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Compression on Wireless Sensor Network with Performance Guarantee

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Abstract

Multimedia contains enormous amount of files it consumes more memory space, hard disk, energy and time. To overcome these problems we propose ―Robust information driven data compression architectures for wireless networks. The relationship between the values of sensors will be useful to improve the compression performance. In this, we are using two types of techniques; they are ―logical mapping algorithm and state of the distributed data compression. The cluster-based and information-driven architecture (RIDA) uses two types of transforms, discrete cosine transform and discrete wavelet transform. This architecture will reduce up to 30% of energy, 80-95% of bandwidth can be saved, and we can find the missing nodes also.

Keywords: Multimedia, compression, architecture, wireless network, cluster-based, information driven architecture

I. Introduction

Wireless sensor network is nothing but the combination of hundreds and thousands of nodes [1]. These nodes can be communicated with each other with the help of co-ordinator. The co-coordinator will send the data to the data sink. Because of this communication method, the sensor network consumes more amount of energy. To reduce the time and energy used, we should reduce the network traffic. So that, the data will besend to the sink. If the sink will become full it will remove the old data to save the new data.

Compression is the process of reducing the length of the data to minimize the memory space, processing time, power consumption.

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In order to circulate the data, the compactness can be done on entire content depending on some conditions. Data compression can be as uncomplicated as to delete all the unwanted spaces, overloading of separate characters, the recapitulate represent the repeated words. This type of compression reduces the file size up to 50%. This process can be done according to some formula or condition. For a wide range of compression procedure we suggest cluster based and information driven architecture [1]. We are comparing some algorithm to produce the compressed data over the network. For that we are having some assumptions like, the sensor network can be assigned as image, each sensor will be allocated as pixels, the values of detectors are colour amplitude values.

By keeping these assumptions we are applying compression techniques over the grid. This process is very critical because the grid does not have clear architecture and we can’t find the locations of each sensors, packets may be lost during transmission these things can be overcome by RIDA. In this we are making two hypothesis condition (1) the sensor network must be a nested topology (2) the process of transmission is slow. By changing the data from sensor to sensor in the nested network, we can explore more independence in the data.

The key benefits of the this article are the following:

i. We suggest information driven architecture with a logical mapping framework for various compression and analysis algorithm.
ii. We provide a resiliency technique in RIDA to overcome the problems regarding missing of nodes.
iii. RIDA can achieve compression ratio 10:1 and eliminate 30% of power consumption with the help of logical mapping compression ratio is increased by double.

2. Data compression

Compression of data is basically needed in conveying, because it wanted to transmit or saving the original data. We are enormous compression technique within that some of the technique are standards. Data compression rapidly used in withdraw concept, groupware applications and in bit map graphics.

2.1 lossless compression

Lossless compression is nothing but reducing the folder size without any loss of data. This technique is evidently paranormal to minimize the size of the data in both image and audio. This method normally rewrites the data without any loss. However, because of this lossless compression there is no loss in quality, the performance will be increased. Compared to lossy compression it reduces the file size up to one tenth of the original folder. There are many algorithm separately used for both the audio and image. Basically it is defined as the decompressed data does have any data loss during compression technique.

2.2 losssy compression

Lossy compression is reducing the folder size with loss of data. This is not magical algorithm to reduce the size of a data. Because of this compression algorithm there may be a loss of important data during the decompression process. Therefore, the quality of the data will be reduced, performance will be degraded. This is useful in both the image files and audio files. But it’s not worth full technique for compression.

2.3 leach protocol

RIDA assumes that all the nodes available in the network can be organized into group of nodes like clusters. According to our concept we are using LEACH protocol (Low Energy Adaptive Clustering Hierarchy). The use of the leach protocol is that the node does not have long life. When the battery is got empty the life of the node get finished. To avoid this problem the leach protocol will define the life time of the node to transmit the particular amount of data. Each cluster having the header that contains the all the information belongs to the particular cluster. According to leach protocol the header having two phases. There are

(1) The Set-Up phase in that the cluster header should be chosen.

(2) The Steady State phase is used to maintain the cluster header, and define the communication between the nodes.

The main concept of RIDA and Leach protocol is to identify the nodes before do the compression process to increase the performance. In existing system we use Discrete Cosine Transform and Discrete Wavelet transform. In that, if nearby nodes having common value, it will compress together or it will do the compression process one by one node. Therefore, the performance will be reduced and time is increased rapidly. But in our concept the network values of same nodes will be compressed together if the nodes are far away from each other. For this magical method,we need logical mapping and compression algorithm. At the starting time of the process, the sensor node will be assigned as zero for deciding which node should send to the sink. Likewise the sink collects all the data and it will compress and decompress the data.

2.4 logical mapping

With the help of this technique each node is observed for a particular time period, and assigned a virtual directory address for each node. The resultant value will be good during compression. In that mapping process first we should rearrange the sensors in particular order based on the virtual address. The neccessity of rearranging is to categorize the sensors with particular value to get the compression performance good. Virtual address is changed for each and every node within the group. We mapped the data as

$$Mt(ds(t), D(t)) = l$$

S = sensor identification number

s(t) = sensor data value of sensor s at time t

D(t) = vector of size n of data values in the group

At time t

Mt = mapping between Ds(t) to a virtual index

When the cluster remaps the data groups it will send mapping message to the sensors. The sensor then acknowledgement like begins mapping message. Then the data will be send to the cluster for remapping process. Each data of each sensor will be collected only by the cluster heads. With the help of this, the header will find the average values. And it will broadcast the new map to the sink/ cluster. After getting their message it will again rebroadcast the data. These two messages are called as end mapping message.

2.5 Main phases

1. MAPPING:

   The cluster head assigns the virtual address for each node, and sends logical map to the remapping process.

2. COMPRESSION PHASE:

   Sensors exchange data within their cluster. Each sensor transform the received data. The transformed data are co-efficient, which contain difference amount of information about the sensor data.

2.6 Compression algorithm

1. DATA TRANSFORMATION:

   a. Within the cluster, sensor use the wireless broadcast capabilities to exchange data within the cluster. After receiving all data the sensors calculate the co-efficient, corresponds to virtual address.

   b. The computational complexity is depends upon the number of nodes present in the cluster. Co-efficient can be calculated by different methods.

   c. By using this algorithm 1D image co-efficient can be calculated correspond to virtual indices.

   d. In 2D image co-efficient can be calculated by quantization matrix.

2. QUANTIZATION ALGORITHM:

Calculate the co-efficient using quantization matrix. The unimportant co-efficient should be non-zero. Important co-efficient should be zero. The sensors transmit only non-zero co-efficient to the sink.

2.7 Rida operation details

In that wireless sensor network compression process we are having three types of nodes. There are

A) Sink

B) Cluster head,

C) Child node.

2.8 The cluster head:

The sink will send the request message to retrieve data from the sensor nodes. During this process it will take some of the following operation for a particular period for remapping technique.

1. The first step is sending the request(begin mapping message) to the cluster, all the nodes available in the cluster should perform the particular function.

2. To find the load balancing value among the all the nodes, we should find the mean for all the nodes, and arranging the mean value in ascending/descending order.

3. Each node should contain the separate virtual address for mapping.

4. Proving the mapping function to all the nodes available in cluster.

5. Finally send the logical mapping to the sink.

6. Wait for each and every acknowledgement.

7. At last send the end-mapping message to all the nodes.

2.9 The sink

After receiving the co-efficient value it should save the result for decompression process. After collecting all the values it will perform the following functions. Those functions are

1. The cluster data will be decompressed

2. Data values and sensor nodes will be compared with the help of received logical map.

3. Find the missing data in each cluster.

4. Getting the network wide calculations.

3. Experimental design and analysis

This section is very much useful to evaluate the architecture of RIDA and justify the results we were got.

3.1 goals and metrics

If we answer for the following question we can give the good performance calculations. The questions are,

i. Whether the current compression techniques are well adjust with RIDA?

ii. The logical mapping providing good compression ratio or not?

iii. How RIDA is very particular about the number of nodes and sinks?

iv. How RIDA is very sensitive about the remapping process?

v. How strong is RIDA when there is missing of data in sensors?

The answer for first question is because of the RIDA algorithm or technique we can easily improve the performance therefore it is well adapted in existing system. We compare the RIDA logical mapping process with Discrete Cosine Transform and Discrete Wavelet Transform. This technique provides good performance in data compression.The question three belongs to some other technique in power consumption. Because while reducing, the number of sinks, sensors, clusters the energy consumption will reduce rapidly.

4. Conclusion

We should concentrate that every node using equal energy consumption or not. It will increase the total life time of the network. Reliability is very important in network. Because if nodes gets fail the entire operation will be failed. The nodes will be getting empty. To do the performance good the node must fill the missing data with the original data and missing data in a sink. It is very much useful in irregular wireless sensor network. RIDA architecture will increase the compression ratio in double the normal compression process.

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