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Enhanced Modified SEP for Maximizing the Hierarchical Wireless Sensor Network

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ABSTRACT

For various human activities like communication, supervision, sensing, deployment so on, on a valuable data a number of sensing devices are used called sensors. The main purpose of sensor nodes are data communication or data transfer with in the network. This is done by choosing a leader among nodes in each cluster called cluster head. There are number of clustering protocols used for the cluster Head selection, e,g SEP the main concept is the life time of a network which depends upon the average energy of the node. In this paper we proposed a model, which uses the residual energy for cluster head selection by varying the values of probability p (from 0.1 to 0.9), value of threshold h (from 100 to 800) and the value of soft threshold and LZW compression technique during the transmission of data packets from CHs to base station, which maximizes life time of network. By varying these parameters we will determine that how and what values are improved and which varying value is directly/inversely proportion to the parameters(p,h,s).

Keywords: — WSN, SEP, Soft- Threshold, Probability Clustering, Residual energy, LZW Compression.

I. INTRODUCTION

Wireless Sensor area Networks are networks, which consist of tiny, battery powered data sensor nodes with limited on-board process, storage and radio capabilities. It consists of hundred to thousands of multi-function allow power sensor data nodes which are working in an unmannered environment and have a ability to sense, computation and communication. Area nodes sense data and send their packet data reports toward a processors processing center, called "sink."The basic components of a data nodes are a sensor device unit, an Analog to Digital data Converter, a Central Processing Unit, a power unit for energy and a communicating unit [3],[4]. The tiny Sensor nodes embedded are micro-electro-mechanical systems (MEMS) that are responsible to make a computable change in some physical average condition related to temperature and pressure. The Sensor sense and compute the physical data of the part to be monitor. The analog signals sense by the tiny small sensors is digitized by analog to digital converter and sends to controller for processing. Sensors nodes used are of very small size, have extremely low power energy, are operated in high volumetric density and can be independent to and adaptive to the network environment. These sensor nodes used are very high expensive and require large amounts of power energy for its operation. The most difficult and hard resource constraint and task to meet is power consumption in wireless sensor networks. The use of WSNs is increasing day to day and at the same period it faces the same physical problem of power energy constraints in terms of limited battery lifetime in area network. As each node depends on power for its activities, this become a major issue in wireless sensor area networks.

There are number of technique in wireless sensor network to handle these problems associated with in the network. Clustering is one of technique in WSN to handle such problems. Number of clustering protocols are invented, The SEP heterogeneous protocol are best examples, but further some limitations are still there. In this paper we proposed a new method to improve the life time of network and storage space during transmission which increases the capability of network to select best clusters heads among nodes over SEP. by varying the values of probability p (from 0.1 to 0.9), value of threshold h (from 100 to 800) and the value of soft threshold and LZW compression technique during the transmission of data packets from CHs to base station, which maximizes life time of network. By varying these parameters we will determine that how and what values are improved and which varying value is directly/inversely proportion to the parameters(p,h,s).

II. SEP

The new version of protocol called SEP (**Stable Election Protocol)**, a heterogeneous protocol which is an improvement over LEACH protocol [1]. In SEP, some of the high energy nodes are referred to as advanced nodes and the probability of advanced nodes to become CHs is more as compared to that of non-advanced nodes. It is heterogeneity-aware protocol and CH selection probabilities of nodes are weighted by initial energy of each node compared to the other nodes in WSN. So basically, SEP protocol is based on two levels of node heterogeneity as normal nodes and advanced nodes.

It assumes that a percentage of the population of sensor nodes is equipped with additional energy resources - this is a source of heterogeneity which may result from the initial setting or as

the operation of the network evolves. SEP does not require any global knowledge of energy at every election round. Probability of a normal node getting elected as cluster head is $P_{normal:}$

$$P_{normal=} p/(1+a\times m)$$

Probability of an advanced node getting elected as cluster-head is $P_{advanced:}$

$$P_{advanced=} [p/(1+a\times m)]\times(1+a)$$

m be the fraction of the total number of nodes n, which are equipped with a times more energy than the others.

The drawback SEP method is that the election of the cluster heads among the two type of nodes is not dynamic, which results that the nodes that are far away from the powerful nodes will die first. The modified version of SEP is Zonal-SEP.

III. PERFORMANCE MEASURING PARAMETERS

Stability Period: This is also called "stable region." And is the time interval from the start of operation until the death of the first sensor node.

Throughput: It is the rate of data sent from cluster heads to the sink also the rate of data sent from the nodes to their cluster heads.

Number of cluster heads per round: This is the number of nodes which would directly send to the sink information aggregated from their cluster members.

Network lifetime: It is the time interval in the sensor network from the start of operation to the death of the last alive node.

Instability Period: This is the time period from the death of the first node in the network to the death of the last sensor node.

Number of alive (total, advanced and normal) nodes per round: This is the total number of nodes and that of each type that has not yet expended all of their energy.

IV. DATA COMPRESSION

We use data compression on SEP protocol by varying the probability (p) and threshold (h) to advance rate of throughput and network life time. In this Section we give overall idea about the data compression and the technique we used to advance SEP. The compression technique we used is LZW compression. The primary objective of the data compression is to minimize the data size which is to be transmitted [8]. The main goal of Data compression is Technique used to reduce the number of bits required of particular information during transmission of data sets or data packets, which means to eliminate the redundancy in a data set which reduces data size.

There many data compression techniques, One the Best lossless data compression technique is LZW (Lempel-Ziv Welch) Compression which is invented by Terry Welch In 1980. LZW algorithm is just like a greedy approach and divides text into substrings [2]. LZW algorithm works in both compression and decompression techniques [4]. The dictionary is created while the data are being encoded. It takes each input sequence of bits of a given length in bits and creates an entry in a table called a "dictionary"[4],[9],[10]. LZW compression is one of the Adaptive Dictionary techniques.

There are mainly two types of implementations in LZW compression. They are: Static and Dynamic.

Static Compression: It use when we use a static number of bits to make the compression. The total number of bits we have to our disposal is 32, which gives a total of 232 that is 4,294,967,295 possible entries in the dictionary.

Dynamic Compression: Dynamic compression changes the number of bits used to compress the data. It starts with 9 bits for each new value, and goes up until it reaches 32 or until the file ends. In this type of compression we can set the size of the dictionary we have.

In this paper LZW data compression technique is used for compression of nodes data packets of sensor nodes which helps in transmitting more data packets in less energy consumption.. LZW compression is accomplished into encoding and decoding.

- **Encoding:**

The LZW algorithm works on the given input string in a given dictionary and on scanning the input string for successively longer substrings until it finds one that is not in the dictionary [9],[11]. When such a string in the dictionary is found, then it retrieves the some index for the string without the last character (i.e., the longest substring that is in the dictionary) from the dictionary and sent to output, and then the heads to the new string (including the last character) is added to the dictionary with the next available code. The last input character is then used as the next starting point to scan for substrings. The general steps accomplished by the processes during encoding is given below.

1. Initialize the dictionary with set of strings of length one.
2. Find the longest string W in the dictionary among set of strings that matches the current input of stirng.
3. Then avoid the dictionary index for value W to output and remove W from the input set string.
4. Then Add W followed by the next symbol in the input string to the dictionary
5. jump Step 2

Algorithm

STRING = get input character
WHILE there are still input characters DO
CHARACTER = get input character

IF STRING + CHARACTER is in the string table then
STRING = STRING + CHARACTER
ELSE
output the code for STRING
add STRING + CHARACTER to the string table
STRING = CHARACTER
END of IF
END of WHILE

- **Decoding**

The decoding or decompression processes is done to retrieve the original data packets at nodes. In decoding process the compressed data packets during the compression process will be transferred from the cluster head to the base station and then the base station will perform the decoding process [9]. Here the received binary data will be back converted in to the character or string. After undergoing all these process we will get the actual data which is sent from the cluster member. The main purpose of using this LZW compression technique is to improve the lifetime of the network.

Algorithm

Read OLD_CODE
output OLD_CODE
WHILE there are still input characters DO
Read NEW_CODE
STRING = get translation of NEW_CODE
output STRING
CHARACTER = first character in STRING
add OLD_CODE + CHARACTER to the translation table
OLD_CODE = NEW_CODE
END of WHILE

The LZW compression technique is used on each time when we vary the value of the Probability factor in the SEP protocol from 0.1 to 0.9 then all compression graph values are compared with the previous compressed phase and so on

V. OBJECTIVE

The following objective are considered in this paper

- To study the LEACH, SEP and ZSEP clustering protocols.
- To get the better Cluster heads on the basis of residual energy with threshold energy.
- To get better data transfer by using LZW compressing technique.
- To achieve the better performance by varying value of p from 0.1 to 0.9.
- To Compare the results with previous technique.

VI. PROPOSED METHOD

This section represents the proposed method, and how the proposed protocol improves the life time of network by varying the probability and threshold values on SEP in presence of LZW compression. The varying values of p=0.1 to p=0.9.

The working flow is given below:

Deployment ➔ Sensing ➔ Network Setup ➔Root➔ Cluster Head Selection ➔ Routing Path Selection ➔ LZW Encoding ➔ Threshold ➔Vary Probability➔ Routing Path Selection ➔ Decoding then whole the process will repeat again and again until all the nodes are dead.

Step1. Initially deploy WSN nodes (N) having average energy.
Step2. Apply cluster head selection based on probability and average residual energy and select cluster heads CHs.Vary P From(0.1 to 0.9).
Step3. Check the condition for residual energy of node if condition satisfies then
Set the node as Cluster head (CH).
else
Set the node as normal node.
Step4. Collect the data transferred from cluster members (CMs).
Step5. Then apply the LZW compressing technique based on minimum threshold distance value.
Step6. Collects the compressed data and sends it to base station (BS) with standard threshold distance value if the distance is less than CH.
Step7. Link broadcast average energy information to WSN structure.
Step8. Repeat process.

VII. RESULT AND DISCUSSION

In this section the comparison of proposed technique (COMPRESSEDSEP) with SEP is discussed by choosing the value of probability from 0.1 to 0.9.
The evaluation process and the implimentation is done in MATLAB. The simulation has been peformed in the network of 100 nodes and are placed randomly in the network. The nodes are in the diameter of field 400m x400m.

The different parameters and their values used in the network is shown Table 1.

TABLE 1: PARAMETERS USED

Parameter	Values
Area (x, y)	400,400
Base station (x, y)	200,200 or mobile
Nodes (n)	100
Probability (p)	0.1
Initial Energy	0.5J
Transmitter energy	$50*10^{-9}$
Receiver energy	$50*10^{-9}$
Free space(amplifier)	$10*10^{-12}$
Multipath(amplifier)	$0.0013*10^{-12}$
Effective Data aggregation	$5*10^{-9}$
Maximum lifetime	2500

Figure 1 shows the improvement over SEP in case of number of alive nodes in the deployed network and figure 2 is in case of number of dead nodes.

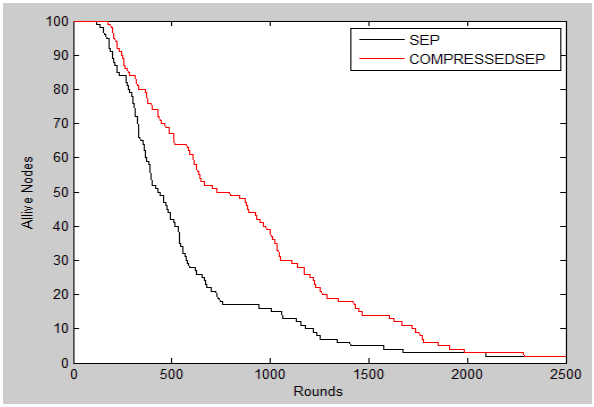

Fig 1 Comparison for number of Alive nodes

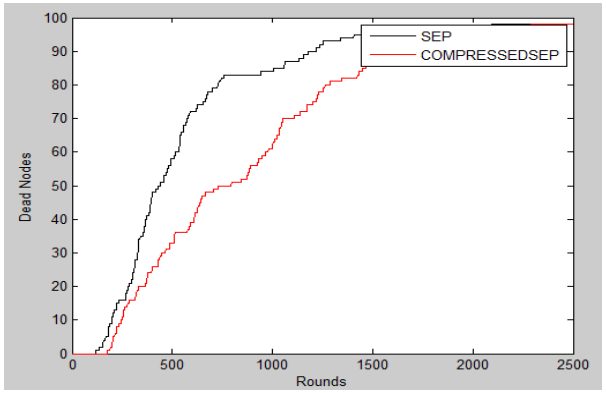

Fig 2 Comparison for number of Dead nodes

Now by varying the value of P from 0.1 to 0.9 the different comparison is shown in figure. Now the probability factor which intially was at p=0.1 will be varied from p=0.1 to p=0.9. by varing the probability in each parameter packet to BS, Dead nodes and Alive nodes, we will get the accurate value on a graph which will help to get the life time of network. The comparision is shown in figure 3, figure 4 and figure 5.

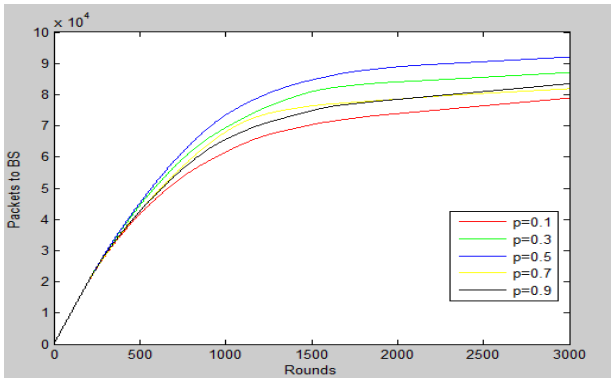

Fig 3 Comparison packet to BS

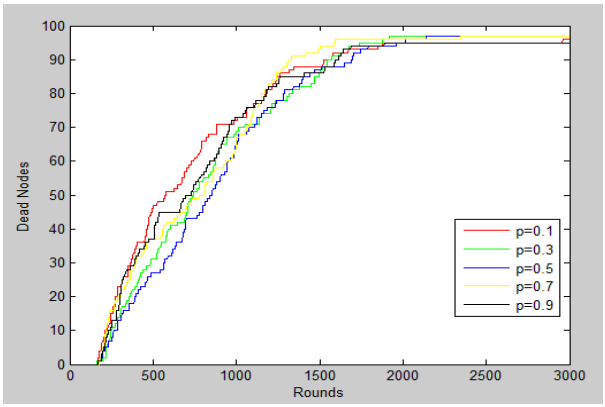

Fig 4 Comparison Of Dead Nodes

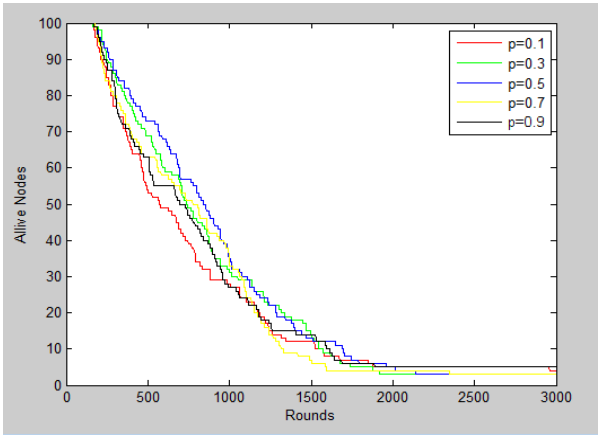

Fig 5 Comparison Of Alive Nodes

VIII. CONCLUSIONS

In this work the probability helps in get the better selection of CH node. The SEP protocol only used the varying probability but does not include the concept of LZW compression, by introduction this technique in this proposed work easily help in better selection of Ch node and easily help in improving the life time of network. The COMPRESSEDSEP with enhanced residual energy is implemented for better performance of the network. The COMPRESSEDSEP consider the values of varying probability from 0.1 to 0.9 and the threshold p and h and checkout the performance and the network life time. Which improves the performance of the network.

In near future, a new and improved cluster based routing protocol with improved compression technique can be proposed to enhance the network life time and optimize the energy level of a node for better selection of cluster head.

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The about contents and research method we used is true to my knowledge and the result at every step we concluded is according to my research work.

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