IJCTA, 10(8), 2017, pp. 509-515 ISSN: 0974-5572

Evaluation of QoS against Reporting Rate in WSN

Dattatray Waghole[1], Vivek S. Deshpande[2] and A.B. Bagwan[3], Prasanna Kadam[4], Abhijith Nair[5], Priyanka Bhosale[6] and Nikhilesh Satnurkar[7]

ABSTRACT

Sensor technology used in various technologies like tsunami monitoring, earthquake detection, environmental sensing and many more. There are many challenges in wireless sensor technology like energy consumption, congestion, traffic control etc. It adversely affects on the network lifespan by degrading the quality factors like energy, throughput, packet loss ratio, packet delivery ratio and reliability. This paper deals with the factor of congestion that can be solved by using the techniques like CODA, ESRT, IACC and CADA. Load balancing and Energy efficiency is also discussed, which equally distributes the packets among the nodes to achieve stable network. This paper will be useful for the researchers to understand the causes of congestion and different techniques to overcome it.

Keywords: WSN, congestion, energy consumption, network lifespan, throughput, reliability, node density, reporting rate.

1. INTRODUCTION

Wireless sensor technology has gained more attention in this era. This technology is basically used for monitoring and recording climatic and environmental condition at diverse location. It is commonly used for monitoring parameters like sound intensity, seismic waves, humidity, smoke etc. It senses the information and sends to the target node.

To avoid the congestion in the network some factors can be used like cost factor which is shortest distance to reach the node. Other parameters are load carrying capacity of the neighbouring sensornodes [1]. Zig-Bee WSN is widely used because of low energy consumption. Node density is more in network then system will need large amount of data, so it will cause congestion [2]. To overcome the problem of buffer overflow and link overflow Congestion Migration technique is used [3]. we have to balance the energy load for improve network performance as well as life, for that authors proposed the EBRP (Energy-based) Routing,protocol.[4]. Different types of techniques are developed by the researcher for minimize traffic-congestion in sensor area, one of them is coding in the network based on network-, coding as well as (cross-.layer) optimization-technique [5] [6]. To control the congestion and inference in sensor network, IACC protocol is used which mainly deals with maximizing the link utilization [7]. We know that energy is crucial factor in WSN. Some amount of it is consumed in sending the data from source node to destination. Hence it becomes important to select the next forwarding node [8][9]. Load balancing is one of the important factor in which packets are distributed fairly. Rerrp protocol focuses on this to technique to control congestion [10].congestion causes problems related to re-routing of the packets and increased energy consumption. To overcome this issue Caar algorithm is proposed [11]. In many to one WSN funneling effect usually occurs. TDMA based event time adaptive slot-time, scheduling used for avoid congestion and energy problem. [12]. To avoid the congestion CAFS (Congestion-.Aware-. Forwarder-. Selection)technique is used for geographical Routing-Protocol-RP [13][14]. We know that congestion causes loss of data, the factor behind it can be heavy traffic and increased transmission. CADA algorithm mainly focuses on this two parameters to achieve good performance [15]. Wireless sensor network comes with many challenges to the protocol

1-7 *Email: dattawaghole10@gmail.com*

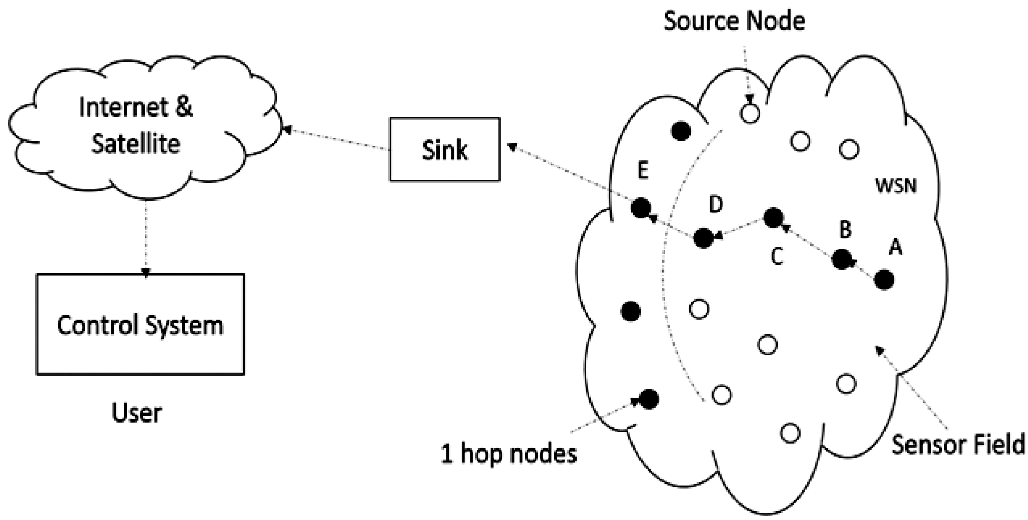

Figure 1: Structure of WSN.

designers like traffic control, congestion control etc. which degrades lifespan of network. Hence it becomes important to understand it and take preventive measures to improve the network performance [16]. Energy consumption and congestion are the main issues in wireless sensor technology concerning with routing protocols. To reduce energy-consumption and delay in the sensor-communication multipath or multipacket data transmission is used by many researcher. [17][18].

In figure 1 number of sensors are randomly deployed in sensor area. Every sensor node is equipped with microcontroller, power source, memory, analog to digital converter and transceiver. The area where sensors are deployed is known as sensor area. A sensor senses the physical parameters and sends the info-packets to receiver (sink) sensor-node.The nodes which are deployed near the destination node is known as one hop nodes. Generally congestion occurs level 1(one) from sink node.

2. LITERATURE SURVEY

A big problems in wireless-, network proposed by many developers like energy-efficiency, congestion..So, to reduce the congestion as it may lead to packet-drop, throughput-decrement & wastage of power (energy). So, to solve this problem the traffic should be effectively distributed from the nodes to the sink by adjusting the data transmission rates. We consider two factors for achieving the expected output which are: Distance cost i.e. shortest path required to route the packets to the sink nodes. Another factor is the load carrying capacity of the neighbouring node that may become the next sender node ,once the packet exceeds a threshold it causes congestion at that area and towards the sink in that path. Also congestion is controlled by distributing the packets through other nodes to the sink so that the load will be balanced. Study of recently developed algorithms shows that the main approach is to reduce congestion by reducing the data transmission rates at the receiver-sensor nodes. One novel protocol name as a congest-detection & avoidance (CODA) is one such algorithm, which mainly works on 2 techniques: Congestion detection and Rate adjustment in closed loop. For rate adjustment in closed loop source node gets alert ack from sink-node & when traffic occurs then acknowledgement stops,. Basic principle in controlling flow of packet by Coda is AIMD (Additive. increase. multiplicatives. decreases) this technique, helps to minimize traffic-load in sensor area,it does not guarantee successful delivery of packets to destination. Another congestion control protocol is ESRT (event-to-sink-reliable-transport), in which all sensors continuously check their packet storage i.e. buffers to check networkcongestion, when network traffic indicate then all nodes send their result to sink node. Then sink nodes broadcast the heavy-traffic-and congestion alert to all sensor-nodes. then after which all nodes tries to reduce their transmission rates. In this algorithm all nodes has its own field which contain shortest cost and traffic loading capacity as an indicator to the neighbouring nodes in direction to the receiver sensor. The nodehaving, the best values is select as next hop and data packets are routed to the sink. To get exact capacity of traffic 2 parameters have to be considered which are: Buffer size field and Congestion threshold. Buffer size field can be considered as packet carrying capacity of node x from node y so that packet loss due to buffer overflow is avoided. Congestion threshold is the ratio of the time-interval between the number of two-packets arrival, packet to average time required to process the data packet. If congestion threshold >1 it indicates that rate of sensing-packets transmission is higher than rate of packet-receiver. consequently the node is not exact slectionfor destination. From the simulation done of this algorithm by considering of scenario of 100 nodes in ns2, we get the improved results in terms of Decreased drop of packets, Decreased energy-usage, Reduced end-to-end-delay. The main reason for achieving these factors is that nodes can determine congestion at the neighbouring nodes by congestion threshold and re-routing the packets through non-congested areas [1].

Congestion will be an unavoidable issue in a wireless-network. ZigBee WSNs is widely used because of low energy consumption and it is area network.so, Zigbee used in many sensor based applications. If node density is more then system needs to manage large-data, it may be effect on network performance due to the congestion,. The paper proposes two solution to avoid this congestion in the network: RandomTrnsmission ,Mechnism (R.T.M) and time-sharing-trnsmission-mechanism (T.S.T.M). In the first technique,network-congestion is avoided. The second technique uses time,division method to avoid channel contention. In RTM mode using random-values interval between the nodes(terminal) are updated,.. It is very- sensible to avoid-congestion with random-interval than ,fixed-interval. In TSTM, packets are transmitted in different transmission slots,to transmitting packet [2].

In wireless sensor technology buffer overflow and link overflow shows that there is congestion occurred inside the network. Due to congestion loss of packets and transmission delay occurred inside the network. To avoid these type of problem author proposes the system energy efficient way. In this system author compares the bandwidth threshold limit to the transmission control rate (EL). The proposed system overcomes the limitations of the RT-MMF technique in which,all the nodes areactive all the time, so that the energy consumption increases. Proposed system uses the congestion migration technique to avoid congestion. All the nodes inside the network need not to be active all the time only some nodes in particular region is active depends on the distance from the source node, so energy is reduced. The unwanted data packets will be removed at the start of the transmission, so the energy for processing unwanted data is saved. In the proposed congestion avoidance technique the value of EL and bandwidth threshold are used for determining rate of data packets. So the congestion is avoided by the energy efficient way [3].

Sensor-network is a collectionof sensor-nodes which has a limited energy and power supply. because of heavy-traffic and congestion in network energy consumption will be increase, so authors are energy efficient routing protocol implemented for resolve this issues in the-network.. So to increase the life-duration of network, we need to minimize total energy consumption as well as balance the energy load. Researchers has implemented different-protocols like Leach,heed, Pega-sis, tbc, Pedap but this protocols have some disadvantage. To reduce the disadvantages of above mentioned protocol author implements General-Self-Organized(Tree-Based),Energy-Balance routing-protocol(G.S.T.E.B).In that protocol Base-station node assign(allocate) a root- node & Broadcast/send information about selection of node. Subsequently,every-node selects by its,parent by assuming, only it-self & it's neighbour's detail- information, due to that G.S.T.E.B balance the Energy load and increase the networks lifetime. Author shows simulation using the MATLAB simulator. By analysing simulation results authors conclude that when first sensor dies then almost-all sensors have a constant as well as same residual-energy. So using G.S.T.E.B. energy load balancing protocol energy-consumption/wastage reduce by the, protocol[4].

3. PERFORMNCE ANALYSIS

In our scenario sensor nodes are deployed using uniform random topology. Number of nodes (node density) varying from (15-to-90) sensors (nodes). A O D V (Ad-hoc-on demand-distance-vector) as routing-protocol

(R.P) and CSMA i.e. 802.11 (Carrier-Sense-Multiple-Access) as MAC protocol used for simulation in NS2. The reporting rate is varying from 10 to 50 packets per second and (packet –size) is (50)bytes.

Figure (2) shows average, (packet-delivery-ratio) for different reporting rate. When the number of nodes is 15 and reporting rate is 10 packets/sec then PDR is highest. When we varied reporting rate up to 50 packets/sec then PDR is decreases due to congestion in the network. If we varying the (reporting-rate) from (10-to-40) packets -per-sec for 15- nodes then PDR is approximately same but if we increase (reporting-rate) from (40-to-50) packets-per-sec then PDR is decreases. Above graph shows that, performance of the network for 15 nodes is drastically better as compared to other node densities. Average PDR for 90 nodes is drastically poor due to the heavy packet transmission in the network. So above graph proves that when rate of data transmission increases as well as no. of sensor-nodes in sensor-area increases then performance of the network is drastically decreases (poor).

Average packet loss ratio is shown in figure-(3). When num. of sensor-nodes are 15 then due to the less traffic, packet loss ratio also less but when number of nodes are increased in network then packet loss ratio

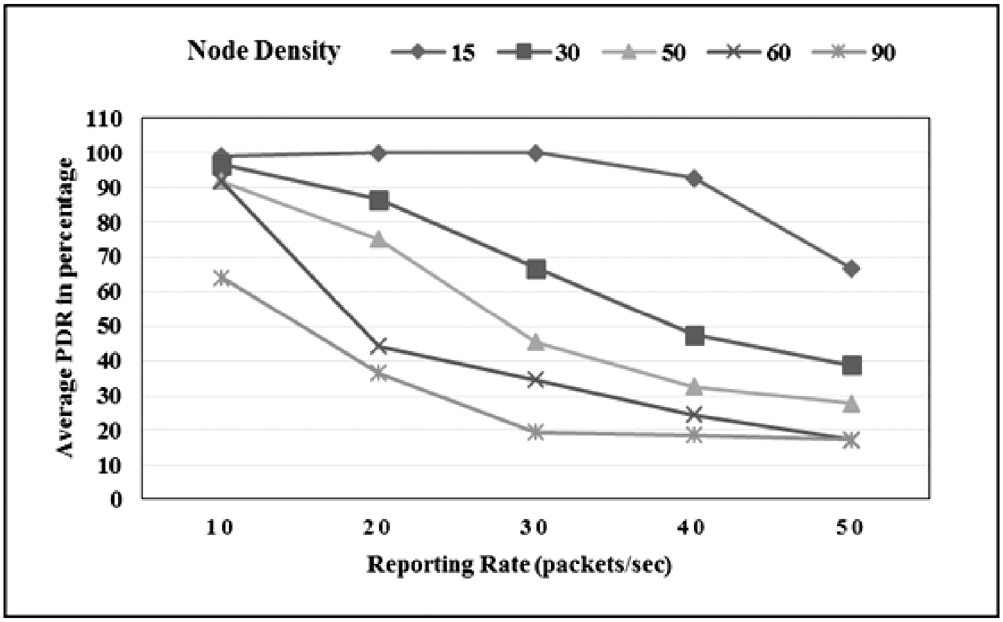

Figure 2: Average (PDR.) for Reporting Rate

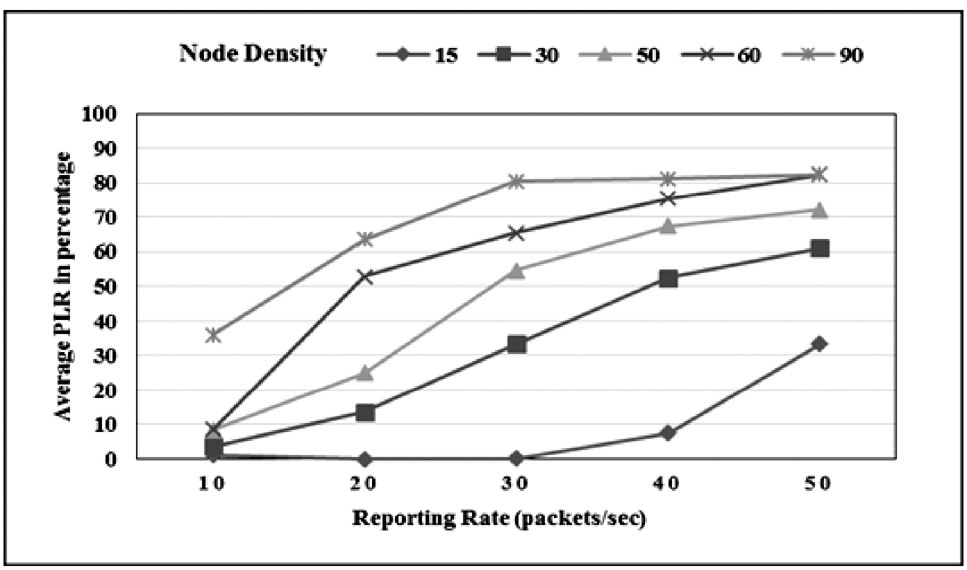

Figure 3: Average PLR for Reporting Rate

also drastically increases. As we increase num. of sensor-nodes inside the network then more information-packets are generated by the nodes so collision and congestion occurs inside the network and packet loss ratio is increased. Less communication channel is also the reason of maximum packet loss ratio when number of nodes increased inside the network.

Avg. energy-consumption as function of reporting-rate, (packets-per-sec). Above graph, show sthat performance of the network is varying with different reporting rate and node density. Average energy consumption for 15 nodes is initially high when (reporting-rate) is 10 packets-per seconds. When reporting-.rate varying from 10 to 50 packets per seconds and node density varying from 15 to 90 then average energy consumption drastically decreases (40% to 50%). Performance of the network for 60 to 90 nodes is better for energy consumption when reporting rate varying from 10 to 50 packets per seconds that is if traffic in the-network increases then performance ofthe sensor-network in case of average energy consumption is same (constant). Changing reporting rate from 10 to 50 packets per second does not affect on node density 60 and 90. Average energy consumption for 30 nodes is medium as compare to 15 and 90 nodes. Average energy consumption ratio is less for higher node density as well as reporting rate and more in case of less node density and reporting rate.

Figure (5) shows averg. throughput for (reporting-rate). Averg. throughput is less when rate of data transmission is 10 packets per second for 15 nodes. When rate of data transmission is varies from 10 to 50 packets per second because of the full-channel utilization, network throughput is drastically increased for varies (node-density) from (15-to-90 sensor-nodes). Less reporting rate gives minimum throughput and maximum reporting rate for maximum nodes shows higher throughput. Average throughput for 50 nodes is drastically increased when reporting rate varies 10 to 50 packets per second but when number of nodes are 90 then average throughput is slightly increased but as compared to 50 node density it is drastically less.

Averg. end-to-end delay for 15 nodes is very less with varying reporting rate from 10 to 50 packets per seconds but at threshold point after 30 (reporting-rate), averge end-to -end delay in network 20% increases and after 40 reporting rate it decreases 20% to 25%. For 30 nodes average end to end delay is initially less but as increased reporting rate from 10 to 50 packets per second then average end to end delay increases. Average end to end delay for 50 to 60 nodes is average as compare to node density 15 and 90. It increase in between 10% to 40% with varying the(reporting-rate) 10-to-50 packets,per second. In case of node density

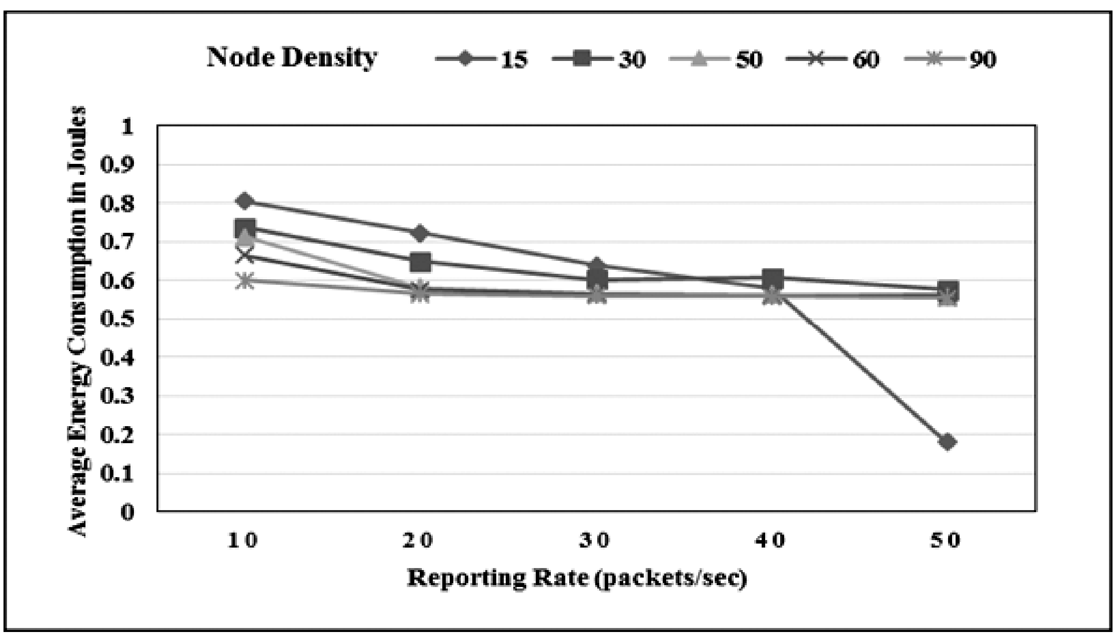

Figure 4: Average Energy Consumption for (Reporting-Rate)

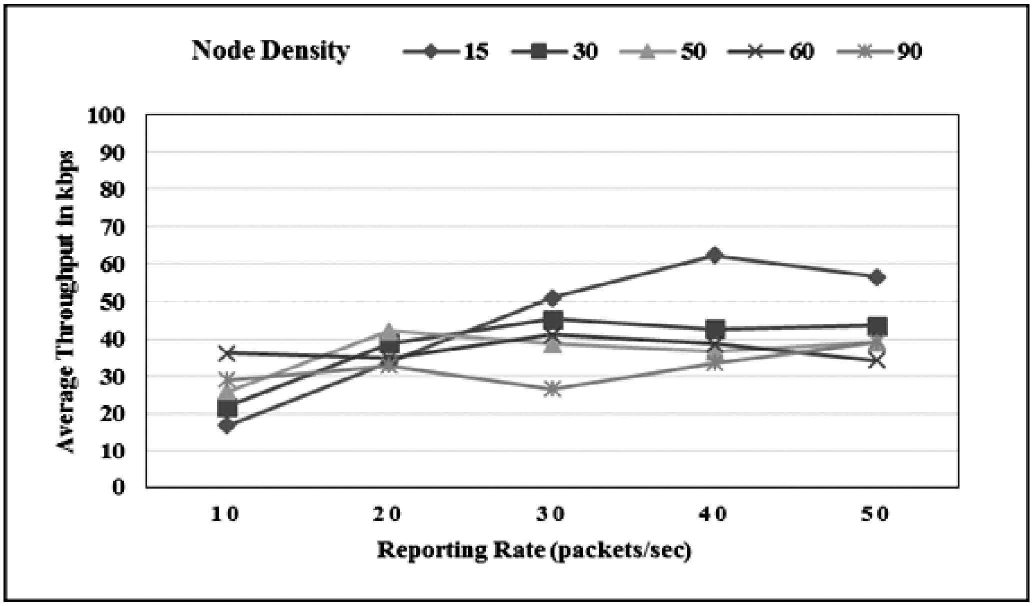

Figure 5: Average Throughput for Reporting-Rate

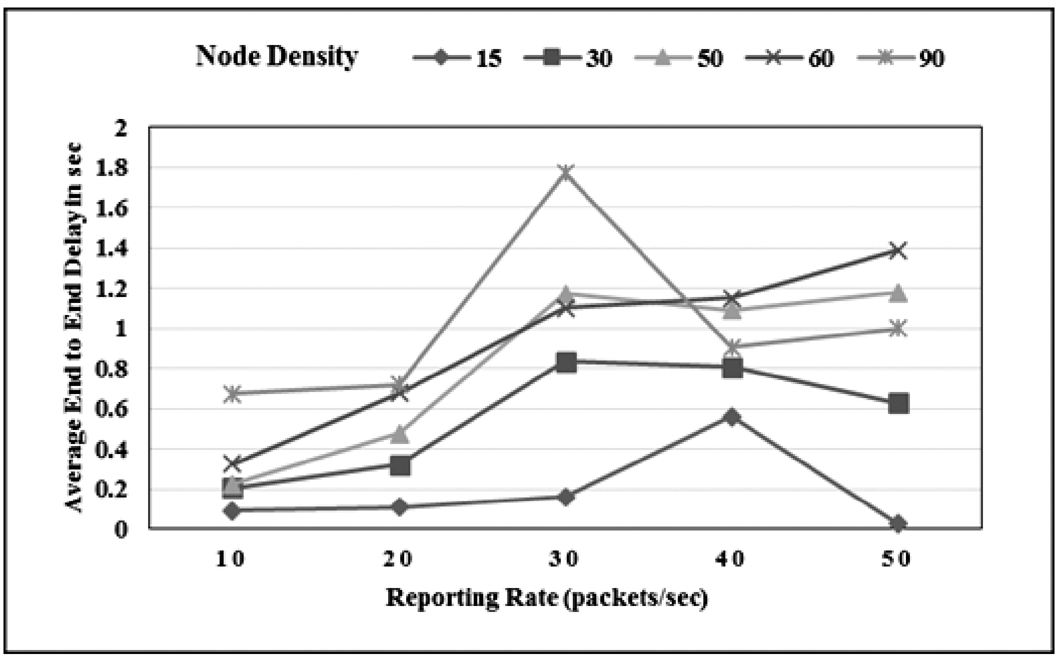

Figure 6: Average End-to-End Delay for Reporting Rate

90 performnce ofthe network for averge end-to-end delay is very poor varying reporting rate from 10 to 50 packets per second. Initially 20% more delay required for 10 to 50 reporting rate it drastically increases (50% to 60%) averg. End-to-end delay. But at threshold point 30 packets per second averg. End-to-end delay drastically decreases inthe network. Dueto the heavily loaded network and less bandwidth minimum packets are transmitted through communication channel so rate of packet transmission is decreases. Average end to end delay increased with increasing reporting rate and node density in the-network. So graphs shows that avg. end-to-end .delay is achieved for 15 nodes.

4. CONCLUSION

In thispaper, we have studied one of the main issue that is congestion control in wireless sensor technology. We also discussed causes of congestion and different protocols to overcome it. To avoid congestion different protocols are used like CODA, ESRT, IACC and CADA. Above given graphs shows that when number of nodes (node density) varying from (15-to-90) &reporting-rate from (10-to-50 packets-per-sec) then average PDR decreases from 30% to 40%, average PLR increases from 10% to 80%, average throughput decreases from 60% to 15% and average energy consumption increases from 20 to 80 and aveg. End-to-end delay increases from 10% to 80%. When the numbers of nodes are 15 and reporting rate is 10 to 30 packets per second then we achieved QoS like PDR, PLR, Throughput and Delay. Performance of the network for 60 to 90 nodes is better foravg. Energy-consumption when(reporting-rate) varies from 10 to 50 packets per seconds. So, we have concluded that when node density varying from 15 to 90 then performance of network decreases due to increased traffic in network. In future we have to implement new traffic aware protocol for congestion control in WSN.

REFERENCES

[1] M. Gholipur, A. Torghi Haghight , M Reza Mey-bodi, "Hop-by-hop trffic-aware-routing to congestion,control in Wireless Sensor Networks" ,. Eurasip Journl on WCN,Springer (2015) (2015:15)

[2] Zhibing Pe, Z. Zhang, Yingdong-Ma, Linhe Fu, Shxiang Qu, Fengqi Wi, "Novel- Congestion Avoidnce Mechnism ZigBee-Based WSN.", Springer, 2015,: E.S.T.C 2015, C-CIS 572, pp. 161–168, 2015.

[3] A. Kadam,P.N. Chtur, "Energy-Efficient Method for Congestion-Avoidance System in WSNs", Interntional Conf on Advances-in-Electrical,-Electronics,-Information, Communication and Bio-Informatics (AEE-ICB16), 2016 IEEE

[4] Zhao H., Je Wu, Jie Zhng, Liefeng L., Kaiyun Tian, "A General Self-Organized Tree-Based Energy-Balance-Routing Protocol for Wireless sensor networks", IEEE-Trans On NS, Vol-61, No-2, April 2014.

[5] D.S. Waghole ,V.S. Deshpande, "Charcterization of WSN for Traffc & Delay," IEEE, Internationl Conference on CUCET, pp 33-37, CUBE Nov-2013, Pune.

[6] Xiaoyn-Yin, Dingyi-Fang, Xiojiang Chen., "A Reliable Congstion-Avoidnce Protocolfor WSN's", R-Wang,F-Xiao,CWSN-2012, CCIS 334, pp. 655–664, 2013. Springer-Verlag- Berlin, 2013

[7] MAmine-Kfia, D-Djenourib, J-Ben Othmnc, Abdelrouf-Oudjaouta, Miloud-Bagaaa, Nouredine-Lslaa,N. Badachea, "Interference-Aware Congestion-Control Protocol for WSN's", The 5th Internationl Conf on Emerging-Ubiquitous-Systems and-Pervasive Networks- (EUSPN-2014), Procdia Computr Science 37 (2014), pp. 181–188.

[8] D.S. Waghole,V.S. Deshpande, "Performnce-analysisof FMAC In WSN's." pp. 1-5, IEEE, Confrence, WOCN, 11-13 Sept 2014, Vijayawda, AP.

[9] R-Annie U., S. Kasmir Raja, "Energy-Efficient Congestion-Control in WSN's", S.M. Thampi et-al. (eds.), Recent-Advances in Intelligent-Informatics, Advances in Intelligent-Systems and Computing (235), Springer International pub.Switzerland-2014.

[10] Liwei T., "Reliable & Energy-Efficient Routing Protocol for WSN's", Zhong (ed.), Proce-dings of the Internationl Conf on (IEA) 2012, Springer-Verlag London 2013

[11] Zhang G. C, "A Effective Congestion-Avoidance Altering Routing-Protocol in Sensor Networks", International-Conference on CS &SE.2008 IEEE .

[12] Sung-Hyun M., SungMin L., and Ho-Jung C., "A Congestion-Control Technque for the Near-Sink Nodes in WSN's", J-Ma et-al. (Eds.): UIC 2006, LNCS 4159, pp. 488–497, 2006. Springer-berlin, 2006

[13] D.S. Waghole & Vivek S. Deshpande, "Performance analysis of FMAC for Different (Packet Size) in WSN's", pp. 1-5, IEEE- ICPC 2015, SIT- Pune.

[14] Jaesung-P., "Congestion-Aware Geographic-RoutingProtocol for Wireless Ad,Hoc and SN", Wireless Pers Commun (2014) 78: pp. 1905–1916.

[15] Wei-w. F., Ji—ming C., L. SHU, Tian-shu C, De-pei Q., "Congestion-avoidance, detection&-alleviation in WSN's", Journl of Zhejiang- University-SCIENCE, ISSN 1869-1951,(Print); ISSN 1869-196-X (Online)

[16] V. P. Munishwr, S. S. Tilk,Nael B. Abu-.Ghazaleh, "Congestion &FC in WSN's", CC and Networks, Springer-londan-2009.

[17] M. Nesa S, S. E.John, M.L. Valrmathi, "Energy-Efficient and Congestion-Control Multipath Routing in WSN's", D.C. Wyld et-al. (Eds.): CNSA-2011, CCIS-196, pp. 225–238, 2011. Springer-Verlag-2011

[18] D.S. Waghole , V.S. Deshpande, "Reducing Delay Data- Dissemination Using MobileSink in WSN's." IJSCE-13, Vol. 3, Issue-1, ISSN-2231—2307, pp. 305-308, March—2013.