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PERFORMANCE ANALYSIS OF QOS AGAINST DIFFERENT NODE DENSITY IN WIRELESS SENSOR NETWORKS

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Abstract: - Sensor networks in terms of stations that are distributed randomly in a sensing region to record data such as temperature, humidity, and other environmental variables. Sensor networks are meant to monitor a variety of environmental characteristics and store data on a cloud server for future prediction. For improved application performance in WSNs, several design issues must be overcome, such as scalability, energy consumption, cost, channel use, and so on. Researchers must address the concerns and obstacles stated above in order to increase the network's performance. In general, source sensor nodes in WSNs collect data and deliver it to the receiving node. The size of the packet, the data transfer rate, as well as the number of sensor nodes located in the sensor area are all crucial in this scenario since node density and packet size have a direct influence on traffic and generate network congestion. In this article, we looked at network performance for various node densities and compared it to wireless sensor network QoS. Packet loss, packet send, latency, energy usage, and throughput are characteristics of quality of the service (QoS). The wsns' QoS is as follows. The results of the study illustrate how the network performs for various QoS when node density is changed from low to high. For network performance analysis, the CSMA and AODV protocols are utilized.

Keywords: - Quality of services (QoS). Carrier sense multiple access (CSMA), Ad-hoc distance vector (AODV), delay, congestion management, and energy use.

Introduction

Sensor-based applications will continue to be in great demand. Sensor-based applications will be required in a range of real-time settings, including toxic gases control in industry, automobile manufacturers, and mobile phones. A Wireless Sensor Network is comprised of a group of sensors distributed throughout an application area, each of which connects to the others to form a network in which all nodes work together to detect and regulate the environment. The military applications, particularly monitoring in war zones, are the driving force behind the development of WSN. WSN today comprises of sensor-embedded devices that utilize sensors to monitor physical conditions and may be used for a number of industrial applications, automation processes, health monitoring, traffic monitoring, and consumer applications. WSNs are made up of numerous sensing nodes, each of which has several components. Sensors, which detect physical factors in the environment, and Analog to Digital Converters, which convert the analogue signal received from the sensor into a digital format that the processing component can read and utilise. The processor block stores and processes data signals, as well as having a radio transceiver that transmits and receives signals through transmitting and receiving antenna. Each node, on the other hand, works or receives energy from a battery or, in certain cases, from a solar system.

In this new increasing situation, the expanding technical research on the sensor has led us to create receiving, transferring, and transmitting multimedia data with scalar data. WMSN represents the contemporary future's development phase. It has poor wifi connectivity and is prone to errors. Along with scalar data, it can transfer an audio stream, a video stream, and images. It has a lot of potential in WSN applications, such as the Internet of Things (IoT), visual targets, smart surveillance, and environmental monitoring, to name a few. Multipath routing aids in load balancing, data delivery assurance, and fault tolerance during WMSN communication. With a network community analysis, the topic of interest of geographic location based route selection attracted a lot of attention. In this article, we investigated network performance in wireless sensor networks with varying node densities. We tried out different node densities ranging from 15 nodes to 90 nodes to see how congestion and traffic increased as node density increased. CSMA and AODV protocols are used to accomplish parameters like latency, throughput, energy, packet delivery ratio, packet loss ratio, and so on are all factors to consider.

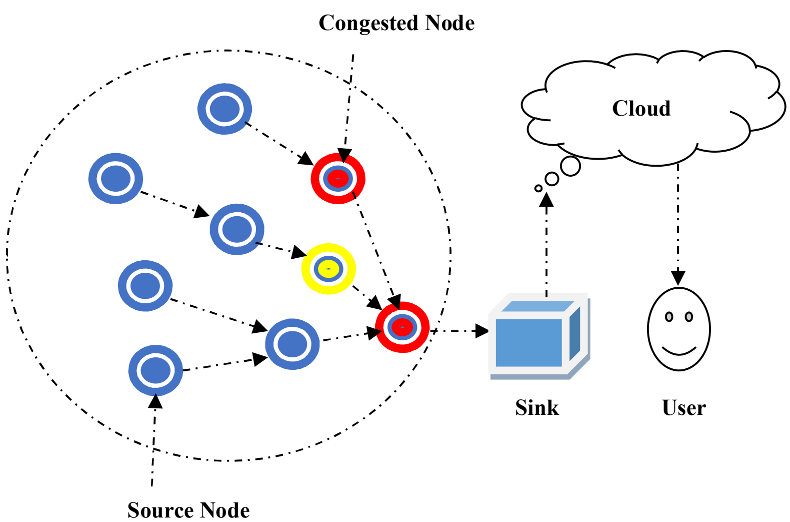

Figure 1: Sensor network connection mechanism.

Figure 1 shows communication in sensor networks. Data is collected from the environment by source nodes, which is subsequently delivered to the base station. Because to excessive traffic and packet collisions at sink closest nodes, red colored nodes are crowded. In the architecture above, the sink node acts as a destination node and is used to disseminate data from source nodes. The data may be stored on a cloud server for users at the destination node. As a result, numerous users may utilize the programme to access data for analysis and prediction.

Literature Survey:-

Two hierarchical approaches, like PD-CH and ECHERP, were used to evaluate the performance of two routing protocols for wireless sensor networks with different quality of service (QoS). LEACH Protocol (ECHERP) is the basis for the first routing protocol, while Pegasis is the basis for the second, and both protocols make use of cluster-based data collecting techniques independently. In order to transport data from common nodes, threshold techniques are used. Cluster nodes are assigned energy resources using a random method in this protocol. It is possible to obtain a high network throughput, energy efficiency, and latency while maintaining a satisfactory packet delivery rate using the suggested method. Hierarchical ECHERP, on the other hand, does not perform as well as the suggested PD cluster head-based approach. The end-to-end delay data reveal that the suggested method performs far better than the ECHE routing protocol. [1]

Better network throughput can be achieved by implementing the authors' G-F-T-E-M protocol, which they developed. The multipath routing method was created by the author to meet the network's energy and performance goals. The proposed system was compared to current routing protocols such as AODV and GPSR by the author of this study.Data routing and load balancing were developed by the author in order to increase data lifespan and eliminate data queuing in a sensor node that is often used. Overall, the suggested method outperforms competing protocols in terms of overall performance and WMSN requirements such as high Quality of Service (QoS) and energy efficiency. [2]

For standard data gathering, this work proposes [3] a novel approach for ENEFC energy efficiency and load balancing. The results of the experiments show that ENEFC performance can extend the network's lifespan and balance node performance. The recommended ENEFC approach surpasses both HEED and ENEFCS in terms of energy savings and compensation.
The articles in this chapter are all about clusters. In the same way, the cluster head may interface directly with the base unit. The cluster members determine their presence and distance from the ground station during the collection and analysis phase by recognizing signals given by the base station at a defined power level. There are three steps: 1) choose the group's leader, 2) form the group, and 3) transmit data. The approach chooses a dispersed team leader with minimal management responsibilities throughout the team leader selection process. A group of nodes will be formed under the group heading when you establish a group.

Result Analysis:-

Sr.No	Simulation Parameters	Quantity / Name
1	Number of nodes	15 to 90 nodes
2	Packet Size	50 bytes
3	Reporting Rate	10 packets per sec
4	Topology	Uniform random

5	Routing Protocol	AODV
6	MAC	CSMA (802.11)
7	Energy	5J

Result Table:-

Parameters	**15 Nodes**	**30 Nodes**	**50 Nodes**	**60 Nodes**	**90 Nodes**
Packet Send	183	364	455	637	728
Packet Receive	106	251	165	142	106
PDR	57.92	68.95	36.26	22.29	14.56
PLR	42.08	31.05	63.74	77.71	85.44
Delay	1.89	0.39	1.28	1.66	1.26
Throughput	9.89	15.61	10.26	8.83	6.59
Packet Drop	77	113	290	495	622
Energy Consumption	0.421	0.60	0.53	0.53	0.52

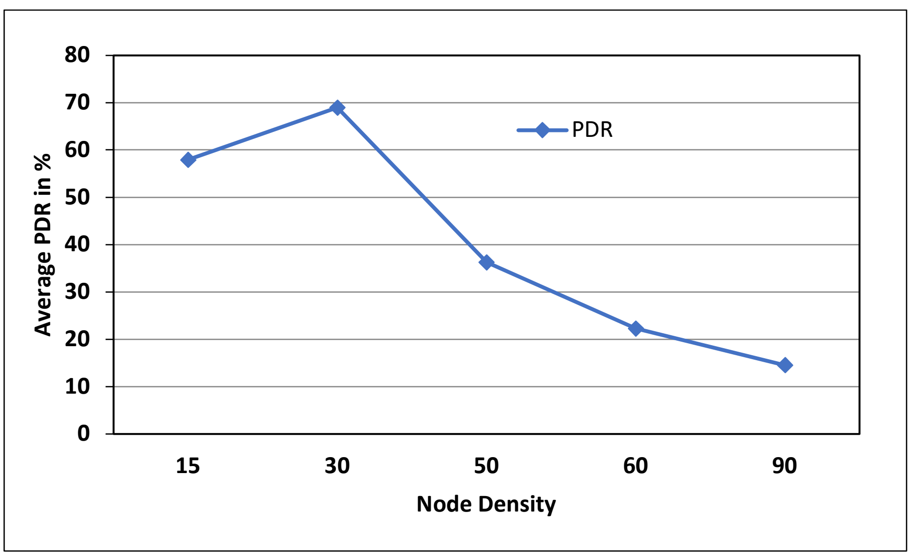

Figure 1 shows the average PDR in relation to node density.

Figure 1 shows the average PDR in relation to node density. Packet delivery ratio is abbreviated as PDR. It refers to the number of packets sent every second. Figure 1 depicts the node density in sensor networks, which ranges from 15 - 90 nodes. As a consequence, the network's PDR performance for 15 nodes is initially bad, but for 30 nodes, the average PDR throughout the networks improves by 12%. Because CSMA is developed for congestion avoidance and detection across networks, it is utilized as a MAC protocol for communication and helps to decrease network congestion. Due to traffic near the destination and network congestion, network performance for node density of 30 to 90 is dramatically reduced. As a result of this situation, the average PDR for 30 nodes is expected to be much higher than for 15,50 to 90 nodes.

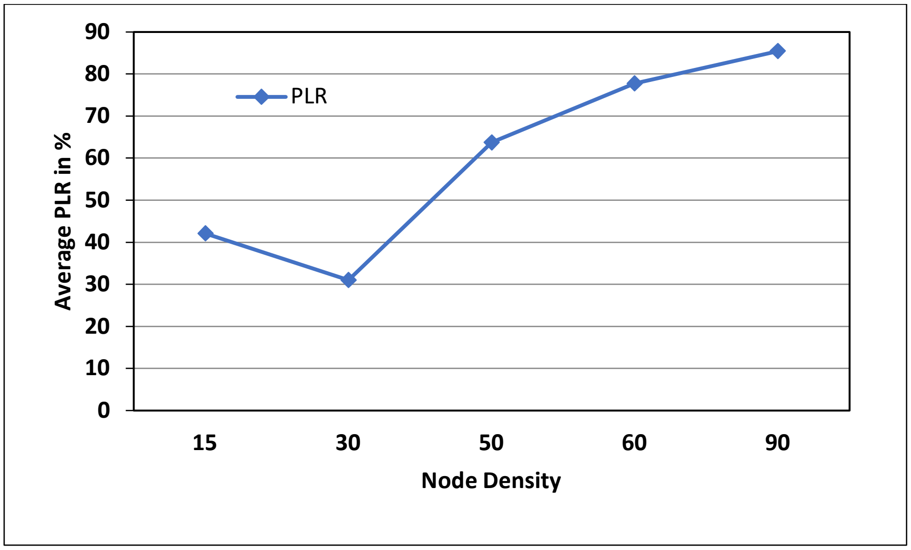

Figure 2 shows the average PLR in relation to node density.

The average PLR for node density is shown in Figure 2. PLR is an abbreviation for packet loss ratio. Most of the time, due to heavy traffic and congestion, the maximum number of packets may be lost across networks. As a consequence, the packet loss ratio would grow, and the number of sensor nodes deployed in the field would have an effect on network performance, making PLR a crucial measure in wireless sensor networks. PLR is initially low for node density, but it increases as node density increases from 15 to 30 nodes. Because of the congestion management provided by the CSMA MAC protocol across the network, the packet loss ratio lowers dramatically. Due to the tremendous traffic and congestion caused by the nodes, PLR rises as The node density increases from 30 - 90 nodes. In comparison to the other node density in the preceding picture, the PLR for 30 nodes is excellent. In wireless sensor networks, the CSMA protocol performs well for 30 nodes.

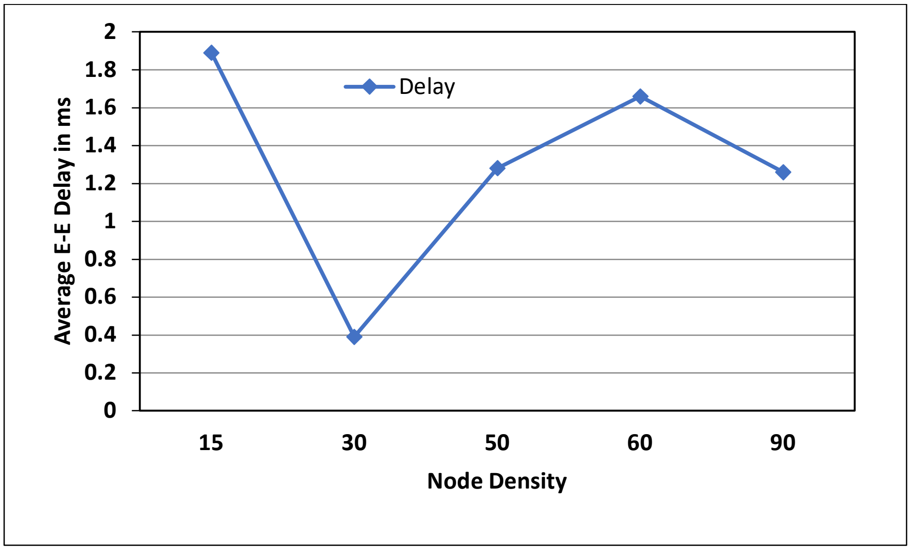

Figure 3 depicts the average E-E delay as a function of node density.

Figure 3 depicts the typical end-to-end latency in wireless sensor networks given node density. Delay, commonly known as latency, is an essential network characteristic. Delay is the amount of time it takes for packets to travel from one node to another. Delay is crucial in sensitive applications of wireless sensor networks because it promotes network dependability in data transfer. Because AODV is built for shorter route discovery between the source and destination, it delivers excellent results for 30 nodes when utilising CSMA MAC with AODV routing protocol. It produces extremely poor results for node density after adjusting node density from 30 to 90 nodes. As a result, the CSMA and AODV protocols function well in networks with 30 nodes.

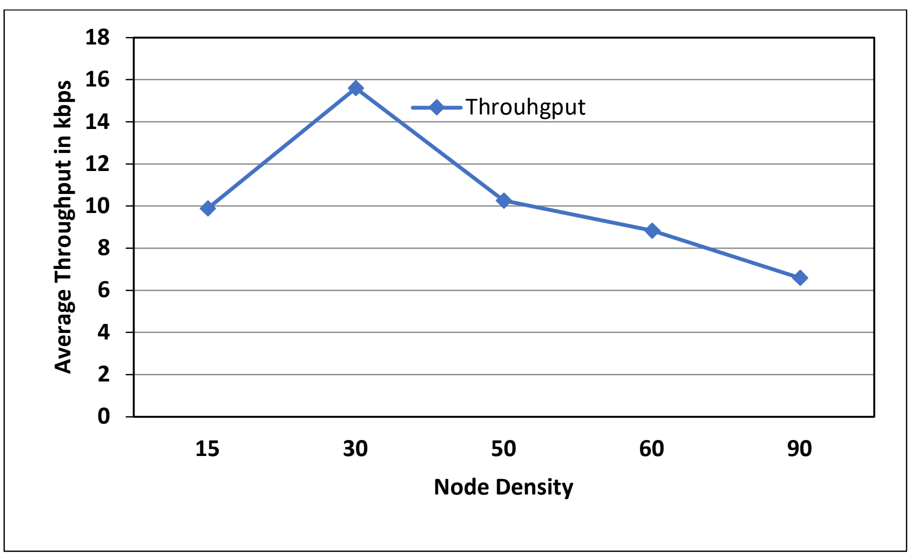

Figure 4 depicts the average throughput as a function of node density.

Figure 4 depicts the average throughput as a function of node density. In wireless sensor networks, throughput is entirely dependent on how the communication channel is used. Maximum network throughput improves network speed while also increasing packet delivery ratio and network dependability. The average throughput for 15 node density is quite low in the picture above However, as the number of nodes reaches 30, the network performance skyrockets. When compared to 15 nodes, the throughput rises by 32%. However, because to excessive traffic and collisions between nodes, the majority of packets will be dropped, and the average throughput would automatically fall. In comparison to other node densities, the CSMA and AODV protocols perform much better in terms of average throughput at 30 node densities.

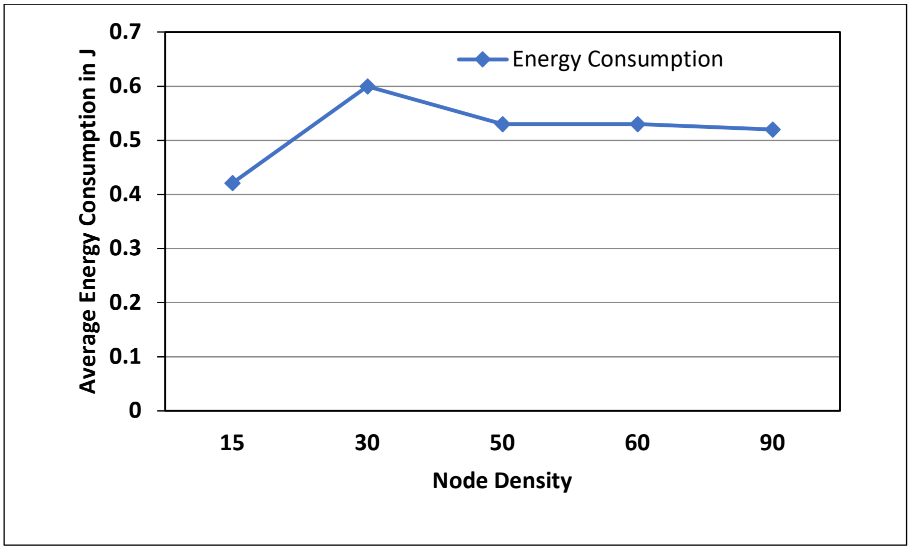

Figure 5 depicts the average energy consumption as a function of node density.

Figure 5 shows the average energy usage for node density. The use of energy is a critical parameter or problem for wireless sensor networks. In crucial applications, transmitting data or packets with the least amount of energy is a major difficulty in wireless communication systems. Congestion, traffic, and simultaneous packet transmission across a single communication channel are the primary causes of energy usage. The performance of the CSMA and AODV protocols is initially quite excellent at 15 node densities, as seen in the figure. When the number of nodes grows from 15 to 90, the node's energy consumption rises dramatically. The number of nodes in a network increases network congestion and collisions.

Conclusion:

The study examines the performance of the CSMA mac protocol and the AODV routing algorithm in wireless sensor networks with varying node densities. As the number of nodes in the network grows, so does the network's performance in terms of different WSN QoS. The performance of the network with 30 nodes for different kinds of wireless sensor network services is much better than with other node densities. According to the graphs, after 30 nodes, network congestion, collisions, and traffic grow, allowing the maximum number of packets to be discarded. Other metrics like as latency, throughput, energy, packet delivery ratio, and packet loss ratio also plummet. CSMA is a carrier sense multiple access routing system that is meant to regulate network congestion and minimise collisions, whereas AODV is an ad-hoc on demand routing protocol that is designed to determine the shortest route between sources and destinations. Both protocols perform better when there are 30 nodes in the network, and they get the best results for different wireless sensor network characteristics when there are 30 nodes. In the future, we will apply a variety of approaches to enhance and accomplish network parameters.

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