is constrained for each and every node in WSN [1]. To keep trace of each sensor with its cost, they are equipped with small batteries that can store at most. An important constraint on the power offered for communications, thus limiting both the transmission range and power consumption, and hence it is advantageous to put in order the sensors into clusters. Operation of efficient energy is prolonging the lifetime of network. Data transmission can be optimized using efficient clustering algorithm. Clustering technique is used data aggregation methods for data transmission route from cluster-head to base station (BS) to save energy of sensor nodes in the network [2].Naturally, grouping sensor nodes into clusters has been widely adopted by the research community to satisfy the above scalability objective and generally achieve high energy efficiency and prolong network lifetime in large-scale WSN environments [3]. The corresponding hierarchical routing and data gathering protocols imply cluster-based organization of the sensor nodes in order that data fusion and aggregation are possible, thus leading to significant energy savings. In the hierarchical network structure each cluster has a leader, which is also called the cluster head (CH) and usually performs the special tasks referred above (fusion and aggregation), and several common sensor nodes (SN) as members [4].

Clustering process includes, for sending and processing data high energy nodes are randomly selected and for send and sensing information to the cluster heads low energy nodes are used. Clustering method includes appointing leader from respective sensor nodes and when the leader node means cluster head is appointed, they collect the data from their cluster members and send the collected data to the base station [5].On the basis of energy clustering can be done in two types of networks, heterogeneous and homogenous networks. Network in which nodes have different initial energy are heterogeneous and nodes have same initial energy are homogenous networks. The routing techniques in wireless sensor networks can be classified on the basis of network structure and protocol operation. On the basis of network structure, flat, hierarchical and location based routing. Routing on the basis of protocol operation can be class classified into multipath, query based, quality of service (QoS) based, and negotiation based and coherent based [6].

II. RELATED WORK

A new routing algorithm has been proposed for maximize the network lifetime based on energy harvesting node [7]. It has been found that the simulation result shows that the effective optimal soluting provides useful bench marks for various centralized and distributed the clustering scheme. The improved Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol has been suggested for wireless sensor network [8]. It has been foundthat the proposed work gives better performance of network lifetime and low energy consumption compared with LEACH. A new three state protocol has been suggested for wireless sensor network [9]. It has been found that the result express the proposed protocol consume minimum energy, improve network lifetime and reduce redundant transmission of the data. A new dynamic energy effective tree structure routing algorithm has been outlined for wireless sensor network [10]. It has been found that simulation result illustrate the efficiency and effectiveness of the protocol in terms of network lifetime with LEACH. A new energy efficient hierarchy based clustering routing protocol has been proposed wireless sensor network [11]. It has been found that simulation result are obtain to reduce energy consumption and increase the lifetime of sensor network compared to other hierarchy routing. A cluster based power saving routing mechanism has been proposed for wireless sensor network [12]. It has been found that the simulation result is used to enhance the network lifetime. A new local search routing algorithm has been suggested for wireless sensor network [13]. It has been found that the simulation result provides energy efficient data aggregation their by increasing the network lifetime. An energy efficient routing scheme has been suggested for cluster based wireless sensor network [14]. It has been found that the simulation result echoes that the clustering reduces traffic flow, minimizes energy, increase residual energy and extend the lifetime of the sensor network

III.PROBLEM STATEMENT

The sensor field is designed with N nodes and each node has number of data around it. Besides, the nodes are permitted to exchange the data through wireless means to any other node in the network. The ambition is to develop a cluster based improved piggybacking routing strategy that offers minimum packet loss, minimum energy consumption, minimum routing delay, and greater efficiency with the highest number of packet received. The network simulator-2 (NS2) based simulation results elucidate the abilityof the proposed scheme with other routing scheme.

IV. PROPOSED ALGORITHM

A. Basic Cluster Structure

The energy efficient dual cluster head based improved piggybacking routing scheme has been developed to enhance the life time of the network. It consists of two phase procedure to transfer the date from defined source to destination as pictured in figure 1.

Steady State

First create three clusters in an environment with number of sensor nodes. It provides some energy then limited constrain for two cluster head, which we going to perform further. By selecting two high-energy nodes that act as cluster head and named it as primary cluster head (PCH) and secondary cluster head (SCH) in single cluster, the primary node is nominated as cluster-head for the beginning task. Then, the PCH assumed as Leader and it sends join request message to all sub nodes except SCH. The status of PCH is idle that has to communicate with BS. The status of SCH is in sleep mode. Data transmission is beginning from node to PCH then it sends data from PCH to BS.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

Change State

When the energy of PCH decrease from the limited range then swapping is made at the appropriate time constrain as PCH to SCH. Now leader of the cluster-head act as SCH and join message is taken place and data are routed to SCH in the next section meanwhile by doing this we can reduces the work load of single cluster and multiple cluster head extends the lifetime of network. PCH and SCH collect information from its cluster and transmit to BS. If SCH energy limit also goes down, then create two cluster-head with the existing node within the cluster based on high energy availability.

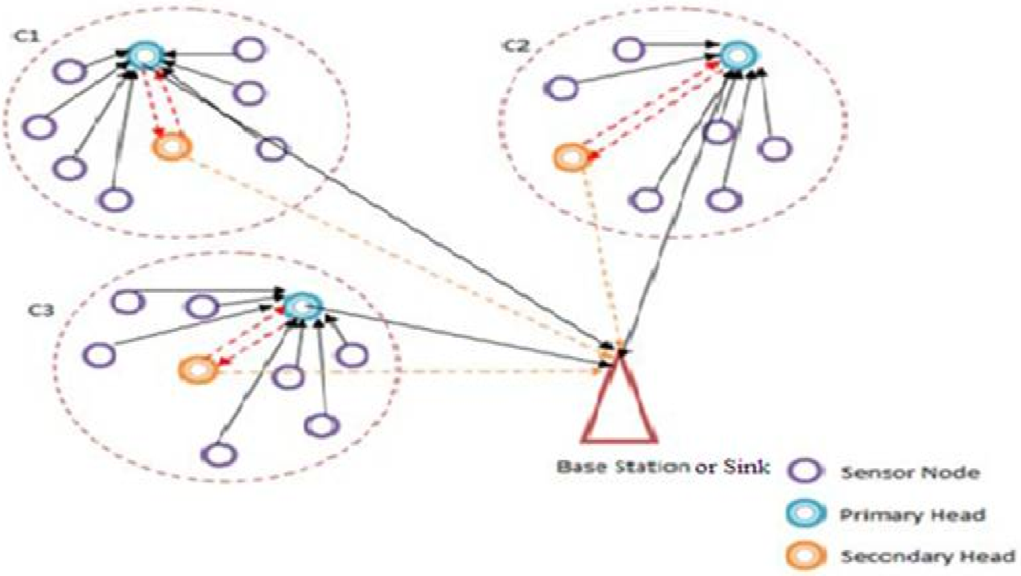

Figure 1 Basic Cluster Structure

B. Dynamic Clustering Algorithm

Based on the analysis of the existing schemes, a single-hop dynamic clustering algorithm is proposed to improve the performances of the clustering WSN in terms of energy saving.

Overview of Dynamic Clustering Algorithm

Dynamic Clustering Algorithm (DCA) improves energy efficiency by optimizing the organization of the clusters to evenly distribute power consumption throughout the network. In addition it reduces flooding by combining the reactive and proactive routing protocols in backbone route discovery. In DCA, topology maintenance is also handled by updating information of the nodes. However in contrast to the traditional clustering schemes, the beacon message in this algorithm is not sent out periodically but it is adaptive. That is, when the mobility rate is high, the period of the beacon message is shortened; when the mobility rate is low, the period is prolonged. This adaptive beacon message can not only reduce the unnecessary flooding beacon message under low mobility rate but also help the network to handle the topology maintenance efficiently under high mobility rate which requires frequent information updates by the nodes.

C. Random Linear Network Coding

Random linear network coding (RLNC) is a simple yet powerful encoding scheme [15], which in broadcast transmission schemes allows close to optimal throughput using a decentralized algorithm. Nodes transmit random linear combinations of the packets they receive, with coefficients chosen from a Galois field. If the field size is sufficiently large, the probability that the receiver(s) will obtain linearly independent combinations (and therefore obtain innovative information) approaches. It should however be noted that, although random linear network coding has excellent throughput performance, if a receiver obtains an insufficient number of packets, it is extremely unlikely that they can recover any of the original packets. This can be addressed by sending additional random linear combinations until the receiver obtains the appropriate number of packets.

D. Flow Chart

The following flow diagram seen in figure 2 explains the function of proposed approach.

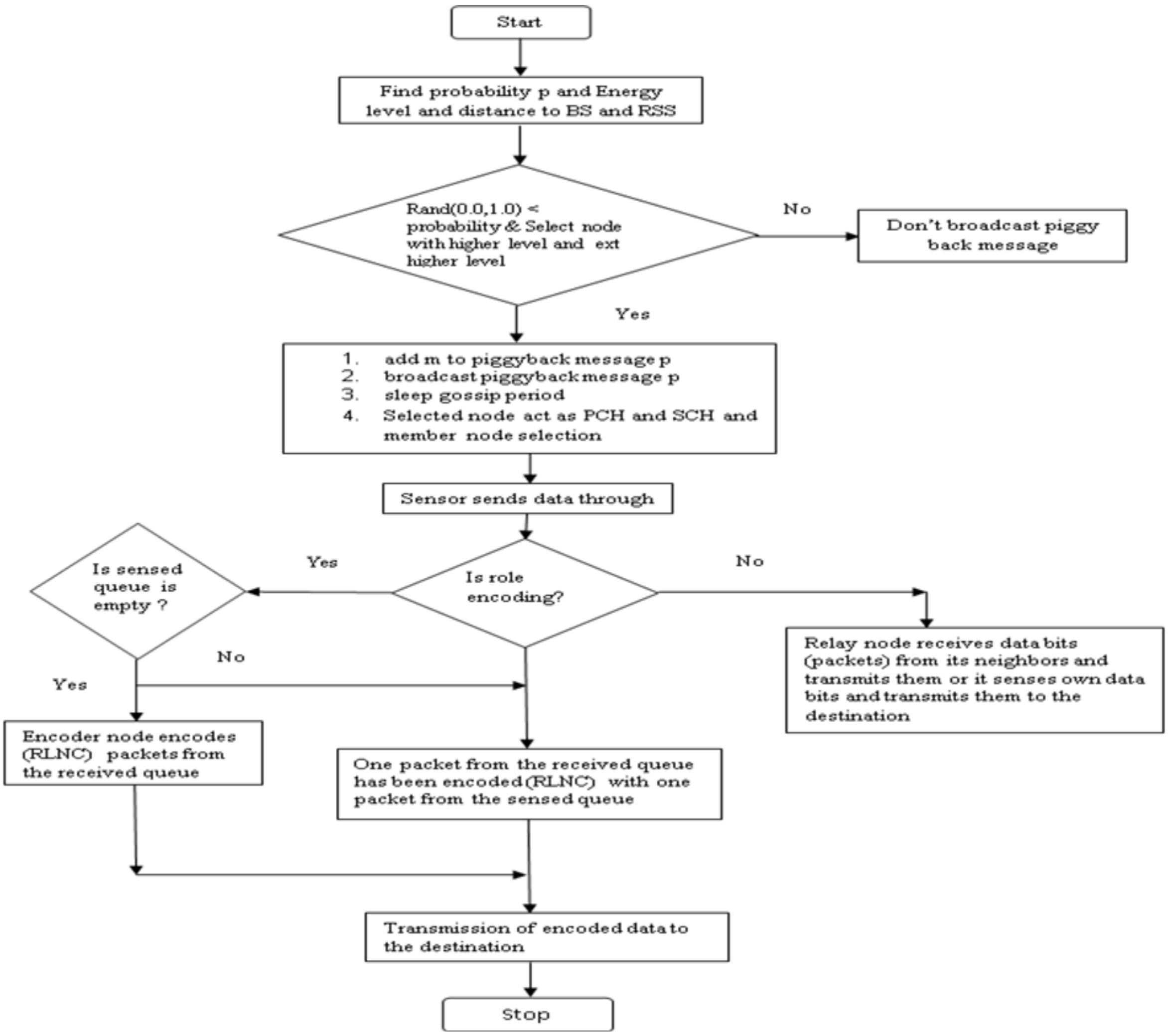

Figure 2 Flow Diagram of Proposed Scheme

V. SIMULATIONRESULTS

The proposed scheme exploring the performance of the routing pattern of a clustered WSN designed with hundred mobile nodes spread in an area of 1000 m X 1000 m as illustrated in Fig.3. It involves the method of exchanging the data of size 512 KB from three sources to corresponding destination nodes. The performance indices like Packets Received, Packet Loss, Throughput, Energy consumption and Routing Delay are calculated through NS2

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

simulation. The deviation of energy utilization is use to realize the data transfer between three sources to the destinations shown in Fig 3. It aids to forecast the path with minimum energy expenditure.It is seen from Figure 4 that the proposed cluster based improved piggybacking algorithm consumes minimum energy than similar routing scheme and offers the minimal routing overhead there by increasing the life time of the network.

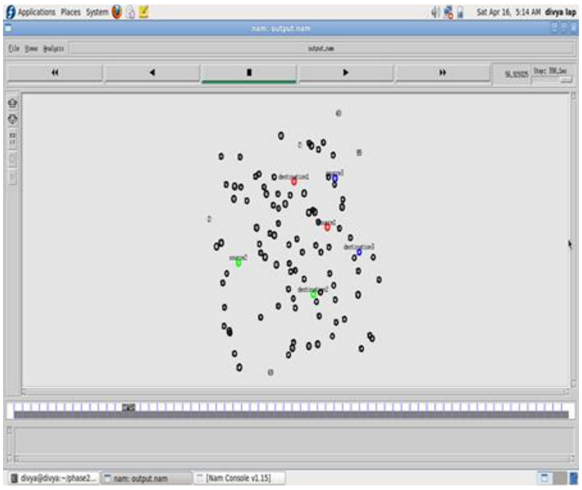

Figure 3 Simulation Model

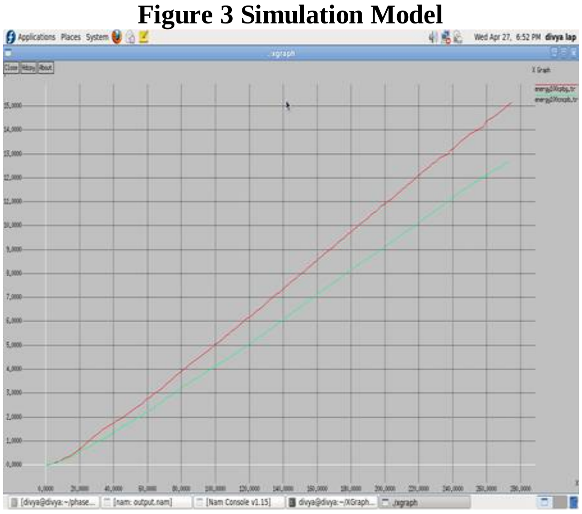

Figure 4 Energy Consumed vs Time

Owing to the fact that the proposed method as outlined in Figure 5 is suitable for maximum number of packets received from identified source to destination. The minimum delay related to proposed scheme explores the suitability of the overall network performance improvement when compared with conventional cluster based piggybacking scheme as shown in Figure 6.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

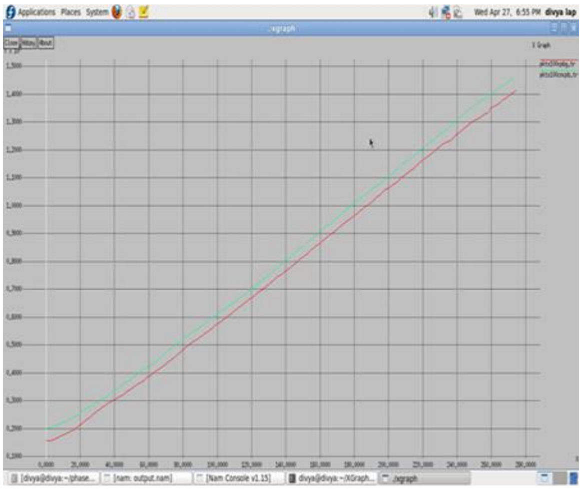

Figure 5 Packets Received vs Time

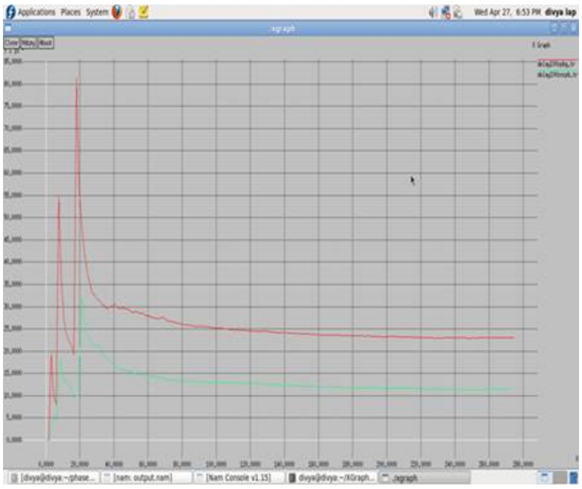

Figure 6 Routing Delay vs Time

The proposed method offers minimum loss of packets as compared to their counterpart as seen in Figure 7 and gives an enhancement of the network efficiency. It is observed from Figure 8 that the proposed scheme provides an incredible throughput for the same size of the data packets transmitted when compared with its matching part.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

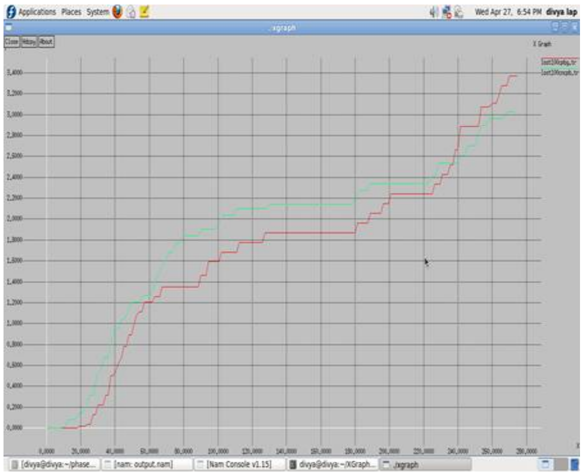

Figure 7 Packet Loss vs Time

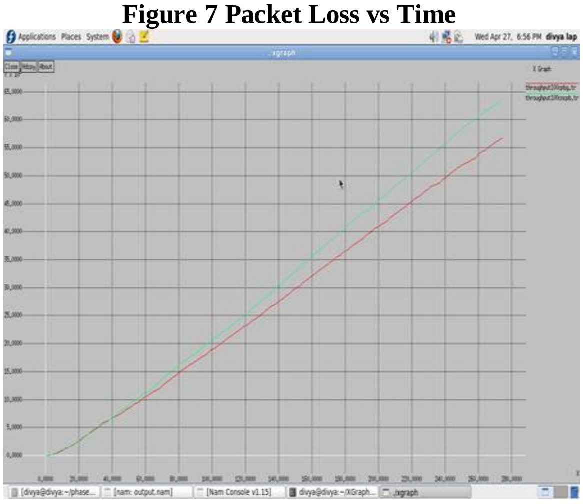

Figure 8 Throughput vs Time

The Packet Delivery Ratio (PDR) of the network under study is depicted in Figure 9. It follows that the proposed routing pattern provides a greater rate with its counterpart.

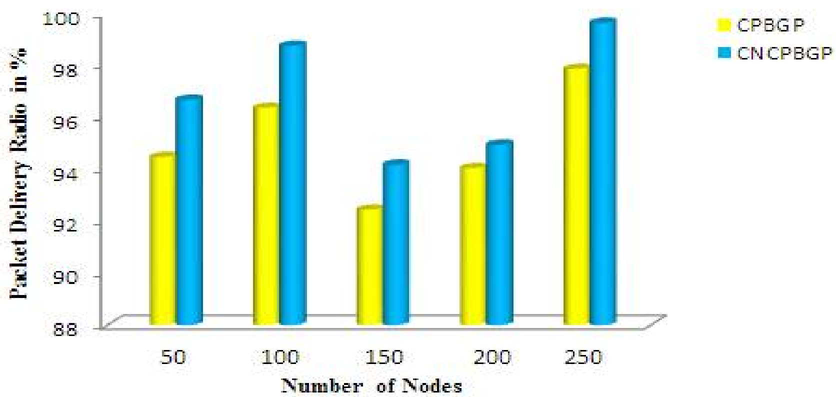

Figure 9 Packet Delivery Ratio vs Number of Nodes

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

The performance metrics listed in Table 1 are derived for two routing scheme with data size of 512 KB along with the number of nodes various from 50 to 250 are allowed to be transmitted between the defined sources and destinations. The investigation proves that the algorithm is stable in its assignment and helps to validate the rewards of the proposed protocol.

Table 1 Performance Comparison with Node Variation

Node	Protocol	Energy in joules	Delay in secs	No.of Pkts Loss	No.of Pkts Received	Throughput in bytes	PDR in %
50	CPBGP	3	0.31	0.9	405	5840	94.47
	CNCPBGP	2.56	0.15	0.58	457	6694	96.67
100	CPBGP	3.06	0.39	0.59	410	5974	96.36
	CNCPBGP	2.59	0.2	0.33	460	6773	98.75
150	CPBGP	2.98	0.21	1.59	403	5801	92.44
	CNCPBGP	2.46	0.11	0.97	447	6431	94.17
200	CPBGP	2.96	0.39	0.96	402	5770	94.04
	CNCPBGP	2.49	0.11	0.79	450	6510	94.94
250	CPBGP	3.12	0.2	0.4	415	6076	97.86
	CNCPBGP	2.69	0.13	0.3	462	6835	99.63

VI. CONCLUSION

A new cluster based improved piggybacking routing strategy viable for WSN has been developed to adapt the data transfer in energy constraint network. The performance metrics of the scheme has been measured with NS2 simulation and the results are compared with similar routing strategy to demonstrate its advantage. The beliefs of the proposed scheme have been taken in terms of higher throughput, PDR and number of packets received in association with other routing protocols. Moreover the proposed method has been coined to extract an improved performance over conventional cluster based piggybacking scheme and expose the fitness of the new algorithm for present day applications. The graphs have been revealed to highlight the effectiveness in terms of minimum delay, packet loss and energy consumption. The results have been institute to arrive at higher echelons of data transfer that considerably improve the life time of the network.

ACKNOWLEDGMENT

The authors thank the authorities of Annamalai University for providing the necessary facilities in order to accomplish this piece of work.

REFERENCES

1) J.Surekha and T.Tamizharasi, "Enhanced Clustering Technique to Improve the Network Lifetime for Wireless Sensor Network", International Journal of Computer Science and Information Technologies, Vol.6, Issue.1, pp. 322-325, 2015.
2) Sherin.T, "Efficient Approach for Cluster-Based Routing in Wireless Sensor Networks", Indian Journal of Research, Vol.3, Issue.5, pp.31-32, 2013.
3) DeekshaVerma, Arun Kumar and Tripathi, "Efficient Cluster based Adaptive Routing for Wireless Sensor Network", Communications on Applied Electronics, Vol. 1, No.3, 2015.
4) Parekh Pranav and Prof. J. H. Joshi, "A Novel Approach on Energy Efficient Cluster Based Routing Algorithm for Wireless Sensor Network", International Journal of Innovative Research in Computer and Communication Engineering, Vol.3, Issue.2, pp.1064-1070, 2015.
5) Dheeraj, Ritu Mishra, "An Improved Deterministic Energy Efficient Clustering Protocol for Wireless Sensor Networks", Journal of Engineering Research and Applications, Vol. 4, Issue.8, pp.125-129, 2014.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

6) ShrutiKarva and Naveen Choudhary, "Energy Efficient Cluster based Multipath Routing in Wireless Sensor Networks", Global Journal of Computer Science and Technology: E Network, Web and Security, Vol.16, Issue.1, pp.19-23, 2016.
7) Pengfei Zhang, Gaoxi Xiao and Hwee-Pink Tan, "Clustering Algorithms For Maximizing The Lifetime of Wireless Sensor Networks With Energy-Harvesting Sensors", Computer Networks, Vol.57, pp.2689–2704, 2013.
8) Dakshayini M, Praveen Kurer and Guruprasad H S, "Energy Aware Dynamic Clustering and Hierarchical Routing Based on Leach for WSN", International Journal of Computer Networking, Wireless and Mobile Communications, Vol. 3, Issue. 3, pp. 79-86, 2013.
9) L. Malathi and R. K. Gnanamurthy, "Cluster Based Hierarchical Routing Protocol for WSN with Energy Efficiency", International Journal of Machine Learning and Computing, Vol. 4, No.5, pp. 474 - 477, 2014.
10) Lin Zhao Zhibo Chen and Guodong Sun, "Dynamic Cluster-based Routing for Wireless Sensor Networks", Journal of Networks, Vol. 9, No. 11, pp.2951-2956, 2014.
11) SubhrenduGuhaNeogi, Anand A. Bhaskar and PrasunChakrabarti, "Energy Efficient Hierarchy-based Clustering Routing Protocol for Wireless Sensor Networks", International Journal of Computer Application, Vol.95, No. 13, pp.1-8, 2014.
12) Vidya K S and ArunAnoop M, "Lifetime Enhanced Cluster Based Routing in Wireless Sensor Networks", International Journal of Engineering Science Invention, Vol.2, Issue.7, pp.69 - 72, 2013.
13) A.Rajasekaran and Dr V. Nagarajan, "Improved Cluster Head Selection for Energy Efficient Data Aggregation In Sensor Network", International Journal of Applied Engineering Research, Vol.11, No.2 pp.1379-1385, 2016.
14) Amjad K and Abu-Baker, "Energy Efficient Routing in Cluster Based Wireless Sensor Networks: Optimization and Analysis", Jordan Journal of Electrical Engineering, Vol.2, No.2, pp.146-159, 2016.
15) **G.Divyalakshmi,B. Santhana Krishnan and Dr. M. Ramaswamy**, "A New Network Coding Based Piggybacking Routing Architecture for Reducing Overhead in Wireless Sensor Networks", International Journal of Engineering Science and Computing, Vol.6, Issue.3, pp.2200-2205, 2016.

BIOGRAPHY

Divyalakshmi. G obtained her Bachelor's degree in Electronics and Communication Engineering from Annamalai University, Annamalai Nagar, in 2014. She is on his way to obtaining her Master's degree in Communication Engineering. She has a one publication in International Journal to her credit. Her areas of interest include Wireless and Mobile Communication and Networks.

Santhana Krishnan. B obtained his Bachelor's degree in Electrical and Electronics Engineering from S.R.M Engineering College under Madras University in 1999 and his Master's degree in Power Systems Engineering from Annamalai University in 2005. He is currently working as aAssistant Professor in the Department of Electrical Engineering at Annamalai University. He is on his way to obtaining his Doctoral Degree. He has a number of publications in International Journalsand one International Conferenceto his credit. His areas of interest include Personal Computer Systems, Communication Engineering, Computer Communication, Wireless Sensor Networks, Power System Voltage Stability Studies and Intelligent Control Strategies.

Ramaswamy. M obtained his Bachelor's degree in Electrical and Electronics Engineering from Madurai Kamaraj University in 1985, Master's Degree in Power Systems Engineering in 1990 and Doctoral degree in Electrical Engineering in 2007 from Annamalai University. He is currently serving as a Professor in the Department of Electrical Engineering at Annamalai University. He has a more than sixty publications in National, InternationalJournalsand International Conferencesto his credit. His areas of interest include Power Electronics, Solid State Drives, Power System Voltage Stability Studies, HVDC transmission, Fuzzy Control Techniques and Communication Networks.