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Compressive Data Gathering Based on Even Clustering for Wireless Sensor Networks

Dhivya M[1], Gurubharani P[2], Lavanya V[4], Nandhini S[4]
Department of Electronics and Communication Engineering
Bharathiyar Institute of Engineering for Women, Deviyakurichi.
ecedivya2000@gmail.com[1], bharanisugu19102000@gmail.com[2], lavanyav926@gmail.com[3], nandhiniskthvl2002@gmail.com[4].

Sethupathy KB
Assistant Professor/Department of Electronics and Communication Engineering
Bharathiyar Institute of Engineering for Women, Deviyakurichi.
sethupathy16@gmail.com[5]

ABSTRACT :

Compressive data gathering (CDG) based on compressed sensing (CS) theory for wireless sensor networks (WSNs) greatly reduces the amount of data transmitted compared with the traditional acquisition method that each node forwards the collected data directly to the next node. CDG combined with sparse random projection can further reduce the amount of data and thus prolong the lifetime of the WSN. The method of randomly selecting projection nodes as cluster heads to collect the weighted sum of sensor nodes outperforms the non-CS (without using CS) and hybrid-CS (applying CS only to relay nodes that are overloaded) schemes in decreasing the communication cost and distributing the energy consumption loads. However, the random selection of projection nodes causes the overall energy consumption of the network to be unstable and unbalanced. In this paper, we propose two compressive data gathering methods of balanced projection nodes. For WSN with uniform distribution of nodes, an even clustering method based on spatial locations is proposed to distribute the projection nodes evenly and balance the network energy consumption. For WSN with unevenly distributed nodes, an even clustering method based on node density is proposed, taking into account the location and density of nodes together,balancing the network energy and prolonging the network lifetime.

KEY WORDS:

Cluster head, compressed sensing(CS), compressive data gathering(CDG), Even clustering, random projection, sensor node, wireless sensor networks (WSN).

INTRODUCTION:

The most immediate goal for wireless sensor networks (WSN) is to collect data. Because the data gathered by the sensor nodes in WSN has spatio-temporal correlation, it satisfies the condition that the signal is sparse or compressible in the application of compressed sensing (CS) theory. The sensor nodes have limited resources and the sink node has strong performance, which is suitable for the simple coding and complex decoding of compressed sensing theory. Therefore, the technology of WSN data collection based on compressed sensing has been gradually and extensively studied and developed.

Compressive data gathering (CDG) is based on the compressed sensing theory.

Each node multiplies the projection coefficient by the locally collected data and passes it to the next node. The next node also multiplies the collected data by the projection coefficient, then pluses the weighted data from the previous node, and transfers the weighted sum to the next node. In this way, each node calculates and transmits a weighted sum along the route. Eventually, the weighted sum of all nodes is transmitted to the sink node, thus the sink gets a measured value.

LITERATURE REVIEW:

A literature review is an account of what has been published on a topic by accredited scholars and researchers. Occasionally you will be asked to write one as a separate assignment, but more often it is part of the introduction to an essay, research report, or thesis.

In writing the literature review, your purpose is to convey to your reader what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are. As a piece of writing, the literature review must be defined by a guiding concept (e.g., your research objective, the problem or issue you are discussing or your argumentative thesis). It is not just a descriptive list of the material available, or a set of summaries. We begin with a study of the overall properties of the network. We show that the density of the network, which measures the amount of interconnection per person, follows the same unexpected pattern in both networks: rapid growth, decline, and then slow but steady growth. We postulate based on the timing of the events that the pattern is due to the activities of early Adopters who create significant linkages in their exploration of the system, followed by a period of rapid growth in which new members join more quickly than friendships can be established, settling finally into a period of ongoing organic growth in which both membership and linkage increases.

[1] J. Haupt, W. U. Bajwa, M. Rabbat, and R. Nowak, "Compressed sensing for networked data"

This article describes a very different approach to the decentralized compression of networked data. Considering a particularly salient aspect of this struggle that revolves around large-scale distributed sources of data and their storage, transmission, and retrieval. The task of transmitting information from one point to another is a common and well-understood exercise. But the problem of efficiently transmitting or sharing information from and among a vast number of distributed nodes remains a great challenge, primarily because we do not yet have well developed theories and tools for distributed signal processing, communications, and information theory in large-scale networked systems.

[2] J. Luo, L. Xiang, and C. Rosenberg, ``Does compressed sensing improve the throughput of wireless sensor networks?"

Although compressed sensing (CS) has been envisioned as a useful technique to improve the performance of wireless sensor networks (WSNs), it is still not very clear how exactly it will be applied and how big the improvements will be. [2] proposed a secure hash message authentication code. A secure hash message authentication code to avoid certificate revocation list checking is proposed for vehicular ad hoc networks (VANETs). The group signature scheme is widely used in VANETs for secure communication, the existing systems based on group signature scheme provides verification delay in certificate revocation list checking. They illustrate two crucial insights: first, applying CS naively may not bring any improvement, and secondly, our hybrid- CS can achieve significant improvement in throughput.

[3] C. Luo, F. Wu, J. Sun, and C. W. Chen, "Effcient measurement generation and pervasive sparsity for compressive data gathering"

We proposed compressive data gathering (CDG) that leverages compressive sampling (CS) principle to efficiently reduce communication cost and prolong network lifetime for large scale monitoring sensor networks. The network capacity has been proven to increase proportionally to the sparsity of sensor readings. In this paper, we further address two key problems in the CDG framework. First, we investigate how to generate RIP (restricted isometry property) preserving measurements of sensor readings by taking multi-hop communication cost into account. Excitingly, we discover that a simple form of measurement matrix [I R] has good RIP, and the data gathering scheme that realizes this measurement matrix can further reduce the communication cost of CDG for both chain-type and tree-type topology. Second, although the sparsity of sensor readings is pervasive, it might be rather complicated to fully exploit it. Owing to the inherent flexibility of CS principle, the proposed CDG framework is able to utilize various sparsity patterns despite of a simple and unified data gathering process. In particular, we present approaches for adapting CS decoder to utilize cross-domain sparsity (e.g. temporal-frequency and spatial-frequency). We carry out simulation experiments over both synthesized and real sensor data. The results confirm that CDG can preserve sensor data fidelity at a reduced communication cost.

EXISTING SYSTEM:

However, the random selection of projection nodes causes the overall energy consumption of the network to be unstable and unbalanced. In this project, we existing two compressive data gathering methods of balanced projection nodes. For WSN with uniform distribution of nodes, an even clustering method based on spatial locations is existing to distribute the projection nodes evenly and balance the network energy consumption. For WSN with unevenly distributed nodes, an even clustering method based on node density is existing, taking into account the location and density of nodes together, balancing the network energy and prolonging the network lifetime. The simulation results show that compared with the random projection node method and the random walk method, our proposed methods have better network connectivity and more significantly increased overall network lifetime.

DISADVANTAGES OF EXISTING SYSTEM:

The random selection of projection nodes causes the overall energy consumption

Network to be unstable and unbalanced.

Taking into account the location and density of nodes together, balancing the network.

PROPOSED SYSTEM:

- The proposed work describes an efficient communication paradigm has been adopted in the bottleneck zone by combining duty cycle and network coding.
- Studies carried out to estimate the upper bounds of the network lifetime by considering
  (i) duty cycle,
  (ii) network coding and
  (iii) combinations of duty cycle

and network coding. The sensor nodes in the bottleneck zone are divided into two groups: simple relay sensors and network coder sensors.

• The relay nodes simply forward the received data, whereas, the network coder nodes transmit using the proposed network coding based algorithm.

• Energy efficiency of the bottleneck zone increases because more volume of data will be transmitted to the Sink with the same number of transmissions. This in-turn improves the overall lifetime of the network.

ADVANTAGES OF PROPOSED SYSTEM:

• The network coding technique improves the capacity of an information network with better utilization of bandwidth and the reliability of the network.

• Energy savings are done at the node level through switching between active and sleep states.

• There is a reduction in energy consumption in the bottleneck zone with the proposed approach. This in turn will lead to increase in network lifetime.

IMPLEMENTATION:

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.

The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of ethods to achieve changeover and evaluation of changeover methods.

MODULES:

1. Cluster Setup
2. Calculating the End-to-End Delay
3. Inter-Cluster Multi-Hop Routing Algorithm
4. Network coding

Module1 :

The algorithm begins with the neighbor discovery phase, which is initiated by the sink by broadcasting an advertisement (ADV) message to all nodes at a certain power level. Each node computes its approximate distance to the sink (dtoSink) according to the received signal strength.

To address this situation, a trade-off for energy and delay (TED) is used to establish a balance between energy consumption and end-to-end delay by adjusting the value of the parameter α based on the remaining energy of the cluster head and the value of the parameter β based on distance from the cluster head to the sink. All cluster head candidates that receive a final cluster head announcement cancel their TED timers to become the member nodes for the current round. After the cluster setup procedure is finished, all cluster heads broadcast time division multiple access (TDMA) message to allocate time slots to their cluster members.

Module 2:

The link delay D(i, j) is a measure of the delay a packet experiences when traversing a link from node i to node j. By definition, a link delay D(i, j) includes the queuing delay dQ per node, the transmission delay dT , and the propagation delay dP . In other words:

$D(i, j) = (dQ + dT + dP)$ (5) where $dT = l/\psi$ and $dP = dij/\gamma$; l is the packet size (bits), ψ is the link bandwidth (bps), dij is the length of physical link from cluster head i to cluster head j, and γ is the propagation speed in the medium (m/s). The value of dQ can be calculated using rules related to queue theory.The nodal queue is considered to be of type M/M/1. In this type of queue, the input is of Poisson type, the output is an exponential random variable, and the amount of service is 1.

[4] discussed that the activity related status data will be communicated consistently and shared among drivers through VANETs keeping in mind the end goal to enhance driving security and solace. Along these lines, Vehicular specially appointed systems (VANETs) require safeguarding and secure information correspondences.

Module 3:

Inter-Cluster Multi-Hop Routing Algorithm Our optimization problem is finding the lowest cost route (most energy efficient) from a Cluster head node x to the sink s such that the end-to-end delay along that route does not exceed a delay constraint Δ. The constrained minimization problem is: where Rk is the kth route, R (x, s) is the set of routes from cluster head node x to the sink s for which the end-to-end delay is bounded by Δ, given by:

By considering the optimization problem above, we propose the algorithm shown in Algorithm 1 to find k-least cost routes that meet the end-to-end delay constraint. If so, Rk is chosen (SeR, lines 9 and 10), and if not, Rk will be removed and added to the No Sa (lines 7 and 13). Line 7 will remove least cost routes that do not satisfy the delay bound Δ.

Module 4:

Network coding is a technique which allows the intermediate nodes to encode data packets received from its neighboring nodes in a network .The encoding and decoding methods of linear network coding are described below. Encoding operation: A node, that wants to transmit encoded packets, chooses a sequence of coefficients q = (q1, q2, ..., qn), called encoding vector, from GF(2s). A set of n packets Gi(i= 1, 2, 3, 4, ..., n) that are received at a node are linearly encoded into a single output packet.
The output encoded packet is given by
the coded packets are transmitted with the n coefficients in the network. The encoding vector is used at the receiver to decode the encoded data packets. Decoding operation: A receiver node solves a set of linear equations to retrieve the original packets from the received coded packets. The encoding vector q is received by the receiver sensor nodes with the encoded data. Let, a set (q1, Y 1), ..., (qm, Y m) has been received by a node. The symbols Y j and qj denote the information symbol and the coding vector for the jth received packet respectively. A node solves the following set of linear equations (2) with m equations and n unknowns for decoding operation.

[1] discussed because of various appealing focal points, agreeable correspondences have been broadly viewed as one of the promising systems to enhance throughput and scope execution in remote interchanges. The hand-off hub (RN) assumes a key part in helpful interchanges, and RN determination may considerably influence the execution pick up in a system with agreeable media get to control (MAC).

CONCLUSION :

LEACH seems to be a promising protocol, there are some areas for improvement that makes the protocol more attractive and widely applicable. In this project,an energy efficient clustering algorithm has been proposed for Wireless Sensor Network using fuzzy logic concept. By selecting suitable fuzzy descriptors one Super Cluster Head is selected among the cluster heads who is the representative for delivering the message to a mobile base station. The idea of sink mobility along with the fuzzy logic increases the network life time dramatically. It is expected that it would be more useful in many practical applications like health care, agricultural field, disaster heat areas, military applications etc. Simulation result shows that the proposed protocol performs better than LEACH protocol in terms of first node dies, half nodes alive, last node dies, better stability and better network lifetime.

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