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# An efficient technique for lossless address data compression using adaptive SPIHT Algorithm in WSN

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**Abstract:***The computer is becoming more and more powerful day by day. Data compression is a popular approach to reducing data volumes and hence lowering disk I/O and network data transfer times. While several lossy data compression techniques have demonstrated excellent compression ratios, lossless data compression techniques are still among the most popular ones. Sensor networks represent a non-traditional source of information, as readings generated by sensors flow continuously, leading to an infinite stream of data. Sensors are non-reactive elements which are used to monitor real life phenomena, such as live weather conditions, network traffic, etc. They are usually organized into networks where their readings are transmitted using low level protocols.*

**Keywords :**Adaptive set of SPIHT algorithm, WSN, LIS, LIP and LSP

## II. INTRODUCTION

An important issue in managing sensor data streams is aggregating the values produced by a subset of sources within a time interval. Here the clustering approach is done using quadtree clustering remains to produce lesser compression rate which acts as a major drawback. The possible extension here will be to include optimal clustering approach and advanced compression scheme like SPIHT algorithms for better compression rate.

## III. RESEARCH OBJECTIVES & APPROCH

- **Aim**

The major aim of the research is to develop an efficient technique for lossless address data compression using adaptive Set Partitioning in Hierarchical Trees (SPIHT).

- **Objectives**

To achieve the above mentioned aim, the research has following objectives:

1. To explore the various conventional techniques and its challenges in lossless address data compression for Wireless Sensor Networks (WSNs).
2. To achieve the greater compression rate using adaptive Set Partitioning in Hierarchical Trees (SPIHT).

## IV. REVIEW WORK ALREADY DONE ON THE SUBJECT

In WSN, data compression is achieved using Joint Photographic Experts Group (JPEG) which is a popular DCT compression scheme (Wallace, 1992; Jeong et al., 2004). The fundamental concept of DCT is to convert a signal into basic frequency components. For the application of compression, an image is divided into several blocks. Then, the sum of cosine functions on different frequencies can be statistically used to express each block of an image (Zheng & Liu, 2011). This approach is analyzed in diverse manners, including reducing the computation complexity, increasing the compression ratio, and minimizing power consumption (Mammeri et al., 2012). The power consumption of DCT-based techniques is more than DWT-based techniques (Pham & Aziz, 2013).

Discrete Wavelet Transform (DWT) is used to overcome the weakness of DCT-based techniques. Furthermore, this is to increase the features of DCT that is frequency and localization (Mallat, 1999). Mu et al., (2005) proposed an image compression technique based on 2Ddiscrete wavelet transform Embedded zero trees of wavelet transform (EZW).It is designed for two dimension, but it is also used in other dimensions. In EZW, encoder compresses the image into a bit stream and it is based on progressive encoding (Shingate et al., 2010). The input image decomposes into wavelet coefficients which is multi-

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pass process. Hamdi et al., (2008) proposed an approach based on EZW for image compression where EZW offers two types of resolution such as high and low resolution. High resolution is used for the regions where interference is detected, while low resolution is used for other regions. The results verified that the approach is better for saving power and bandwidth. Moreover, packet loss is an important factor due to the fact that EZW is vulnerable against packet losses (Chithra et al., 2008).

Zhang et al., (2015) proposed a lightweight lossless data compression technique that balances the performance between compression and decompression. This Bit plane bitmap Quadtree (BQ-Tree) based approach encodes the bitmaps of raster bitplanes as compact quadtrees that compress and index rasters simultaneously. Nelson et al., (2005) proposed a simple quadtree based algorithm to compress the graph without read the entire graph into the main memory. This algorithm uses the quadtree data structure that is implicitly created to produce the compressed graph output. Yang et al., (2016) proposed an image compression technique using quadtree decomposition to reduce bit rate and blocking effect by employing the error diffusion technique. The results shows that the proposed technique achieves better performance based on the quantitative evaluation and visual quality.

Wang & Zhang, (2010)proposed SPIHT with image stitching to make multi-view image compression for WMSN and to remove the overlap and spatial redundancy. Image sensors first captured images and sent images to microprocessor to achieve image stitching and eliminate overlap redundancy. Then stitched image was compressed with modified SPIHT coding to reduce amount of transmitted bits. Their simulation result indicatedthat the data to be transmitted can be reduced by 10–45% using the stitched images.EBCOT is the highest algorithm in the performance ofcompression quality is proposed (Taubman et al., 2000). Nevertheless, the process of Tier-1 is responsible for arithmetic encoding and context formation for encoding code block. Therefore, consumed most of encoder's power and consequently increase power consumption, computational complexity, memory required and processing time. Thus, EBCOT not very beneficial for power constrained WMSN.

## V.CURRENT WORK AND PRELIMINARY RESULTS

The main objective of the proposed methodology is to provide an efficient technique for lossless address data compression using adaptive Set Partitioning in Hierarchical Trees (SPIHT) in Wireless Sensor Networks (WSNs). The proposed data compression technique is applied to any block of binary address data words which fulfils the following conditions.

i) Address data words should be separate from one another and no repetition is permitted. This requirement is essential, since the addresses have to be unique to differentiate one from the other.
ii) The order of the data words is irrelevant. That is, it should be a set.
iii) The width of all the data words should be same.

Repetition or duplicate words cause uncertainty in the process of compression. Therefore,Repetition or duplicate words are not allowed. The proposed technique applies a set rather than a sequence during compression and decompression to overcome the information is lost.

Set Partitioning in Hierarchal Tree (SPIHT) is a powerful wavelet based image compression algorithm that achieved very compact output bit stream than Embedded Zero Tree of wavelet coefficients (EZW) without adding an entropy encoder. This improves its efficiency based on computational complexity. In the SPIHT, spatial orientation tree (SOT) arrangement is used to connect the coefficients after the (DWT) is applied to decompose an image into different sub bands. Furthermore, progressive mode in SPIHT permits the process of coding/decoding to be stopped at any stage of the compression. Sorting pass and the refinement passes are used in coding process in SPIHT. It consists three lists namely list of insignificant sets (LIS), list of insignificant pixels (LIP) and a list of significant pixels (LSP) are used to store coding information. Fig. 1 shows a block diagram of SPIHT scheme for data compression.

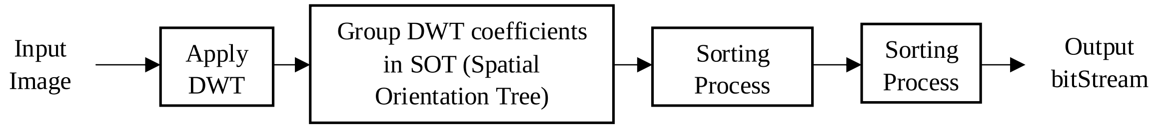


Fig.1 Proposed SPIHT scheme for Data Compression

## VI. PERFORMANCE EVALUATION

The following evaluation parameters are to be estimated for proving the superiority of the proposed SPIHT based lossless address data compression techniques.

a) Peak Signal to Noise Ratio (PSNR)
b) Compression Ratio
c) Throughput
d) End-to-End delay
e) Execution time

## VII.NEED FOR THE PROPOSED RESEARCH WORK

The proposed research solves data compression problem in quadtree technique using an efficient technique for lossless address data compression using adaptive Set Partitioning in Hierarchical Trees (SPIHT). Due to the efficient lossless address data compression of proposed adaptive SPIHT, the transmission of data consumes less energy. Therefore, lifetime of the sensor network is to be improved. Moreover, the proposed work increases the speed of the transmission due to reduced size of the packet.

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