International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 5 (2015) pp. 13615-13623

http://www.ripublication.com

Data Compression Using Combination Of Huffman And Lempel-Ziv Welch Technique Based On Wavelet Transform

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ABSTRACT

Compression is a practical method which is used to minimize the quantity of data without compromising the quality of data. Compression method has many types. In embedded applications, the feasibility of exceptions is absolutely small, so in a normal circumstance, data obtained at regular time points by the same nodes are time connected while spatial connection may obtain in data acquired at the similar time by adjacent nodes and essential for absorption of energy minimization of the nodes. In this paper has proposed the data compression algorithms based on the combination of Huffman and Lempel-Ziv techniques and combine the efficiency of these algorithms based on wavelet transform. And comparison of some experimental results based on transform formerly proposed in sensor nodes. Hence data compression methods are used for transmitting the number of the bits which can be minimized by the transmission module. This method will significantly lessen the energy requirement and maximize the life expectancy of the sensor node.

Keywords: Compression, Huffman, Lempel-Ziv, Wavelet Transform, Wireless sensor network.

I. 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 a set of principles as shown in fig 1.1, where principles is said to be a coding and it represented a data which satisfies a certain need. The transmission and storage of data can be formed easily and efficiently by requiring of few bits is said to be conversion of data in compression. The amount of data can be reduced by compression and the reproducing of data can be needed. And the compression is done either to minimize the volume of information in case of text, fax and images or minimize bandwidth in case of speech, audio and video.

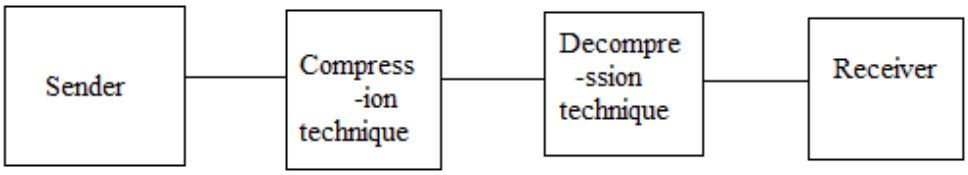

Fig 1.1: Outline representation of data compression

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.

II. CLASSIFICATION OF COMPRESSION METHODS

There are two types of data compression methods are shown in fig 2.1:

LOSSLESS COMPRESSION: -

It is a data compression technique which is used for compressing the data without affecting the quality of data and minimizes the amount of information. So it is called lossless compression.

LOSSY COMPRESSION: -

During this compression, the data are compressed in such a way that the data are lost. This gives more importance to the meaning of data not for the quality of the data.

The tree structure of data compression technique is shown as fig 2.1 with their sections. There are two major categories of compression algorithms: lossy and lossless which can be divided into three methods.

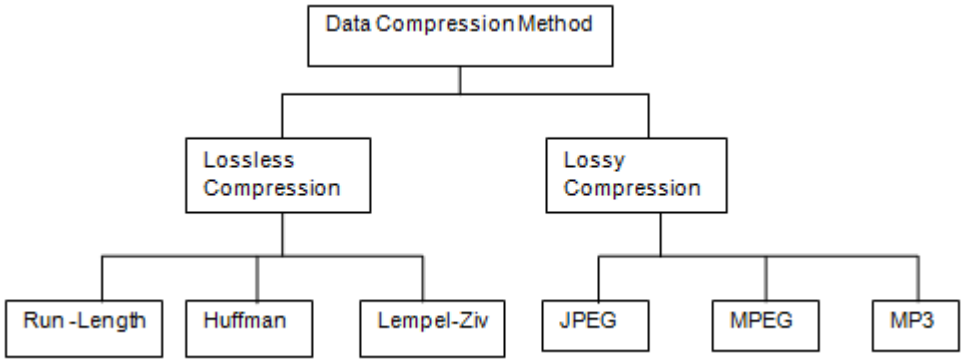

Fig 2: Tree stucture of data compression methods

This paper gives more importance to the lossless compression methods for formatting the text and it also used to describe these data with the assist certain procedure.

III. RELATED WORK

In [1] authors have discussed the comparison of lossless data compression technique such as Huffman and Lempel-Ziv Welch (LZW) and Run Length Encoding (RLE). In proposed algorithm in [1] exploits the effective comparison of these techniques by assuming the same number of original bits. In their effort to cascade various types of Huffman based algorithms such as Static Huffman coding gave ratio of 65%, Minimum variance Huffman coding gave ratio of 75%, adaptive Huffman coding gave ratio of 74 percent and Variation 1 and 2 gave ratio of 73% and 97 percentages.

In [2] authors have discussed the Lempel-Ziv Welch compression technique improved the ratio of compression. For example when the raw data ranges are 6000, improved Lempel-Ziv Welch would compress the data into 41921 which gave [2] the compression ratio 59.66 percentage and in [1] cascading LZW gave ratio of 66.48 percentage. The result of cascading run length encoding with Huffman coding gave 48 percentages only so there is no effective compression ratio for this coding in wireless sensor network [1].

IV. PROPOSED APPROACH

The objective of the process which can be proposed here is to keep all of the information in the data of a relating to time sequence while enhancing the differences between data takes. When working with an individual compression technique of Huffman coding and Lempel-Ziv algorithm, it is very difficult to attain a maximum of

output in terms of compression ratio, mean square error and peak signal to noise ratio. The compression process is very fast responding process and depends on many parameters, and sometimes errors may occur. To solve this problem, a new specific grouping algorithm technique is proposed here that has been designed to achieve a maximum of compression ratio and peak signal to noise ratio such a proposed technique is the combination of Huffman Lempel-Ziv algorithm based on transform of wavelet families.

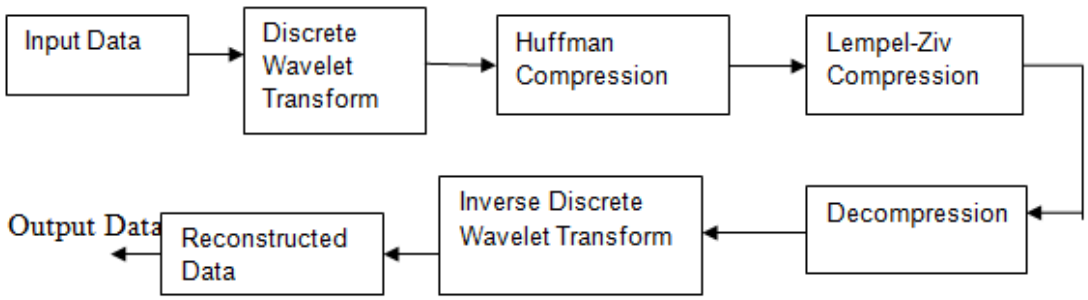

Fig: 4.1: Block Diagram of Proposed System

Step 1:

Enter the input data for performing the compression and decompression technique and get the reconstructed data as a output with no loss in original data.

Step 2:

Perform the forward wavelet transforms function for identifying the hybrid contents such as audio, video and binary in one as a documentation file. There are three types of transform of wavelet families can be used for it such as Daubechies transform, Haar transform, and Symlet transform. Select the transform and perform the function of these transforms.

Step 3(a):

Perform the compression technique of both Huffman and Lempel-Ziv Welch coding. The output bits of transform are given to Huffman encoding for compression. The block diagram of Huffman encoding algorithm is given below:

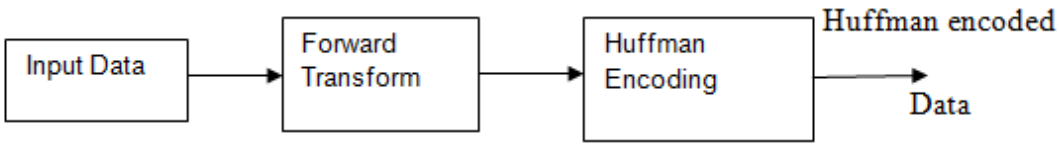

Fig: 2.7: Block Diagram of Huffman Encoding

Step 3(b):

After Huffman compression the output of Huffman encoded data is given to input of LZW encoding for compression and get the data as bit stream data. The block diagram of Lempel-Ziv encoding algorithm is given below:

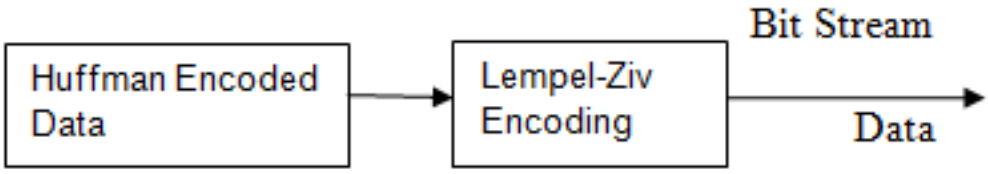

Fig: 2.8: Block Diagram of Lempel-Ziv Encoding

Step 4:

After compressing the input data as a bit stream data then it can be decompressed by decompression technique of both Huffman and LZW decoding technique. The block diagram of Huffman and Lempel-Ziv decoding algorithm is given below:

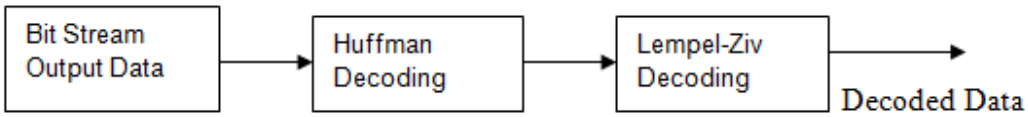

Fig: 2.9: Block Diagram of Huffman and Lempel-Ziv Decoding

Step 5:

The decompressed data is given to the inverse transform of wavelet families (such as Daubechies, Haar and Symlet) and it performs the inverse function of transforms to achieve the reconstructed data as output.

Step 6:

Finally gets the reconstructed data as a output and find the effective compression ratio as a parameter value than the previous techniques.

V. RESULT ANALYSIS AND DISCUSSION

The results of compressing data with the combination of Huffman encoding and Lempel-Ziv are shown below in a table I using MATLAB. From the Table I, it is observed that the combination of Huffman and Lempel-Ziv Welch technique is more efficient than the individual technique in [1]. It gives a maximum of compression ratio than the individual Huffman and LZW technique. The combination of Huffman and LZW compression technique can be represented in the form of graph as below in fig

5.1. In this denotes the maximum range of compression in combination of Huffman and Lempel-Ziv than the individual of these techniques

Table-I Combination of Huffman and Lempel

S.No	Parameters	Huffman Technique	Lempel-Ziv Technique	Combination of Huffman and Lempel
1	Mean Square Error (MSE)	0.3422	0.0625	***0.6276***
2	Peak Signal to Noise Ratio (PSNR)	11.831	17.014	***25.001***
3	Compression Ratio (CR)	0.4135	0.2520	***0.5341***

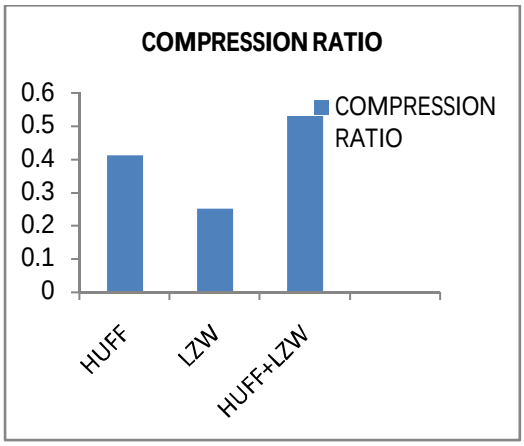

Fig 5.1: Graph of compression ratio

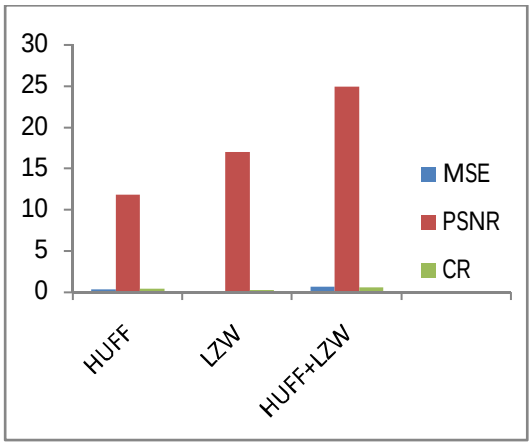

Fig: 5.2 Graph of comparison of compression technique

In this graph 5.2, explains the results, by combining Huffman and Lempel-Ziv technique. Its gives a compression ratio other than it also gives the result of the peak signal noise ratio and mean square error value differences which can be expressed. The range of compression ratio and mean square error is moreover the nearest values. Peak signal noise ratio is calculated based on mean square value.

The Resultant of comparison of wavelet transform families such as Daubechies, Haar and Symlet are shown below in a table II. From Table II, it is observed that the difference between compression ratios. Because these transforms are used to identify the hybrid contents in documentation file. Symlet transform has low range values because it has increased in symmetry only than other transforms

Table-II Comparison of compression ratio based on transforms:

TRANSFORM	MEAN SQUARE ERROR	PEAK SIGNAL TO NOISE RATIO	COMPRESSION RATIO
DB6	0.6969	25.001	0.5341
HAAR	0.7405	24.134	0.5326
SYM2	0.6947	25.050	0.5321

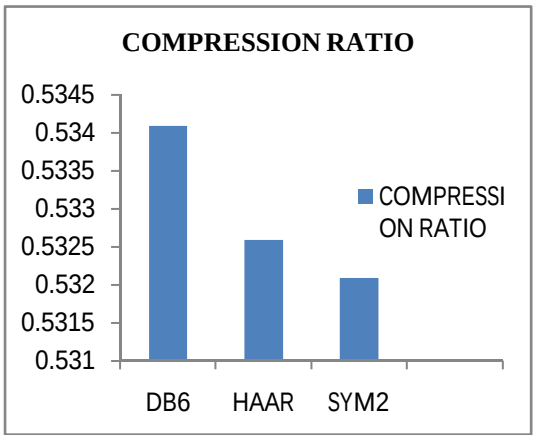

Fig 5.3 Comparison of compression ratio based on transforms

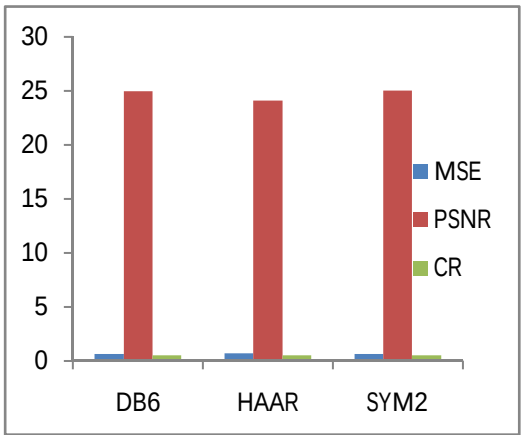

Fig 5.4: Graph of compression ratio based on transforms

In this graph 5.4, explains the results by using the different types of transform in wavelet families for compressing the, data, from the result It also produce the peak signal noise ratio and mean square error values.

VI. CONCLUSION

In the proposed method combination of Huffman and Lempel-Ziv technique has been found to be very effective, in compressing the data up to 70-80%, in some cases. This grouping algorithm gives maximum compression ratio than the individual compression technique because of inserting the technique between forward transform and inverse transform. In documentation file, there are many hybrid contents are available such as text, video, binary values, audio. These contents can be identified and separated by the transforms for splitting these files and then compress it by using the certain technique. By doing this process the compressing of data is more efficient and simple and it gives maximum compression ratio than other techniques.

VII. REFERENCES

[1]. Renugadevi, S., Nithya Darisini, "Huffman and Lempel-Ziv based data compression algorithms for wireless sensor networks", IEEE Transitions on P.S Pattern Recognition, Informatics and Mobile Engineering (PRIME), International Conference on 21-22 Feb. 2013, pages 461 – 463.

[2]. Huan Zhang,Xiao-Ping Fan,Shao-Qiang Liu, Zhi Zhong, " Design and Realization of Improved LZW Algorithm for Wireless Sensor Networks, International Conference on Information science and Technology, March 26-28, 2011,Nanjing, China.

[3]. S. Kaur and V.S.Verma," Design and Implementation of LZW Data Compression Algorithm", International Journal of Information Sciences and Techniques (IJIST) Vol.2, No.4, July 2012

[4] Manjeet Gupta Brijesh Kumar," Web Page Compression using Huffman Coding Technique," International Conference on Recent Advances and Future Trends in Information Technology (iRAFIT2012) Proceedings published in International Journal of Computer Applications® (IJCA), 2012.

[5]. I Made Agus,Dwi Suarjaya," A New Algorithm for Data Compression Optimization, "International Journal of Advanced Computer Science and Applications (IJACSA), Vol. 3, No.8, 2012.

[6]. Rupinder Singh Brar, Bikramjeet singh, "A Survey on Different Compression Techniques and Bit Reduction Algorithm for Compression of Text/Lossless Data," International Journal of Advanced Research in Computer Science and Software Engineering(IJARCSSE),Volume 3, Issue 3, March 2013.

[7]. S. Shanmugasundaram and R. Lourdusamy, "A Comparative Study of Text Compression Algorithms" International Journal of Wisdom Based Computing, Vol. 1 (3), December 2011

[8]. Capo-chichi, E. P., Guyennet, H. and Friedt, J. K-RLE a New Data Compression Algorithm for Wireless Sensor Network. In Proceedings of the 2009 Third International Conference on Sensor Technologies and Applications.

[9]. Ahmed Desoky and Mark Gregory, Compression of text and binary files using Adaptive Huffman Coding Techniques.In Proceedings of IEEE conference, Aug, 2002, U.S.A.

[10]. Francesco Marcelloni and Massimo Vecchio, " A Simple Algorithm for Data Compression in Wireless Sensor Networks", IEEE Communications Letters, vol. 12, no. 6, June 2008.

[11]. C.Tharini and P.Vanaja Ranjan,"Design of Modified Adaptive Huffman Data Compression Algorithm for WSN", Journal of Computer Science, June 2009.

[12]. Rajinder Kaur,Mrs. Monica Goyal,"A Survey on the different text data compression techniques," International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Volume 2, Issue 2, February 2013.

[13]. B. Venkatraman,V. Vaithiyanathan and B.Karthikeyan," Review on Lossless Image Compression Techniques for Welding Radiographic Images," Research

Journal of Applied Sciences, Engineering and Technology 5(1): 167- 170, 2013.

[14]. Kaouri, A. H. Fractal coding of still images. Queen's university of Belfast, UK. 2002. [17] Sachin Dhawan," A Review of Image Compression and Comparison of its Algorithms," IJECT Vol. 2, Issue 1, March 2011

[15]. Peng Jiang and Sheng-Qiang Li, "A Data Compression Algorithm for Wireless Sensor Networks Based on an Optimal Order Estimation Model and Distributed Coding" Academic Journal of Sensors,Vol. 10 Issue 10, p9065, October 2010

[16]. T.Welch, 1984 "A Technique for High-Performance data Compression",IEEE Computer,Vol 17.

[17]. Marcelloni, F. and Vecchio, M., "A Simple Algorithm for Data Compression in Wireless Sensor Networks", Communications Letters, IEEE (Volume:12, Issue: 6), June 2008.

[18]. Chou, J. Petrovic, D.Kannan Ramachandran, "A distributed and adaptive signal processing approach to reducing energy consumption in sensor networks", INFOCOM 2003.Twenty-Second Annual Joint Conferences of the IEEE Computer and Communications. IEEE Societies (Volume: 2) pgs 1054 - 1062, April 3 2003.

[19]. Sundeep Pattem, Ramesh Govindan, "Distributed compression in a dense micro sensor ne9twork", Signal Processing Magazine, IEEE (Volume: 19 Issue: 2) pgs 51 – 60, 07 August 2002.

[20]. Broersen, P.M.T.,"The Quality of Lagged Products and Autoregressive Yule–Walker Models as Autocorrelation Estimates", Instrumentation and Measurement, IEEE Transactions on (Volume:58, Issue: 11) pages 3867 – 3873, Nov. 2009.

[21]. Ming-Bo Lin Jang-Feng Lee ; Gene Eu Jan, "A Lossless Data Compression and Decompression Algorithm and Its Hardware Architecture", Very Large Scale Integration (VLSI) Systems, IEEE Transactions on (Volume:14, Issue: 9) Page(s):925 – 936, 23 October 2006.