Comparative Analysis of Data-Gathering Algorithm for Industrial WSNs

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Abstract: This paper discuss about the various data gathering algorithms used for industrial Wireless Sensor Network. Wireless sensor networks (WSNs) have been applicable in various fields in industries. From approximately last decades; a large number of routing protocols has been designed so that it can achieve energy efficiency in data collecting wireless sensor networks. A large number of small sensor nodes with low power, transmission abilities and storage limitation is consisted by WSN. In communication phase, lots of energy of a sensor in data gathering process, especially for a massive amount of heterogeneous sensory data. Also, to solve various problems efficiently like energy consumption, hotspot problem various data gathering algorithms are proposed. So, in this survey paper I had discussed about the different algorithms with their energy consumption and efficiency.

Keywords:- *WSN, Mobile Sink, Sink Node, CC*

I. INTRODUCTION

Wireless sensor networks are composed of very large number of wireless sensor nodes which are either densely deployed inside the phenomenon or are very close to it. Sensors are usually have limited energy and deploy randomly. WSNs are applicable in various industrial fields, e.g., monitoring patient and analysis of disease, monitoring of equipment and fault prediction, monitoring of pollution and source detection, sea searching, monitoring tide, military application, environment monitoring, health-care, smart home, etc. Among the all applications, one of the most important is sensor data collection, where data is sensed continuously and collected of the sensor nodes and forwarded through wireless communications to a central base station for further processing [2]. In industries, Data has to be collected for every single minute so that efficient and effective product can be made without any interrupt but, sometimes it becomes really hectic to gather the data manually and maintain that data efficiently. Mobile sink can solve these problems effectively. And also, fixed sink can outperform both in economization of energy, decreasing the delay and prolonging the lifetime of networks. Sink node is used for collecting data in WSN; data collection can be done with single hop, multi- hop and all sensor collect data is send to the base station that is called as sink node [1]. A very large or we can also say that thousands numbers of sensor nodes are deployed to collaborate so that a network can be formed that is capable of reporting to data collection and deployment can be random deployed or self-organized. Also in some cases, mobile sink node travel or move in sensing area and directly collects data from the sensors and then that data is send to the main operating station or we can also say that base station for further processing.

Because of several reasons Wireless sensor networks became very useful, and that reasons are as follows: 1) connectivity as sensor nodes are moving 2) to reduce the cost of network, cost fewer node are used 3) As the multi-hop transmission increase the message loss, so reliability and 4) As sensor node send the message and that is collected by sink node and node near to sink more overloaded so, energy efficiency.

II. CIRCLE - BASED DATA DISSEMINATION (CBDD)

Circle-based data dissemination (CBDD) algorithm aims at increasing the energy utilization and prolonging the lifetime of network [3]. In this approach, sensor nodes are arranged in a circular sensor field and to collect data the mobile sink moves all around the circles instead of moving inside it. When the sink transmits a query message to a particular node in the circle area, then only the data gathering process starts. During the process, the node which is queried on inner layer that sends the data packets to a node on the outer layer and in this way the sink obtains targeted information from node which is on the outermost layer. As the deployment of nodes is symmetrical, so when the mobile sink moves, the total number of nodes which are near to sink is dramatically increases, As compare to that in WSNs with any other

randomly deployed senor nodes or in any static sink. So, consequently the hot spot issues effectively handled as the energy dissipation is evenly distributed in the whole network and also the network lifetime is prolonged.

III. COMPETITIVE CLUSTERING ALGORITHM

A competitive clustering algorithm for wireless sensor network using a controlled mobile sink is really an energy-efficient clustering algorithm. In competitive clustering (CC) algorithm, each sensor node needs to participate in competing for cluster heads. Cluster heads will be selected based on the competition range and the residual energy. On the basic, a controlled mobile sink is used to instead of the fixed sink node to mitigate the hop spot problems. The mobile sink node moves at a definite speed along a predefined path and stay temporary at several park positions to collect data packets from cluster heads selected according the competitive clustering algorithm. Results of simulation validates that the competitive clustering algorithm can perform better than LEACH, and by using mobile sink node one can improve the performance of sensor networks significantly, by improving utilization of energy and prolonging the lifespan of network. In this work, the mobile sink node moves at a certain speed along a predefined path and we ignore the movement speed of the sink node and the data transmission delay among sensor nodes.

IV. ENERGY-EFFICIENT ROUTING ALGORITHM

Energy-efficient Routing Algorithm (ERA), was proposed by Yi-hua Zhu, et al [38] is a data gathering algorithm that propose to prolong the lifetime of network while efficiently expends energy. In the ERA, a data gathering sequence is used to avoid mutual transmission and also loop transmission among nodes, it is constructed, and each node proportionally transmits the traffic signals to the links confined in the data gathering sequence. And also in a mathematical programming model, minimum energy remaining of nodes and total energy consumption are included, and is presented to optimize the lifetime of network.

V. NOVEL CLUSTERING ALGORITHM OCABTR

A novel clustering algorithm OCABTR was Proposed, Ying Liang, Hongwei Gao [29] consider fully the characteristic of occurrence of target in monitor area. In OCABTR, adopts the strategy to form a cluster first and then selecting the cluster-head after that. The cluster is actually formed by genetic algorithm so to optimize and to partition the adjacent nodes and that adjacent nodes will sense the similar target into one cluster. To improve the rate of data aggregation in clusters, this approach adapted as it can effectively reduce redundant data transmission and also reduce the whole energy consumption in the network.

VI. MULTI-LAYERAND CHAIN-BASED DATA GATHERING ALGORITHM

Multi-Layer And Chain-Based Data Gathering Protocol proposed by [27], Lingyun Yuan, et aldescribes the idea of multi-layer chain, and uses the minimal amount of total energy algorithm for the construction of chain. For selection of leaders Maximum residual energy of nodes is considered. Also this data gathering algorithm is energy-efficient and delay-reducing data gathering algorithm. The result shows that it works better than LEACH and PEGASIS, which prolongs the lifespan of network and also reduces the network delay remarkably.

VII. ENERGY-EFFICIENT DATA GATHERING PROTOCOL

Energy-Efficient Data Gathering Protocol (EEDGP) was suggested by Jun Yang, et al.[34] includes a clustering method for balancing the consumption of energy, a prediction of data transmission strategy and an energy-aware multi hop routing algorithm. In phase of clustering process, initially probability of node for cluster head is derived from mathematical relation between seamless coverage fraction of application and required number of cluster heads. In data aggregation phase, within a cluster the spatial correlated data is utilized by cluster head to aggregate sampling data. Cluster heads senddata to sink node using prediction transmission strategy according to temporal correlation of sampling data while in the data transmission phase satisfies the transmission precision, and the lifetime of network is greatly prolonged by this strategy. Simulation results show that this algorithm performs really out of the box for network lifetime by balancing the energy consumption and decreasing the transmission while it meets the desired application-specific requirements.

VIII. ENERGY EFFICIENT DATA GATHERING ALGORITHM

The Energy-Efficient Data Gathering Algorithm (EEDGA) was suggested by Jing Yang et al. [38], to minimize the energy consumption and maximize the network lifetime. In order to realize the goal, the basic operations of EDGA are divided into three phases: Cluster Formation, Chain Construction and Data Transmission. In first phase, the network will be grouped into clusters and then in next phase, the CHs use ACO to construct chain in their cluster and finally in last phase, data is gathered and transmitted to the sink. It is assumed that each node can obtain the statuses of all its neighbours through broadcasting a topology discovery message, which includes the information of neighbours, such as the residual energy and ID.

CONCLUSION

In this paper, I discussed about different types of data gathering algorithms in industrial wireless sensor network. As there are various approaches proposed by many authors, there are still some problems that are unsolved like energy efficiency, hotspot, etc, and it can be solved in near future wireless sensor network is still a young topic for research and many activity is going on still to solve some issues. In this paper I have mainly focus on two things that the data gathering algorithm should have long network lifetime and can save energy on it.

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