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A New Sink Placement Strategy for WSN

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Abstract:

In this paper we have urbanized a fresh sink placement policy in Wireless Sensor Networks WSNs. We studied the problems with previous sink placement strategies and then proposed a new strategy that reduces both energy consumption as well as routing overheads etc.

Keywords: **Wireless Sensor Networks, Multiple Sinks, Energy.**

1. INTRODUCTION

1.1 Wireless Sensor Networks

A Wireless Sensor Network is a system that is combination of numerous tiny sensor nodes which are thickly positioned in ad-hoc fashion in an unattended situation and skilled of collecting, analyzing, computing plus transmitting real time information to a middle processor node for advance analysis and statement generation. There are a number of different routing, data distributions and power organization protocols have been planned and introduced for wireless sensor networks (WSNs), needy on both the architecture of wireless sensor network (WSN) and the applications that WSN is projected to support. These networks offer advantages over conventional sensing devices as they are mistake tolerant and robust as well as offer low cost network deployment. [1], [5].

The ordinary fundamentals in the WSN are:

*Sensor Node or Source Node***:** is liable for physical sensing of ecological phenomenon and reporting dimensions throughout wireless statement to the sink.

- *A Sink or Base Station*: is a node that edges the feeler field and the networks by the internet. In extra words, it acts as a doorway among the WSN and the external world.
- *Task Manager Node:* shows data for client scrutiny and facilitates the network manager to doubt for feeler nodes.

1.2 Characteristics of WSN

Wireless feeler systems have characterized on the source of requirement plus plotting area. Feeler networks have the subsequent exclusive uniqueness and restraints.

A) Limited Resources: Feeler nodes have several constraints which affects the overall performance of the network such as it consists very limited memory, bandwidth and computation ability.

B) Limited Battery-Powered: Feeler nodes are motorized by battery and organized in a cruel environment, where existence time of a feeler node is fully dependent on the existence time of battery and it is extremely hard to alter or renew the batteries in some application scenario

*C) Dense Deployment***:** Feeler nodes are habitually thickly positioned where each node has many neighbors in the network. The connection between any two individual sensor nodes defines the network connectivity in which node can communicate directly when using a sufficiently high transmission power.

D) Self-Configurable: Feeler nodes are arbitrarily positioned in the network along with automatically constructs them into a communication system.

E) Medium of Transmission: Wireless medium is used to associate nodes which are used for transmission and communications aim. Some of the relations can be shaped by an Optical media, a radio frequency (RF) wave, Infrared which is certify free and hearty to intrusion from electrical appliances.

F) Data Redundancy: In the majority feeler network function, sensor nodes are thickly organized in a region of interest and work together to complete a general sensing task. Thus, the data senses by numerous sensor nodes naturally have a certain level of association or joblessness.

G) Many-to-One Traffic Pattern: In the majority feeler network request, the data sensed by feeler nodes flow from numerous source feeler nodes to a scrupulous sink or base station, demonstrate a many-to-one transfer pattern.

H) Application Specific: Sensor network is usually intended and organized for a explicit application. The mean requirements of a feeler network modify with its application.

I) Unreliable Sensor Nodes: Fleer nodes are deploying in ruthless ecological conditions the chances of physical damages or failures are more. Therefore, there is no guarantee for data delivery to the base station.

1.3 Applications of Wireless Sensor Network

WSNs nodes (WNs) can intellect the situation, can converse with neighboring nodes, and execute essential computations on the data being collected. WSNs maintains a large variety of helpful applications and talented to monitor a extensive multiplicity of ambient conditions like warmth, lightning condition, dampness, vehicular society, , pressure, soil makeup, noise levels, the attendance or nonattendance of certain kinds of objects, automatic stress levels on close objects, and the present characteristics such as speed, way and dimension of an object.

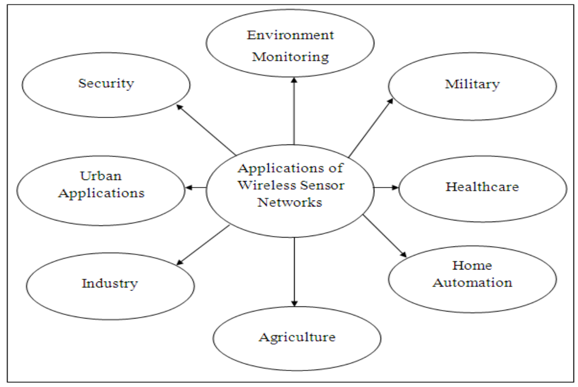

Fig 1.1: Wireless Sensor Network Applications

2. LITERATURE REVIEW

The major issues and confronts in the WSNs is energy effectiveness due to the incomplete energy resources of sensors. The main purpose at the back of plan is to remain the sensors in service for as long as promising by growing life span of the network. The power utilization of the sensors is conquered by data broadcasted and response. Therefore network must be separated into minor sub-networks for large-scale sensors network to boost manageability of the network as well as the network life span.

The amount and the precise areas of the sink nodes directly affects the lifetime of the sensor network. So, the designer must have the knowledge on correct placement of the sink nodes. So to achieve a scalable network, the sensor nodes should be divided into clusters and the nodes within a cluster will then be associated to the sink nodes. For that cause the numeral of clusters as well as finest location must be decides for large-scale feeler network. To know the position of every entity feeler node must have to estimate sink locations. The central or distributed methods are helpful to offer the position information [10].

The authors in [2] mentioned dissimilar sink placement policies which are Random Sink Placement (RSP) policy, Geographic Sink Placement (GSP) policy, Intelligent Sink Placement (ISP), Genetic Algorithm-based sink placement (GASP) and talk about their advantages and disadvantages. They explained the life span of WSNs depends on the figure of sinks with a exchange stuck between the duty cycle and the figure of sinks as well as bring in a method to find out applicant locations which helps in the examiner for the most positive sink duty.

In [3] authors designed a mathematical replica that make a decision the sites of the sinks by declining the sensor's normal distance from the adjoining sink by organizing numerous sinks in its place of one in such a behavior that each feeler communicates with the adjoining sink and to accomplish the straight distances. They have planned two iterative algorithms for the exploitation of numerous sinks. The universal algorithm which uses universal information about the location of the feeler nodes, and an additional is the 1hopalgorithm carries out the exploitation based only on the site in series of the neighboring nodes even as the position of the isolated nodes is being approximated. They evaluated the two algorithms and demonstrate that 1hopapproaches the presentation of universal very closely. Another significant subject is that the neighboring nodes of the sinks have a high traffic load, so the lifetime of the network can be elongated by relocating the sinks from time to time. Based on the 1hopalgorithm they have proposed the 1hop relocation algorithm for the coordinated relocation of multiple sinks which show that the algorithms add to the network lifetime severely.

In [4], authors described energy utilization is the key devise decisive factor for routing data in Wireless Sensor Network. These days the use of numerous sinks as an alternative of sole is considered as a research theme for energy saving. The major focus is to make the most of the network life span by reducing remoteness from font node to sink during data broadcast. The authors suggest a network divider algorithm based on selection of farthest node from k-Nearest Neighbor Graph. After partitioning, a limited flooding-based routing protocol is functional for data broadcast. By this the system life span significantly adds to in a partitioned network in evaluation with a non-partitioned network.

In [5], authors explain the idea of sensor networks that has been made feasible by the meeting of micro electro-mechanical systems knowledge, digital electronics and wireless communications. The sensing job and the possible sensor networks applications are investigation, and a evaluation of factors influence the design of feeler networks is provided. The communication structural design for sensor networks is observed, and the algorithms and protocols are created for every layer in the literature is explored.

In [6], authors explain the formulation to find the best locations of the numerous sink nodes and to find the best traffic flow rate are planned. Maximizing system life span and make sure fairness are the major objectives of this linear programming formulation. The authors planned system is contrasted with m-MDT (multi-sink aware Minimum Depth Tree), and there results defines that the proposed scheme improves network life span and fairness drastically. The projected formulation allows sensor nodes to communicate with the one or more sink nodes during numerous paths.

In [7], authors intend a local search method for sink assignment in WSNs that tries to reduce the maximum worst-case delay and enlarge the life span of a WSN. It is not viable for a sink to use universal information, which specially applies to large-scale WSNs; they initiate a self-organized sink placement (SOSP) approach. The goal of this investigate is to supply a better sink assignment strategy with a lower communication overhead. By keeping away from the luxurious design of using nodes location in order, each sink maintains its own group by communicating to its n-hop distance neighbours. By keeping the nearby best residency, SOSP provides a superiority of the solutions with respect to statement overhead as well as computational endeavor that are better than earlier solutions.

In [8], authors bring in two sink assignment strategies i.e. Candidate Location with Minimum Hop (CLMH) and Centroid of the Nodes in a Partition (CNP) and talk about their advantages and disadvantages in evaluation with an accessible policy. The two strategies CLMH and CNP are match up to with the Geographic Sink Placement (GSP) [3] policy which is used as a yardstick. These policies are executed and assessed in a recreation environment and their performances are analyzed and investigation results are offered. It has been observed that the projected strategies exhibit improved performances with respect to energy practice and life span in evaluation with GSP.

3. SINK PLACEMENT STRATEGIES IN WSN

There are more than a few sink placement strategies defined as per their performances for attain longer life span, energy effectiveness, as well as sooner data delivery to every sink like Random Sink Placement Strategy (RSP), Geographical Sink Placement Strategy (GSP), Candidate Location with Minimum Hop (CLMH), Centroid of Nodes in a Partition Strategy (CNP), Intelligent Sink Placement Strategy (ISP), Genetic Algorithm Sink Placement Strategy (GASP), Self Organized Sink Placement Strategy (SOSP) etc.

4. PROBLEM FORMULATION

An ISP (under certain restrictions) strategy provides optimal sink placement and GASP gives a good solution as other heuristic methods, but both of them needs information about the location of the feeler nodes beforehand. CNP plus CLHM need global knowledge of the topology of the network under consideration. Only for RSP, GSP and SOSP strategy, no prior knowledge on the sensor positions are needed. Moreover none of the above mentioned sink placement strategies is concerned about dynamicity of the network under consideration. The information about sensor nodes positions is not known beforehand in concerned WSN environment. On the contrary, GSP policy is designed particularly for unidentified feeler nodes site and is proposed as a standard sink placement policy in WSNs. So, GSP has been chosen to compare our strategy.

5. PROPOSED SINK PLACEMENT STRATEGY

We have proposed Multiple sink placement at the central circular region & division of network into concentric spherical rings about the middle spherical region with numerous sinks using multiple sink assignment strategy for large scale WSN's. By organizing network separation in concentric spherical rings around the central spherical area & additional authority optimization by turning nodes off in inactive state and control packet overhead and contention. The numeral of hops should be diminished i.e. distance should be utmost covered inside the series of sender node i.e. Optimal Transmission distance (stopping Over-Minimization).

A). Improved Uniform Strategy

In improved uniform policy entire exposure area is covered by concentric circles and the sinks are located uniformly in the central ring. In this policy the information is sent from one knob to other in such a way that the data tour from knob of one ring to knob of other ring which makes the steps of broadcast simple and this ring to ring transmission save time and energy of the arrangement

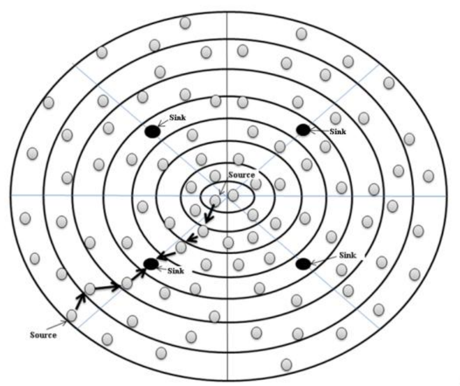

Fig 1.2: Illustration of data packets development toward the uniform sink placement.

B).Improved Random Strategy

In improved random strategy the sinks are placed in region enclosed by concentric circles according to the attentiveness of knobs. In this strategy, the information transmitted likewise in ring to ring blueprint means node of one ring broadcast information to knob to additional ring which is time plus energy saving concept.

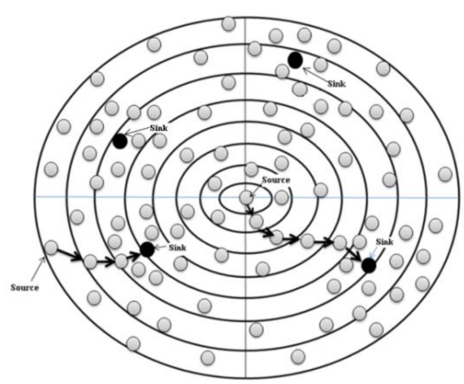

Fig13: Illustration of data packets development towards the random sink placement.

5.1 Advantages and Disadvantages

Advantages of these strategies are reduced number of dead nodes; increased throughput; decreased routing overhead; increased average balanced energy.

The only Disadvantage being, requirement of more computing ability for each node.

Simulation Parameters

We used MATLAB™ for simulation of the algorithm and result generation. The simulation parameters are as follow:

Parameters	Value
Nodes	100
Environment Size	100x100
Initial Energy	100 Unit

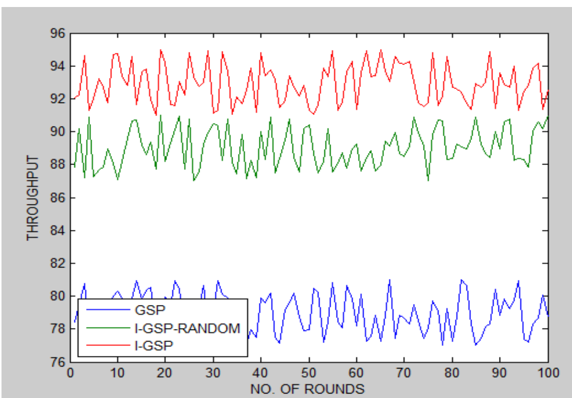

Fig 1.4: Throughput Comparison

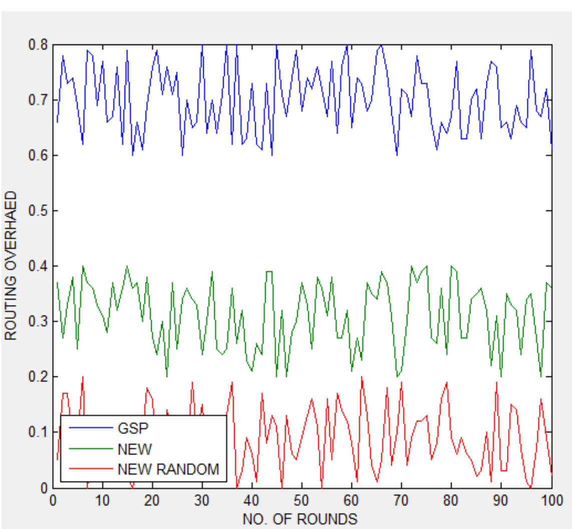

Fig 1.5: Routing Overhead

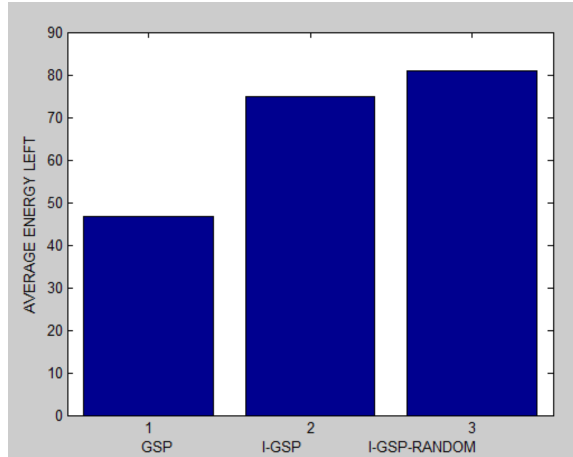

Fig 1.6: Average Balance Energy

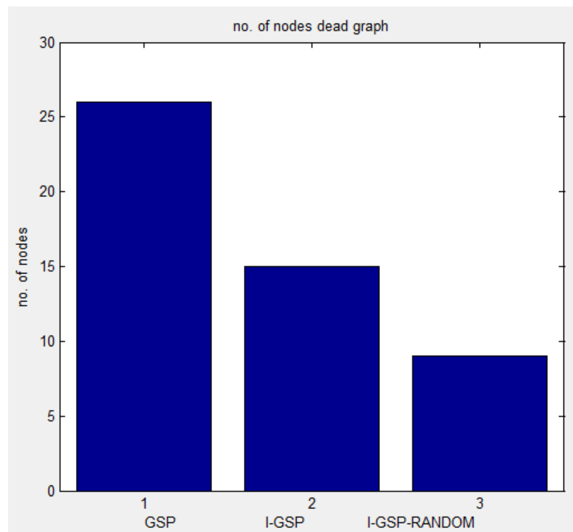

Fig 1.7: Dead Nodes Comparison

6. CONCLUSION

- Throughput has increased in I-GSP and I-GSP-RANDOM strategy.
- Routing Overhead has decreased in improved uniform strategy from GSP strategies.
- Routing overhead in improved random is even more decreased than improved uniform strategy.
- Average Balanced Energy of I-GSP and I-GSP-RANDOM is more than GSP.

- Dead Nodes are more in number in GSP as compared to both I-GSP and I-GSP-RANDOM strategies.

7. FUTURE SCOPE

In this analysis we are succeeded in improving throughput, routing overhead, average balance energy and dead nodes in improved uniform and random strategies. Future scope of this research is that, in this research we have placed sinks in concentric circles in consistent and accidental manner but investigate can be done if the sinks are surrounding by concentric circles having sinks at center in uniform or random surroundings.

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