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Sectoring Method for Improving Various QoS Parameters of Wireless Sensor Networks to Improve Lifespan of the Network

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***Abstract*—** The wireless sensor network is set of distributed nodes, which are randomly deployed in sensor field to capture various parameters and send it to receiver station for further analysis and prediction. There are two types of protocols essential for communication. One is MAC protocol and another is routing protocol. Routing protocols are used for finding shortest path between sources to destination. MAC protocols are used for reliable data delivery from source to destination. The design of a reliable wireless sensor network (WSN) must handle the failure of single or many network components, still, because of the deployment of mechanisms to tolerate faults at various levels. the most objective of this paper is to review different existing algorithms proposed by different researchers and merge their work for further study. This paper studies different prototypes and proposed algorithms, and also the objectives of the papers. Also, the paper elaborates on the proposed algorithm within the particular paper together with their objectives. Proposed algorithm is very useful for to reduce heavy congestion over the networks and achieve various parameters of sensor networks.

Keywords—WSN, reliability Algorithms, the proposed method,protocols, QoS (Quality of services), sectors, congestion,collision.

I. INTRODUCTION

Wireless sensor networks are made of several small sensor nodes with limited power and processing capabilities. Individual sensor node lifetimes are difficult to predict, and also the network must be built autonomously because it's impossible to manually find a sensor network for all applications. Since the sensor network comprises a spread of nodes, heterogeneity must be addressed. the amount of sensor nodes within the network doesn't remain constant over time thanks to the installation of the latest sensor nodes or the removal of nodes thanks to their death. Some quality parameters have to be considered while designing a network. which incorporates reliability, delay, energy efficiency, etc.

The reliability of a system is one of the most important factors that require to be focused on while developing any system. Reliability is defined because of the ability to confirm successful packet delivery on both ends. There are various kinds of reliability Figure 1 shows the relation between them.

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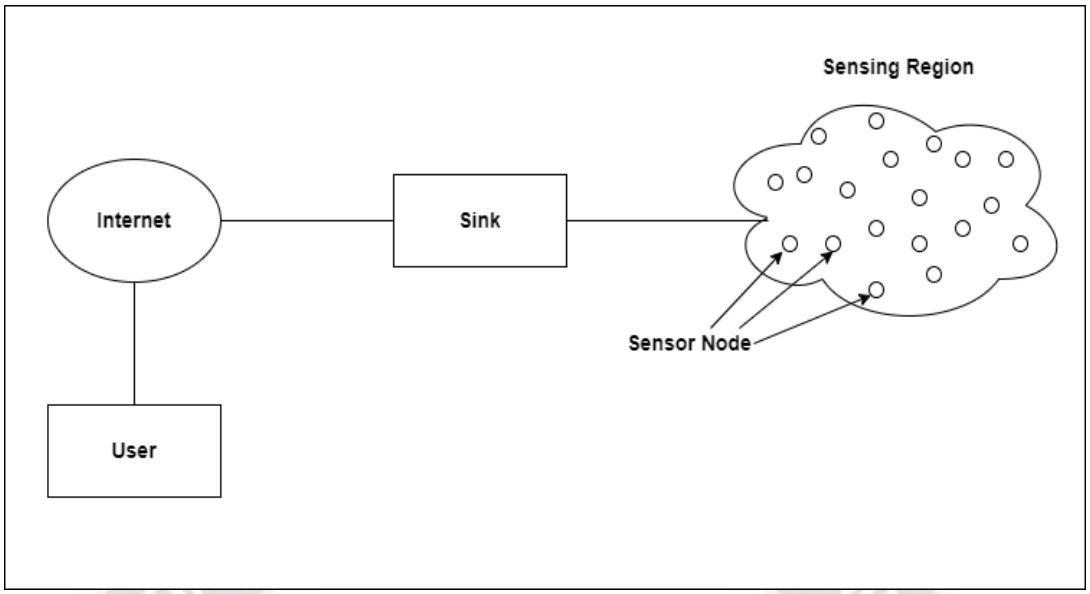

Figure 1. Structure of Wireless Sensor Networks

Structure of wireless sensor networks shown in figure 1. In structured wireless network, source nodes acts like transmitter nodes. This plays very important role in networks. Collection of information and capture the important data is the role of source nodes. Sink node is acts like received nodes, which is deployed for data dissemination or collection of the data from source node to transfer it to cloud for future analysis and predictions. In this context, this paper studies different proposed approaches to achieving reliable data transmission with the assistance of various protocols and algorithms. The aim is to produce a much better understanding of this emerging field. We've got provided an in-depth investigation of current proposals and different algorithms which aims to induce higher reliability while data transmission.

II. LITERATURE SURVEY

The authors present an energy-efficient and reliable routing algorithm supported Dempster–Shafer (DS) evidence theory (DS-EERA) by using the multi-attribute decision-making approach to enhance network lifetime, energy efficiency, and data transmission reliability. This paper proposes an energy-efficient and trustworthy routing algorithm supported by weighted DS evidence theory by applying the information fusion criteria of DS evidence theory to WSN routing decision-making. Three attribute indexes are established for every node within the network: idleness degree, transmission energy efficiency ratio, and energy density factor, and also the entropy weight method is employed to dynamically determine the load of every index, and therefore the BPA function is obtained by combining the above two.[1]

The use of WSNs particularly areas, like ecological, military, flora and fauna, commercial, medical, and urban, was investigated during this article through the examination of matching typical examples, both unique and well-known. This investigation revealed that the utilization of WSNs not only gives several advantages in specific fields when put next to straightforward relative means and procedures, but it also brings unique applications. Furthermore, the difficulties and solutions generated for diverse applications were identified and analyzed.[2]

The use of WSNs in specific sectors, like military, environmental, flora and fauna, health, industrial, and urban, was investigated during this article through the examination of related typical examples, both new and well-known. This investigation revealed that, as compared to plain relative means and procedures, the use of WSNs not only gives significant advantages in specific sectors but also brings unique applications. Furthermore, issues and solutions were discovered and explored for a range of applications.[3]

In this paper [4], Congestion of data occurs when a large number of network sensors form a large network of communication. The traffic of type many to one and one to many have characteristics of data transmission between many sink and source which leads in a bottleneck surrounding to sink in this situation. Congestion in wireless sensor network architecture occurs when quality of channel deteriorates and packet loss per-unit time rises, resulting in drop of packets at the buffer. As a result, numerous strategies and protocols are used to overcome the wireless sensor networks congestion problem. Congestion also can occur as a result of packet loss that occurs upon collision.

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As a result, due to the interaction of simultaneous data transmission through varied radio-links or an increase in the reporting rate, congestion in network becomes much more accountable in this case.

There are two types of congestion in wireless sensors networks - location based congestion and packet based congestion. Location based congestion is of three types first is sink congestion second is source congestion and third is forwarder congestion. There are two types of packet-based congestion: node-level congestion and link-level congestion.

In this paper [5], Congestion Detection and Avoidance is a mainline congestion control method that saves energy. Congestion Detection based on receiver, hop by hop open loop backflow, and multisource-regulation closed loop are the three primary components of congestion detection and avoidanve. congestion detection and avoidance aims to identify congestion using receiver-based detection of congestion by monitoring occupancy of buffer and load of current channel. Congestion is inferred when occupancy of buffer or load of channel exceeds a certain threshold level. When a node detects congestion, it sends out a backpressure-message. Messages of backpressure are sent across to the source. A node can alter its rate and select whether or not to continue broadcasting the backpressure message after receiving it, depending on its local network status. All sources linked with a certain data event will be regulated by closed - loop system multisource regulation.

In this paper [6], Congestion control using priority based congestion control – PCCP, Congestion is detected by Priority based Congestion Control using the Degree of congestion, which is calculated as the proportion of time of packet arrival to time of packet service. The intensity of congestion at the sensor node which is congested is defined by the congestion degree. It indicates congestion through internal notification of congestion, which saves energy by avoiding unnecessary packets for notification of congestion. Priority based congestion control gives each node a priority depending on the contribution it makes. It allows for priority adjustments rate based on priority-rate-adjustment (PRA). This ensures heavily skewed fairness by distributing greater bandwidth to the nodes that contribute the most.

III. REVIEW TABLE

Table 1: Study of various existing protocols in wireless sensor networks

Paper No.	Parameters Achieved	Algorithm Proposed
7.	Deal with the matter of Energy Consumption to maximize network lifetime.	Energy Candidate Set-opportunistic Routing(ECS-OR)
8.	Ensures the redundancy of knowledge links, and reduces the number of information transmission and energy consumption.	Improved Flooding Routing Protocol
9.	Looks for the shortest path leading to less energy consumption and an improved life cycle of the network.	Algorithm for the shortest minimal path with multistate nodes
10.	The proposed protocol has established an accurate benchmark for consuming transmission energy, maintaining active clusters, and efficiently utilising network resources such as bandwidth, among other things.	Energy-Efficient Reliable Routing Algorithm for WSN (EERA)
11.	to detect malicious moreover as	Secure Low Energy Clustering (SecLEC)

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	malfunctioning nodes within the network and excludes them from network operation to ensure reliable data delivery.	
12.	Use of concurrent woven multi-path technology to boost the transmission efficiency of information packets.	Multipath reliable transmission protocol(RCB-MRT)
13.	To maximize the network lifetime by balancing energy consumption across multiple nodes and increase the reliability of knowledge delivery through utilizing a lightweight XOR-based FEC (Forward Error Correction) technique to produce data redundancy.	Energy-efficient and QoS based multi-path routing protocol (EQSR)

IV. PROPOSED SYSTEM

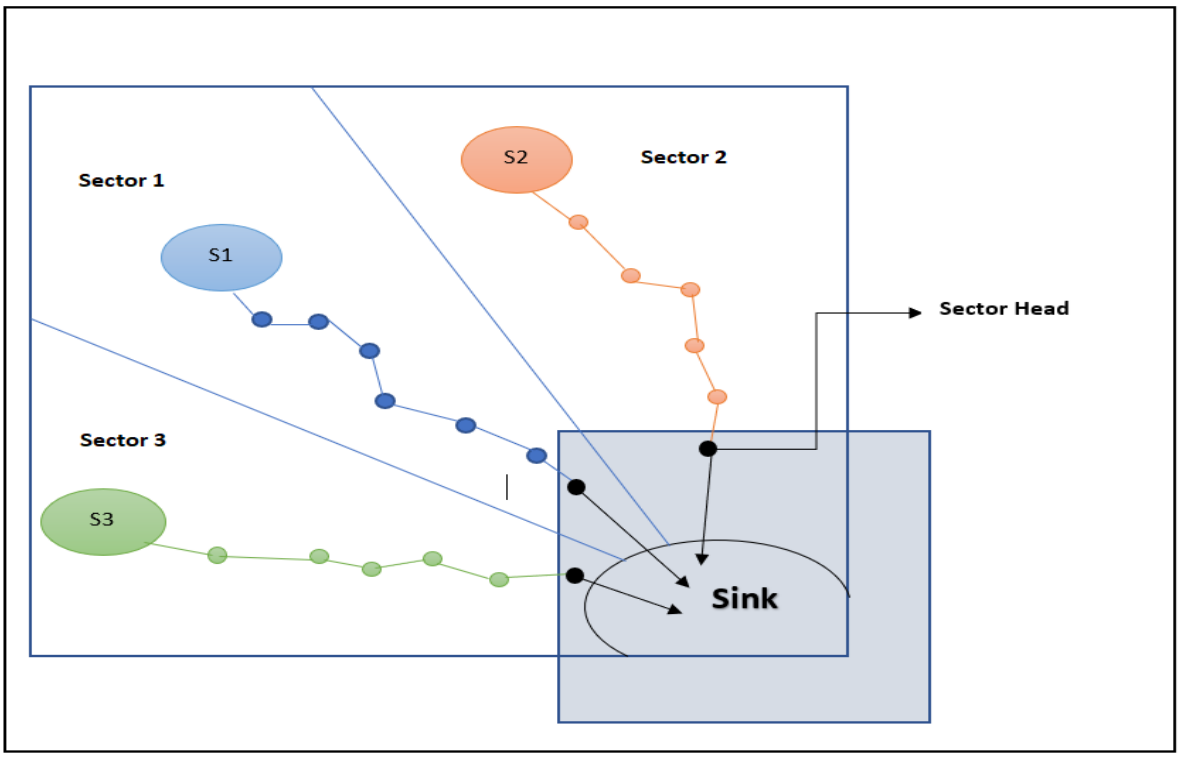

Figure 2. Architecture of sectoring technique in sensor networks

Figure 2 shows architecture of sectoring technique in sensor networks. In wireless sensor networks , so many techinques are proposed by various authors like clustering, sleep active meachnism, bandwidth control, congestion control algorithms etc. In above figure, sectoring technique shows for congestion as well as traffic contol in wirless sensor networks.

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Which helps to reduce traffic and achieve various QoS parameters of wireless sensor networks. In sectoring technique, sink nearest nodes ie level 1 from sink nodes acts like sector heads , which helps to send packets to destination nodes. Because level 1 nodes are within communication range of destination node. Remaining nodes which are randomly deployed in sensor network, these nodes can divide into equal no of nodes and divide it into different sectors. Source nodes only transmit data to destination node through sector heads. This techique helps to reduce interference between the two sectors nodes. So congestion and traffic will be reduce in sensor networks.

V. ALGORITHM

Step 1: Initialize scenario
Step 2: Logically divide sensor network into 'N' number of sectors.
Step 3: The node which are one hop away from sink node, will be assigned as the sector head.
Step 4: Divide common nodes into N number of sectors.
Step 5: Wherever an event occurs, only the current sector is activated; all other sector nodes will be in idle mode.
Step 6: Nodes in the event occurred sector only transfer packet data to their corresponding Sector Heads within the event sector.
Step 7: Packet will be transferred to sink through sector heads
Step 8: Stop

VI. RESULT ANALYSIS

In this research, numbers of sensor nodes are deployed in sensor field for analysis. One node assigned as sink node and remaining nodes behave likes source nodes. AODV – ad hoc on demand distance vector routing protocol used for finding shortest path and CSMA protocol used for communication in sensor network. Packet size is varied from 50 bytes to 150 bytes and rate of data transmission is 10 packets per seconds. Node density is 30 nodes.
[1] Delay for node density

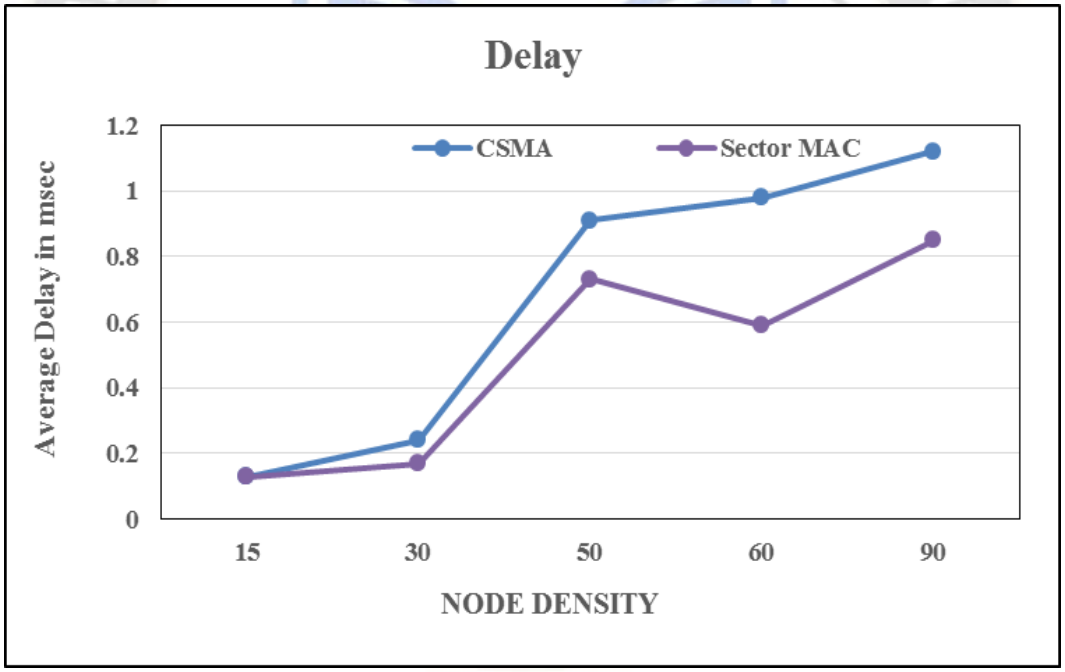

Figure 3. Delay for node density

Figure 3 shows average Delay for node density. Total time required for packet transmission from sender to destination is a delay. It is very important parameter of wireless sensor networks. In sensitive application it plays important role to increase reliability. Above graphs shows that, performance of the sector MAC is drastically better as compare to existing CSMA protocol. Sector MAC is designed for reliable data delivery from source to destination without congestion as well as congestion free. Initially average delays for both protocols are same but when it increase node density from 15 to 90 nodes. It gives 10 to 35% better result as compare to CSMA Protocol.

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[2] Throughput for Node Density

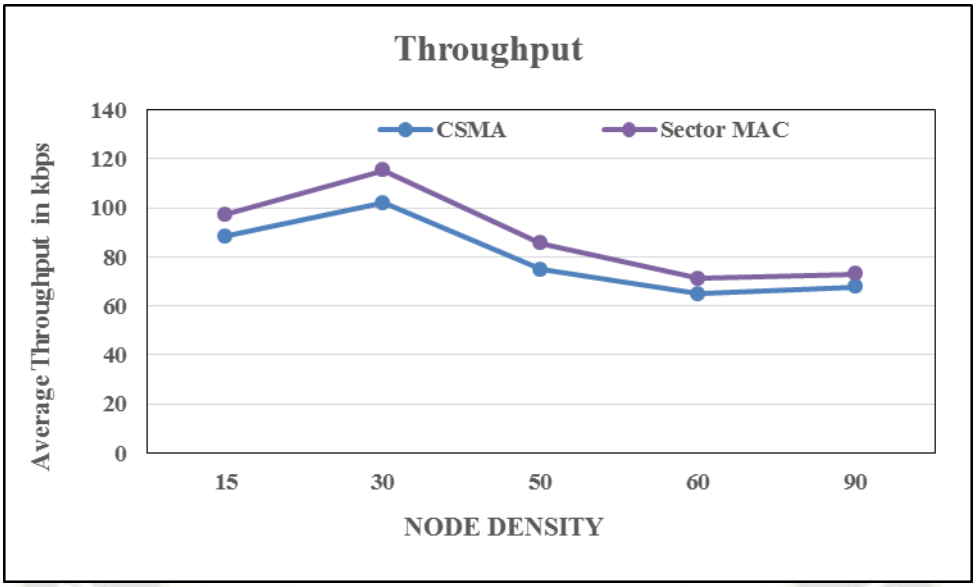

Figure 4. Throughput for Node Density

Average throughput for Node density shown in figure 4. Throughout is depending upon the utilization of communication channel. Full utilization of communication channel gives better result for throughput. In above figure, average throughput for sector MAC for 15 node density shows 5% better result as compare to CSMA. It gives 25% better result for sector MAC for throughput as compare to CSMA. Sector MAC helps to reduce congestion and interference between the nodes, so average throughput for secotr MAC for various node density is good.

[3] PDR for Node Density

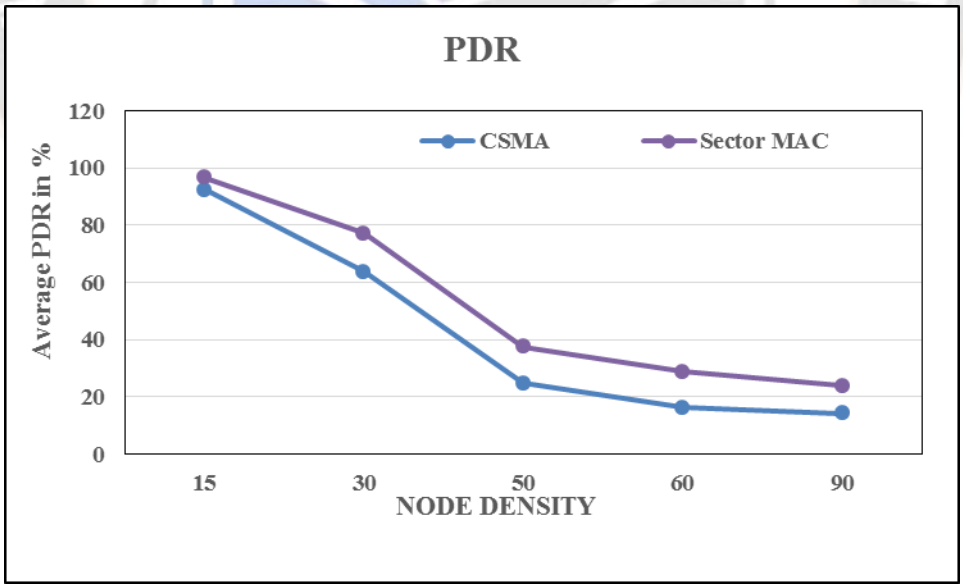

Figure 5. PDR for Node Density

Average PDR for Node density shown in figure 5. Maximum number of packets transmission from source to destination increases the average PDR in the network. Above figure shows drastically better result for average PDR for sector MAC as compare to CSMA Protocol. Congestion free data delivery to the sink node, helps to increase packet delivery ratio in wireless sensor networks. Initially average PDR for 15 nodes for both protocols is good but after 15 nodes, it is decreases as node density various from 15 to 90 nodes. But performance of sector MAC for various node densities is

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drastically good as compare to CSMA. It gives 20 to 25% better result for different node density.

VII. CONCLUSION

In this paper, we focus mainly on the newest research work done in the field of reliable data transmissions and studied different protocols used or the algorithms proposed by various researchers. This may help the new researchers to urge knowledge of existing algorithms. As per the survey, only a few researchers have explored the hybrid prototypes which include multiple algorithms to boost data transmission redundancy and help to realize reliability. In this paper we have achieved various parameters of wireless sensor networks like Packet delivery ratio, delay and throughput, which performance very good for various node densities (15 to 90 nodes) in the network. Sector MAC gives 30 to 35% better result for different node densities, 15 to 25% better result for average throughput and 20 to 25% result for Average PDR as compare to CSMA Protocol. In future work, we will innovate new novel hybrid protocol for congestion control.

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