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Reliable Communication using FEC in Wireless Sensor Network

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ABSTRACT Wireless Sensor Networks spend more energy in communication as compared to computation and storage cost. When the nodes in the same sensing region transmit the similar information to the base station then the overlapping of the sensing regions is higher. This will lead to loss in energy. Redundancy in such systems is high. To reduce this effect new techniques and algorithms are need to be designed. Forward erasure coding (FEC) technique is applied for loss recovery. Results show that the proposed system will increase the network lifetime by controlling the redundancy.

KEYWORDS : Forward Erasure Coding, Reliable, Correlation.

I. INTRODUCTION

The small device called sensor nodes are deployed with sensors, transceivers, processing unit, storage resources and actuators. These nodes are used to achieve some process related to sensing. In traditional sensor networks, the common communication channel is used. Heterogeneous wireless sensor networks (HWSNs) are deployed for many wide range of applications such as atmosphere, temperature, humidity, pressure, sound intensity, power-line voltage, pollutant levels and important body functions. Node failure is a common problem in wireless sensor networks. This problem is due to the energy constraints and the nodes are to be deployed compactly. In WSN, the detection and reporting of an event is important. Due to which the overlapping of the sensing regions occur. Thus multiple nodes containing the same information may be generated. If the information in the overlapped area is transmitted, then the loss of energy will take place which is in scarce in WSN based systems. Therefore the transmission of the information in the overlapped region must be avoided. Data aggregation can be used to eliminate redundancy. If this happens then substantial amount of energy and bandwidth saving will take place. We need methods to ensure proper delivery of the data in the aggregator nodes. If the loss occurs, then FEC based loss recovery can be done.

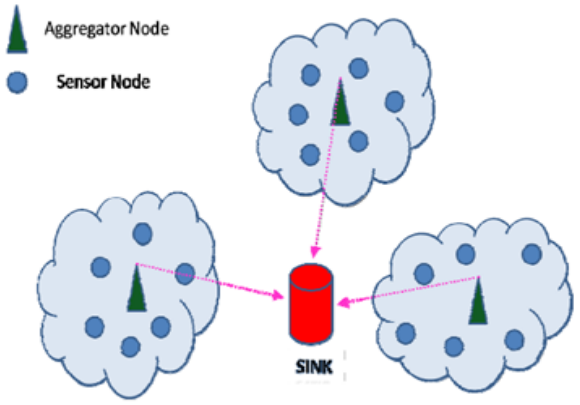

Fig 1. Heterogeneous Wireless sensor networks

II. RELATED WORK

As mentioned, communication costs are more in WSNs. So if these are reduced then efficiency and battery life will automatically improve. The following algorithm to reduce the redundancy is used. The algorithm is Redundancy Elimination for Accurate Data Aggregation (READA). Another method for improving the efficiency is Reliable Data Aggregation Forwarding Protocol for Wireless Sensor Networks. This protocol forms clusters and a coordinate node (CN) is selected near the cluster to monitor the nodes near the cluster. The nodes in the cluster maintain a Node Information Table (NIT) containing Node Id, Distance and Cost. Another proposed protocol is LEO. It has one level data aggregation for wireless sensor networks. Erasure coding is one of the techniques for loss recovery. The communication cost should be reduced by the implementation of new techniques and on the same hand reporting of the data to the sink node must be done. Successful event report can be done by using the erasure coding. So that both the aims can be achieved.

III. DATA AGGREGATION

Main issue in data aggregation is to eliminate the overlapped data. That means the repeated data should be removed to save the power and bandwidth. If the aggregation is performed successfully but if the data is not reached to the sink at the proper time, then it is of no use. The loss recovery can be done by using the FEC or erasure coding as mentioned earlier. Energy consumption and resource utilization should be optimum to increase the throughput.

A. SVM based Redundancy Elimination

The support vector machine learning method is a supervised and to provide the best generalization performances. Support vector machine learns a supporting hyper plane to maximize the margin and it is mainly used to the classification and regression. In our approach the data aggregator has to eliminate redundancy.

B. FEC based Loss Recovery

Before the non redundant data is passed to the base station the data will be coded using erasure coding or Forward error correction technique. After erasure coding, the data will be sent to the base station which will again apply the erasure technique to regain the data. Hence this approach prevents the loss of data during transmission. ERD uses the advantages of the multiclass SVM to identify and to reduce the redundant data. The erasure coding technique helps to recover the loss occurred in the transmission of the aggregated packet. Thus ERD achieves reliable reporting with minimum energy consumption.

IV. COMPLEXITY ANALYSIS

In this section we study the complexity of the iterative multiuser receiver/decoder. This is important so that we can determine which parts of the system will consume most computational resources, and, therefore, where to concentrate efforts for complexity reduction.

A. Complexity Reduction Techniques:

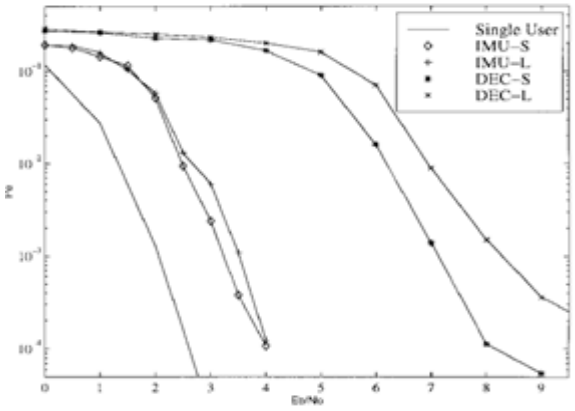

Fig. 2. Reduced complexity receiver performance

V. ATTRACTIONS OF FEC

Earlier it was concluded that the ARQ techniques are more efficient than the FEC based systems. FEC was found to be inefficient and unreliable; also it was slow and expensive. But continuous changes are being taken place to improve the efficiency of the FEC systems.

Some changes that were taken place in the conventional FEC systems was the broadband fibre packet networks were introduced and replaced by the existing copper circuit. The main advantage of using fibre is the link errors are significantly reduced. Some cells in FEC are badly corrupted. In FEC the lost cells are better than the corrupted cells.

To reduce the management and storage of transmitted data, the decoding of the FEC should be efficient. FEC based systems are bandwidth efficient, so they are preferred over simple replication.

VI. DESIRED FEC CHARACTERISTICS

The desired characteristics of the FEC are summarized below:

a) BURST CORRECTION: Errors are in multiples of the cell length and are coincident with cell boundaries.

b) ERASURE CORRECTION: Most errors are because of congestion: resulting in cell erasures,

c) ADAPTABILITY: the channel error statistics and application requirement (for delay, throughput and reliability) varies over a wide range in a short period of time.

d) LOW REDUNDANCY: The number of errors can be very small and the block size can be very large.

e) LOW LATENCY: Some application needs small encoding/ decoding delay,

f) HIGH THROUGHPUT: Applications need throughput of 1 gigabit per second,

g) LOW COMPLEXITY: Implementable should be economical.

VII. AVAILABLE RESEARCH ISSUES

The physical layer is a largely unexplored area in sensor networks. Open research issues range from power-efficient transceiver design to modulation schemes:

- ***Modulation schemes*:** Simple and low-power modulation schemes need to be developed for sensor networks. The modulation scheme can be either baseband, as in UWB, or passband.
- ***Strategies to overcome signal propagation effects***
- ***Hardware design*:** Tiny, low-power, low-cost transceiver, sensing, and processing units need to be designed. Power-efficient hardware management strategies are also essential. Some strategies are managing frequencies of operation, reducing switching power, and predicting work load in processors.

VIII. CONCLUSION

This paper proposes how to achieve the reliable data aggregation by eliminating the overlapped data. It also proposes how to save bandwidth and power. Techniques used to achieve the above mentioned things are also analyzed. Energy saving takes place by the deployment of such techniques which in turn reduces the communication costs. The research can be done how to optimize and improve the data aggregation techniques further.

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