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ENERGY EFFICIENT APPROACH FOR MOBILE DATA GATHERING IN WIRELESS SENSOR NETWORKS

Menaga.M [1], R.Sudha[2]

PG scholar, ME-CSE, Gnanamani College of Engineering, Namakkal, T.N, India[1]

AP/CSE, Gnanamani College of Engineering, Namakkal, T.N, India[2]

Abstract: Energy consumption becomes a main concern in a Wireless Sensor Network. Wireless sensor network (WSN) requires robust and energy efficient communication protocols to minimize the energy consumption as much as possible. In this project, the investigation of the impact of outlying sensor readings and broken links on high-fidelity data gathering is carried out, and propose Compressive sensing Theory based bounded relay hop mobile data gathering (CST-BRH) approaches, Here a subset of sensors will be selected as polling points that buffer locally aggregated data and upload the data to the mobile collector when it arrives. It also identify outlying sensor readings and derive the corresponding accurate values, and to infer broken links. The proposed design is validated by an extensive simulation study, and the results indicate that CST-BRH method is superior over traditional in-network data compression techniques for practical sensor network settings**.** This analyze the trade-off between energy saving and data gathering latency in mobile data gathering.

1. INTRODUCTION

In this work, the investigation of the impact of outlying sensor readings and broken links on high-fidelity data gathering is carried out, and propose approaches based on the compressive sensing theory to identify outlying sensor readings and derive the corresponding accurate values, and to infer broken links. The proposed design is validated by a comparison based extensive simulation study, and the results indicate that compressive data gathering is superior over traditional in-network data compression techniques for practical sensor network settings**.** This analyze the trade-off between energy saving and data gathering latency in mobile data gathering. It focuses on selecting a subset of sensors as the PPs using Compressive sensing. Each PP temporarily buffers the data originated from its affiliated sensors. When the mobile collector arrives, it polls each PP to request data uploading. Upon receiving the polling message, a PP uploads data packets to the mobile collector in a single hop. The mobile collector starts its tour from the static data sink, which is located either inside or outside the sensing field, collects data packets at the PPs and then returns the data to the data sink. Since the data sink is the starting and ending points of the data gathering tour, it can also be considered as a special PP. Also refer to this scheme as the polling-based mobile data gathering scheme.

2. WIRELESS SENSOR NETWORK (WSN)

In recent years Wireless Sensor Network has become potentially most important technology. Improvisation in wireless communications and electronics paved way for the production of low-cost, low-power, multifunctional miniature devices that can be implemented in remote sensing applications. As a result of these factors, it is possible to collect the process and disseminate valuable information that has been gathered from variety of environments using a sensor network comprising a large number of intelligent sensors.

A large number of sensor nodes that is capable of performing operations such as sensing, data processing

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and communicating together forms a sensor network. It is mandatory that all Sensor network protocols and algorithms should be self-organizing. Sensor networks add a distinctive feature of cooperative effort of sensor nodes. Sensor nodes are suitable with an onboard processor. Nodes responsible for the fusion utilize their processing abilities to locally carry out simple computations and transmit only the required and partially processed data rather than sending the raw data.

Primarily Sensor networks are data-centric than address centric so sensed data are directed to an area that consists of a cluster of sensors rather than particular sensor addresses. In a dense cluster, sensors obtain similar data and aggregation of the data is performed locally. In order to reduce the communication bandwidth, an aggregator node within the cluster prepares an analysis of the local data thereby increasing the level of accuracy and reducing data redundancy. Features such as network scalability, robustness, efficient resource utilization and lower power consumption are permitted by network hierarchy and clustering of sensor nodes. The ultimate aim for sensor networks is to achieve reliability, accuracy, flexibility, cost effectiveness and ease of deployment.

2.1 REQUIRED MECHANISMS

To realize these requirements, innovative mechanisms for a communication network new architectures and protocol concepts have to be found. A particular challenge here is the need to find mechanisms that are sufficiently specific to the idiosyncrasies of a given application to support the specific quality of service, lifetime, and maintainability requirements (Estrin et al 1999). On the other hand, these mechanisms also have to generalize to a wider range of applications lest a complete from-scratch development and implementation of a WSN becomes necessary for every individual application. This would likely render WSN as a technological concept economically infeasible.

While wireless communication will be a core technique, a direct communication between a sender and a receiver is faced with limitations. In particular, communication over long distances is only possible using prohibitively high transmission power. The use of intermediate nodes as relays can reduce the total required power. Hence, for many forms of WSN, so-called multi-hop communication will be a necessary ingredient.

A WSN will have to configure most of its operational parameters autonomously; independent of external configuration, the sheer number of nodes and simplified deployment will require that capability in most applications. As an example, nodes should be able to determine their geographical positions only using other nodes of the network so-called “self-location”. Also, the network should be able to tolerate failing nodes or to integrate new nodes.

In some applications, a single sensor is not able to decide whether an event has happened but several sensors have to collaborate to detect an event and only the joint data of many sensors provides enough information. Information is processed in the network itself in various forms to achieve this collaboration, as opposed to having every node transmit all data to an external network and process it “at the edge” of the network. An example is to determine the highest or the average temperature within an area and to report that value to a sink.

The principle of locality will have to be embraced extensively to ensure, in particular, scalability. Nodes, which are very limited in resources like memory, should attempt to limit the state that they accumulate during protocol processing to information only about their direct neighbors. The hope is that this will allow the network to scale to large numbers of nodes without having to rely on powerful processing at each single node. Similar to the locality principle, WSN will have to rely to a large degree on exploiting various inherent trades-offs between mutually contradictory goals, both during protocol design and at runtime. Higher energy expenditure allows higher result accuracy, or a longer lifetime of the entire network traded off against the lifetime of individual nodes. Another important trade-off is node density: depending on

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application, deployment, and node failures at runtime, the density of the network can change considerably. Then the protocols will have to handle very different situations, possibly present at different places of a single network.

2.2. SYSTEM ARCHITECTURE AND DESIGN ISSUES

Secure routing protocol performance depends upon the architectural model and design of the sensor networks. Based on the application requirements different architectures and design goals/constraints have been considered for sensor networks.

2.1.1 Sensor Node Hardware Overview

The end device in WSNs, the sensor node, is composed of four basic units (Marcos et al 2006): sensing unit, processing unit, power unit and transceiver unit as depicted in Figure 1.1. These four units are briefly explained as follows:

- **Sensing Unit:** It consists of an array of sensors that can measure the physical characteristics of its environment, like temperature, light, vibration, and others. Each sensor has the ability to sense environmental characteristics via the sensing unit and then use the Analog to Digital Converter (ADC) to convert the sensed analog data into digital.
- **Processing Unit:** It is, in most cases, composed of an internal memory to store data and application programs, and a microcontroller to process the data. The microcontroller can be considered as a highly constrained computer that contains the memory and interfaces required to create simple applications. This unit should be able to work with a limited resource of energy and process efficiently the digital data delivered by the sensing unit.
- **Power Unit:** It provides the energy required by all the sensor components, and such energy may come from either a battery or from renewable sources.
- **Transceiver Unit:** It is able to send and receive messages through a wireless channel. In other words, it gives the sensor the ability to talk to other sensor nodes and form an Ad-hoc Network.

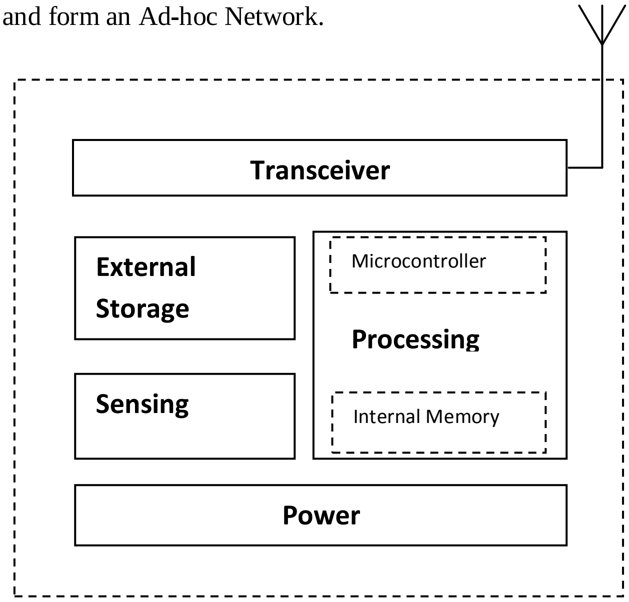

Fig2. 1.1 Main Components of a Sensor Node

3 SYSTEM ARCHITECTURE

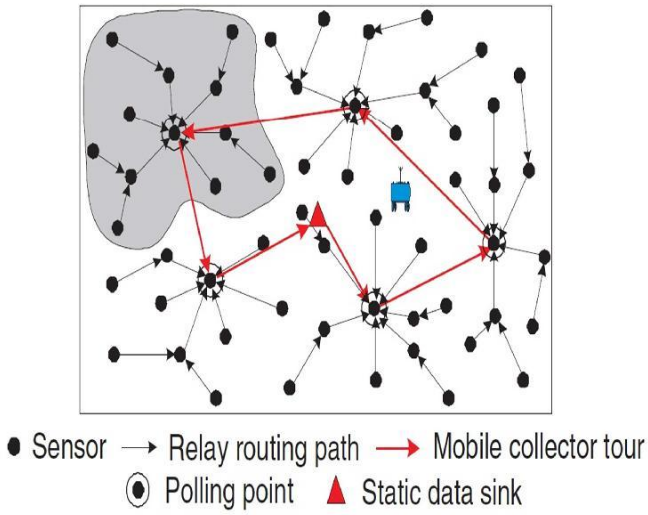

Fig 3.1 System Architecture

3.1 MOVING DATA PACKETS TO SINK

Data packets are forwarded to the data sink via multi-hop relays among sensors. However, due to the inherent nature of multi-hop routing, packets have to experience multiple relays before reaching the data sink. As a result, much energy is consumed on data forwarding along the path.

3.2 MULTI HOP ROUTING

Here adopt multi-hop routing for data gathering and each packet is forwarded along its shortest path with the minimum hop count to the data sink, where each packet needs some number of hops on average to reach the data sink. On the other hand, when a mobile collector is employed, here the mobile collector gathers data packets by sequentially visiting each sensor, which guarantees that each sensor can directly upload data to the mobile collector without any relay. In this way, the number of transmissions is greatly reduced.

3.3 BOUNDED RELAY HOP FOR MOBILE DATA GATHERING

In order to shorten data gathering latency, it is necessary to incorporate multi-hop relay into mobile data gathering, while the relay hop count should be constrained to a certain level to limit the energy consumption at sensors. Here a subset of sensors will be selected as the polling points (PPs), each aggregating the local data from its affiliated sensors within a certain number of relay hops. These PPs will temporarily cache the data and upload them to the mobile collector when it arrives.

3.4 COMPRESSIVE SENSING THEORY IMPLEMENTATION

It investigates the impact of outlying sensor readings and broken links on high-fidelity data gathering, and proposes approaches based on the compressive sensing theory to identify outlying sensor readings and derive the corresponding accurate values, and to infer broken links.

4. CONCLUSION

A spatiotemporal compression technique called Temporally Compressed Random Access Compressive Sensing (T-RACS) that directly addresses the energy and bandwidth constraints of periodic data-collecting WSNs will be proposed. In this project it is shown the reduced data gathering delay from sensor node to base Station by Implementing the Polling points between the clusters & using bounded relay hop Mobile collector. Overall Energy consumed by each sensor nodes is comparatively low with maximum throughput of data. It is been achieved with moving tour length of mobile collector & total data aggregation in each cluster & base station. T-RACS effectively combines temporal compression through piecewise linear approximations, compressive sensing theory, and a random access channel. The resulting algorithm achieves high overall compression ratios and does not require any form of synchronization or scheduling. The only feedback from the fusion center is the broadcast of one parameter, the error margin, during initialization and infrequent system updates. T-RACS offers a scalable and highly energy- efficient algorithm for collecting large amounts of data continuously in a sensor network.

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BIOGRAPHIES

M. Menaga received the MCA degree from Vivekanandha Institute Of Engg & Tech For Women / Anna University, in 2011. Now she is doing PG degree at Gnanamani College of Engineering, Namakkal.

R. Sudha received UG, PG degree from Anna University affiliated colleges. She is currently working as assistant professor in the CSE department at Gnanamani College of Engineering, Namakkal.

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