ENERGY EFFICIENT CLUSTERING TECHNIQUES FOR MOBILE DATA GATHERING IN DISTRIBUTED WSN

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ABSTRACT

Now a days the "big data" emerged as a hot topic because of the tremendous growth of the Information and Communication Technology (ICT). The key contributors of the big data in the networks is the distributed Wireless Sensor Networks (WSNs). The data generated by an individual sensor node may not appear to be significant, the overall data generated across numerous sensors in the densely distributed WSNs can produce a significant portion of the big data. The researchers introduces a data-gathering technologies for large-scale wireless sensor networks by introducing mobility into the network. An M-collector (mobile data collector) starts the data-gathering tour periodically from the static data sink, polls each sensor while traversing its transmission range, then directly collects data from the sensor in single-hop communications, and finally transports the data to the static sink. We mainly focus on the problem of minimizing the length of each data-gathering tour and refer to this as the single-hop data-gathering problem (SHDGP). We have a data-gathering algorithm where multiple M-collectors traverse through several shorter sub tours concurrently to satisfy the distance/time constraints. Simulation results will try to demonstrate that the proposed data-gathering algorithm can greatly shorten the moving distance of the collectors and significantly prolong the network lifetime.

Keywords : Data Gathering, Energy Harvesting, Life Time, WSN.

I. INTRODUCTION

A wireless sensor network (WSN) consists of sensor nodes. These sensor nodes collect information from the environment and communicate with each other via wireless transceivers. The data collected by these sensor nodes will be delivered to one or more sinks, generally via multi-hop communication. The sensor nodes operate with batteries. These sensor nodes are deployed to not-easily accessible or hostile environment, sometimes in large quantities. It can be difficult or impossible to replace the batteries of the sensor nodes. On the other hand, the sink is typically rich in energy. Since the sensor energy is the most important resource in the WSN, The communications in the WSN has the many-to-one property in that data from a large number of sensor nodes tend to be concentrated into a few sinks. Since multi-hop routing is generally needed for distant sensor nodes from the sinks to save energy. The sensor nodes near a sink can be burdened with relaying a large amount of traffic from other nodes. Sensor nodes are resource constrained in term of energy, processor and memory and low range communication and bandwidth. Limited battery power is used to operate the sensor nodes and is very difficult to replace or recharge it, when the nodes die. This will affect the network performance. Energy conservation and harvesting increase lifetime of the network. Optimize the communication range and minimize the energy usage, we need to conserve the energy of sensor nodes .Sensor nodes are deployed to gather information and desired that all the nodes works continuously and transmit information as long as possible.

This address the lifetime problem in wireless sensor networks. Sensor nodes spend their energy during transmitting the data, receiving and relaying packets. Hence, designing routing algorithms that maximize the lifetime until the first battery expires is an important consideration. Designing energy minimized algorithms increase the lifetime of sensor nodes. In some applications the network size is larger so we need scalable architectures. Energy conservation is the primary objective of wireless sensor networks, however for efficient working of wireless sensor networks it includes other objectives like scalable architecture, routing and latency.
The WSN is built of nodes from a few to several hundreds or even thousands, where each node is connected to one or more sensors. Components of sensor nodes are as follows: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth.

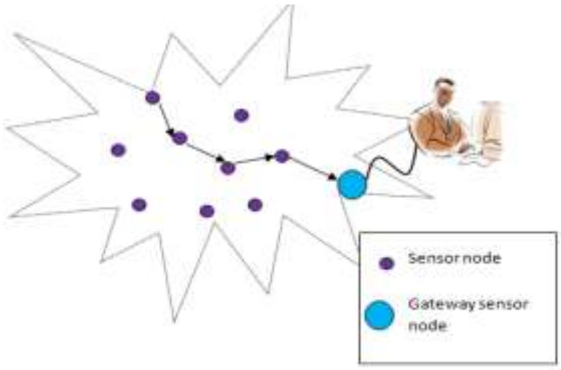

Fig 1: Multihop wireless sensor architecture

Collecting the large volume and variety of the sensed data is indeed, difficult as a number of important domains of human endeavor are becoming increasingly reliant on these remotely sensed information. For example, in smart-houses with densely deployed sensors, users can access temperature, humidity, health information, electricity consumption, and so forth by using smart sensing devices. In order to gather these type of data, the WSNs are constructed whereby the sensors relay their data to the “sink”. In case of widely and densely distributed WSNs for e.g. in schools, urban areas, mountains, and so forth, there are two problems in gathering the data sensed by millions of sensors. First, the network is divided in to some sub-networks because of the limited wireless communication range. For example, sensor nodes deployed in a building may not be able to communicate with the sensor nodes which are distributed in the neighboring buildings. Therefore, limited communication range may raise a challenge for data collection from all sensor nodes. Second, the wireless transmission consumes the energy of the sensor nodes. Even though the volume of data generated by an individual sensor is not significant, each sensor node requires a lot of energy to transmit the data generated by surrounding sensor nodes. Especially in dense WSNs, the life time of sensor nodes will be very small because each sensor node transmits a lot of data generated by tremendous number of surrounding sensors. To solve these problems, we need an energy-efficient method to gather large volume of data from a large number of sensors in the densely distributed WSNs. To achieve energy-efficient data collection in densely distributed WSNs, there have been many existing approaches. For example, the data compression mechanism is capable of shrinking the volume of the transmitted data. Although it is easy to be implemented, the data compression mechanism requires the nodes to be equipped with a big volume of storage and high computational power. In addition, the topology control mechanism can evaluate the best logical topology and reduce redundant wireless transmissions.

When the redundant wireless transmissions are minimized, the required energy for wireless transmissions can be also minimized. Furthermore flow control and routing can choose the path which consists of nodes having high remaining energy. However, these technologies are not able to deal with the divided networks problem. To deal with both the divided sub-network problem and the energy consumption issue, the mobile sink technology have received great attention in literature. In such schemes, the data collector, referred to as the "sink node" or simply the sink is assumed to be mobile such as Vehicle, Unmanned Aerial Vehicle (UAV), and so on. As the sink node moves around the sensing location, the sensors send data to the sink node when the sink node comes in their proximity. Thus, energy consumption can be minimized by reducing the amount of transmissions in the WSN. Since the mobile sink schemes aim to reduce wireless transmissions, the trajectory of the sink node is decided based on the sensor nodes' information (e.g., location and residual energy). The sink node divides the sensor nodes into a number of clusters based on a certain condition. Then, the sink node roams around in these clusters.

II. LITERATURE SURVEY

W. Heinzelman, A. Chandrakasan, and H. Balakrishnan proposed Energy efficient communication protocol for wireless microsensor networks [1] in Jan. 2000. Distributed wireless sensor network will enable the reliable monitoring of a variety of environments for both civil and military applications. In communication protocols, which can have significant impact on the overall energy dissipation of these networks. The conventional protocols of direct transmission, minimum-transmission-energy, multihop routing, and static clustering may not be optimal for sensor networks, we propose LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster base stations to evenly distribute the energy load among the sensor nodes in the network.

N. Li, J. Hou, and L. Sha proposed Design and analysis of an MST-based topology control algorithm[2] in May 2005, They introdused a Minimum Spanning Tree (MST) based topology control algorithm, called Local Minimum Spanning Tree (LMST), for wireless multi-hop networks. In this algorithm, each node builds its local minimum spanning tree independently and keeps only on-tree nodes that are one-hop away as its neighbors in the final topology.

T. Khac and C. Hyunseung proposed Connectivity-based clustering scheme for mobile ad hoc networks [6] in July 2008. This describess several new clustering algorithms for nodes in a mobile ad hoc network. The main contribution is to generalize the cluster definition and formation algorithm so that a cluster consists of s all nodes that are at distance at most k hops from the cluster head. They also describe algorithms for modifying cluster structure in the presence of topological changes. They also introduced a unified framework for most existing and new clustering algorithm where a properly defined weight at each node is the only difference. They studied node connectivity and node ID as two particular weights, for k = 1 and k = 2. Finally, they introduses a framework for generating random unit graphs with obstacles.

K. Miyao, H. Nakayama, N. Ansari, and N. Kato proposed LTRT: An efficient and reliable topology control algorithm for ad-hoc networks [7] in Dec. 2009. Transmission is a costly operation in the context of ad-hoc networks, and thus topology control has been introdused to achieve efficient transmission with low interference and low energy consumption. By topology control method, each node optimizes its transmission power by maintaining network connectivity in a localized manner. Local Minimum Spanning Tree (LMST) is the topology control algorithm, which has been proven to provide satisfactory performance.

S. He, J. Chen, D. Yau, and Y. Sun proposed Cross-Layer optimization of correlated data gathering in wireless sensor networks [8] inJun. 2010. They consider the problem of collecting correlated sensor data by a single sink node in a wireless sensor network. They assume that the sensor nodes are energy constrained and design efficient distributed protocols to increase the network lifetime. Many existing approaches focus on optimizing the routing layer only, but in fact the routing strategy is often coupled with link access in the MAC layer and power control in the physical layer.

III. EXISTING SYSTEM

The Existing System of this project is energy minimized clustering algorithm by using the Expectation-Maximization (EM) algorithm for 2-dimensional Gaussian mixture distribution. This system aims to minimize the sum of square of wireless communication distance since the energy consumption is proportional to the square of the wireless communication distance. Moreover, we first focus on the “data request flooding problem” to decide the optimal number of clusters.

The data request flooding problem refers to the energy inefficiency that occurs when all the nodes broadcast data request messages to their respective neighboring nodes. This problem wastes energy, particularly in the high density WSNs. Previous research work advocates increasing the number of clusters to reduce the data transmission energy. However, in this method, we point out that an excessive number of clusters can result in performance degradation, and therefore, we adopt an adequate method for deriving the optimal number of clusters.

IV. PROPOSED SYSTEM

The aim of this project is to achieve energy efficient Data Collection in densely distributed Wireless sensor networks using Mobile Collector. The K-medoids algorithm is used for the clustering. In this proposed system new data-gathering mechanisms for large-scale sensor networks when single or multiple M-collectors are used. In our data-gathering scheme with multiple M-collectors, only one M-collector needs to visit the transmission range of the data sink. While the entire network can be divided into sub networks. In each sub network, an M-collector is responsible for gathering data from local sensors in the subarea. Once in a while, the M-collector forwards the sensing data to one of the other nearby M-collectors, when two M-collectors move close enough. Finally, data can be forwarded to the M-collector that will visit the data sink via relays of other M-collectors. All data are forwarded to M-collector 1 from other collectors, and then, M-collector 1 carries and uploads data to the data sink.

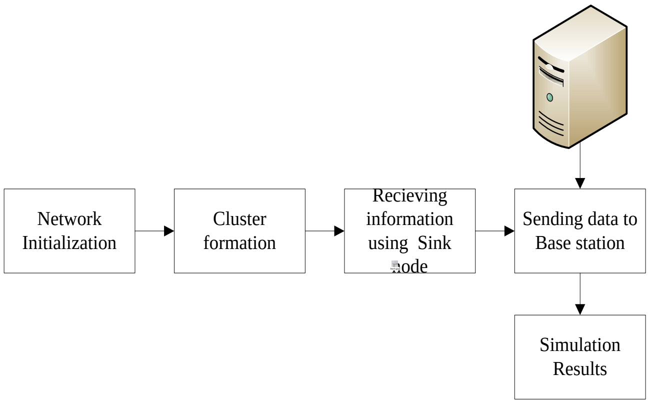

Figure 2: Architecture of proposed System

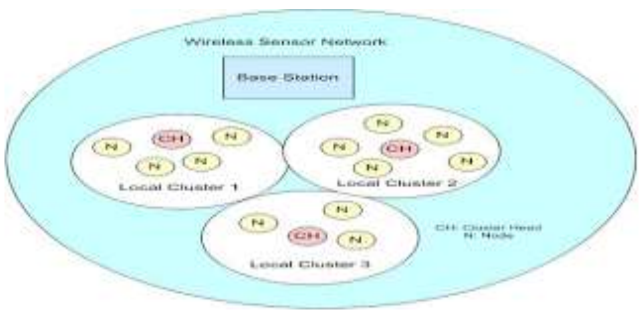

Figure 3: Cluster formation

V. CONCLUSION

The mobile data-gathering scheme for large-scale sensor networks increases the performanse of the network . The concept mobile data collector, called an M-collector, which works like a mobile base station in the network. An M-collector starts the data gathering tour periodically from the static data sink, traverses the entire sensor network, polls sensors and gathers the data from sensors one by one, and finally returns and uploads data to the data sink. In addition, it can prolong the network life time significantly compared with the scheme that has only a static data collector and scheme in which the mobile data collector can only move along straight lines.

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