

Eleventh International Multi-Conference on Information Processing-2015 (IMCIP-2015)

A Cluster-Tree based Data Dissemination Routing Protocol

Neeraj Bagga*, Suraj Sharma, Shubhra Jain and Tushar Ranjan Sahoo

International Institute of Information Technology, Bhubaneswar 751 003, India

Abstract

Immobile sensor nodes are deployed in the gigantic area and formed a network, known as the Wireless Sensor Network (WSN). Mobile sink is a resource opulence node, whose duty is to receive the data from all the sensor nodes. Energy efficiency and network lifetime is the prime concern of the WSNs. In this paper, we propose a Cluster Tree based Data Dissemination (CTDD) routing protocol. Theoretical analysis evince that the CTDD protocol is more energy efficient, sturdy protocol with relatively less delay than another protocol because in CTDD there will be no issue of frequent tree re-construction for load balancing.

© 2015 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of organizing committee of the Eleventh International Multi-Conference on Information Processing-2015 (IMCIP-2015)

Keywords: Cluster Based Routing; Energy Efficiency; Mobile Sink; Tree Based Routing; Wireless Sensor Networks.

1. Introduction

Wireless sensor network predominantly includes sensor nodes, a processor, batteries, radios and mobile sink. The operation of sensor node includes sensing the physical world data, processing those data and relaying the data into the entire network. Applications of WSNs include habitat monitoring, area monitoring, water quality monitoring, landslide detection, health care monitoring, earth sensing, precision agriculture, automation, disaster detection etc.¹⁻⁴ The advantage of WSNs includes flexibility, low-cost and centralized monitoring, etc.^{5,6}

Sink aggregates all those data and forward it to the user through the Internet. The sink is movable or mobile in the case of WSN that makes the network dynamic. The energy consumption of the sensor nodes, which are nearest to the sink node, is much more than other nodes in WSNs. Because of more energy consumption, the nearest nodes died prior to the other nodes. This problem is known as an energy-hole problem. The mobility of the sink overcomes the energy-hole problem. Energy efficiency and lifetime of the network is the prime concern of any WSN. The sensor network requires routing techniques for increasing the efficiency of any sensor nodes. Wireless sensor network includes many types of routing techniques. Network structure based routing techniques and Protocol based Routing techniques are the two main categories of WSN⁷. In this proposed work, the network is divided into equal sizes virtual grids, then the cluster is formed within the grids, and at last the tree structure is formed over the clusters. Only cluster heads are included in the formation phase of tree structure, i.e. all cluster heads are treated as a vertex of a tree structure in the wireless sensor network.

The subsequent section of the paper is organized as follows: section 2 delineates the related work, section 3 delineates the protocol description, section 4 includes the theoretical analysis part, and finally section 5 concludes the entire paper.

*Corresponding author. Tel.: +91-7751009335.

E-mail address: neerajbagga01@gmail.com

2. Related Work

2.1 Cluster based routing

For routing purpose, cluster based protocol is used that is based upon LEACH⁸ algorithm. The cluster based routing protocol (CBRP)⁹ uses the probability function for selecting the cluster head (CH). In the setup phase of this protocol, each node creates a random value of probability and also computes the value of the threshold level¹⁰. The maximum threshold value node is selected as cluster head. By the help of *join-REQ* packet to all cluster nodes are connected with corresponding cluster heads. At the end of setup phase cluster head knows about all its cluster members. In the steady phase of this protocol, the cluster head communicates with a base station (BS) and send collected data to the BS.

2.2 Tree based routing

Tree based routing is the part of hierarchical routing protocol. The Tree Based Routing Protocol (TBRP)⁷ forms the tree structure in the whole network area. Each sensor node calculates its distance and levels from the base station (BS). After assigning the levels, *join-REQ* is used for attachment of all the nodes from one level to other levels. Once the tree is formed according to the levels, the data are sent from lower level nodes, i.e. from child nodes to its upper level nodes, i.e. to parent node and finally data reaches to the root node. The root node provides TDMA schedule to all its child nodes and in that time intervals child node forwards their data to root node and at last root node forwards the whole aggregated data to the BS.

2.3 Cluster and tree based routing

The General Self-Organized Tree Based Energy-Balancing Routing GSTEB¹¹ protocol is basically based on clustering and tree based routing concepts. In the GSTEB protocol, firstly cluster is formed in wireless sensor network and then tree structure is formed by including all cluster heads (CHs) as a vertex of a tree. Fuzzy logic¹² is used for the cluster head election procedure because fuzzy logic is useful for evaluating the energy level of each and every sensor node. After the formation of clusters, each cluster head finds its location by using GPS (Global Positioning System) and its distances from the base station. All the distance are organized in ascending order by any of the sorting techniques, the minimum distance value node becomes a root node of the tree and second minimum value node become a left child of the root node and similarly the third minimum distance node become a right child of the root node and so on. According to the distance values the nodes are arranged in the form of tree structure.

All above defined routing protocols are less energy efficient because of few reasons like tree reconstruction, network delay, less throughput etc. The proposed protocol CTDD is constructed by following efficient features like less end to end delay, more throughput and energy efficiency.

3. Network Model

The proposed protocol assumes that all sensor nodes are homogeneous in nature and deployed randomly in the network area of 100 meter² diameters. All sensor nodes have equal radio range having its minimum (Min_R) and maximum (Max_R) values. Sensor network environment includes some basic assumptions such as:

- Every node has ability to convey the message from one node to another node as well as to mobile sink.
- The movement of the mobile sink is randomly in the case of wireless sensor network.
- All sensor nodes are immobile in nature as well as all are energy constrained.

3.1 Cluster-tree based data dissemination protocol

Cluster-Tree Based Data Dissemination (CTDD) protocol is the coalition of two schemes, one is a cluster formation in the entire network and the other is the tree structure formation over the clusters. In CTDD protocol, the entire

Download English Version:

<https://daneshyari.com/en/article/487429>

Download Persian Version:

<https://daneshyari.com/article/487429>

[Daneshyari.com](https://daneshyari.com)