A Survey on Data Compression Techniques in Wireless Sensor Network

A. Alish Preethi¹, Anjali Ramakrishnan²

¹(Department of Electronics and Communication, Sathyabama University, India)
²(Department of Electronics and Communication, Sathyabama University, India)

ABSTRACT: Compression is useful because it helps us to reduce the resources use, such as data storage capacity or transference capacity. Compression methods have a many types. In this survey explain a different simple efficient data compression algorithm which suited to be used on available many commercial nodes of a wireless sensor network, where energy, memory and computational resources are limited. Some experimental results and comparisons of lossless compression algorithm formerly proposed in the literature to be inserted in sensor nodes. Hence data compression methods are used to minimize the number of bits to be transmitted by the transmission module will significantly lessen the energy requirement and maximize the life expectancy of the sensor node. The present explanation of the study contracted with the sketching of systematic efficient data compression algorithm, particularly suited for wireless sensor network.

Keywords - Data compression, Lossless compression, Sensor nodes Wireless sensor networks.

1. INTRODUCTION

A wireless sensor network is a group of exceptional unique transducers with a communications infrastructure that uses radio for monitoring and recording the physical or environmental conditions at many and various locations. Commonly monitored parameters are temperature, airlessness, pressure, wind direction and speed, illumination concentration, vibration strength, sound potency, power-line voltage, chemical concentrations, pollutant regulars and vital body functions. A wireless sensor network consists of three major components which are classified as nodes, gateways, and software. The spatially distributed calculation nodes interface with sensors to observe assets or their surrounding conditions. The obtained data wireless transmits to the gateway, which can operate separately or attach to a host system where you can assemble, accumulate procedure, analyze, and submit your calculation data using software. Routers are a unique type of calculation node that you can use to widen WSN distance and reliability. WSN architectures unite various categories of nodes and gateways to meet the specific needs of application.

Data compression is commonly referred to as set of principles, where principles is said to be a coding and it represented a data which satisfies a certain need. Compression is the conversion of data in such a format that requires few bits usually formed to store and transmit the data easily and efficiently. Compression is perfected to reduce amount of data and needed to reproduce that data. And the compression is done either to reduce the volume of information in case of text, fax and images or reduce bandwidth in case of speech, audio and video.

Figure shows the compression method with the help of following figure 1:

![Diagrammatic representation of data compression](image)

Fig 1: Diagrammatic representation of data compression

A data compression is that it converts a string of characters in another representation into a new string which have the same data in small length as much as possible. Data compression may be viewed as the study of information theory in which the main objective for the efficient coding and to minimize the speed of transmission bandwidth. The main purposes of this paper to shows the variety of various lossless compression techniques and their comparative study.

2. CLASSIFICATION OF COMPRESSION METHODS

There are two types of data compression methods:
2.1. LOSSLESS COMPRESSION

It is used to minimize the amount of source information to be transmitted in such a way that when compressed information is decompressed, there is not any loss of information.

2.2. LOSSY COMPRESSION

The aim of lossy compression is normally not to replicate an exact copy of the information.

Fig 2: Tree representation of data compression methods

But in this paper has concentrated only on the lossless compression methods which are used on the text data formatting and define them with the help of some algorithms.

2. LITERATURE SURVEY

The survey of different data compression techniques can be explained as below:

Peng Jiang and Sheng Qiang Li, (Oct 2010) has proposed an optimal order evaluation type and dispersed set of principles can be explained in spatial correlation and it is used for supporting a one-dimensional signal. It gives the maximum signal noise ratio (SNR) value. [1]

S.Shanmugasundaram, et, al., (Dec 2011) are explained there are lots of data compression concepts which are obtainable to compress set of data in different formats. This paper explains a survey of dissimilar basic lossless data compression algorithms. The investigational outcomes and collations of the lossless compression method using statistical compression method ion after decompression. In this case some information is lost after decompression. And dictionary based compression method were performed on text data. [2]

C.Tharani and P.Vanaja Rajan, (2009) has proposed the improved adaptive Huffman data compression method based on distributed source compression (DSC) for increased the complexity in encoding and decoding. So this algorithm was not suitable for wireless sensor node. It gives the low compression ratio. [3]

Francesco Marcelloni, and Massimo Vechhio, (Jun 2008) has proposed a basic technique for data compression explained based on dictionary compression algorithm which is said to be Lempel Ziv Welch (S.LZW) for data storage resources of sensors node but it gives the less compression ratio. [4]

Jim Chou, et, al., (April 2003) has proposed a dispersed and adaptive signal processing proceed towards to reducing vitality ingestion i.e. (energy consumption) in sensor networks is based on orthogonal approach for computing power is limited and it gives less energy saving methods [5]

Sundeep Pattem, Ramesh Govindan, (Aug 2002) are explained distributed compression in a dense micro-sensor network is explained based on three algorithms such as Time Division Multiple Access(TDMA), Frequency Division Multiple Access(FDMA), Code Division Multiple Access(CDMA) for decoding process and the process of decoding is difficult in it. It gives the parameter of achieved gain value. [6]

Piet M. T. Broerson, (Nov 2009) has proposed the standard of delayed products and autorevertive Yule–Walker Models as autocorrelation which explains by the fast Fourier transform algorithm. This algorithm needs maximum number of data for compression and to produce the results. The output value of the data compression has low auto correlation. [7]

U.Khuranaand, A.Koul, (July 2012) are explained a new compression algorithm that uses referencing through two-byte numbers (indices) for the cause of encoding has been presented. The procedure of working is efficient in supplying high compression ratios and faster search through the text. [8]

Ming-Bo Lin, et, al., (Sep 2006) has proposed a lossless data compression and decompression technique and its tools and equipment structure explained by Parallel dictionary Lempel Ziv Welch (PDLZW) technique. The resulting structure shows that it is not only to reduce the tools and equipment cost significantly and it gives the low data reduction. [9]
4. LITERATURE SURVEY TABLE

To analyze the effects of different kinds of data compression in wireless sensor networks a survey has been conducted and discussed in tabular form.

<table>
<thead>
<tr>
<th>S L. No</th>
<th>Title</th>
<th>Author</th>
<th>Existing Method</th>
<th>Drawbacks</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A data compression algorithm for wireless sensor networks based on an optimal order estimation model and distributed coding</td>
<td>Peng Jiang and Sheng Qiang Li, (Oct 2010)</td>
<td>Spatial Correlation</td>
<td>It is only support for one-dimensional signal</td>
<td>• High SNR value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Auto correlation</td>
</tr>
<tr>
<td>2</td>
<td>A universal algorithm for sequential data compression</td>
<td>Jacob Ziv, et, al., (May 1997)</td>
<td>Optimal Fixed Code</td>
<td>Susceptibility to error propagation in the event of a channel error.</td>
<td>• High compression ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Mean square value</td>
</tr>
<tr>
<td>3</td>
<td>Design of modified adaptive Huffman data compression algorithm for wireless sensor network</td>
<td>C. Tharini And P. Vanaja Ranjan, (2009)</td>
<td>Distributed Source Compression (DSC) Algorithm</td>
<td>Increased the complexity in encoding and decoding. So this algorithm was not suitable for Wireless sensor node.</td>
<td>• Low compression ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• PSNR value</td>
</tr>
<tr>
<td>4</td>
<td>A lossless data compression and decompression algorithm and its hardware architecture</td>
<td>Ming-Bo Lin, et, al., (Sep 2006)</td>
<td>Parallel Dictionary LZW (PDLZW) Algorithm</td>
<td>The resulting architecture shows that it is not only to reduce the equipment cost significantly</td>
<td>• Data reduction is low</td>
</tr>
<tr>
<td>5</td>
<td>A simple algorithm for data compression in wireless sensor networks</td>
<td>Francesco Marcelloni, et, al., (June 2008)</td>
<td>Dictionary Based Compression Algorithm (S.LZW)</td>
<td>Poor data storage resources of sensors node.</td>
<td>• Less compression ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Low auto correlation</td>
</tr>
<tr>
<td>6</td>
<td>A distributed and adaptive signal processing approach to reducing energy consumption in sensor networks</td>
<td>Jim Chou, et, al., (April 2003)</td>
<td>Orthogonal approach</td>
<td>Computing power is limited</td>
<td>• Less energy can be saved</td>
</tr>
<tr>
<td>7</td>
<td>Distributed compression in a dense micro-sensor network</td>
<td>S. Sandeep Pradhan, et, al., (Aug 2002)</td>
<td>TDMA, FDMA, CDMA</td>
<td>Decoding process is difficult</td>
<td>• Achieved gain value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Compression ratio</td>
</tr>
<tr>
<td>8</td>
<td>GIST: Group-independent spanning tree for data aggregation in dense sensor networks</td>
<td>Lujun Jia, et, al., (2006)</td>
<td>Constructing Aggregation or Dissemination trees</td>
<td>There is a limit to routing nodes</td>
<td>• Time out value is too small</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Correlation coefficient</td>
</tr>
<tr>
<td>9</td>
<td>The impact of spatial correlation on routing with compression in wireless sensor networks</td>
<td>Sundeep Pattem, et, al., (April 2004)</td>
<td>Distributed source coding</td>
<td>Need space for routing</td>
<td>• Low Correlation coefficient</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• PSNR</td>
</tr>
<tr>
<td>10</td>
<td>The quality of lagged products and autoregressive Yule–Walker models as autocorrelation estimate</td>
<td>Piet M. T. Broersen (Nov 2009)</td>
<td>Fast Fourier Transform</td>
<td>It needs maximum data</td>
<td>• Low Auto correlation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Compression ratio</td>
</tr>
</tbody>
</table>
5. CONCLUSIONS

Sensor nodes are usually battery powered and thus how to conserve their energy is a primary concern in WSNs. In this paper the survey is based on data compression in wireless sensor network for minimize the energy consumption and for processing and transmission of data. Lossless data compression schemes are mostly used due to their simplicity of algorithms & better compression efficiencies but lossy compression has high value of compression ratio with some fraction of original features lost which may not introduce a severe case. The researchers keep on introducing their improvisation in this field and try to make them more efficient. Hence much more advancement is being expected in future in the field of data compression.

REFERENCES


