Fault Tolerant Wireless Sensor Network with Neural Networks

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Abstract- The wireless sensor networks is the type of network in which sensor nodes sense the network information and pass sensed information to base station. This network use the wireless links for the communication. The energy consumption is the major issue of the sensor networks on which various research is been done. In this research technique, will be proposed in which neural networks technique is been proposed in which optimal cluster head is selected which has least chances of fault in the network. The simulation is been performed in MATLAB and it is been analyzed that energy consumption, delay is reduced and network throughput is increase in the network.

Keywords- Fault Tolerance, LEACH, Neural Networks, Back Propagation

I. INTRODUCTION

An infrastructure in which several sensing, computing as well as communicating devices are deployed such that it is possible to monitor the surroundings and collect important information of a specific region is known as a sensor network. The control and activation are also of higher interest along with sensing. Large number of distributed sensors, an inter-connected network, a central authority for clustering of information and a set of central computing resources are the four common components present within a sensor network [1]. Several individual tasks are performed by these components. The communication of a hub to other hubs with the help of direct links is not possible. The hub can be deployed far from the nodes since there are huge areas in which these networks are spread. Since the hubs are out of reach of each other, the information needs to be passed on using the intermediate nodes to the destination. Across the path, the nodes that are available are used to pass on this information and this mode of communication is known as multi-hop. Thus, several nodes coordinate with each other such that the data can be transferred all across the network. A network provides a shared communication and thus, the nodes are not concentrated on one particular region. Within WSNs, the nodes can either be added or eliminated from the network [2]. Within the topology of network, several changes can be made. A sink is referred to as the hub in which all important information is collected. With the help of exchanging specific information across the external environments, internet is used along with certain time constraints. There is very limited battery power available within the sensor nodes of the networks. Thus, there is reduction in the lifetime of sensor nodes and thus the network as well faces numerous problems [3]. However, in almost all the applications, it is very important to provide better lifetime for these networks. Since the nature of sensor networks is highly dynamic, the thickness of nodes and topology can be adjusted within them. Thus, there versatility is known to be very high than other networks. The nodes however are at a very calm state until no changes are seen within the observation applications. Thus, within such exceptional occasions, the network must be able to respond by keeping in mind the granularity level. It is important to ensure that the sensor networks include maintenance [4]. Across the wireless channels, the sensor networks are either completely finished or halfway. It is important to update all the sensor nodes and it is important to ensure that wired programming and WSNs have similar restricted sizes. It is important to represent the misfortune of packets and right reprogramming must not be interrupted due to it. It is important to uphold reprogramming for the code that is running within the nodes continuously. In relevance to network connectivity and coverage, data collection is provided. Using pervasive mobile agents in the network is very useful [5]. These nodes move all across the region and collect important information from the nodes and transmit it further to the access points. The completely gathered data is considered to be passed on to the base station. However, the network lifetime can be abbreviated due to this type of centralized collection and accumulation of data. In terms of various aspects, this parameter can be defined. One can define it as the time in which all the energy of sensor node is consumed. Another definition that can be stated for this parameter is the time in which one cannot guarantee the QoS of applications. The time for which the network cannot be disjoined is also defined as the lifetime of a system. For showing the reliability of a sensed event, this parameter is measured in WSNs. This information is further forwarded to the sink such that this information can be further used by other networks to establish connection. It is possible to ensure that the network does not face packet loss this parameter is calculated. The ratio of packets received successfully to the number of packets

transmitted overall in the network is defined as the reliability [6]. The batteries present within the sensor nodes are deployed with very limited amount of energy. Thus, the lifetime of the overall network is very limited which is a major issue of WSNs. Since the sizes of sensor nodes are very small, they have limited amount of batteries, processors as well as storage capacities. The amount of energy that is being consumed by the networks is required to be controlled as a major objective here. In order to transmit the collected data towards the destination, regular time constraints are provided as a solution to the energy related issues. This helps in preventing the occurrence of any kinds of issues that were found earlier. When the data is transmitted across the network, higher amount of energy is transmitted in comparison to the energy that is being consumed at the time of processing. Therefore, this issue has been studied largely by various researchers. In case when power is drained completely out of a node in the networks, node failure occurs. In order to focus on the major objective to be achieved, this network provides a reliable service [7]. The network can however, be made to act naturally also in such conditions by providing certain adjustments. Several adaptable properties have been provided in the network over the time by several researchers. However, the failure will occur when the constraints of battery will be provided. There are certain network protocols also proposed by different researchers to ensure that the failure is handled properly and the operations are performed in a better way. A TDMA based MAC protocol that aims to enhance the overall lifetime of WSN such that only minimal energy is consumed is known as LEACH protocol [8]. The set-up phase and steady phase are the two different phases of LEACH protocol. There are various rounds in which LEACH protocol operates. Each round included within it two phases. Mainly, the representation of hierarchical routing protocol is the typical representation of LEACH [9]. The self-adaptation and self-organization are the two properties of this protocol a round is used as a unit within this protocol. A cluster set-up state is used to generate each round. The unnecessary energy costs being generated by the network are minimized through steady storage state.

II. LITERATURE REVIEW

Ram Murthy Garimella, et.al (2018) presented the energy efficient is considered as the most essential technique in the wireless sensor network. There is more consumption of energy in this network due to which functioning of network hampered thereby, considered as the major issue in this network. Therefore, to minimize this issues various methods has been proposed so far by the researchers. They proposed a system and method using which gap in the research is filled. They also utilized the concept of the Hessian matrix for the processing of data gathering and routing in the wireless sensor network [10]. Experiments were done, for the evaluation of the proposed method and the made conclusion that method can be used in any clustering approach using its mathematical design. They also provide the low-energy communication structure to the network.

Deepa PUNEETH, et.al (2018) presented the technology of wireless sensor network in this paper in which essential role is played by the energy efficiency, data reliability, and security used for the functionality of network. In this paper, they provided the Shamir's ramp secret sharing (SRSS) method using which efficient energy and data reliability obtained easily [11]. In the condition of minimum number of compromised nodes, there is occurrence of compromised node (CN) attack in the network. Thus, data reliability, efficient energy in the network is obtained by this method in the network. The main objective of this paper was to define the SRSS and a round-reduced AES cipher using the split hop AES (SHAES). Therefore, for the validation of the method near-sink CN attack, various analysis and simulation has been performed by them so far. Experiments were done and concluded that proposed method outperforms as compared to other methods.

Ramin Yarinezhada, et.al (2018) presented the wireless sensor network in this paper in which to forward the more traffic loads it is required to have a good relationship shared between the sensor nodes and sink node [12]. If the position of the sink is known to the sensor nodes, then the consumption of energy and network delay is more in the network. They proposed a routing algorithm which is based on the virtual grid infrastructure and mobile sink for performing different tasks. In order to maintain the position of the sink they utilized the proposed method and the use of virtual infrastructure for the selection of the nodes from the network. Experiments were done and obtained results proved the effectiveness of the proposed method in terms of performance, energy efficient and compared delay as compared to the other methods.

Peijun Zhong, et.al, (2018) presented the emerging technology of wireless sensor networks and its extensive applications in this network have been utilized in different major fields. The sensor node more close to base station is stop working earlier than other sensors due to which they discussed the major issue of hot spot problem in this paper. Therefore, to minimize this issue, they introduced the concept of mobile sink node [13]. The sink node can move along different trajectories which is the reason nodes can distributed evenly in all direction. They studied the energy efficient routing method in which multiple mobile sinks was used. In order to show the effect of mobile sink on the network lifetime, they performed various experiments in this paper in which whole network is divided in several clusters.

Hassan Oudani, et.al (2017) presented the study related to the wireless sensor network in which number of issues has been faced due to which there is reduction in the lifetime of the network. There is reduction in the network traffic in sink that leads to development in hierarchical protocols and also provide optimal results in increasing the network capabilities [14]. In order to perform the survey on the energy-efficiency, the hierarchical cluster-based approach has been utilized by them called as LEACHES. Therefore, they proposed a new method using which energy consumption issue is minimized and sensor network lifetime is increased. Matlab Simulink simulator was used by them for the evaluation of the proposed method and to enhance the performance of the LEACH protocol.

Nukhet Sazak, et.al (2017) presented the study related to design issues faced by the wireless sensor network in which sensor nodes are deployed randomly within the network. There is degradation in the functionality of network due to some other issues such as limited battery, resource constraints and remote location that hampered the working [15]. In this paper, they proposed an active node determination method (ANDM) for the WSN MAC design using which energy efficiency in the network is improved. The combined the different techniques in this paper such as ANDM with ETDMA for the comparison it with other methods. Experiments were done for the evaluation of proposed method which shows its usage up to 31 % approx. for the optimal energy.

Research Methodology

In the existing technique the clustering of grids is static but in our proposed work, the clustering of grids is dynamic. The situations arising can change and adjust them accordingly. According to the situation and the calculations made on the basis of battery consumption the node data sent is easily adjustable. The major concern here is to avoid the battery wastage. The cluster head selection is also done on the basis of minimum battery consumption through election algorithm. For instance, let us consider a network which has number of batteries placed in it each having the data send capacity in milliampere. Each battery available in the network forwards the data from source to destination with the help of AODV algorithm. There are three clusters and so their respective cluster heads are also present. The maximum sensing capacity and minimum battery consumption factors help in selecting the cluster heads. So the battery with both the mentioned factors is chosen as cluster head.

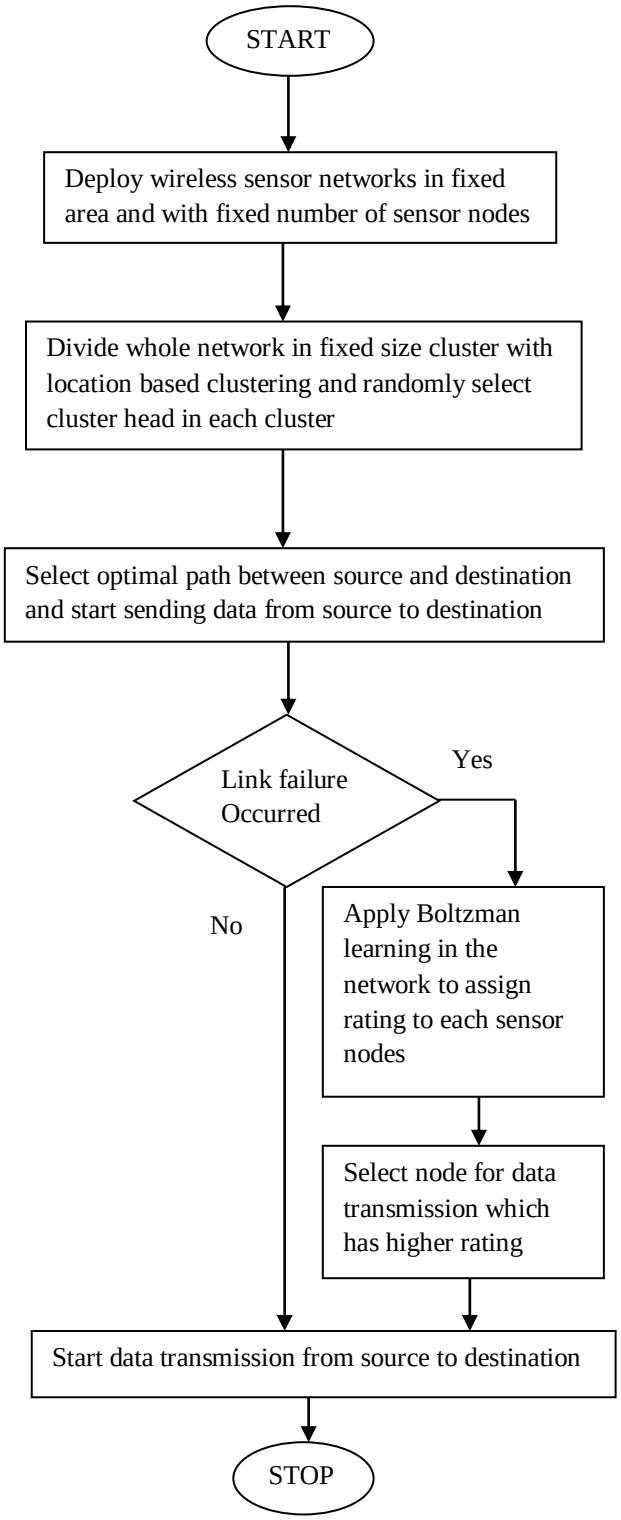

Fig.1: Proposed Flowchart

Let us assume that the three batteries available in the network have the capacity of sending the data of 8 milliampere, 12 milliampere and 12 milliampere respectively. Now the cluster head is to be selected to send full data after it is dead. If the 12 milliampere battery is chosen as a cluster head, it will send our data successfully but is not sufficient for any other data transmission after it and thus proves to be wastage there. If the 10 milliamapere battery is chosen, there is wastage of 2 milliampere and so it cannot be used in the transmission of another data packet. When we chose battery of 8 milliampere capacity as a cluster head, the data can be sent through it completely. There is no wastage in it. For choosing the best path or route the minimum battery wastage and minimum hop count factors are also to be kept in consideration. After the transmission of the data, battery will die. The re-clustering of grid starts again in the network.

III. EXPERIMENTAL RESULTS

The proposed work has been implemented MATLAB and the results are evaluated by making comparisons against existing approach in terms of number of packets transmitted, lifetime of network, number of dead nodes, and the remaining energy.

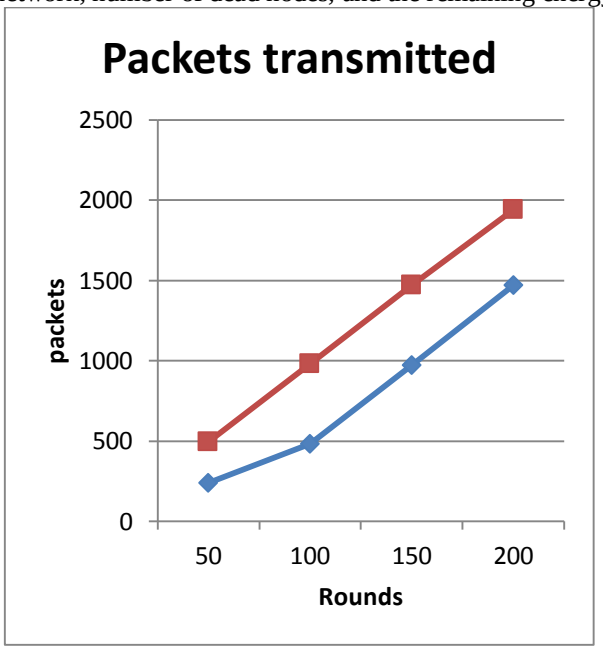

Fig.2: Number of packets Transmitted

As shown in figure 2, the LEACH and WSN with Selected nodes are compared in terms of number of packets transmitted to base station. It is analyzed that more number of packets are transmitted in the proposed technique as compared to existing technique.

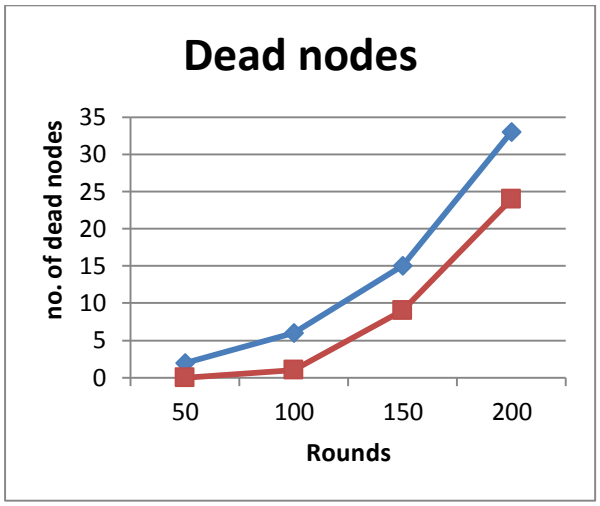

Fig.3: Last Node Dead Comparisons

As shown in figure 3, the LEACH and WSN with selected node is compared in terms of last node dead. The x-axis represents the number of rounds. The y-axis shows that number of rounds on which all sense nodes die. The comparison shows that in the proposed technique number of sensor nodes alive for more number of rounds.

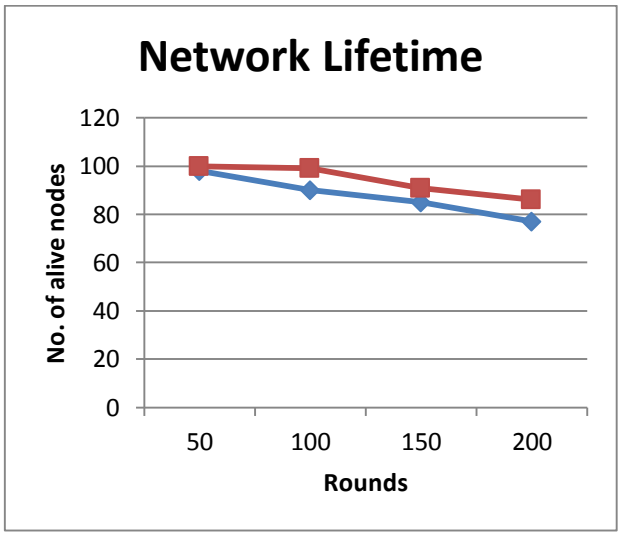

Fig.4: Network Lifetime

As shown in figure 4, the network lifetime of proposed algorithm is compared with existing LEACH technique. It is analyzed that lifetime of cache technique is more than that of LEACH WSN after 200 rounds.

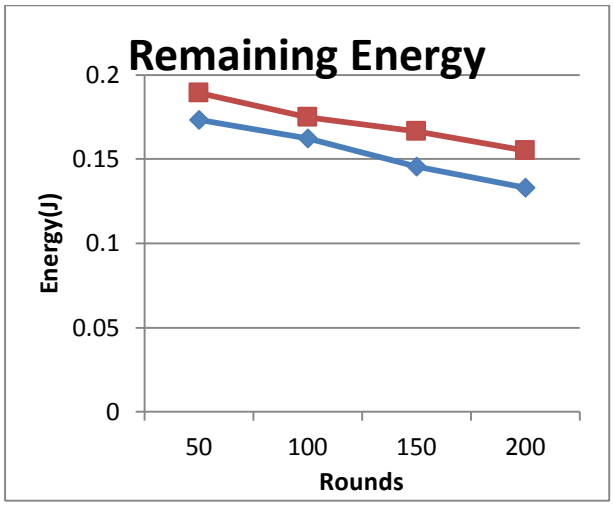

Fig.5: Energy Comparison

As shown in figure 5, the energy consumption of LEACH and selected technique is compared. It is analyzed that energy consumption of cache technique is less as compared to fuzzy technique.

IV. CONCLUSION

This work is based on H-LEACH protocol in which whole network is divided into fixed size clusters and in each cluster, cluster heads are selected on the basis of energy and distance. The node which has maximum battery and minimum distance from the other nodes is selected as the cluster head. The cluster heads communicate with each other and pass the sensed information to base station. In each protocol the cluster heads are selected dynamically means that after each round the cluster head get changed due to which fault may raised in the network. In this work, neural networks is been applied for the selection of optimal cluster head in the network. The neural network selects the best optimal cluster head which has least chances of error and gave it maximum rating. The sensor node which has maximum rating is selected as the best cluster head node in the cluster. The simulation results show that the proposed algorithm leads to reduction in energy consumption and delay in the network. The throughput of the network is increased at steady rate due to reduction in chances of network fault.

V. REFERENCES

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