

Multi-Level Hierarchical Routing in Wireless Sensor Networks

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Abstract - A distributed type of network in which there are large numbers of sensor nodes deployed such that the surroundings of the area can be monitored and important information can be gathered is known as wireless sensor network. The lifetime of WSN is extended using the clusters. The approach in which the original data is combined into smaller sized data such that only important information can be forwarded to the individual sensors is known as aggregation which is used within LEACH. There are several clusters of sensors in which LEACH is partitioned the localized coordination and control is utilized for constructing this approach. In this research work, the cache nodes are deployed in the network for the data aggregation from the wireless sensor nodes. The proposed algorithm is implemented in MATLAB and results are analyzed in terms of certain parameters. It is analyzed that in the proposed algorithm number of dead nodes are less, alive nodes are more and number of packets transmitted to base station are also high as compared to existing algorithm.

KEYWORDS - WSN, Energy Efficient, LEACH, Multi-level

I. INTRODUCTION

A distributed type of network in which there are large numbers of sensor nodes deployed such that the surroundings of the area can be monitored and important information can be gathered is known as wireless sensor network. The sensor nodes present within the network are very small in size and have very less power for processing the tasks. The users can gather, process and then transmit the important information that is available within the surroundings as per the changes. There are very strict computing and processing capabilities available. The small sized computers that gather information from the network are known as motes. They provide multi-functioning and are also energy efficient. There are several industrial applications that are including motes within them. For accomplishing specific objectives of an application, the information is gathered from surroundings with the help of group of motes [1]. For achieving highest performance results, links are made by these motes with each other with respect to various configurations. Transceivers are used by the motes to for communicating with each other [2]. There can be either

hundreds or thousands numbers of sensor nodes present within WSN. In case of ad hoc networks which do not have any infrastructure, there are less numbers of sensor nodes deployed in comparison to the sensor networks. There are un-tethered as well as un-attended sensors nodes present within the wireless sensor networks. Within the area of interest, there are several small sized, low cost and multi-functioning sensor nodes deployed such that a wireless sensor network is generated. The data can be sensed, processed and communication facilities can also be provided by the sensor nodes due to the available sensors, microprocessors as well as radio transceivers, even though they are small in size [3]. A wireless medium is used for providing short distance communications and for accomplishing a common task, these nodes collaborate with each other. There are several unique properties as well as characteristics of wireless sensor networks which differentiate them from other existing networks. Across the region of interest, these sensor nodes are distributed which communicate with each other using multi-hops [4]. Thus, an ad hoc network is generated here through such deployments. There are limited and irreplaceable energy resources present within the sensor nodes. The information that is gathered by the nodes from the network is processed and stored by the special sensor nodes which are known as sink node or gateway nodes. For performing data acquisition, battery is an important component present within these nodes. However, the replacement or recharging of these sensor nodes is not possible. There are few energy generating units known as photo-voltaic cells within are used to create batteries. Limited amount of energy of order 1 to 2 J is provided through node acquisition since these batteries are very small in size [5]. Thus, the life of a sensor is limited and the overall performance of the network is affected due to this. The information about location of sensor nodes plays an important role within the location-based protocols. In order to calculate the distance amongst two specific nodes, most of the routing protocols need the information about the location of sensor nodes. It is easy to estimate the amount of energy being consumed by the networks through this approach. Since the data is transmitted here from the source sensors towards the sink, the data-centric protocols are very different from other protocols. The data is sent independently by each sensor to the sink by each source in which appropriate data is available in

case of the address-centric protocols [6]. There are several viewpoints with respect to which the hierarchical clustering in WSN has been studied by different researchers over time. For transmitting the sensed data towards the sink, an energy-efficient communication protocol known as clustering is utilized.

II. LITERATURE REVIEW

Ramin Yarinezhada, et.al (2018) presented the closeness of sensor nodes towards the sink leads to more traffic loads in the wireless sensor network, due to which large amount of energy is depleted [7]. There is more consumption of energy and increase in the delay of network when the nodes are informed about the sink position. They proposed a routing algorithm in this paper based on the virtual grid infrastructure and mobile sink. With the help of this proposed method and with the use of virtual infrastructure some of the nodes are selected using which the position of the sink is maintained. On the basis of obtained results, it is concluded that better performance is shown by the proposed method as compared to the other methods in terms of energy efficient and compared delay.

Hassan Oudani, et.al (2017) presented the lifetime of the network is affected due to the more consumption of the energy by each node within the wireless sensor network. They performed the survey on the energy-efficient using hierarchical cluster-based approach namely LEACHES which is their main objective in this paper [8]. They also proposed a new method in order to maximize the lifetime of network sensor. With the help of this method large amount of energy is consumed when data is transmitted to the base station. They evaluated the performance of the LEACH protocol with the proposed method on the basis of obtained simulation results. They utilized the Matlab Simulink for the purpose of simulation.

Nukhet Sazak, et.al (2017) presented the most significant design issues faced while deploying the nodes in the constrained of resources in the remote location, issue is energy efficiency as these nodes are left unattended for long time within the wireless sensor network [9]. Therefore, in order to improve the energy efficiency, they proposed an active node determination method (ANDM) in this paper for WSN MAC design. They presented the integration of ANDM with ETDMA and compared it with E-TDMA concluded that it provides better energy usage up to 31 % approximately.

Harshita Jain, et.al (2017) presented the limited lifetime of the battery is considered as the major issue in the wireless sensor networks. It is not an easy task to change the battery of WSN all the time as it is not possible for a human to reach in the region of difficult area where nodes are deployed. They

discussed the some energy efficient routing protocols of WSN in this paper. The frequently updation of the routing tables leads to the reduction in packet overhead due to which energy consumption can also reduced [10]. In this paper, they combined the dynamic source routing (DSR) with power efficient gathering in sensor information system (PEGASIS) with the help of which optimal path is determined as it used the GA and BFO.

Vivek Kumar Singh, et.al (2017) presented the communication infrastructure having the set of independent transducers and utilized at different locations for recording and monitoring known as wireless sensor network [11]. The efficiency, reliability, heterogeneity, scalability, robustness, privacy and security are some of the major challenges faced by the WSN. Both parameters are not utilized by the researchers in order to address the major challenges of WSN. They proposed a method in this paper using which the life of sensor in wireless sensor network can be enhanced, make more reliable and energy efficient using new cluster based approach. The prevention of the crashes of cluster head node means the network reliability and the election of cluster head is take care by energy efficiency within the new cluster technique.

Sheikh Tahir Bakhsh, et.al, (2017) proposed a new algorithm of adaptive sleep efficient hybrid medium access control (AEH-MAC) in this paper has been widely utilized in the improvement of scheduling in the wireless sensor network. This proposed method also minimizes the scheduling time for which it adjust the sleep times of the nodes [12]. Hence, it is necessary to use MAC protocol in the efficient manner. In order to improve the waiting time of the source code, further improvement is required for which ACK packets are generated which are transferred to the receiver as they take short packets. A conflict-free time slot for itself up to two-hop neighboring nodes is taken by each node in this proposed method. As per simulations results, it is concluded that the proposed algorithm has high performance in terms of runtime, number or rounds energy consumption, and slot reservation.

III. RESEARCH METHODOLOGY

The proposed technique is particularly based on the selection of cluster head for the transmission of data, the selected cache nodes aggregate to the base station.

Step 1: Cluster head selection: The random distribution of nodes is one of the basic requirements of the clustered wireless sensor network's application. The cluster heads are created due to this random distribution of sensor nodes which further creates several issues. Due to the energy consumption, there is a need to avoid dispossability for the cluster head. Also, the long distance communication in the cluster head is

prevented and the addition of nodes below them is also done here. The nodes are not selected by the intended standards which are not perfect in any way and are called cluster head. The conditions of nodes made the nodes difficult to available in the network and almost impossible for them to be available at remote a area which further causes inappropriate nodes. When the intra-cluster energy is increased then these nodes are used as cluster heads.

Step 2: Cache node selection: The intra-cluster communication which exists inside the energy cluster relies on the appropriate factors. Cluster is one of them factors. The energy consumption of node radio and distance and the communication in the cluster is very expensive, and due to this the intra-cluster energy will be increased. Centrality is another important mechanism described in the paper. When the distance is less amongst the central cluster and receiver node, then the second power average is minimized which minimizes the intra-cluster energy.

IV. EXPERIMENTAL RESULTS

The proposed research work is implemented in MATLAB and the results are evaluated in terms of energy consumed, number of dead nodes and number of packets transmitted.

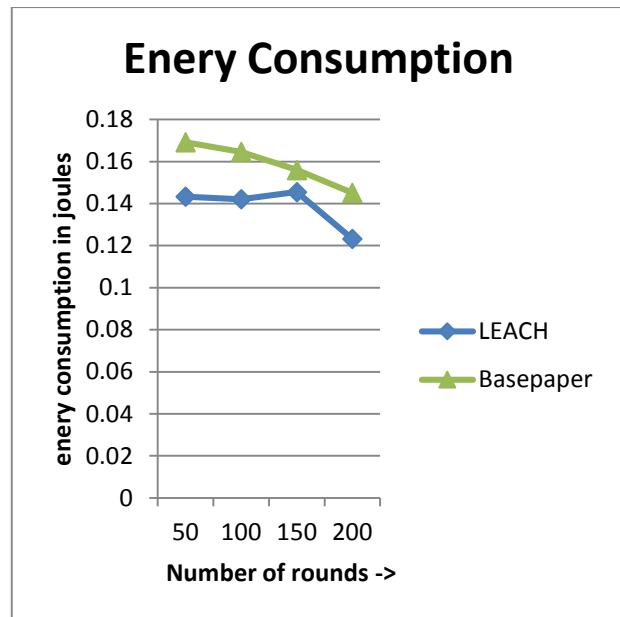


Fig 1: Energy Consumption

Figure 1, represents the comparison of base paper and proposed technique. It results that the proposed protocol has minimum amount of energy consumption in comparison to the other techniques.

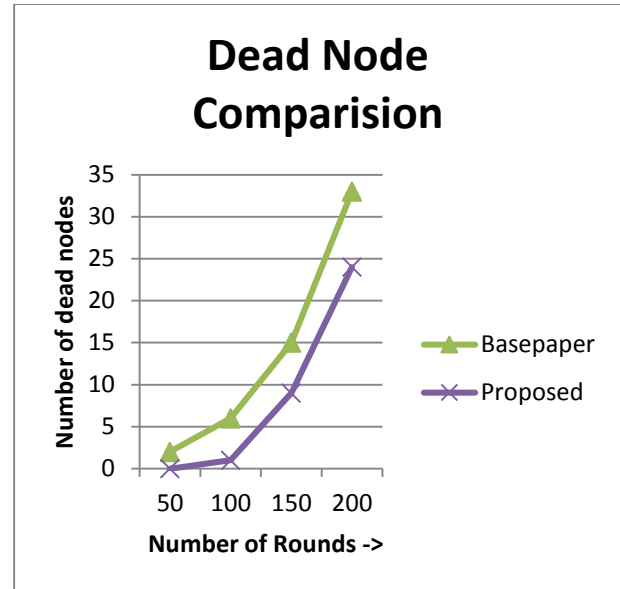


Fig 2: Number of dead Node Comparison

Figure 2, demonstrates the comparison between LEACH protocol and cache technique in terms of the dead nodes. The proposed technique has fewer amounts of dead nodes in the give amount of rounds.

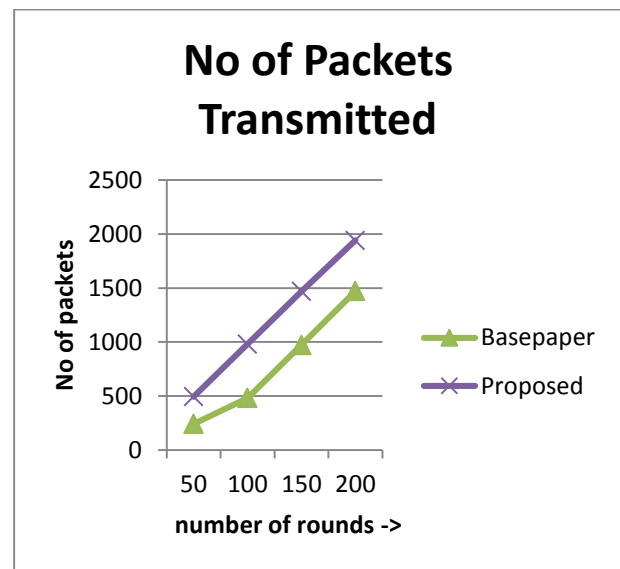


Fig 3: No of Packets Transmitted

Figure 3; show the comparison between the number of packet transmitted to the base station, proposed technique, base paper, LEACH and cache technique. The proposed technique transmits the large number of packet in comparison to the other techniques.

V. CONCLUSION

The wireless sensor network is the decentralized and self configuring type of network in which sensor nodes sense information and pass it to base station. Due to such type of network, energy consumption and security are major issues of WSN. The clustering is the efficient approach which increase lifetime of the wireless sensor networks. In the approach of the clustering, the cluster heads are selected on the basis of distance and energy. The cluster heads transmit data to the base station. In this research work, the cache nodes are deployed which aggregate data from sensor nodes and cache nodes with forward data to base station. The proposed algorithm is implemented in MATLAB and results are analyzed in terms of certain parameters. It is analyzed that proposed algorithm performs well as compared to existing algorithm in terms of certain parameters.

VI. REFERENCES

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