IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 08, Issue 6 (June. 2018), ||V (III) || PP 48-53

Improving the Performance of Spatial Reusability Aware Routing in Multi-Hop Wireless Networks

K. Sudhaker[*1] C. Shoba Bindu[*2] P. Dileepkumar Reddy[*3]
[*1]*M Tech scholar, Department of CSE, JNTUACEA, Anantapurumu, Andhra Pradesh, India*
[*2]*Professor, Department of CSE, JNTUACEA, Anantapurumu, Andhra Pradesh, India*
[*3]*Lecturer, Department of CSE, JNTUACEA, Anantapurumu, Andhra Pradesh, India*
Corresponding author: K. Sudhaker

Abstract-In multi-hop wireless networks, transferring of data from the initial node to final node out of its transmission range, the initial node depending on some other interior nodes for relaying the packet. Also, in order to minimize overall transactions on delivering of a single packet from source node to the destination node and to maximize throughput in a communication system. The proposal of Tong, Meng, yang known as Spatial reusability aware routing in multi-hop wireless network using SASR and SAAR protocols. They demonstrated that SASR and SAAR offer improved throughput under high data rates compared to DSR-ETX and SAF routing protocols respectively. But, it fails to explain about compression and reduction in transmission count. This proposed model aims to further improve the performance of the entire system, by using the data compression methods. The deflate data compression method gives the better results compared with lossless compression methods.

Keywords: wireless network, data compression, LZW algorithm, deflate algorithm.

Date of Submission: 01-06-2018 Date of acceptance: 16-06-2018

I. INTRODUCTION

The discovery of path in multi-hop wireless networks is mandatory to grow up the throughput in the network. Because, the wireless networkshas the limited capacity in the communication media.Even though the new versions of the routing protocols are invented to increase throughput in multi-hop wireless networks i.e to decrease the overall transmissions from initial to the final node[2][5].However, the spatial reuse is considered in the communication media in multi-hop wireless networks, the reduction of transmissions have increased the throughput. But, it holds more energy consumption in the network. Also, the sensing of the signals is rapidly increased. To, reduce the more energy consumption in the network by the data compression process.

Compressing data is the process of data encoding so that it takes minimum forwarding time than it, if data were not compressed (or) original data. Due to the less forwarding time the network strength will automatically improve. And the compression is also used for increasing the use of channel across a network or reduction of the file/data size. Hence data compression on the system is to make the server with better spatial so that large files should store on it.

In the proposed work, DEFLATE is the best compression technique supporting the all constraints relating to the wireless networks, it is a lossless data compression invented by U.S.Patent. The technique involves LZ77 and Huffman coding defined by Abraham Lempel and Jacob Ziv respectively. And the comfortable lossless compression algorithm is Huffman code there is no any dropping of data in the encoding and decoding. The comparison takes place between DEFLATE and other lossless algorithms such as LZW (Lempel Ziv Welch), RLE (Run Length Encoding), observing results shows that DEFLATE obtains the perfect and better results.

II. RELATED WORK

This section briefly reviews the data compression techniques before transmitting from source to the destination. Also discussing the best path selection based on reusability and other related protocols existed in the system.

2.1 Data compression

The transmission over the wireless network may contain the best technique for saving the energy consumption using the compression [6],[7] were proposed a system for reduction of total number of transmissions. However, the limited resources of wireless sensor nodes such as the processor abilities or RAM are the constraints in WSNs. The two main kinds of algorithms available: lossy and lossless compression algorithms in which needs only the lossless algorithms such as LZ77, LZ78 and LZW are the dictionary based algorithms [10]. These algorithms use extensive use of RAM, but the sensor platforms will have the limited RAM. By observing the upcoming technologies of data compression on networks there exist one suitable algorithm satisfies the constraints of the sensor nodes such as RAM called Run Length Encoding (RLE). Even though it is a low power compression algorithm, its new versions are lossy by observing the levels such as K-RLE [6].

2.2 Spatial reusability

Particularly in multihop wireless networks, when two or more links are sharing the common frequency channel in the common spatial vicinity at the same time that is known as the spatial reuse. Since wireless communication media is having the property of spatial reusability. To capture the quality of the single-hop wireless link, choose the route that is having the minimum cost and increasing the end to end throughput. It completely depends on the frequency of a channel. The below figure shows that the working of spatial reuse [1][4]

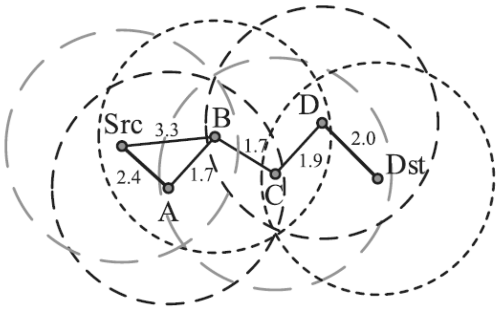

Fig.1. Importance of spatial reuse

2.3 Coding

Coding is the process of converting the messages into bit strings based on the probabilities [8]. In general a small message can have different type and it can be retrieved from its probabilities based on coding. One of the most popular coding in data compression methods is that Huffman coding. Generally, coding is done through procedures adapted to a particular message.

2.4 Protocols for path selection

According to the spatial reusability of the wireless networks, the Dijkstra algorithm for single path routing is the best path selection algorithm. Whereas any path routing will be based on the forwarders list proposed by Shortest any path first (SAF) is completely about the mechanism between the forwarders in the system; MORE [3] describes such theory, all of the forwarders are works based on their work efficiency. Even though, single path and any path routing protocols cannot guarantee maximum end to end throughput and requires additional transmission overheads it takes more energy consumption.

III. TECHNICAL PRELIMINARIES

3.1 Expected Transmission Time (ETT)

Consider the static multi-hop wireless network with N number of nodes; the forwarding rate of the nodes must be the same.Considering the link delivery of probability from the nodes i to j is calculated for the number of transmissions in it; i.e the packet is transmitted from the node i to node j, the probability Pb_{ij} is to be decoded and the node i needs to do K_i times of transmissions [1].

$$K_i = \frac{1}{Pb_{ij} \times Pb_{ji}}, \qquad \text{------ (1)}$$

The transmission time and transmission acknowledgment of the data packet are T_{data} and T_{ack}, the expected delivery time of a packet from node i to node j is [1]

$$Tranmission\ time(t_{ij}) = k_i \times T_{data} + k_i \times pb_{ij} \times T_{ack}$$
$$= \frac{T_{data}}{pb_{ij} \times p_{bji}} + \frac{T_{ack}}{p_{bji}} \qquad \text{--- (2)}$$

3.2 SASR Routing

3.2.1 Calculation of Fused cost

The single path routing is the best routing algorithm for finding the low-cost path and the path cost is calculated based on the set of non-interfering nodes I. The group of wireless links that can work simultaneouslyare the set of non interfering nodes I .The fused cost of the non-interfering set I is to be calculated [3] as the largest link delivery time in the set,

$$c(I) = \max\{t_{ij} \mid (i,j) \in I\}. \quad \text{---- (3)}$$

The path delivery timeis calculated from the set of I of non-interfering sets, given the interior condition of the links on the spatial path P.

3.2.2 Path delivery time

The delivery time (C) depends on the collection of a non-interfering set of nodes I and the fused cost [1] as follows:

$$C = \sum_{I \in I} c(I) \quad \text{------- (4)}$$

Here, Iis the collection of all non-interfering sets on path P, each link is involved in exactly one non-interfering set. The possible values of c(I) depends on non-interfering set I, itis selected to the collection, c(I) is to be one, otherwise it would be zero.

3.4 Data compression ratio

"It is the ratio between compressed data to the uncompressed data". It depends on the nature of data to be compressed.

$$Compression\ rate = \frac{\text{data length after compression}}{\text{data length before compression}} \times 100 \quad \text{---- (5)}$$

3.5 Throughput

The number of bits delivered successfully to the end within time is called throughput.

$$Throughput = \frac{I}{T} \quad \text{----- (6)}$$

i.e the average output of something over a given amount of time.

IV. LOSSLESS COMPRESSION

A compression system which doesn't loss any data after completion of the task is known as lossless compression. It is a special type of compression that follows the procedure of source data to be exactly regained from the compressed data. Lossless data compression is not same as the lossy compression used in several applications. The place where lossless compression used, the original, decompressed data are same. Examples include source code executable programs and text documents also some of the files like PNG or GIF image formats. Some of the lossless file compression techniques discussed below.

4.1 LEMPEL-ZIV-WELCH Model

LZW is a normal lossless compression technique. This technique is normally used in GIF and also even used in PDF type as well as in TIFF. Due to versatility and simplicity, LZW is the regular base data compression technique, is commonly used in GIF.

The working principle of LZW compression technique is that reading a sequenced set of symbols and grouping them into strings and finallyconverting them into codes. Because of the codes take up lesser space than the strings when they replace.

At an initial state of the encodingprocess, the code table has the first 256 entries, with remaining entries of the table gets empty. The process of encoding continues, LZW recognizes the repeatable strings presented in the original data and adds them to the code table. Decoding done by taking single code from the compressed file/data, and translating through the code table for finding character or characters representing the code in the table.

The technique in front of the compression algorithm is that the initial data has processed a dictionary will keepcorrespondence between the longest encountered words and a list of code values. The symbols are placed with their respective codes and the original file is compressed. Finally, the efficiency of the compression algorithm increases as the number of long, repetitive words in the input data decreases.

V. PROPOSED MODEL

5.1 The DEFLATE model

The DEFLATE is a lossless data compression algorithm and associated file format that uses both the combination of the **LZ77** algorithm and the **Huffman.** It isproposed by Phil Katz,the version 2 of PKZIP tool [8].

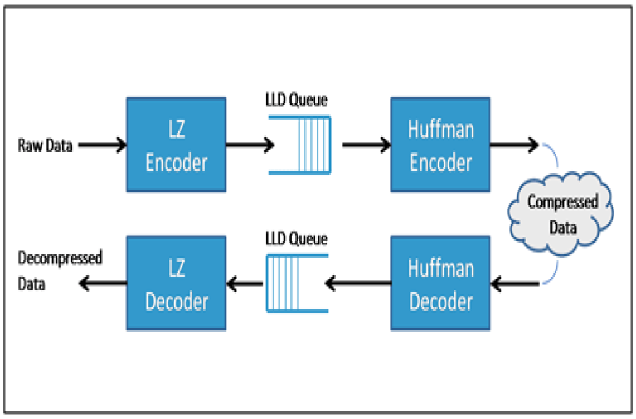

Fig: The DEFLATE compression process

5.1.1 LEMPEL-ZIV(LZ77)

Jacob Ziv and Abraham Lempel proposed a file compression algorithm called Universal Algorithm for Sequenced data Compression. The LZ77 algorithm works on the principle of dictionary-based algorithm that finds outs the sequence of bytes from formed content instead of the initial data. In LZ77, only one coding pattern is presentedand all remaining data should be coded into the common form:

- Addresses the repeated content
- Sequenced code length
- First eliminated symbol

The following example explains how the byte contents, length and the address that are coded.
Example “abcabca”:

	Address	Length	Eliminating Symbol
abcabca	0	0	a
a bcabca	0	0	b
Abcabca	0	0	C
Abcabca	3	1	ab
Abcabca	5	2	Empty

Table: LZ77 explanation

In LZ77, the obtainable compression rate depends only on the repetition and the process implementation is relatively slow. Since each byte is extended through the starting symbol eliminating from the formed content, the set of repeated words will continue to grow up. In which there is no additional coding is needed and it is an easy implementation for encoding and decoding. The addressing must be limited to a certain maximum, we say that message exceeds will no longer coding and will not covered by the addressing pointer.

5.1.2 HUFFMAN Coding

The principle existed in the Huffman coding technique is that by taking the binary tree, nodes are either leaf nodes or interior nodes. At initial, all the nodes are taken as the leaf nodes and each contains the character itself named as the weight of the character. Every interior node link to two child nodes and are having the own weights. The bit with ‘0’ represents left child and the bit with ‘1’ represents right child of the tree, it finishes with ‘n’ leaf nodes and ‘n-1’ interior nodes.

Huffman code says that, a tree should remove unused symbols in the text for the production of most optimal code lengths. The following procedural steps show the working of a Huffman code method, list of characters and frequencies [9];

Algorithm: Huffman Algorithm(S)
Input: String S of length l with d distinct characters
Output: Coding tree for S.
1 Calculate frequency f(c) of each character c of S
2Next, a priority queue Qis initialized.
3**for each**of the symbol c in S then **do**
4 Forma binary tree T ofsingle node, stores c
5 Insert a tree T into the queue Q with key f(c)

whileQ.size()>1 then**do**
Entry e1=Q.removeMin() with e1 contains thekeyf1 and value T1.
Entry e2=Q.removeMin() with e2 contains key f2 and value T2.
Form a new tree T with left sub tree T1 and right sub tree T2.
Insert T into Q with key f1+f2.
Entry e=Q.removeMin() with e having tree T as its value.
return tree T.

5.2 Encryption

The encryption scheme is known to be encoding the message or data that it is accessible through only authorized users. The lossless compression algorithms works on the principle of data encryption schemes with dictionary based. LZ algorithms can utilize, the complex data structure to encrypt one bit at a time. Also, the algorithm uses a variable length dictionary and is mainly used to encrypt an unknown data stream. And the algorithm is capable of compressing the streamed data generated up to 10-20 Mbps in a real-time environment. Even though the algorithm uses larger dictionary size, LZA can still achieve the decompression with same speed like other compression algorithms. LZ77 algorithm encodes a sequence byte data from already presented contents instead of the original data. there is no identical byte sequenced data is available in the existing contents, the starting address and sequence length isfixed as '0' and the new symbol will be encoded with either '1'or'0'.LZ77 extended by the LZMA algorithm by adding a Delta Filter and the Range Encoder. However, sliding window delta Filter replaces input data for effective data compression. LZ77 stores or transmits the entire data in the form of sequential data formats. The output of the first-byte deltaencoding is the data stream itself.

5.3 Decryption

Decryption is the process of taking encoded data is transformed into the lossless original data, the resultant data should be understood to the computer which is in the coded format. LZ77 can decrypt the encrypted data in the reverse of the encryption process. Based on an encoded stream of byte data from encryption process, file size and original data can recover through the decryption. The procedure needed for encrypting is taken the reverse for the decryption. The resulting decrypted data is same as the original data that is encrypted without losing any single character.

VI. PERFORMANCE EVALUATION

The effectiveness of the DEFLATE algorithm is to be found by compressing labeled data, its lossless compression performance is compared with other well-known compression algorithms namely Huffman coding, Arithmetic Coding and LZW.

Hop type	Dataset	Compression ratio			
		DEFLATE	ARITHMETIC	HUFFMANCODE	LZW
Single hop	Indoor	14.0	45.7	46.4	32.7
	Outdoor	16.2	36.6	46.4	36.6
Multihop	Indoor	16.2	36.9	47.0	36.9
	Outdoor	10.5	45.7	59.0	33.5

Table: Comparison of compression ratio

A good characteristic of DEFLATE based labeled data compression is achieved; it is compared with other approaches. A direct comparison is taken with the results of existing methods using the same datasets. The table summarizes the experimental results of compression algorithms based on compression ratio. As by the table results, the overall compression performance of DEFLATE algorithm is significantly better than other algorithms on dataset.

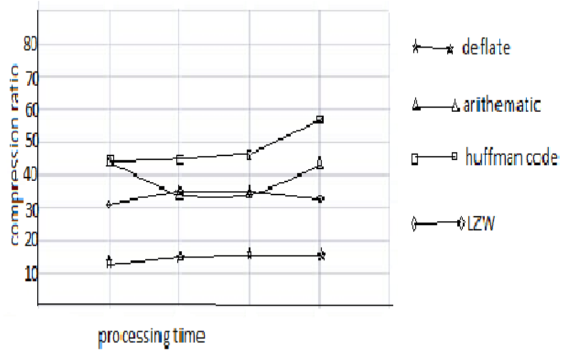

Fig: comparison graph

In LZW, the dictionary size increases then, the number of bits required for the indexing also increases. This limitation of LZW makes the results to lag behind the DEFLATE.

VII. CONCLUSION

Compression algorithms are invented to provide the utilization of optimal resources in the WSN. This paper shows the overall strength improvement of a network through DEFLATE lossless compression technique to compress the wireless sensor labeled data. The compressed data over a communication channel decreases transmission counts and the labeled node uses DEFLATE algorithm and is the better compression algorithm among other lossless compression algorithms such as Arithmetic, LZW and LZ77/78. The compression ratio for DEFLATE is very low under smaller data rates. This paper uses further on improving the lifetime of network turns to a better.

REFERENCES

[1]. TongMeng, Fan Wu, Zheng Yang, "Spatial reusability-aware routing in multi-hop wireless networks,"IEEE Transaction on Computers,vol. 65, no. 12, pp. 0018-9340, 2016.
[2]. W. Hu, J. Xie, and Z.Zhang, "Practical opportunistic routing in high-speed multi-rate wireless mesh networks," in MOBIHOC, 2013.
[3]. E. Rozner, J. Seshadri, Y. A. Mehta, and L. Qiu, "Soar:Simple opportunistic adaptive routing protocol for wireless mesh networks," IEEE Transactions on mobile computing, vol. 8, no. 12, pp.1622-1635, 2009.
[4]. B. Radunovic, C. Gkantsidis, P. B. Key, and P. Rodriguez, "An optimization framework for opportunistic multipath routing in wireless mesh networks," in INFOCOM, 2008.
[5]. S. Chachulski, M. Jennings, S. Katti, D.Katabi, "Trading structure for randomness in wireless opportunisticrouting, "in SIGCOMM, 2007.[MORE]
[6]. Abhishek Sharma, Ramesh govindan, Leana, "Dynamic data compression in multi-hop wireless networks," 10.1145, in 2009.
[7]. Shelja Sharma, Suresh kumar, "Study and analysis of DSR and SASR protocols in MANETS," in International Journal of Computer Applications, 8887, 2013.
[8]. SavanOswal, singh,Kirthi, "DEFLATE compression algorithm," in International Journal of Engineering Research, 2091-2730, 2016.
[9]. Sunyongkim, Chivoocho, Kyung, "Increasing network lifetime using data compression in wireless networks with energy harvesting," in International Journal of Distributed Sensor Networks, year 2017.
[10]. Mudgule, Uma, Ganjewer, "Data compression in wireless sensor network: a survey," International Journal of Innovative Research in Computer and Communication Engineering, 2320-9801.

K. Sudhaker "Improving the Performance of Spatial Reusability Aware Routing in Multi-Hop Wireless Networks." IOSR Journal of Engineering (IOSRJEN), vol. 08, no. 6, 2018, pp. 48-53