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A Robust Scheme for Energy Aware Data Collection for Wireless Sensor Networks

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Abstract

In Wireless Sensor Networks, directly sending large amount of data to the sink node may cause several problems. So, the data collection is a basic task in wireless sensor network. Certain application needs approximate data collection. In this paper, we focus on to collect a data approximately and efficiently with limited energy. So, we propose a technique called ADC (Approximate Data Collection). It divides a sensor network into cluster and determines data association on each cluster head. It performs global approximate data collection on the sink node according to model parameters uploaded by cluster heads. It can be formulate the problem of selecting the minimum subset of sensor nodes. In particular, we propose an OLSR Routing Protocol to minimize the overhead from flooding of control traffic by using only selected nodes, called MPRs to retransmit control messages. This technique significantly reduces the number of retransmissions required to flood a message to all nodes in the network. The proposed technique is adaptive to environment changes. It is more efficient and reduces the amount of message transmission when compared to existing techniques.

Keywords

Wireless sensor networks, Approximate Data Collection, Data Aggregation, OLSR Protocol

I. Introduction

The wireless sensor networks are used in applications such as military surveillance, battle fields etc. A wireless sensor networks consist of minute resource bounded sensor, which is equipped with limited battery power, so the transmission may consumes a lot of energy. To avoid this problem, data aggregation technique is taken into an account. This technique efficiently reduces data redundancy and saves energy. In many applications of wireless sensor network, it is avoidable to collect complete set of data from a resource bounded WSN. In wireless sensor networks, directly sending large amount of data to sink node may cause several problems. The problems occur due to this are i) the quality of data get lost because of packet loss. ii) huge data collection leads to excessive communication overhead. Due to this the lifetime of the sensor nodes get deployed. So the data collection strategy must be designed carefully to minimize energy consumption and to increase the lifetime of the network as much as possible.

For long term data collection in wireless sensor networks with bounded bandwidth, approximate data collection is the best method. A recent application of WSNs needs to collect data approximately and efficiently due to constraints in energy budget and communication bandwidth. In this paper we consider the problem of data collection in physical environments where the different sensors containing a data are correlated. The correlation of the data being collected can be influenced by approximately fusing the data inside the network sensor and reduces the number of transmission and energy consumption, for data collection process. To achieve this we propose a technique called ADC (Approximate Data Collection).

In many scenarios with densely deployed sensor nodes, the sensor data gathered by sensor nodes may have a spatial – temporal correlation characteristic. By surveying such characteristics, the sensor nodes can be collecting a data in an aggressive manner. So the data accuracy will be increased just by reducing data traffic. The Approximate Data Collection scheme should be scalable. This technique is more efficient to physical environmental changes and reduces message transmission.

II. Proposed Work

In wireless sensor network, packet loss due to communication overhead and energy consumption is the major problem. To avoid those, several data aggregation schemes are proposed. In this paper we focus on to reduce the packet loss and energy consumption, we propose a technique called semantic correlation tree and to approximate the sensing data and we propose an Approximate Data Collection with OLSR (Optimize Link State Routing) protocol. ADC method should be scalable, Efficient and Self adaptive.

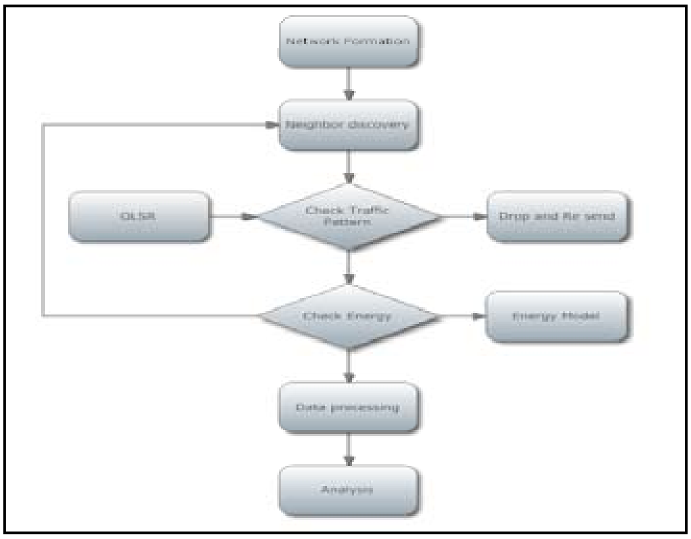

Fig. 1: Proposed Diagram Energy Data Collection for WSN using OLSR Protocol

A. Architecture Design

We used ns2 simulator on Linux machine. Because, we focus on the link stability and route lifetime, no route overhead was considered in our simulation. In 300 X 300 m2area, sensor nodes exist using manna-sim for data generation. We used square area to increase average hop length of a route with relatively small nodes. The transmission range is fixed at 250 units. Maximum speed of node is set to 10 m/sec. The number of nodes is varying from 50 to 100.

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B. Protocol Implementation

Cluster head selection hybrid of residual energy (primary) and communication cost (secondary) such as node proximity Number of rounds of iterations, Tentative CHs formed ,Final CH until CHprob=1, Same or different power levels used for intra cluster communication Assigned Cluster heads collect the recorded information from the sensor nodes and perform filtering upon raw data and forward the filtered information to the appropriate "Ingress Node". Assigned Cluster heads collect the recorded information from the sensor nodes and perform filtering upon raw data and forward the filtered information to the appropriate access point node which is placed nearer to sink node. The access point then transfers its data to the sink node.

C. Energy Optimization

Proposed to achieve trade of energy consumption and time delay. Sensors send their measurement to a subset of sensors called relay points (RPs) by multi-hop communication, A sink moves around in the network and retrieves data from encountered RPs. RPs are static, data dissemination to RPs is equivalent to data dissemination to static sinks.

D. OLSR Routing Protocol

OLSR is a proactive routing protocol for mobile ad hoc networks. The protocol inherits the stability of a link state algorithm and has the advantage of having routes immediately available when needed due to its proactive nature. OLSR is an optimization over the classical link state protocol, tailored for mobile ad hoc networks. OLSR minimizes the overhead from flooding of control traffic by using only selected nodes, called MPRs, to retransmit control messages. This technique significantly reduces the number of retransmissions required to flood a message to all nodes in the network. Secondly, OLSR requires only partial link state to be flooded in order to provide shortest path routes. The minimal set of link state information required is, that all nodes, selected as MPRs ,must declare the links to their MPR selectors. OLSR may optimize the reactivity to topological changes by reducing. The maximum time interval for periodic control message transmission.

As OLSR continuously maintains routes to all destinations in the network, the protocol is beneficial for traffic patterns where a large subset of nodes are communicating with another large subset of nodes, and where the [source, destination] pairs are changing over time. The protocol is particularly suited for large and dense networks, as the optimization done using MPRs works well in this context. The larger and more dense a network, the more optimization can be achieved as compared to the classic link state algorithm. OLSR is designed to work in a completely distributed manner and does not depend on any central entity. The protocol does not require reliable transmission of control messages each node sends control messages periodically, and can therefore sustain a reasonable loss of some such messages. Such losses occur frequently in radio networks due to collisions or other transmission problems. Also, OLSR does not require sequenced delivery of messages. Each control message contains a sequence number which is incremented for each message. Thus the recipient of a control message can, if required, easily identify which information is more recent - even if messages have been re-ordered while in transmission.

E. Analysis

In this proposed system analyzed the following parameters

1. Packet Delivery ratio

Many protocols in wireless sensor networks use packet delivery ratio (PDR) as a metric to select the best route, transmission rate or power. PDR is normally estimated either by counting the number of received hello/data messages in a small period of time, i.e., less than 1 second, or by taking the history of PDR into account. The first method is accurate but requires many packets to be sent, which costs too much energy. The second one is energy efficient, but fails to achieve good accuracy. Therefore in this paper we propose a novel estimation method which takes advantage of receiving signal strength. We show our proposed method is much more accurate than the second estimation method, while being simple and energy efficient at the same time.

2. Packet overhead

It takes to transmit data on a packet-switched network. Each packet requires extra bytes of format information that is stored in the packet header, which, combined with the assembly and disassembly of packets, reduces the overall transmission speed of the raw data.

3. Routing cost

In packet switching networks, routing directs packet forwarding (the transit of logically addressed packets from their source toward their ultimate destination) through intermediate nodes. Intermediate nodes are typically network hardware devices such as routers, bridges, gateways, firewalls, or switches. The Routing cost should be reduced by using OLSR Routing Protocol which have the correct routing path with minimum distance.Our proposed method, reduces the routing cost successfully.

4. Originator Address

This field contains the main address of the node, which has originally generated this message. This field should not be confused with the source address from the IP header, which is changed each time to the address of the intermediate interface.

5. Loss Ratio

Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is distinguished as one of the three main error types encountered in digital communications the other two being bit error and spurious packets caused due to noise. It also reduces the packet loss ratio.

III. Results

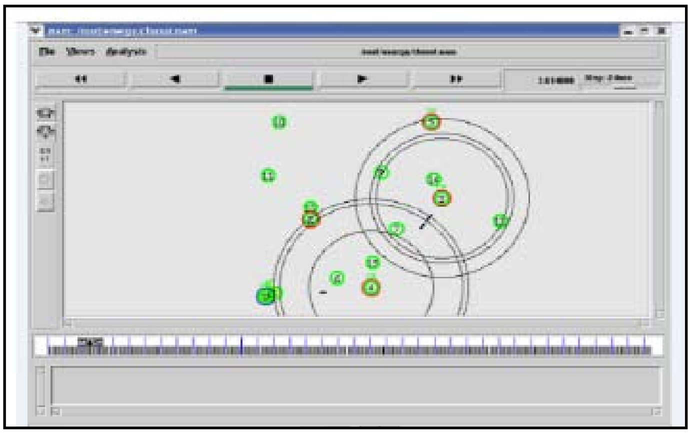

Fig . 2:Initialize the Node list

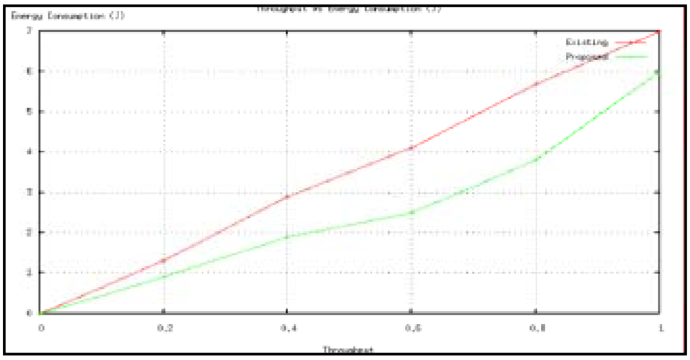

Fig. 3: Comparison of Existing and Proposed system for Throughput vs Energy Consumption

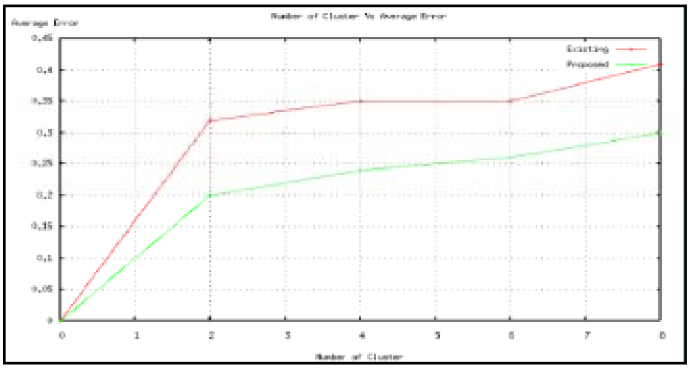

Fig. 4: Comparison of Existing and Proposed System for Number of Cluster vs Average Error

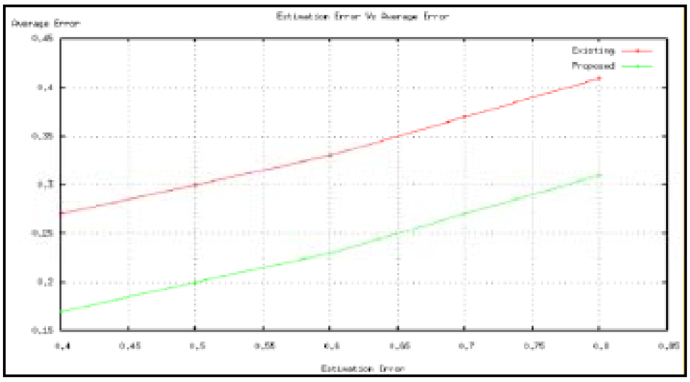

Fig. 5: Comparison of Existing and Proposed system for Estimated Error vs Average Error

IV. Conclusion and Future Work

In this paper, we propose novel approximate data collection in WSNs. ADC can approximate all reading of the sensor network by exploiting the fact that physical environments frequently exhibit predictable weak stable state and strong temporal and spatial correlations between sensor readings. It detects data similarities among the sensor nodes by comparing their local estimation model rather than original data. The simulation results show that this approach can reduce the communication when compared with existing models.

In the future, this uses the relay-based data collection approaches RPs are static, once selected they do not change.This method is used for security purpose . However due to message relay overhead, uneven energy depletion will appear around RPs as the network evolves, offsetting the effectiveness of the algorithm for network lifetime elongation.

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