INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume3, Issue5)

Available online at www.ijariit.com

Mid-Point Algorithm Based Sink Movement to Improve Lifetime of the Wireless Sensor Networks

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Abstract: ***The wireless sensor networks with the mobile sink are more effective in providing better network performance as compared to the ones with the static sinks. This paper proposes a scheme cluster based WSN with the tour planning of the mobile sink. Since the deployment of the nodes in the WSN is purely random, this leads to some nodes in the network not connected to any cluster (when the clustering is done). The proposed scheme takes into consideration cluster heads and unconnected nodes to plan the trajectory of the sinking movement. The scheme was implemented in NS2.35 and compared with the existing approach based on the remaining energy, routing overhead and packet delivery ratio. The scheme has outperformed the existing scheme.***

Keywords: WSN, Clustering, Mobile Sink, Overhead, Packet Delivery Ratio.

I. INTRODUCTION

Energy proficiency is the maximum imperative subject for wireless sensor networks (WSN) as sensor nodes have inadequate batteries. Substituting the batteries of sensor nodes is expected to need significant work; consequently, WSNs have to be capable to function without human interference for a sufficiently extensive time. In WSNs with stationary sinks, the nodes near to the sinks are more expected to exhaust their battery provisions beforehand other nodes due to the joint of multi-hop paths and concentration of information traffic in the direction of the sinks. This difficulty is mentioned as the hotspot problem [6], [7]. Node expiries would lead to disorders in the topology and lessening of sensing coverage. Furthermore, sinks could turn out to be inaccessible and sensor information produced through the network would no longer be attained. Consequently, routing procedures intended for immovable sinks have to integrate load matching in order to attain the consistency of energy depletion through the network. The practice of moveable sinks is planned and is discovered as a probable answer to this difficulty [8]–[12]. Another thing to be focused upon is the tour planning of the sink node. The sink node must move in a way that communication with the cluster heads becomes effective to improve the performance of the network. This paper analyzes various sink movement related approaches in section 2. Furthermore, Section 3 explains the motivation to work on the mobile sink tour planning and section 4 explains the proposed scheme with the results explained in section 5.

II. LITERATURE SURVEY

This paper [1] offers an energy-proficient routing method centered on the cluster-based technique for the moveable sink in WSNs with hindrances. Conferring to the cluster-based technique, the nodes designated as cluster heads gather information from their cluster members and handover the information gathered to the moveable sink. In this paper, the moveable sink begins the data-congregation route intermittently from the starting position, then straight gathers information from these cluster heads in a single-hop communication, and lastly, returns to the starting position. Nonetheless, owing to the difficulty of the scheduling issue in WSNs with hindrances, the orthodox procedures are tough to resolve. To cure this matter, the authors suggest an effective scheduling method centered on spanning diagrams in this paper. Centered on the spanning diagram, they present an experimental tour-formation

procedure for the moveable sink to discover the obstacle-escaping direct route. Simulation consequences confirm the efficiency of their technique.

To evade uneven energy depletion, this paper [2] provides a novel technique to gather information by the moveable sink. The appropriate information gathering path is nominated conferring to the sinking velocity and buffer size of the sensors. The sensors merely wake up once the sink comes near them. When few sensors notice a disaster, the sink catches the note rapidly and travels to the spot to lessen message relay in the network. The outcome of simulation by OPNET displays that this procedure can decrease communication information in the network and lengthen the network lifespan.

The clustering procedures for WSNs with a stationary sink often suffers from irregular energy depletion issues, where cluster heads (CHs) further away from sink ingest extra energy in a single hop communiqué, with the CHS transmitting its information straight to the sink. To resolve such issues, the authors in [3] suggest a Distributed Energy-efficient Clustering Algorithm for moving-sink centered WSNs, where the sink travels about the target zone with a static route and velocity. The suggested clustering procedure binds individual sensor node with a CH by means of single or multi-hop communiqué, where a CH conveys its information packet to the sink once distance among them is least. Consequently, the precise movement of the sink around the network aids in matching the energy depletion of the sensor networks. The investigational outcomes prove the competence of their suggested procedure over the present state-of-the-art procedures in terms of dissimilar metrics like network lifespan, energy depletion, etc.

In this paper [4], the authors offer a novel routing procedure centered on the optimum quantity of hops to divide the route from the source to the sink. The procedure is established on energy depletion controlled routing technique. The exact exemplary usages mixed-integer programming (MIP), centered on the Lagrangian relaxation (LR) technique, to describe serious factors that govern the adaptive hop-by-hop switching. LINGO is used to examine the performance trade-offs amid energy competence and quality of service (QoS). Simulation outcomes discovered that their procedure expressively expands the lifespan by 46.91, 73.00, and 80.00% as linked to the renowned node density control, upper-bound, and WSN optimization of network lifespan procedures, correspondingly.

This paper [5] proposes a multipath topographical routing approach with the on-demand moveable sink. The approach includes three stages to recognize sink's on-demand movement that does promise lowest energy depletion and, consequently, extend network lifespan. At the route selection stage, the enhanced Tabu search procedure is employed for examining the universally optimum route set, which is stretched to an extensive network. The method also improves a multi-objective optimization structure and uses the health table of linkage model joined with the standard of buckets influence in economics for the trade-off amid the energy depletion and the performance inclinations of diverse uses for example dependability and real-time personality in concern. They suggest a detailed proof that the suggested new plan has a greater energy competence, and its network lifespan is about four times as those in a stationary sensor network with the immovable sink. The consequences they gained in wide simulations outdo the standard methods such as the DD procedure.

III. MOTIVATION

The existing scheme [3] offers the idea of the moveable sink, which would travel uninterruptedly about the network at a static velocity. Entire the cluster heads will subsequently keep a trajectory of the present movement of the sink node and will forward the information to the moveable sink when distance among them is least. Still, it can be claimed here that if the sink node retains its motion uninterruptedly about the network then each cluster head would acquire not as much of time to connect with it appropriately.

IV. PROPOSED WORK

The sink node will virtually divide the whole network into four zones. Initially, the advanced nodes having high energy will be selected as cluster heads from each zone. The cluster heads will send advertisement message to the all the nodes in the communication range to form a cluster.

Once the clustering phase is over, all the cluster heads will broadcast a message to the sink node, which would include the cluster head ID, cluster member IDs, and their locations. Then, for each zone, the sink node will find the location to move to collect the data. The location will be defined by a virtual node whose x and y coordinates will be the mid-point of the cluster heads and unconnected nodes. At each point, the sink node will stay for a predefined period of time so that data transmission between the cluster heads and sink node becomes more effective.

V. RESULTS

The proposed work aimed at improving the data collection procedure using the mobile sink node. The performance of the network was analyzed based on remaining energy, packet delivery ratio and routing overhead.

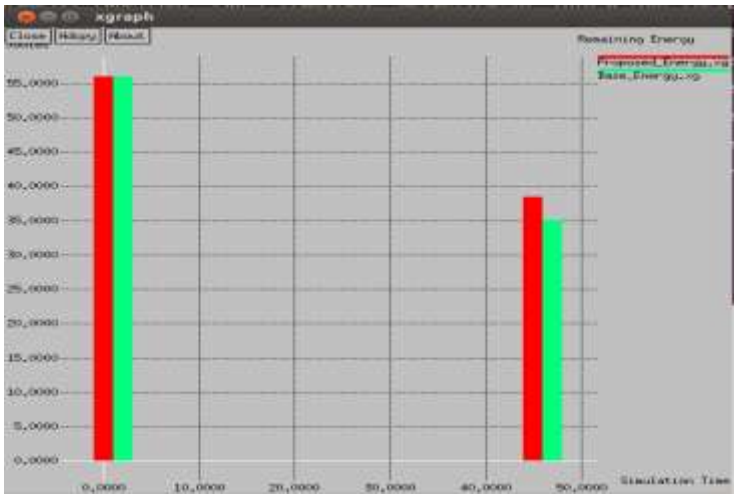

Fig: Remaining Energy Comparison

The above graph shows the remaining energy values obtained for both the schemes. While the value of remaining energy for the proposed scheme was at approx. 38 Joules, the same parameter showed the value of 35 Joules. Thus, it shows that proposed scheme provides better network lifetime.

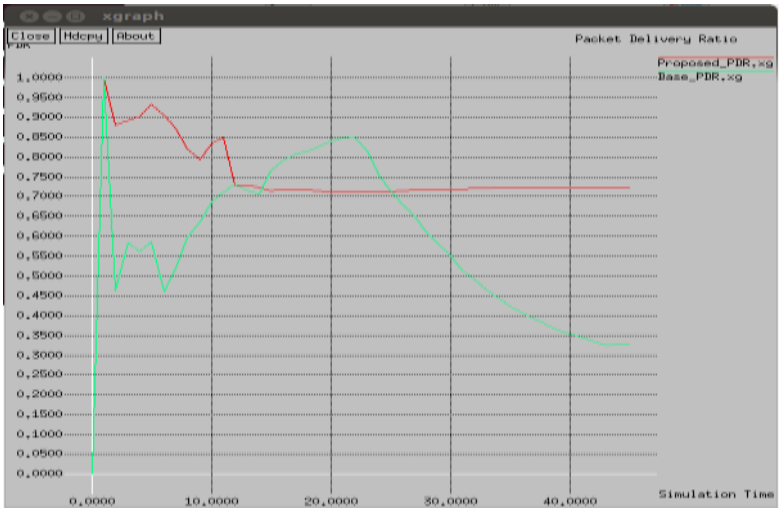

Fig: PDR Comparison

The above graph shows the comparison of the packet delivery ratio for both the schemes. It is defined as the ratio of a number of packets received to the number of packets sent in the network. It reflects the percent of the packets successfully delivered in the network. The parameter showed higher values for the proposed scheme as compared to the existing scheme. The value for the proposed scheme was at 0.72 or 72 percent and for existing scheme, it was at 0.33 or 33 percent.

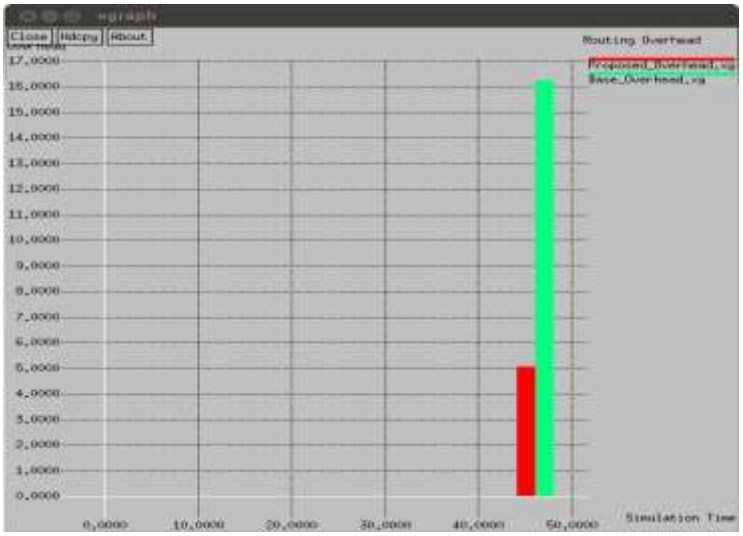

Fig: Routing Overhead Comparison

It reflects how many numbers of control messages are required to be sent in the network so that data messages can be received. This parameter should be less for the better performance of the network. For the proposed scheme, the routing overhead was approx. 5 while for the existing scheme it was 16. Therefore, it reflects that network has performed better with the proposed scheme.

CONCLUSION AND FUTURE SCOPE

The performance of the network was analyzed on the basis of remaining energy, packet delivery ratio and routing overhead. These parameters showed an improvement over the existing scheme. When the data collection was performed with the mobile sink moving within the network, it reduces the communication distance between the cluster head and the sink node. Therefore, the shortening of the communication distance leads to increase in the values for the remaining energy and the packet delivery ratio. Secondly, the mobile sink stays at a particular location, which reduces link breakage and overhead.

In future, this work can be extended to include various security measures against hello flood attacks (the attack to which the clustered wireless sensor network is easily prone to).

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