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A Study on Energy Efficient Multicast Approach for Grid Based WSN

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ABSTRACT

In Wireless Sensor Network the sensor nodes are deployed either in random or deterministic fashion. Sensor nodes are energy constrained and energy would be consumed if each node directly transmits data to the base station. Different topologies considered before for energy efficiency like the one cluster based, tree based and grid based. Various data routing approaches used to ensure balancing the overall network lifetime. Transmitting the data to multiple destinations i.e. multicast approach is very much required for the present real time application. When large numbers of nodes deployed over a network, then groups to be formed along with Head for each group through which data transmission can take place. However, node deployment and head selection is the major concern. The proposed project work aims at studying behavior of network with node placements in random and deterministic way. Dijkstra's algorithm employed to establish the path from sink to the multiple destinations for data transfer. Using MATLAB as a tool, the working of the approaches is simulates for different number nodes. Based on the simulation it can be observed that head selection is an important stage, for deterministic head selection energy efficiency is achieved for small number of nodes where for random head selection consumes less energy for large number nodes.

Keywords :- Wireless sensor networks, Grid, Tree, Multicast, Dijkstra's algorithm

I. INTRODUCTION

Remote Sensor Networks have developed as one of the key empowering influences for an assortment of utilizations such as environment observing, vehicle following and mapping, and crisis reaction. Sensors are conveyed in a substantial physical environment where area data of every sensor is basic to the applications, e.g. environment checking, target following, war zone observation, and so on. A sensor node with mobility has an energy looming crisis as its critical aspect. Certainty of nodes which repeatedly proclaim their ubiquity and being cognizant to discover neighboring nodes for exchanging of data will consume enormous energy in sensor applications.

In Wireless Sensor Network, information transmission happens in multi-jump style where every node advances its information to the neighbor node closer to the sink. In a thickly populated system, adjacent sensor nodes sense information that are associated, along these lines prompting information repetition. Information created is a lot for end-client to process; capacity for joining information into little arrangement of valuable data is required. In-system separating and handling methods can save the rare vitality assets. A more down to earth method for doing this is accumulating information starting from various nodes in the connected zone. Information accumulation is a procedure of conglomerating sensor information utilizing information total methodologies. A number of aggregation algorithms and database systems targeting different sensor network scenarios have been proposed in [5,6,11]. These protocols aim at taking out repetitive information transmission and enhancing the lifetime of vitality obliged Wireless Sensor Network.

This paper is a study of network and its energy efficiency when the nodes are placed in deterministic and random sets and head selection made in different ways and the scenarios are compared for different set of nodes and head selection is done for three different scenarios

i) When nodes are places deterministically and head is selected from set of nodes inside a virtual grid where grids are equally divided as virtual grids.

ii) Head selected from set nodes when nodes are placed deterministically but not only from virtual grids.

iii) Head selected from set of nodes that are randomly placed in the network. For all the three scenarios, considered heads and Heads selected are representatives to communicate with Base station.

II. HIERARCHICAL SELECTION APPROACH

In this selection approach heads selected from a set of nodes that are placed in the grid network. Nodes are placed either in deterministic or random type. Heads from set of nodes are selected on different scenarios. A study based on different scenarios are made.

1. *Grid based network:*

Grid based system is considered to look at vitality proficiency over various framework sizes and to designate the nodes in network based using pivot. A test zone partitioned into square-molded frameworks of certain length. Matrix organizes usually sent when enormously giant territory of system required. Nodes organization are conceivable inside the grid taking into account the pivot position and it is exceptionally simple to decide the position of nodes. Base station or sink nodes can be set any place over the matrix to speak with the sensor nodes. Nodes inside matrix are composed with the head inside the network that depends on most elevated bore of vitality every grid contains. Grid head used to speak with Base station with a most limited way.

2. *Node deployment in grid*

Nodes placed in 2 ways. Nodes placed in random format where nodes will spread across the network. Another way of node deployment is Deterministic where nodes placed in uniform way. Node deployment plays a very important role in network. When the nodes placed randomly, then the efficiency will be less but also it gives more challenges to implement several algorithms to determine the paths.

3. *Multicast*

Multicast infrequently likewise mistakenly used to allude to a multiplexed show. Multicast is correspondence between a solitary sender and numerous collectors on a system. Multicast is a bit of data is sent to the next arrangement of purposes of correspondence where the term used to portray one or more focuses. For this situation, there might be one or more senders and a recipient of data is circulated as it were. Regular applications incorporate office and versatile staff to overhaul and online pamphlets occasional issuance.

Multicast sometimes also incorrectly used to refer to a multiplexed broadcast. Multicast is communication between a single sender and multiple receivers on a network. Multicast is a piece of information is sent to the other set of points of communication where the term used to describe one or more points. In this case, there may be one or more senders and a receiver of information is distributed only. Common applications include office and mobile staff to update and online newsletters periodic issuance.

III. RELATED WORK

In [1], we advantage both cluster and tree structures for information gathering. In our proposed vitality productive component, the most appropriates jumps for information sending will be chosen and the lifetime of the entire system will be amplified.

In [2], primarily, a parallel virtual tree topology is built in view of frameworks. Also, considering the activity heap of each sensor hub, a more productive virtual tree topology is remade by advancing connection headings. Since the recreated tree utilizes corner-to-corner matrices, execution is significantly enhanced as far as vitality proficiency and the span of information transmission.

In [3], Handiness of authorizing a base division separation between group heads in a bunch based sensor system, i.e. dragging out system lifetime by bringing down the vitality utilization.

In [4], the grid multicast that fabricates a vitality effective Steiner tree taking into account just individuals' geographic positions. The grid multicast is exceptionally customized for sensor systems by three configuration standards: i) it plans to minimize vitality utilization in parcel multicast; ii) its stateless outline does not require middle of the road hubs to keep multicast states; iii) it builds the vitality proficient multicast tree without dependence on the worldwide topology. These whole attributes make the matrix multicast a reasonable convention for sensor systems with constrained assets.

In [5], Cluster Based Data Routing for In-Network Aggregation that has some key perspectives, for example, a diminished number of messages for setting up a directing tree, augmented number of covering courses, high conglomeration rate, and solid information collection and transmission and gives the best total quality when contrasted with other existing calculations.

In [6], different information driven accumulation systems is talked about like TAG, EADAT, AGIT, SRTSD and PEDAP conventions under tree based and LEACH, PEGASIS, TEEN,APTEEN and HEED under group based methodology for WSN. Moreover this paper gives a review tree-group based directing conventions.

In [7], numerous clustering conventions have been proposed in light of heterogeneity like SEP,LEACH,E-LEACH and so on. In these conventions, a Cluster Head (CH) is chosen having greatest vitality among every one of the hubs. This paper will overview some of these bunching conventions for heterogeneous remote sensor system.

In [8], A Low Power Grid-based Cluster Routing Algorithm of Wireless Sensor Networks (LPGCRA). The normal for this calculation is that the WSN is isolated into various matrices as per data of the hub area, and afterward the hubs are sorted out inside the matrix by the bunching way. The bunching head is picked powerfully as per vitality scattering of the group hubs, then speaks with BS hub through a transferring hub. This calculation is valuable to diminish hub vitality utilization and delayed existence of the framework, likewise upgraded the parity of system burden.

In [9], An enhanced clustering based multicast approach that permits any bunch head to be a multicast source with a boundless number of endorsers, to improve bunch correspondence in WSNs whilst guaranteeing sensor hubs don't expostulate quickly in vitality levels.

In [10], in wireless sensor networks, the size of backbone network have a great impact on communication overhead, as well as the network lifetime. It can be designed based on cluster tree. MIS (maximum independent sets) composed of cluster-heads is achieved by clustering algorithm, based which MCDS(minimal connected dominating sets) and ST(minimum spanning tree) are built with improved Prim algorithm, and construct backbone network. Besides that, the maintenance and update algorithm of spanning tree is also given. In the end, simulation analysis proves the efficiency of the proposed algorithm.

In [11], the productive and powerful engineering and system of vitality proficient strategies for information accumulation and gathering in WSN utilizing standards like worldwide weight estimation of hubs, information gathering for bunch head and information conglomeration procedures utilizing information shape collection.

IV. PROPOSED WORK

In proposed system i.e. "Energy Efficient multicast approach for grid based WSN" consists of 2 phases Setup phase and steady phase. Setup phase forms grid and sensor nodes deployed either in random or deterministic way and a head for set of nodes selected. Head selection is based on deterministic and random nodes deployment. In the Steady phase, base station constructs a shortest path algorithm. Sensor nodes transmit data to its respective head. These heads aggregate the data and transmit the data to base station through shortest path.

1. Head Selection approach

A. **K-means approach:** In this approach head selection is done by calculating mean distance from the set of nodes considered and head is selected from this approach.

B. **K-mediods approach:** k-medoid is an established apportioning system of bunching that groups the information set of n nodes into k clusters known from the earlier. A valuable device for deciding k is the outline. It is more strong to clamor and anomalies when contrasted with k-implies in light of the fact that it minimizes a total of pairwise dissimilarities rather than a total of squared Euclidean separations. A medoid can be characterized as the object of a cluster whose normal disparity to every one of the items in the group is insignificant. i.e. it is a most halfway found point in the group.

From the above two approaches heads can do selection from a set of nodes. In K-mediods approach heads are selected from within nodes and in a set nodes one node is considered as head node.

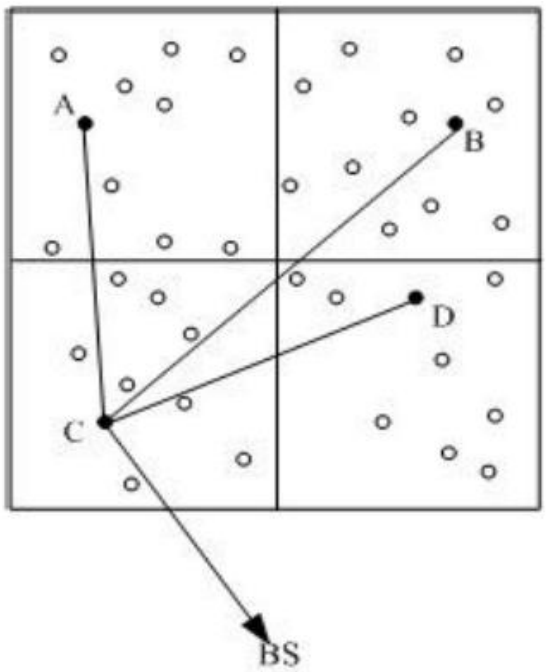

Fig 1: Grid network proposed

In the Fig 1, Grid divided virtually equal parts and nodes are placed in the virtual grids and each grid have one node head which is communicating to the base station.

2. Greedy approach:

Greedy-based techniques use the principle of finding the best solution based on the values of the current solution. is basically utilized as a part of little scale sensor systems and use separation based ascribes to discover the CH node in the area territory. The node with most extreme vitality is chosen as the CH node. Since, the part of CH node continues differing, the insatiable methodology chooses the best ideal CH node in the system. Vitality effective insatiable plans conquer the issue of inactive nodes with less remaining vitality and least number of neighbor nodes.

3. Distance approach

Data aggregation conventions utilize short separation and multi-hop ways to total the information in the system. As the separation between the hub expands, the vitality utilization in Data aggregation process increments. Delay-Aware methodology, occasionally finds the base separation between the nodes in the system. For every session, the non-dynamic nodes along the course ways are handicapped, and the nodes with most extreme vitality in the area of base station are chosen as the CH node. Extra repeaters are sent in the system to set up availability with the CH nodes that are far from the base station. This strategy minimizes the vitality of information gatherers that utilization most limited course ways to total the information. This technique arranges the sensor nodes and builds up the streamlined connections in the system.

Dijkstra's algorithm: Dijkstra's calculation is a calculation for finding the most brief ways between hubs in a diagram, which may speak to, for instance, street systems. In this proposed system Dijkstra's algorithm is applied to heads for set of nodes from base station and heads as the shortest path created.

Algorithm :

```
1  function Dijkstra(Graph, source):
2      create vertex set Q
3      for each vertex v in Graph:           // Initialization
4          dist[v] ← INFINITY                // Unknown distance from source to v
5          prev[v] ← UNDEFINED               // Previous node in optimal path from source
6          add v to Q                        // All nodes initially in Q (unvisited nodes)
7      dist[source] ← 0                      // Distance from source to source
8      while Q is not empty:
9          u ← vertex in Q with min dist[u]  // Source node will be selected first
10         remove u from Q
11         for each neighbor v of u:         // where v is still in Q.
12             alt ← dist[u] + length(u, v)
13             if alt < dist[v]:             // A shorter path to v has been found
14                 dist[v] ← alt
15                 prev[v] ← u
16     return dist[], prev[]
```

4. Energy Efficiency calculations in three scenarios

i) Nodes placed deterministically in the grid and group the nodes which are inside virtual grids and select a node as head inside virtual grid and Dijsktra's algorithm applied to heads in the grid to base station.

ii) Nodes placed deterministically in the grid and heads are selected randomly and Dijsktra's algorithm applied to heads in the grid to base station.

iii) Nodes placed deterministically in the grid and heads are selected randomly and Dijsktra's algorithm applied to heads in the grid to base station.

Simulation is done on these three scenarios and Energy efficiency is calculated and compared for different set of nodes.

1. Deterministic deployment for Grid approach

Table 4.1 Energy Consumption

No of nodes	20	40	60
Energy consumed In joules	2.1676	3.6676	4.6676

2. Deterministic node deployment and random head selection

Table 4.2 Energy consumption

No of nodes	20	40	60
Energy consumed	2.6381	4.1581	5.4181

3. Random node deployment for random head selection

Table 4.3 Energy consumption

No of nodes	20	40	60
Energy consumed	2.3304	3.8504	5.1104

V. CONCLUSION

In a Wireless Sensor Network, the sensor nodes are battery powered and this act as a major constraint on the energy. Energy consumed in sensing and transmission. In a densely populated network, nearby nodes sense the same information and this results in transmission of redundant data to the sink. To conserve energy, it is essential to employ energy efficient routing techniques and to avoid transmitting redundant data to the base station. This paper proposes energy efficient approaches survey named "Energy efficient multicast approach for grid based WSN".

Three scenarios are used for energy efficiency in the network for different set of nodes and first approach deterministic deployment for grid approach is better considered to other two approaches. Further research can be done on more number of nodes.

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