International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 05, May-2022

Analysis of QoS Parameters of Sectoring-based Algorithm for Congestion Control in Wireless Sensor Networks

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***Abstract*—It is quite a challenging task to maintain and improve the QoS features in the Wireless Sensor Networks. The challenges like improving Quality of Service features of a network which has distributed topology, managing the nodes data transfer during a natural disaster, improving the life of the battery need to be achieved. In this paper we have analysed different routing protocols(AODV, DSDV, DSR) on nodes placement in a random scenario and in the proposed Sectoring Scheme. Different QoS features are also analysed by dividing the network field into different sectors and optimal Node Density. An energy-efficient sectoring algorithm is proposed which selects an optimal sector head for each sector in the network. The QoS features such as Packet Delivery Ratio and Delay is computed for Static and Dynamic nodes placement in the Sectoring Scheme and compared with the results of the node placement randomly. According to the simulation results, it has been concluded that the proposed Sectoring Scheme generates optimal QoS results.**

***Keywords*—WSN- Wireless Sensor Network, Sectoring, QoS, Quality of Service..**

I. INTRODUCTION

In this growing field of Information Technology, the systems communicate with each other in a network field with the help of multiple sensor nodes. A wireless Sensor network is apprehended as a group of sensor nodes that are trained in sensing physical events in the surrounding area, sensed data is processed and eventually routed the typical or cumulative data to the base station. Wireless Sensor networks are relatively self-organized isolated systems, and they rely on large numbers of low cost tiny sprinkled devices having high restrictions in terms of memory, processing, energy capabilities and communications. Wireless Sensor networks are set of communication networks made up of various independent sensors that record various material or environmental parameters, such as pressure, sound, temperature, motion and vibration at various locations. wireless sensor network come up with a inexpensive, completely distributed computing and sensing solution for areas where traditional networks are unfeasible to use.

The proposed work explores the issue of congestion in sensor networks. The issue of congestion is all-around and causes packet loss and packet delivery delay. In a wireless sensor network, a reliable protocol is one that permits data to be reliably transferred from source to destination with minimal packet loss. The majority of the protocols described merely offer reliable data transfer and congestion control. Several protocols, however, provide both functionalities of the transport protocol. To address these challenges, consideration should be given to protocols of transport layer that combine standardized data release with congestion control.

In this paper [6], Node Energy consumption is the major and the biggest issue for life of a node in the network field. Energy in the network field can be used(consumed) by useful work and also by wasteful work. Nodes in network field works on battery and making nodes full of energy is one of the impossible task. Therefore survival of node depends on the remaining energy when it is in use in the network field. There are some challenges with energy consumption such as huge number of nodes in network field that results in impossible task of recharging every node and other challenge could be complexity of network, which result in replacing every dead node.

In this paper[14] WSNs have a broadcasting nature and to avoid duplicity of the same data on the network they require tight control, else it might result in wastage of bandwidth and reduction in the network throughput. The deployment of a wireless sensor network in an uncontrolled manner might cause an unwanted behaviour like high packet drop. It might arise due to mac layer congestion, while attempting to send/ receive data packets on a shared channel with help of CSMA protocol between the sensor nodes. Multipath routing sends various copies of the similar data packets on different paths

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increasing data delivery ratio of the information between source and destination. This method also increases the throughput of a network, transmitting the data packets in pieces which are parallel along various paths with combining the complete data at destination. The transmission of data mostly relies on an ideal primary path and an alternate path is reserved to be utilized when nodes in that primary path fail. Using the sensor node routing table which consists of every neighbour node with the probability of transmission computed, the system identifies multiple route but utilizes just one of them for a particular transfer. This reduces the stress on a specific route and increases lifetime of the network.

In sensors, real-time, computing indicates that their is presence of micro controller or micro processor which consume energy at high scale. These tools in sensors decides which part to work when and when to turn it on and when to turn it off. Energy consumption here is done in two ways energy used in switching and energy which is leaked. By the using software energy is consumed because of supply of voltage and capacitance. There are sometime when no computation is going on and still there a energy loss, this is nothing but energy leakage.

In this paper[2] , CODA, or Detection of congestion and Sensor Networks congestion avoidance, is made up of three strategies for congestion control: congestion detection based on receiver, hop-by-hop open loop backpressure, and multisource regulation closed-loop . Congestion detection and avoidance(CODA) employs the current and previous channel loading condition, as well as the occupancy bufer level, to detect congestion. Without ARQ link layer , occupancy buffer cannot reflect correct congestion levels, as has been demonstrated.] To alleviate the control of congestion, CODA considers both data rate and node density. There is a greater likelihood of chronic congestion which is far from sink node and near the source node in networks with high node density and high data rate. Backpressure messages are sent from the congestion hotspot to the source nodes in this situation.

In this paper[11] Delay in grid topology whole network field is divided into multiple organized shaped grids. Delay is also known as latency. Each grid contains one head called the master node, which collects data and send it further. This data forwarding causes accumulation of data at some point in the network field.

Now there can be two things, one that this could make data flow slower than usual flow speed due to congestion on the master nodes and this would lead to delay until it reaches destination node.

Second, accumulation of data can also cause data loss as the master node might receive more data packets than it can handle and this would also be one of the case delay in wireless sensor network.

II. SIMULATION SCENARIO

The proposed Sectoring scheme follows the algorithmic steps as:

Step 1: Divide wireless sensor network in the ‘n’ sectors.

Step 2: Node which is nearest to Sink is assigned as Sector Head (SH).

Step 3: Only activate the current sector, when an event is occurred and remaining sectors nodes are kept in sleep mode.

Step 4: Nodes transfer packets to respective Sector Head where event is occured .

Step 5: Sector Head, transfer the packets to sink.

The proposed Sector-based algorithm can follow the below topology for packet transmission. Here the sink is at the extreme middle and the nodes are divided into three sectors where the nearest node to the sink is the Sector Head and is responsible for parsing all the data packets.

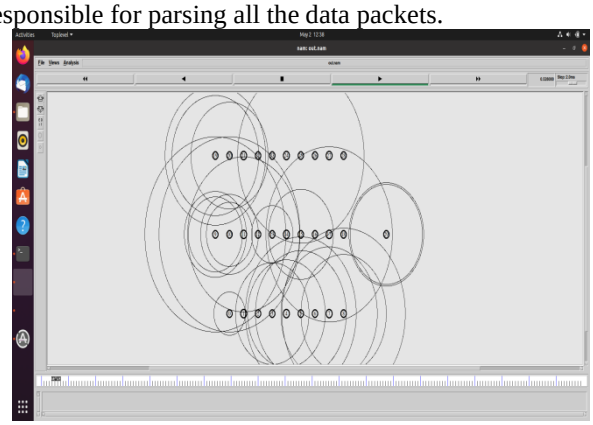

Fig: Node Arrangement in the Sectoring Scheme

Table: Simulation Parameters Used

Simulation Parameter	**Value**
Simulator	NS2
Scenario Area	1000*1000 m^2
Node Density	10, 30, 50, 90
MAC Protocol	IEEE 802.11
Packet Size	50, 100, 150
Number of Sink Node	1
Position of Sink Node	Center
Routing Protocol	AODV
Transmission Rate	10 pkt/sec
Network Traffic	CBR

III. RESULT ANALYSIS

Throughput Analysis:

On comparing the throughput of the network of node placement in a random scenario to the node placement in the proposed sectoring scenario statically/dynamically, it can be concluded from the graph below that the Sectoring scheme gives better throughput

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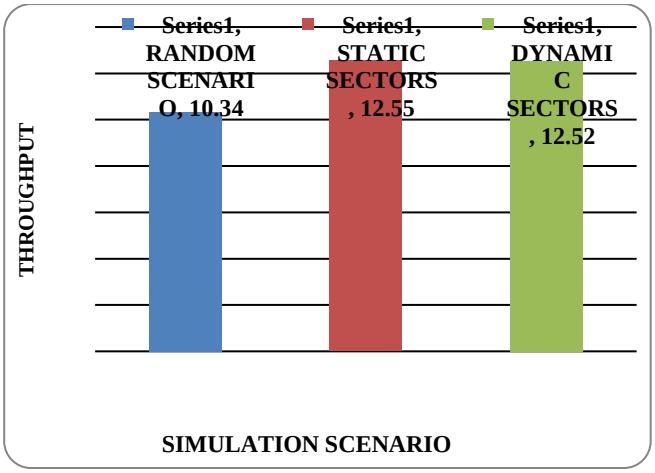
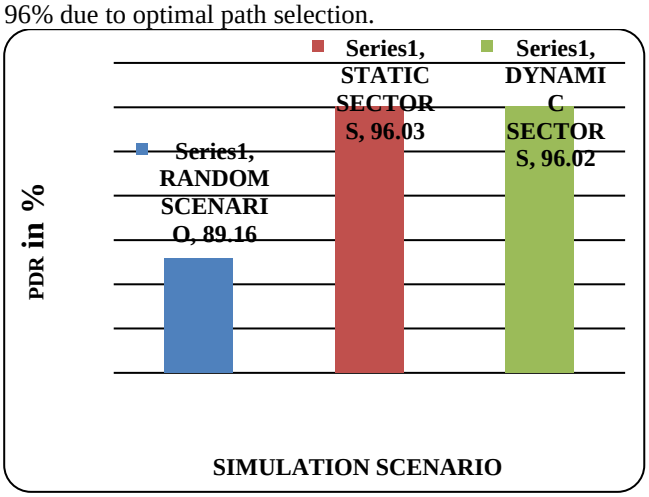


Graph: Throughput Analysis

Packet Delivery Ratio Analysis:

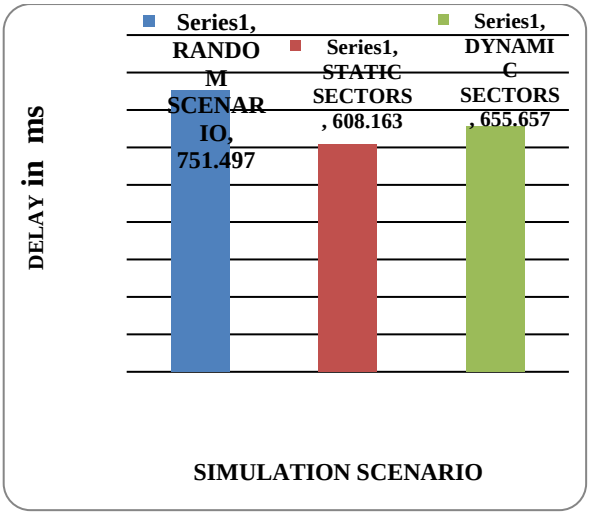
On comparing the Packet Delivery Ratio of the nodes in the random scenario to the nodes in the proposed sectoring scenario statically/dynamically, it can be concluded from the graph below that the Sectoring scheme gives better PDR of 96% due to optimal path selection.



Graph: PDR Analysis

Delay Analysis:

On comparing the Delay of the nodes in the random scenario to the nodes in the proposed sectoring scenario statically/dynamically, it can be concluded from the graph below that the Sectoring scheme generates less Delay of 600ms due to reduced congestion and optimal waiting time of the nodes to send the packets.



Graph: Delay Analysis

IV. CONCLUSION

On comparing different routing protocols(AODV, DSDV, DSR) for data transmission in Wireless Sensor Networks, AODV gives better performance among the others by avoiding congestion and by providing better packet delivery. Hence, we have used AODV algorithm to perform our simulation scenario. On plotting the nodes in a simulating environment, we found that on increasing the Node Density the efficiency decreases and a major effect in the QoS parameters is observed. Therefore, a sectoring scenario with 30 Nodes gives optimal results like increased Packet Delivery, Less Packet Loss, Less Delay, and an increased throughput.

According to the simulations, it is observed that proposed sectoring technique performs better than random scenario in terms of QoS parameters. From the simulation results obtained it is concluded that the Sectoring technique serves better with 13% throughput, 96% PDR, 3% PLR and with 600ms Delay. Hence from the results it is deduced that the proposed sectoring algorithm gives better results on different QoS parameters, on comparing with a random node placement scenario.

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