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QoS optimization in wireless sensor networks using multi-hop multi clustering algorithm in a heterogeneous network

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ABSTRACT

The method provided did improve the energy consumed for each simulation round is reduced and also the energy left is increased. The major breakthrough is that by implementing the proposed program the delay for each simulation round is not only greatly reduced but also uniformed, it is also clearly visible that the throughput in (bit per second) is drastically increased. When compared with traditional methods. The existing paper provides an interesting method using Lagrangian Relaxation(LR) to control the adaptive switching of the hop- by-hop QoS routing. The method utilized timely information collection to validate and respect the QoS requirements of all the nodes making the whole network obeying the QoS parameter. This is done by utilizing the modified Markov Chain model for prediction. Multi-hop multi-cluster QoS algorithm using Matlab proposed and implemented a new optimized method our QoS based multi-path routing using 'k' neighbours based node switching in corresponding hops. The node will be switched if and only if the QoS threshold and distance threshold value is satisfied. The switching of nodes improved drastically on Throughput. The proposed algorithm has little high drop ratio as compared to the existing algorithm which is partially due to the multi-path approach in packet splitting. If all the portions of split packet are not received, the overall packet is dropped. This introduced a marginally higher packet drop ratio which can be managed later on and provides the scope for further improvement.

Keywords— *Lr (Lagrangian relaxation), Markov chain, Qos (Quality of service), WSN (Wireless sensor networks), Energy left, Throughput, Packet drop, Routing, Hop, Cluster, Nodes, Threshold*

1. INTRODUCTION TO WIRELESS SENSOR NETWORKS

Generally, a helpful format of a Wireless Sensor Network has changed into a central region of investigating. A Sensor is a contraption that reacts and perceives a kind of duty from both the physical or common conditions, for example, weight, warm, light, and so on. The yield of the sensor is commonly an electrical pennant that is transmitted to a controller for advance dealing with. In remote sensor-on-screen character systems; sensors test their condition and advance their data to on-screen character center points. On-screen characters collect sensor data and play out express attempts because of different occasions. [5]

1.1 WIRELESS SENSOR NETWORKS (WSNS)

WSN is a remote system that incorporates base stations and measures of center points (remote sensors). These structures are utilized to screen physical or natural conditions like sound, weight, temperature and co-operatively go data through the structure to a basic area[8][9] as appeared in the figure.

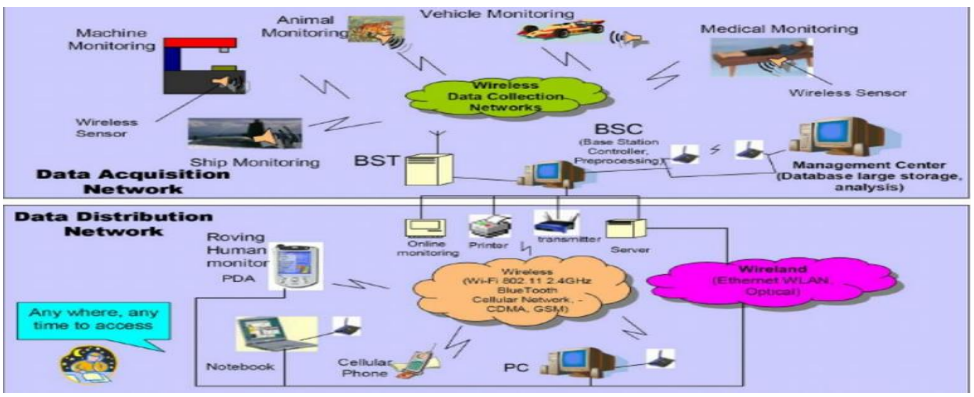

Fig. 1: WSN'S

1.2 TYPES OF WSNS NETWORK TOPOLOGIES

For radio correspondence forms, the structure of a WSN merges different topologies [10] [11] like the ones given underneath.

a) **Star Topologies:** Star topology is a correspondence topology, where every center point interfaces unequivocally to a passage. [9] A solitary passage can send or get a message to various remote center points. In star topologies, the centers are not allowed to send messages to each other. This licenses low-inertness trades between the remote center point and the entry (base station).

b) **Tree Topologies:** Tree topology is in like way called as a fell star topology. In tree topologies, every center interfaces with a center point that is put higher in the tree, and after that to the segment. The standard great situation of the tree topology is that the improvement of a system can be feasibly conceivable, in addition, other than botch disclosure winds up being fundamental. The weight with this system is that it depends earnestly on the vehicle associate; in the event that it breaks, all the structure will overlap.

c) **Mesh Topologies:** The Mesh topologies permit the transmission of data starting with one center point then onto the following, which is inside its radio transmission run. In the event that a center needs to have an effect on another center, which is out of radio correspondence go, it needs a focal point of the road center point to propel the message to the pined for center. The favored perspective with this work topology joins direct division and disclosure of deficiencies in the structure. The avoidance is that the structure is gigantic and requires enormous theory.

d) **Hybrid Topologies:** Some structure topologies utilized for remote sensor organizes applications utilize a crossover mix of the past topologies, to make more noteworthy systems including hundreds, even an extensive number of center points. A cream structure incorporates a mix of star and work topologies. [10] This blend comes to fruition on a star-work arrange that endeavors to manhandle the low power and straightforwardness of the star topology, and the extended territory and self-recuperating nature of a work sort out topology. For this condition, center points serve to perceive, develop the degree of the system and offer acclimation to non-essential frustration. Since center points can converse with different center points, if a center comes up short or if a radio affiliation goes down (for instance because of checks or nonappearance of battery), the system will reconfigure itself around the rest of the center points.

2. PROPOSED METHODOLOGY

The existing paper [1] provides an interesting method using Lagrangian Relaxation (LR) to control the adaptive switching of hop-by-hop QoS routing. The provided method did improve the end-to-end delay, packet drop ratio and energy consumption when compared with traditional methods. The method utilized timely information collection to validate and respect the QoS requirements of all the nodes making the whole network obeying the QoS parameter. This is done by utilizing the modified Markov Chain model for prediction. Although the system performs really well, it has major loopholes that can be seen in the light of the heterogeneous network. We have seen that while a tradition multi-hop routing protocol when optimized, have limitations when the underlying protocol is changed it can affect the optimization adversely. To solve the problem we propose the use of multi-hop multi-cluster algorithm. In this algorithm, the heterogeneous nodes will form a cluster and in every round the clustering is re-performed. With re-performing the clustering, we will keep a track of all nodes with barrier energy. The clustering is based on barrier energies. So, we will have 4-5 barrier energy levels. Each node will be assigned in one of the cluster based on its energy value. Now, with barrier energy-based clustering in place, the QoS optimization is done considering neighboring nodes as well, so if a node has lower energy than its neighboring node and the distance between the nodes is less than the threshold, the low energy node will be skipped. This will keep the network less traffic intense and will preserve more energy.

3. PROPOSED ALGORITHM

The algorithm for the proposed work is as follow:

1. The network is initialized with ‘n’ nodes. The network will be homogeneous initially, i.e. all the nodes will have the same energy.
2. For, the round, the source and sink are selected randomly.
3. The path between them is computed using a multi-path routing protocol.
4. The nodes in the paths and their ‘k’ neighboring nodes are then clustered in one of the 5 levels based on their energies.
5. Then the nodes chosen to be in the paths are replaced with one of their neighboring nodes if their energy level is in lesser barrier than their neighbor. This switching is performed only if the distance between the next-hop and the replacing node is less than a threshold, ‘txh’ and QoS threshold ‘qth’.
6 Finally, the routing is performed and the metrics are computed.
7. The experiment will run for 100 rounds performing the steps mentioned in 2-6 for each round.
8. Finally, the results are stored for comparison.

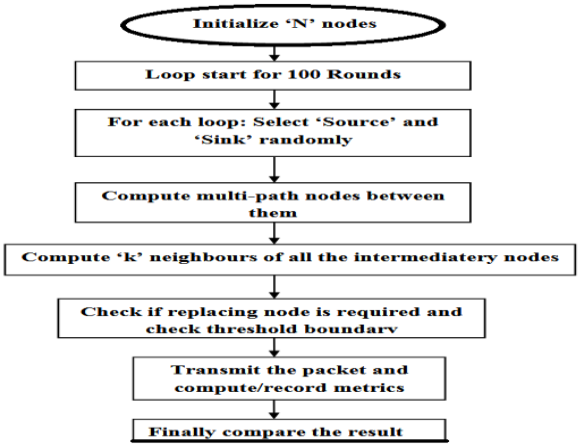

Fig. 2: Block Diagram of Proposed System

4. EXPERIMENTAL RESULTS AND PERFORMANCE ANALYSIS

4.1 VISUAL REPRESENTATION OF IMPLEMENTED ALGORITHM

This section discusses the results performed in the experiment as follow: Fig.3, Fig.4, Fig.5, Fig.6 and Fig. 7.
The below fig. 3 shows the multi constraint QoS routing in the existing paper.

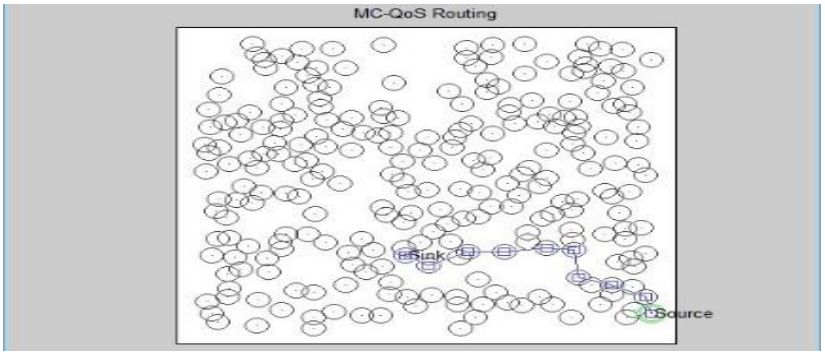

Fig. 3: The Old Method of Routing proposed in [1]

The below figure 4 shows the Modified multi constraint QoS routing Protocol using Multi-Path Multi-Cluster Routing in the proposed paper.

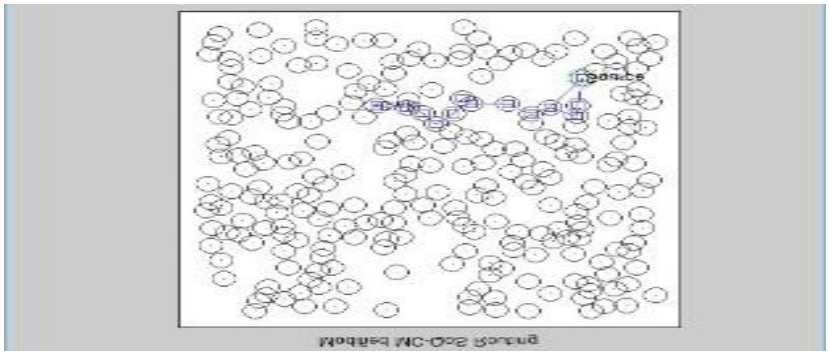

Fig 4: The new proposed method of Routing Protocol using Multi-Path Multi-Cluster Routing.

5. RESULTS AND ANALYSIS

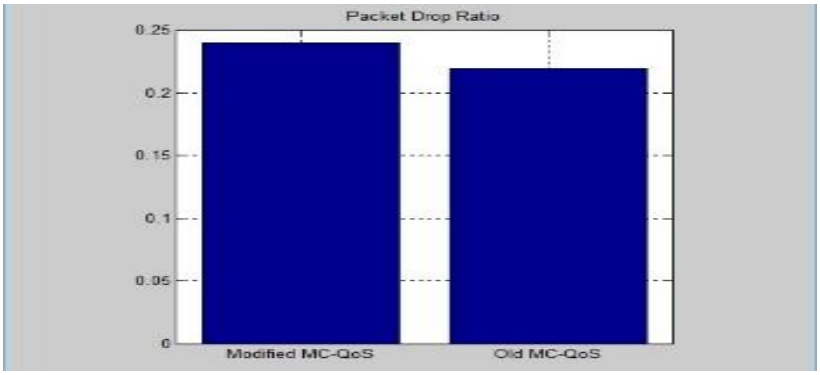

Fig 5: Packet Drop Ratio Comparison in the old method and new method

As seen in Figure 5, the packet drop ratio in our technique has deteriorated a bit in comparison to the existing technique. We will tackle this in our future scope. Fig 6 and 7 show the result of throughput and energy left. The result shows that the performance of the proposed work is better than previous work.

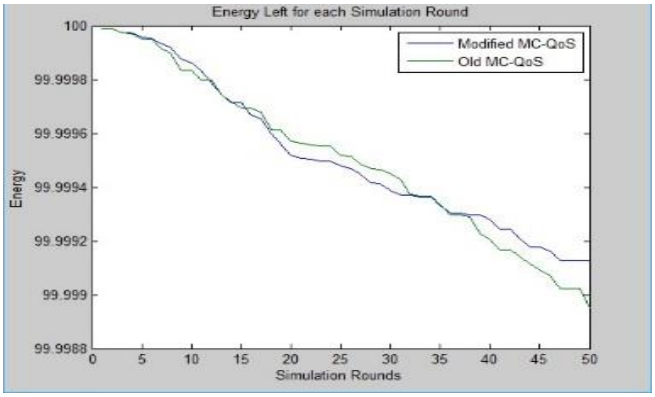

Fig. 6: Comparison of Energy Left using for Old and New Method

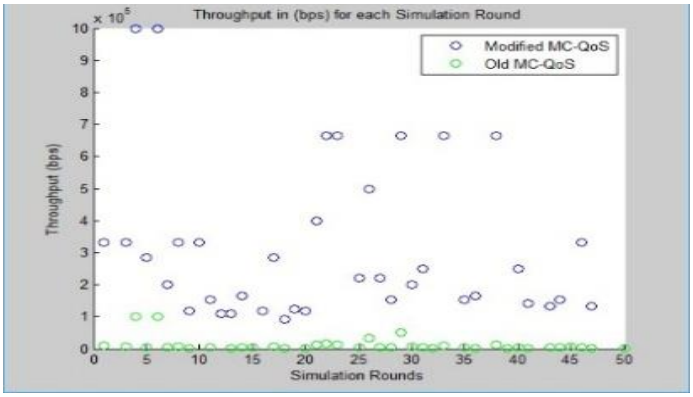

Fig. 7: Comparison of throughput in (bps) for Old and New method

6. CONCLUSION

In this paper, we have proposed and implemented a new optimized method our QoS based multipath routing using 'k' neighbours based node switching in corresponding hops. The node will be switched if and only if the QoS threshold and distance threshold value is satisfied. The switching of nodes improved drastically on Throughput.

The challenges in wireless sensor network routing with the consideration of Quality of Service (QoS) was effective managed and efficiently achieved. We have used the most reliable tool to implement the proposed with the help of existing work and both works have been compared effectively to achieve the desired results. The proposed work was based on multi-hop multi-cluster by implementing cluster-based neighbourhood routing in Quality of Service (QoS) optimized network.

The proposed program performs the various experiments and effectively generated the various results for effective comparison of the proposed work, we can see that by introducing the cluster-based neighbourhood routing in Quality of Service(QoS) optimized network the energy consumed for each simulation round is reduced and also the energy left is increased. The major breakthrough is that by implementing the proposed program the throughput in (bit per second) is drastically increased.

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