

Analysis of Grid Based Approaches for Wireless Sensor Networks

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Abstract: In this 21st century Wireless Sensor Networks (WSN) are one of the leading trends due its various applications in the field of health, safety, military, police equipments, detector devices and disaster management etc. As there is scarcity of battery resources so certain energy efficient algorithms are designed to attain the desired energy level. The cluster based techniques are one of them which includes cluster based and grid based approaches. In cluster-based technique nodes are combined together to form a cluster whereas the grid based techniques split the entire space into the grid cells. This paper highlights and discusses the planning challenges for cluster-based schemes, the necessary cluster formation parameters, and classification of grid based approaches according to hierarchal network planning. Moreover, existing grid-based techniques are evaluated by considering bound parameters to assist users in choosing applicable technique and a close outline of those protocols is conferred with their merits, demerits and their limitations

Keywords: Wireless Sensor Networks, Grid Based , Grid Cells, Hierarchal Network

I. INTRODUCTION

Wireless sensor networks are made by sensor nodes which are group together to perform various tasks in several environments. The nodes are processed by base station and transfer information to nearby nodes, so it's important to distribute the load equally among the sensor nodes so that the optimization of potential can be done.

A variety of energy efficient algorithms are designed, one of them is hierarchal techniques. In these techniques a cluster head is chosen on the basis of some standard and a cluster network is formed by combining nodes in a group. This technique uses a two layer approach in which sensing is done by first layer and routing is done by another one. First layer is consist of low energy while second has higher energy potential which process the signal for data transfer. Hierarchal clustering approaches are the most significant energy efficient protocols to optimize the energy level by distributing the load equally. There are numerous techniques for this approach like clustering techniques, grid based techniques etc. but this paper mainly focuses on basic grid based techniques.

The first section of paper consists of design challenges in network, second section shows the basic concept of clustering, third section has the details of grid based approaches and these are summarized in section four which finally concluded in section five.

II. DESIGN CHALLENGES IN CLUSTERING NETWORK

There are various challenges in designing the clustering networks for wireless sensor networks for different environment. It is really a typical job to completely replace the whole device or recharge the battery again and again so

there should be some clustering algorithms which efficiently manage the load distribution and energy utilization. The formation of cluster and management of information processing is an important task. The clusters have to be formed in such a manner so that the load ought to be balanced and choosing the cluster head is also an important parameter to design the cluster network. The most significant node should be selected to stabilize the system efficiency and lifetime of network should increase [8]. Information collection is done through member nodes by sensing them and send it to CH [6, 10].

III. CLUSTERING IN WSN

Due to scarcity of resources, the transfer of information between nodes has become a difficult task to perform as energy level decreases while sending the data and sensor nodes die very early.

Network of hierarchal approach consist of two level hierarchy that has the member nodes at lower level and head of the cluster at upper level. The whole data is collected by cluster head and transfer it to the base station. Due to continuous working of CH, energy consumption becomes high. So after some time CH dies due to the high energy utilization.



CH: Cluster Head
 MN: Member Node

IV. GRID-BASED APPROACHES

Grid based approaches are more efficient one because of their simple management. In this technique whole space is partitioned into virtual grids. The choice of cluster head is done by the member nodes itself by pertaining some criteria. The major objective of this approach is to utilize limited resources particularly the battery which is not replaceable.

Grid based approaches plays a vital role in ascending networks. These are helpful for increasing network lifetime, energy potential and time period for system network. The basic grid based techniques are explained below to understand the approach.

(A) Grid Based Data Dissemination (GBDD):

In this technique the whole network is partitioned into square sized grids by the base station. The node by which data is transferred is denoted as the crossing point of the grid and its coordinates are considered as the start line of the grid cell [24].

The sizes of the cells vary according to the range of the sensor nodes. Every node works according to the power ranges i.e. high range transmission and low range transmission. Earlier Intelligent Grid Based Information Dissemination (IGBDD) [16] was used, GBDD is the improvised version of IGBDD in which its not mandatory to send the data to other nodes and also the cluster head selection is based upon the virtual crossing point of the grid cell.

IGBDD uses applied mathematics to select the crossing point and increases the lifespan of the network whereas GBDD forward the data continuously to the destination however it utilizes more energy potential due to high speed.

(B) Grid Based Hybrid Network Deployment Scheme (GHND):

Earlier the constellation is initializing by using centralized technique after that grid based technique is employed with cluster head choice. In this technique whole network is divided into two virtual square grids [9]. Each grid is considered as a zone. The authors apply this technique for various types of nodes and this is found that this approach is more stable and performance is high as compare to other ones like LEACH, PEGASIS and CBDAS etc.

(C) Cycle Primarily Based Data Aggregation Theme (CBDAS):

Cycle primarily based data theme [15] is basically a grid based approach in which the whole network is divided into 2D square grid cells. In this technique every cell head is connected to the other cell head which makes a cyclic chain.

The base station chooses the head of the cycle which has the highest energy level. Each cell transfers the data to the head of the cycle. As the cell head directly communicates with the base station so it decreases the traffic and the utilization of energy is less. The major demerit of CBDAS is that the cell head are at the large distance from base station so consume more energy and die early.

V. SUMMARY

In this section, the above-discussed grid-based techniques are summarized. The advantages and disadvantages of the prevailing techniques are showcased. The head choice is taken into the account to analyze these techniques. The type of approach can be probabilistic or non-probabilistic. A summarized table is given below to understand the concept of grid based techniques.

Table 1: Comparison of Grid Based Approaches

| Sr. No. | Name of the technique | Approach for CH Selection | Type | Merits | Demerits |
|---------|-----------------------|---------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | GBDD | Probabilistic | Distributed | (i) Information is surely transfer from source to destination continuously | (i) communication overhead (ii) Timestamp is used for grid validity and has to reconstruct it, which is an overhead |
| 2. | GHND | Non probabilistic | Hybrid | (i) Evenly distributed load (ii) energy efficient (iii) Reduces network overhead (iv) Enhances overall network lifetime | (i) Only reliable for static node (ii) Not reliable for large scale networks |
| 3. | CBDAS | Non probabilistic | Distributed | (i) Cycle head is responsible for energy efficiency as only data is send through only one | (i) In a long stream of chain, distant nodes might be selected as CH resulting in high energy consumption (ii) Chain breakage due to suboptimal CH (iii) Cycle head election depends upon only residual energy |

VI CONCLUSION

Wireless Sensor Networks (WSN) are attaining an additional attention as they are lower in cost, small in size and has supercharged battery etc. These devices are embedded with other technologies also like IoT, IEEE802.11, mobile phones etc. Various techniques used in wireless sensor networks are very efficient in 21st century in account with the limited battery resources. This paper basically elaborates the economical and efficient grid based approaches with its comparative analysis.

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