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ANYLSIS OF NK-RLE VS RLE DATA COMPRESSION SCHEME IN WIRELESS SENSOR NETWORKS

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Abstract: In this paper we have evaluate our proposed algorithm NK-RLE with the existing RLE using similar parameters for all algorithms to evaluate energy efficiency on various parameters i.e. Stability Period, Middle Node Death (MND), Network Life time and Total Remaining Energy of network in the WSN. Our proposed algorithm is developed on the principal of RLE and K-RLE technique of data compression with an objective to increase the compression and energy efficiency. The research focused on reducing the number of bits transfer during data collection by nodes to base station in sensor networks. Minimizing the number of bits in transmissions ultimately leads to energy savings in a wireless sensor network. In this paper we have compare both the algorithm using MATLAB simulation software on stability period, middle node death and network life time.

Keywords: WSN, Data Compression, Energy Efficiency, NK-RLE**,** RLE.

Introduction:

The rapid growth in communication technology has resulted in many promising and innovative technologies. Wireless Sensor Networks (WSN) is one from these technologies. In wireless sensor network various sensors are established in physical environment for physically sense the phenomena like sound, temperature, light, humidity etc [1]. Usually, sensor nodes are tiny units which have of following components: a sensor to sense the data, a computing unit to compute and storage unit, to store data a wireless communication media for transmitting the data, a small power unit a battery for power supply basically this battery is a small power unit which have limited energy, because due to deployed in hostile environment, in most of cases, it could be not possible to recharge these batteries or replace these batteries [2]. In some cases, solar units are used with sensor nodes to recharge the batteries [3]. Numerous previous studies have shown that maximum energy is Consumed at the time of data transmission and related process [4]. So, the energy-saving techniques & related issues are focusing on data sensing techniques & transmissions are major issue of research [5].

Literature Survey:

Jonathan Gana Kolo, et, al., presented a lossless adaptive compression technique for WSNs. This technique is easy, well-organized, and is mostly appropriate for resource constrained nodes. The techniques get used to changing connection in sensed data to efficiently compress the data with the use of two Huffman code tables. These techniques minimize the size of transmitted data that contributes to save energy [6]. Zheng Bin, et. al. introduced an algorithm to compress the data which minimize the size of data so it consumes less energy at the time of data transmission based on bearing monitoring scheme [7]. Ammar Yaseen Tuama, et.al. have presented a lossless data compression technique mostly suitable for wireless sensor network, dealing with a little size of data without requiring for large data relationship or sign duplication [8]. Finally, this research shows the lack of processing for a variety of previously presented data compressions schemes while compress the small size data. H. Anwer Basha, S. Arivalagan, P. Sudhakar, R.P. Narmadha presents a Deterministic Code Allocation (DCA) scheme for efficient data compression. This scheme is based on dictionary-based technique, single character encoding algorithm that utilizes a static dictionary to allocate code words [9]. Shahina Sheikh, Ms.

Hemlata Dakhore, introduced a new data compression scheme based on the Adaptive Huffman algorithm, for WSN. [10]. Mo yuanbin, et.al. [11], introduce an algorithm to compress the data based on adaptive Huffman algorithm for WSN. S. Renugadevi and P. S. Nithya Darisini [12], Compared the evaluation of Huffman & LZW Compression for data in WSNs application. The data compression evaluation of Huffman scheme & LZW scheme by a range of input usually evaluation with a wireless sensor node has considered. Mohamed Abdelaal and Oliver Theel [13] introduced an Effective and Adaptive Compression scheme for power conservation in WSNs. The Fuzzy convert has presented for newest local adaptive data compression to reduce the memory size, bandwidth, and power used in radio broadcast. In the valuation, this scheme is evaluated with actual sensed temperature data. Xi Deng and Yuanyuan Yang [14], presented a new adaptive data compression scheme has been measured for lossless data compression that minimizes quantity of data which should send with the network and to base station and therefore have power advantages which are multiplicative by the various hops the data travel during the sensor network. S. Renugadevi, et. al. [15], Introduced a Huffman scheme and LZW based compression schemes for WSNs. The outcome of data compression on back-to-back packet interruption in data collecting in Wireless Sensor Networks has been considered in this research. A.V. R. Maheswari [16], compare the least variation Huffman data compression scheme, adaptive Huffman coding scheme as well as distinction of Huffman coding scheme has been compared. Francesco Marcelloni and Massimo Vecchio, have talk about the utilization of static Huffman encoding algorithm for data compression from a WSN [17]. This scheme utilizes the features of high connection of sensed data for compression.

Limitations of Existing Approaches:

Various existing schemes conversed in the literature survey are principal component analysis-based schemes for mathematically minimizing only. Though, these schemes are too rigorous to be used for sensor nodes, As increase overhead computation memory necessities and lead to extra power utilization for data transmission from node to cluster head and further to base station .

Energy efficiency design is also a major challenge and can be achieved by using improving operational aspects and by detecting non operational, power wasteful operation, like listening to nearest nodes, broadcasting duplicate repetitive data, in active listening phase unnecessarily all time. To address these research gaps and to achieve the goal of designing energy efficient technique in WSN, an enhanced novel energy efficient approach based on data compression is proposed, which takes into consideration, to address the WSN challenges. In this paper we have done the comparative study of proposed scheme with existing schemes.

Existing Data Compression Algorithms:

RLE: Run Length Encoding is simple scheme to reduce digital data. It represents consecutive runs of similar value in data as cost followed with the count. Run length is defined as number of consecutive equal values. the objective is to minimize the volume of data required for storage transmission The design of this scheme is, in case a data item d occur n uninterrupted times in input information we swap the n happening through single pair nd. [18]

K-RLE: The study in [19] illustrates K-Run Length Encoding, a lossy data compression scheme. K-RLE is an advance version of RLE data compression scheme. It represents improved compression ratios in comparison to RLE scheme, but with certain quantity of error or loss of data. The presentation of this scheme depends on the selection of value of K parameter which presents precision. This scheme gives emphasis to on computing data local at sensor node level. In this, in case a data item is d or among the d+k and d-k happen for n repeated times then the happening is restored with a single pair ‘n’ ‘d’. In case K=0, then K-RLE scheme work similar as RLE scheme. The selection of K also influences the percentage of information and the amount to which it's customized with this scheme.

Proposed Data Compression Scheme:

NK-Run Length Encoding [20]

Our proposed data compression algorithm NK-RLE is based on significant hypothesis regarding data sensing and transmission within WSNs that is we are transforming the difference between sense value and previous

value. In our proposed NK-RLE scheme if value repeat and lies between d-k to d+k (the value of k depends on the user choice) then instead of sending counter with repeating value i.e. nd1, nd2, nd3. In our proposed algorithm the data is send i.e. n(d1,d2,d3) in this way we are sending the repetitive count only once rather than sending it again and again as compare to previous DK-RLE algorithm. This algorithm minimizes quantity of information to be transmitted at a node. Hence, in results energy utilization is minimizing which increase the network life spam.

Experimental Results:

Performance Evaluation of Proposed Algorithm:

To validate the energy efficiency of our proposed data compression scheme, we implemented algorithm in MATLAB on the random sample data. The sample data set consist of temperature data. We simulate our algorithm on various parameters like stability period, middle node death, network lifetime, to make energy efficient. Network parameters which are taken in consideration for simulation are as shown in Table-1.

Table-1: Simulation Parameter:

S. No	Parameter symbol	Name	Value
1	m × m	Size of Network	100 × 100
2	N	Total Sensor nodes in Network	100 nodes
3	EDA	Data aggregation energy	Five nanojoule/ bit/signal
4	Efs	Free space energy	Ten quadrillion joules (PJ) /bit/m^2
5	Emp	Amplification energy	0.0013 quadrillion joules (PJ) /bit/m^4
6	L	Message Size	500 bytes
7	E_0	Initial Energy	0.25 joules
8	BS	Base Station position	50 m × 50 m

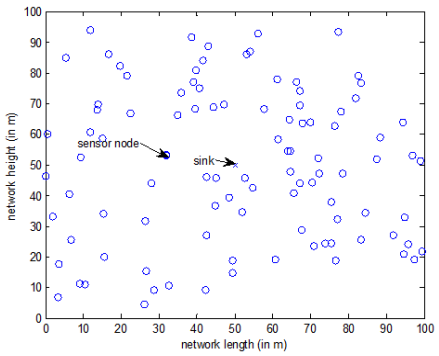

Figure-1: Network Area

Performance Evaluation of proposed:

NK-RLE for Energy Efficiency

Our proposed algorithm is evaluated for energy efficiency on stability period, middle node and network life time by changing the initial energy level, the number of rounds in which death of first sensor node ,half nodes and full network happen, Figure-2, shows the graph of stability period, middle node, and network life time for a range of values of Initial energy of node have been Indicated for temperature. The x-axis of the graph represents the variable values for initial energy, and y-axis presents number of rounds.

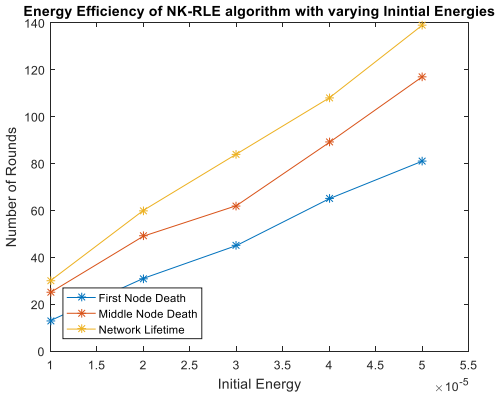

Figure-2: Energy Efficiency of NK-RLE Scheme

Performance Evaluation of Existing RLE for Energy Efficiency:

RLE is evaluated for energy efficiency on stability period, middle node and network life time by changing the initial energy level, the number of rounds in which death of first sensor node ,half nodes and full network happen, Figure-3, shows the graph of stability period, middle node , and network life time for a range of values of Initial energy of node have been Indicated for temperature. The x-axis of the graph represents the variable values for initial energy, and y-axis presents for stability period in term of number of rounds.

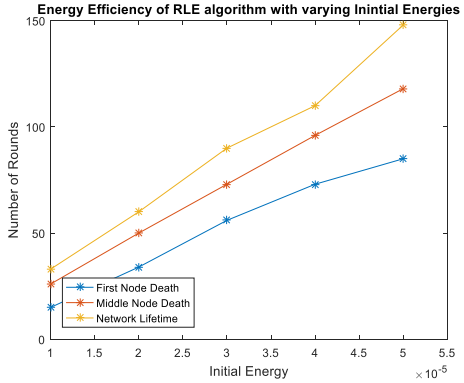

Figure-3: Energy Efficiency of RLE Scheme

Comparison of Stability period, Middle Node Death and Network life time for RLE and NK-RLE:

To compare the for energy efficiency of proposed NK-RLE algorithm with existing RLE algorithm we simulated the algorithms on stability period, middle node and network life time by varying initial

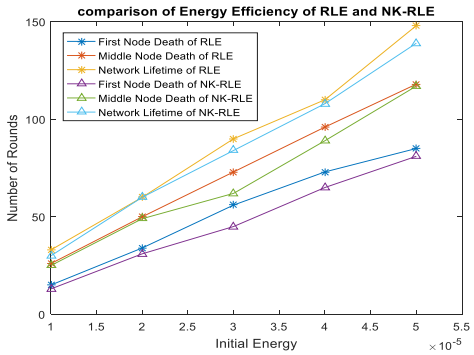

Figure-4: Comparison of Energy Efficiency of RLE and NK-RLE Scheme

energies from 0.00001J to 0.00051J. Simulation results for stability period, middle node and network life time for RLE and NK-RLE are shown in analytical graph of the comparison of stability period ,middle node and network life time for RLE and NK-RLE with respect to various initial energy is shown in figure-4.

Analysis of the Performance of Existing RLE and Proposed NK-RLE:

As the simulation results of RLE and NK-RLE shows that our proposed algorithm has better Stability Period, Middle Node Death, Last Node Death, and Network Life Time. This is because in RLE algorithm, it stores the repetitive sense value once in one variable and repetitive count in another variable. If the new value repeats same time as previous it will store both the value and send to the base station differently. But in our proposed NK-RLE algorithm we have remove this repetition. In our proposed algorithm if the various sensed values are repeating again and again and repetition count is same, we will send the repetition count once which lead to energy efficiency.

Conclusion and Future work:

The present research is focused on the development and enhancement and analysis of compression algorithm for WSNs. The compression algorithms discussed in this paper is mainly based on RLE and K-RLE technique of data compression with an objective to increase the compression and energy efficiency. The research focused on reducing the number of bits transfer during data collection by node to BS in sensor networks. Minimizing number of bits in transmissions ultimately leads to energy savings in a wireless sensor network. We compare our proposed algorithm NK-RLE with the existing RLE using similar parameters for all algorithms for evaluate energy efficiency on various parameters i.e., Stability Period, Middle Node Death (MND), Network Lifetime and Total Remaining Energy of network in the network. Simulation outcomes of proposed NK-RLE presents that our proposed scheme has much better results in forms of energy efficiency. As in NK-RLE the difference value of current sensed data and previous sensed data is send to sink node which reduces the bits in transmission. And further we have removed this repetition, if the various sensed values are repeating again and again and repetition count is same, we will send the repetition count once. So, the transmitted data is less with respect to RLE algorithm, this makes it more energy efficient as compare to RLE. We have considered static sensor node and sink node Implementation of sensor nodes with mobility and mobile sink node can be done in future. In this research main consideration was based on performance of compression algorithm in terms of energy efficiency security issue are neglected. so, in future security in term of privacy, integrity and authentication can be considered.

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