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IMPROVING ENERGY EFFICIENCY IN A WIRELESS SENSOR NETWORKS BY USING LBC & DDU TECHNIQUES

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Abstract:

In this paper, a three-layer framework is proposed for mobile data collection in wireless sensor networks, which includes the sensor layer, cluster head layer, and mobile collector (called SenCar) layer. The framework employs distributed load balanced clustering and dual data uploading, which is referred to as LBC-DDU. The objective is to achieve good scalability, long network lifetime and low data collection latency. At the sensor layer, a distributed load balanced clustering (LBC) algorithm is proposed for sensors to self-organize themselves into clusters. In contrast to existing clustering methods, our scheme generates multiple cluster heads in each cluster to balance the work load and facilitate dual data uploading. At the cluster head layer, the inter-cluster transmission range is carefully chosen to guarantee the connectivity among the clusters. Multiple cluster heads within a cluster cooperate with each other to perform energy-saving inter-cluster communications. Through inter-cluster transmissions, cluster head information is forwarded to SenCar for its moving trajectory planning. At the mobile collector layer, SenCar is equipped with two

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antennas, which enables two cluster heads to simultaneously upload data to SenCar in each time by utilizing multi-user multiple-input and multiple-output (MU-MIMO) technique. The trajectory planning for SenCar is optimized to fully utilize dual data uploading capability by properly selecting polling points in each cluster. By visiting each selected polling point, SenCar can efficiently
gather data from cluster heads and transport the data to the static data sink. Extensive simulations are conducted to evaluate the effectiveness of the proposed LBC-DDU scheme. The results show that when each cluster has at most two cluster heads, LBC-DDU achieves over 50 percent energy saving per node and 60 percent energy saving on cluster heads comparing with data collection through multi-hop relay to the static data sink, and 20 percent shorter data collection time compared to traditional mobile data gathering
.

INTRODUCTION:

A **WSN** sometimes called a **wireless sensor and actor network (WSAN)** are spatially distributed autonomous sensors to *monitor* p hysical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *control* of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected one (or sometimes several) sensors. Each such sensor network node has typicallyseveralparts: radio transceiver with 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. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

A wireless sensor network (WSN) consists of sensor nodes capable of collecting information from the environment and communicating with each other via wireless transceivers. The collected data will be delivered to one or more sinks, generally via multi-hop communication. The sensor nodes are typically expected to operate with batteries and are often 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 precious resource in the WSN, the communications in the WSN has the many-to-one property in

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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 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 life time until the first battery expires is an important consideration. Designing energy aware algorithms increase the lifetime of sensor nodes. In some applications the network size is larger required scalable architectures. Energy conservation in wireless sensor networks has been the primary objective, but however, this constrain is not the only consideration for efficient working of wireless sensor networks. There are other objectives like scalable architecture, routing and latency. In most of the applications of wireless sensor networks are envisioned to handle critical.

The WSN is built of "nodes" from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: 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. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

The proliferation of the implementation for low-cost, low-power, multifunctional sensors has made wireless sensor networks (WSNs) a prominent data collection paradigm for extracting local measures of interests. Christo Ananth et al. [3] discussed about Reconstruction of Objects with VSN. By this object reconstruction with feature distribution scheme, efficient processing has to be done on the images received from nodes to reconstruct the image and respond to user query. Object matching methods form the foundation of many state- of-the-art algorithms. Therefore, this feature distribution scheme can be directly applied to several state-of- the-art matching methods with little or no adaptation. The future

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challenge lies in mapping state-of-the-art matching and reconstruction methods to such a distributed framework. The reconstructed scenes can be converted into a video file format to be displayed as a video, when the user submits the query. This work can be brought into real time by implementing the code on the server side/mobile phone and communicate with several nodes to collect images/objects. This work can be tested in real time with user query results.

Based on the focus of these works, we can roughly divide them into three categories. The first category is the enhanced relay routing, in which data are relayed among sensors. Besides relaying, some other factors, such as load balance, schedule pattern and data redundancy, are also considered. The second category organizes sensors into clusters and allows cluster heads to take the responsibility for forwarding data to the data sink.Clustering is particularly useful for applications with scalability requirement and is very effective in local data aggregation since it can reduce the collisions and balance load among sensors. The third category is to make use of mobile collectors to take the burden of data routing from sensors.

Although these works provide effective solutions to data collection in WSNs, their inefficiencies have been noticed. Specifically, in relay routing schemes, minimizing energy consumption on the forwarding path does not necessarily prolong network lifetime, since some critical sensors on the path may run out of energy faster than others.

Objective:

To an efficient, large-scale data collection scheme should aim at good scalability, long network lifetime and low data latency.

It is crucial to design an energy-efficient data collection scheme that consumes energy uniformly across the sensing field to achieve long network lifetime.

Furthermore, as sensing data in some applications are time-sensitive, data collection may be required to be performed within a specified time frame.

Literature Review:

1.W. C. Cheng, C. Chou, L. Golubchik, S. Khuller, and Y. C. Wan, "A coordinated data collection approach: Design, evaluation, and comparison," IEEE J. Sel. Areas Commun., vol. 22, no. 10, pp. 2004–2018, Dec. 2004.

We consider the problem of collecting a large amount of data from several different hosts to a single destination in a wide-area network. This problem is important since improvements in data collection times in many applications such as wide-area upload applications, high-performance computing applications, and data mining applications are crucial to performance of those applications. Often, due to congestion conditions, the paths chosen by the network may have poor throughput. By choosing an alternate route at the application level, we may be able to obtain substantially faster completion time. This data collection problem is a nontrivial one because the issue is not only to avoid congested link(s), but to devise a coordinated transfer schedule which would afford maximum possible utilization of available network resources. Our approach for computing coordinated data collection schedules makes no assumptions about knowledge of the topology of the network or the capacity available on individual links of the network. This approach provides significant performance improvements under various degrees and types of network congestions. To show this, we give a comprehensive comparison study of the various approaches to the data collection problem which considers performance, robustness, and adaptation characteristics of the different data collection methods. The adaptation to network conditions characteristics are important as the above applications are long lasting, i.e., it is likely changes in network conditions will occur during the data transfer process.

In general, our approach can be used for solving arbitrary data movement problems over the Internet. We use the Bistro platform to illustrate one application of our techniques.

2.K. Xu, H. Hassanein, G. Takahara, and Q. Wang, "Relay node deployment strategies in heterogeneous wireless sensor networks," IEEE Trans. Mobile Comput., vol. 9, no. 2, pp. 145–159, Feb. 2010.

While a lot of existing research attempts to extend the lifetime of a wireless sensor network (WSN) by designing energy efficient networking protocols, the impact of random device deployment on system lifetime is not stressed enough. Some research efforts have tried to optimize device deployment with respect to lifetime by assuming devices can be placed deliberately. However, the methodologies and solutions therein are not applicable to a randomly deployed large scale WSN. In this research, we propose three random deployment strategies for relay nodes in a heterogeneous WSN, namely, connectivity oriented, lifetime-oriented and hybrid deployment. We investigate how a strategy can affect both connectivity and network lifetime of a multi-hop heterogeneous WSN, in which relay nodes transmit data to the base station via multi-hop relay. The performance of the three strategies is evaluated through simulations. The results of this research provide a viable solution to the problem of optimizing provisioning of a large scale heterogeneous WSN.

Due to stringent energy constraints on small wireless devices, lifetime extension is one of the most critical technical concerns of WSN design. Many efforts have been made to improve the energy efficiency and extend the lifetime by designing energy efficient networking protocols. However, in a randomly deployed network, the significant influence of device deployment on the lifetime has been mostly overlooked. Device deployment is a fundamental issue in WSN design. It determines many intrinsic properties of a WSN, such as coverage, connectivity, cost, and lifetime. It has been examined in terms of its effect on coverage and/or connectivity However, the significance of deployment on lifetime in a randomly deployed network, in which the position of devices cannot be precisely known or controlled, is not addressed. A few research efforts have tried to optimize the device placement with respect to system lifetime . However, they all assume the relay nodes (RNs), or high profile nodes, can be deliberately placed. Hence, the methodologies and solutions therein are not applicable to the applications where deliberate placement is not feasible. The infeasibility usually occurs in two situations, one where the number of devices is very large, and the other where the application environment is not completely accessible. In these situations, well designed deployment density functions become viable approaches to optimizing the network provisioning.

3.O. Gnawali, R. Fonseca, K. Jamieson, D. Moss, and P. Levis, "Collection tree protocol," in Proc. 7th ACM Conf.

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Embedded Netw. Sensor Syst., 2009, pp. 1–14.

This paper presents and evaluates two principles for wireless routing protocols. The first is datapath validation: data traffic quickly discovers and fixes routing inconsistencies. The second is adaptive beaconing: extending the Trickle algorithm to routing control traffic reduces route repair latency and sends fewer beacons. We evaluate datapath validation and adaptive beaconing in CTP Noe, a sensor network tree collection protocol. We use 12 different testbeds ranging in size from 20–310 nodes, comprising seven platforms, and six different link layers, on both interference-free and interference-prone channels. In all cases, CTP Noe delivers > 90% of packets. Many experiments achieve 99.9%. Compared to standard beaconing, CTP Noe sends 73% fewer beacons while reducing topology repair latency by 99.8%. Finally, when using low-power link layers, CTP Noe has duty cycles of 3% while supporting aggregate loads of 30 packets/minute.

Reliability: a protocol should deliver at least 90% of end-to-end packets when a route exists, even under challenging network conditions. 99.9% delivery should be achievable without end-to-end mechanisms.

Robustness: it should be able to operate without tuning or configuration in a wide range of network conditions, topologies, workloads, and environments.

Efficiency: it should deliver packets with the minimum amount of transmissions across the network and requiring little state. Hardware Independence: it should achieve the three above goals without assuming specific radio chip features, as sensor networks use a wide range of platforms.

4.E. Lee, S. Park, F. Yu, and S.-H. Kim, "Data gathering mechanism with local sink in geographic routing for wireless sensor networks," IEEE Trans. Consum. Electron., vol. 56, no. 3, pp. 1433– 1441, Aug. 2010.

Most existing geographic routing protocols on sensor networks concentrates on finding ways to guarantee data forwarding from the source to the destination, and not many protocols have been done on gathering and aggregating data of sources in a local and adjacentregion. However, data generated from the sources in the region are often redundant and highly correlated. Accordingly, gathering and aggregating data from theregion in the sensor networks is important and necessary to save the energy and wireless resources of sensor nodes. We introduce the concept of a localsink to address this issue in geographic routing. The local sink is a sensor node in the region, in which the sensor node is temporarily selected by a global sink for gathering and aggregating data from sources in the region and delivering the aggregated data to the global sink. We next design a Single Local Sink Model for determining optimal location of single local sink. Because the buffer size of a local sink is limited and the deadline of data is constrained, single local sink is capable of carrying out many sources in a large-scale local and adjacent region. Hence, we also extend the Single Local Sink Model to a Multiple Local Sinks Model. We next propose a data gathering mechanism that gathers data in the region through the local sink and delivers the aggregated data to the global sink. Simulation results show that the proposed mechanism is more efficient in terms of the energy consumption, the data delivery ratio, and the deadline miss ratio than the existing mechanisms.

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5.D. M. Blough and P. Santi, "Investigating upper bounds on network lifetime extension for cell-based energy conservation techniques in stationary ad hoc networks," in Proc. 13th Annu. ACM Int. Conf. Mobile Comput. Netw., 2002, pp. 183–192.

Cooperative cell-based strategies have been recently proposed as a technique for extending the lifetime of wireless ad hoc networks, while only slightly impacting network performance. The effectiveness of this approach depends heavily on the node density: the higher it is, the more consistent energy savings can potentially be achieved. However, no general analyses of network lifetime have been done either for a base network (one without any energy conservation technique) or for one using cooperative energy conservation strategies. In this paper, we investigate the lifetime/density tradeoff under the hypothesis that nodes are distributed uniformly at random in a given region, and that the traffic is evenly distributed across the network. We also analyze the case where the node density is just sufficient to ensure that the network is connected with high probability. This analysis, which is supported by the results of extensive simulations, shows that even in this low density scenario, cell-based strategies can significantly extend network lifetime.Wireless ad hoc networks arenetworks where multiple nodes, each possessing a wireless transceiver, form a network amongst themselves via peer-to-peer communication. An ad hoc network can be used to exchange information between the nodes and to allow nodes to communicate with remote sites that they otherwise would not have the capability to reach. Wireless ad hoc networks are usually multi-hop networks because, as opposed to wireless LAN environments, messages typically require multiple hops before reaching a gateway into the wired network infrastructure. Since nodes in a wireless ad hoc network are battery powered, energy conservation is important to extend the functional lifetime of both individual nodes and the network. Much of the prior work on energy conservation in wireless ad hoc networks has focused on energy-conserving routing protocols. However, the maximum energy savings, and hence lifetime extension, that can be achieved through routing algorithm optimization could be quite limited. This is because the energy used by standard wireless interfaces just to sense the channel can be nearly as much as that used in receiving a message and about 60% of the energy used in transmitting [8]. A few prior works have proposed more aggressive strategies for energy conservation in which some nodes' transceivers are completely shut down for some period of time . This type of approach has the potential to reduce energy consumption dramatically and, therefore, to increase network lifetime significantly. However, no general analyses of network lifetime have been done either for a base network (one without any energy conservation techniques) or for one using an aggressive energy conservation technique.

EXISTING SYSTEM:

- Several approaches have been proposed for efficient data collection in the literature. Based on the focus of these works, it can roughly divide them into three categories.
- The first category is the enhanced relay routing, in which data are relayed among sensors. Besides relaying, some other factors, such as load balance, schedule pattern and data redundancy, are also

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considered. The second category organizes sensors into clusters and allows cluster heads to take the responsibility for forwarding data to the data sink. Clustering is particularly useful for applications with scalability requirement and is very effective in local data aggregation since it can reduce the collisions and balance load among sensors.

The third category is to make use of mobile collectors to take the burden of data routing from sensors.

DISADVANTAGES OF EXISTING SYSTEM:

Cluster heads will consume much more energy than other sensors when of overloading occurs. So, the lifetime of the node will be reduced quickly. If cluster head destroyed the whole system will be collapse.

There are no proper load balancing methods.

If traffic occurs the message wait for long queue.

If the information destroys due to collusion, the transmission node estimates the retransmission request to source.

PROPOSED SYSTEM:

The proposal System has a three-layer mobile data collection framework, named Load Balanced Clustering and Dual Data Uploading (LBC-DDU).The main motivation is to utilize distributed clustering for scalability, to employ mobility for energy saving and uniform energy consumption, and to exploit Multi-User Multiple-Input and Multiple-Output (MU-MIMO) technique for concurrent data uploading to shorten latency. The main contributions of this work can be summarized as follows.'First, proposal is to introduce distributed algorithm to organize sensors into clusters, where each cluster has multiple cluster heads.Second, multiple cluster heads within a cluster can collaborate with each other to perform energy efficient inter-cluster transmissions.Third, is deploy a mobile collector with two antennas (called SenCar in this paper) to allow concurrent uploading from two cluster heads by using MU-MIMO communication. The SenCar collects data from the cluster heads by visiting each cluster. It chooses the stop locations inside each cluster and determines the sequence to visit them, such that data collection can be done in minimum time

ADVANTAGES OF PROPOSED SYSTEM:

In contrast to clustering techniques proposed in previous works, our algorithm balances the load of intra-cluster aggregation and enables dual data uploading between multiple cluster heads and the mobile collector. Different from other hierarchical schemes, in our algorithm, cluster heads do not relay data packets from other clusters, which effectively alleviates the burden of each cluster head. Instead, forwarding paths among clusters are only used to route small-sized identification (ID) information of cluster heads to the mobile collector for optimizing the data collection tour. Our work mainly distinguishes from other mobile collection schemes in the utilization of MUMIMO technique, which enables dual data uploading to shorten data transmission latency and coordinate the mobility of SenCar to fully enjoy the benefits of dual data uploading, which ultimately leads to a data collection tour with both short moving trajectory and short data uploading time.

Conclusion:

we would like to point out that there are some interesting problems that may be studied in our future work. The first problem is how to find polling points and compatible pairs for each cluster. A discretization scheme should be developed to partition the continuous space to locate the optimal

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polling point for each cluster. Then finding the compatible pairs becomes a matching problem to achieve optimal overall spatial diversity. The second problem is how to schedule MIMO uploading from multiple clusters. An algorithm that adapts to the current MIMO-based transmission scheduling algorithms should be studied in future.

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