The Cache Based Scheme To Increase Lifetime of Wireless Sensor Networks

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Abstract— The wireless sensor networks is the decentralized type of network in which sensor nodes join or leave the when they want. The energy consumption is the major issue of wireless sensor networks due to small size and far deployment of the sensor nodes. The whole network is divided into fixed size clusters and cluster heads are selected in each cluster based on distance and energy. The hierarchal routing is the efficient technique for the data aggregation which uses least network energy. The TH-leach is the improved version of LEACH protocol to increase lifetime of the sensor network. In this research work, the TH-leach routing protocol will be further improved to increase one level to improve lifetime of the network.

Keywords—EnergyEfficient,LEACH,LEACH-TLCH,TH-LEACH

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 collect, 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 [1]. 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. 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. There are un-tethered as well as un-attended sensors nodes present within the wireless sensor networks [2]. Across the region of interest, these sensor nodes are distributed which communicate with each other using multi-hops. 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 [3]. Thus, the life of a sensor is limited and the overall performance of the network is affected due to this. The most important factor to be considered within WSNs is the energy. It is important to save energy within the hardware and software solution such that the lifetime of network can be maximized. Through several researches it is found that in comparison to data sensing and processing, the data communication process consumed highest amount of energy within these networks. Thus, due to the required amount of transmission power, it is prominent to use only the short-range communications amongst the sensor nodes and avoid any long-rage data transmissions [4]. Close to the area of interest and at distance from the sink nodes, it is possible to sense events within most of the WSNs. Thus, the intermediate nodes can be used to forward the data packets along multi-path path, by using the short-range communication. The clustering method is employed so as to save lots of the energy accessible among the sensor nodes. Each of the nodes present among the network will be divided into many smaller groups which are known as clusters with the help of productive network organization. A cluster head is present among every cluster along with all different individual nodes. A two-level order is provided among the clustering method. The higher level is accommodated here by the cluster heads form. The second part involves the

nodes of these networks. The nodes are grouped into clusters through the clustering process [5]. Sensing the data available in surrounding environments is the most important task of sensor nodes of WSNs. Within multi-hop scenarios, it is important to provide routing path for transmitting the gathered data towards the base station using multi-hop. There are large numbers of routing protocols proposed such that a routing path can be defined from source node to the base station. The power as well as resource limitations of the sensor nodes are important to be considered during the designing of routing protocols for WSNs. Further, the time-varying quality of wireless channels as well as the possibility of packet loss and delay is required to be considered here as well [6]. Various routing mechanisms are proposed for WSNs such that the design requirements can be addressed in these networks. 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. A sample of location-based routing protocols is proposed by researchers for these networks. 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. Some kind of data aggregation can be performed on the data that is being originated from multiple source sensors in case of data-centric protocols in case when the data is transmitted by the sensors to the sink. Since there is less amount of transmission needed to send the data from source to sink, higher amount of energy can be saved here [7]. 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. Samples of layered protocols that include several clusters of sensors within them are presented in this study. A special node known as cluster head is present within each cluster, the data transmission activities of all the sensors are coordinated by this cluster head.

II. RELATED WORK

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. It is also required to know the position of the mobile sink prior to senor nodes in order to transfer their data into it [8]. 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.

Hajer Ben Fradj et.al (2018) proposed [9] Opportunistic routing (OR) for energy consumption in wireless sensor network (WSN). It is widely concerned approach as is able to improve the energy consumption and its reliability on WSN. Moreover, the sensor nodes are fully equipped with limited number of non-rechargeable battery power. The optimal routing strategy is most difficult task in the wireless sensor networks. The objective of this paper is to minimize the energy consumption and increase the lifespan of the network. Although, a new technique was also proposed called ECS-OR (Energy Candidate Set-opportunistic Routing) this balances the energy consumption. Therefore, the researchers conclude that the proposed technique can improve the performance of network during energy consumption and wireless connectivity as compared to other existing wireless sensor networks.

Huseyin Ugur Yildiz et.al (2018) proposed [10] a hybrid energy harvesting model which is used to exploit both solar and electromagnetic energies. It develops a Mixed Integer Programming (MIP) method to minimize the energy dissipation of sensor nodes. With help of MIP framework, the researchers had measured the impact of proposed technique and the control of transmission power on energy consumption. The utilization of power transmission control by adjusting the powers according to the natural conditions was the method to reduce the energy consumption. Hence, the researchers had drawn some conclusions from the results that developed method of energy harvesting can minimize energy consumption by 91.46% when solar energy is used. But, when the solar energy cannot be used then the proposed technique can decrease the energy consumption at the rate of 81.40%.

Satyasen Panda et.al (2018) proposed [11] an Artificial Bee Colony (ABC) algorithm in which clustering model is used to improve the capacity of the energy is nay wireless sensor networks. The proposed technique was used to improve the internal dynamics of both i.e. cluster heads as well as sensor nodes. The algorithm also reduces the energy indulgence of the nodes, balances the energy consumption and most importantly increases the life time of the networks. The proposed technique is used to balance the energy consumption power, conserve energy and enhances the lifespan of the clustered network. Therefore, the researcher had concluded that the proposed algorithm increases the lifespan of the clustered networks which in turn optimizes

the ability of network just have increased number of communication rounds. The approach is quite useful in various technical appliances like smart homes, smart manufacturing and plant automation etc.

Madiha Razzaq et.al (2018) proposed a K-means clustering-based routing protocol and considers an optimal fixed packet size a [12] according to the radio parameters and channel conditions of the transceiver. The proposed method is used to reduce the energy consumption value of each node and enhances the life period of the whole network. Different amount of power is required for the transmission from cluster head to cluster member and base station. An optimal fixed packet size is required for the data transmission in order to conserve energy and to increase the network lifetime. Therefore, the result concludes that the proposed method has the capacity to conserve huge amount of energy and prolongs the lifespan of the networks. The simulation result provides better performance than any other conventional K-mean based energy and enhances the overall networks security.

Nazia Suraia Usha et.al (2017) introduced [13] a new management scheme for the duty cycle based MAC protocol for the reduction of energy consumption by the sensor nodes and improves the network lifetime. The total duty cycle is divided into two equal halves, one half is used for transmission of data and the other half is used for transmission of data from the neighbour's node data. If the is not available on either of the nodes i.e. from neighbour and own node then the network will go to hibernation mode at that part of the duty cycle just to conserve energy. The duty cycle will reduce the only listening period in order to save energy as we as increases the network lifetime. Hence, the author concludes that performance of the energy consumption was evaluated using numerical simulations. The performance was compared with the already existing schemes which show that the respective method increases the lifespan of the network and shows better energy consumption performance.

III. 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 disposability 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.

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. The energy is affected because of the other several factors.
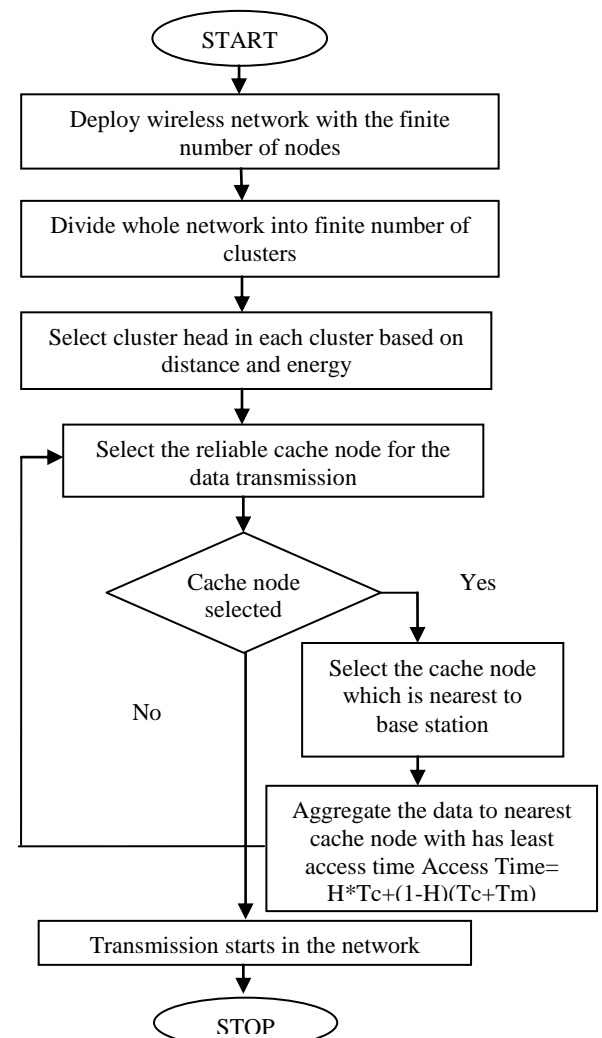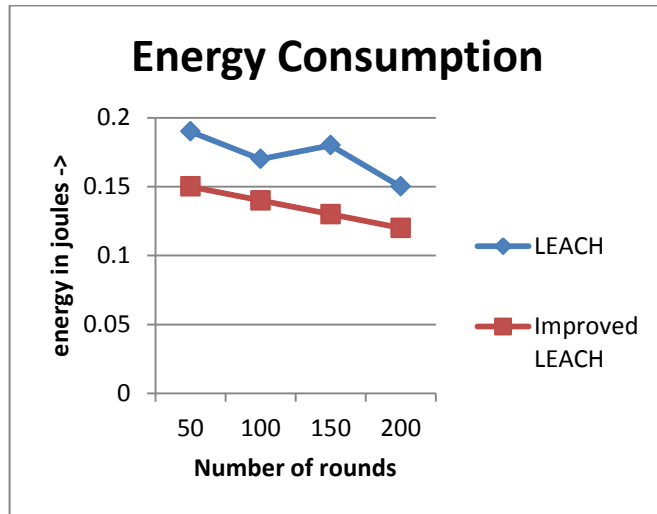

Fig 1. Proposed Flowchart

### IV. RESULTS AND DISCUSSION

The proposed research has been implemented in MATLAB and the results have been evaluated through comparisons

against proposed and existing techniques with respect to several different parameters.


Fig 2. Energy Consumption

Figure 2. represents the comparison of base paper and proposed technique. It results that the proposed protocol has least amount of energy consumption in comparison to the other techniques.
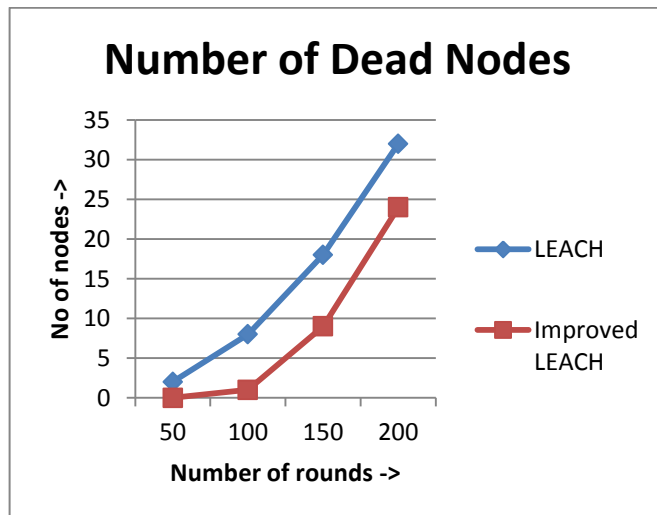
Fig 3. Number of dead Node Comparison

Figure 3. shows the comparison between LEACH protocol and cache technique in terms of the dead nodes. The proposed technique has less amounts of dead nodes in the give amount of rounds.
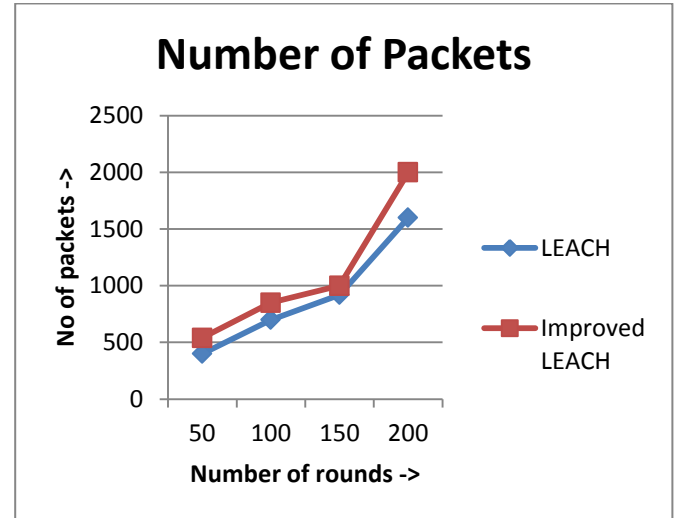
Fig 4. No of Packets Transmitted

Figure 4. demonstrates the comparison between the number of packet transmitted to the base station, proposed technique, base paper, LEACH and cache technique. The proposed method transmits the huge number of packet in comparison to the other techniques.

V. CONCLUSION AND FUTURE SCOPE

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. There are limited and irreplaceable energy resources present within the sensor nodes. The power consumption is minimized by applying the energy efficient clustering algorithm known as LEACH. Depending upon the duration, the task of performing clustering is rotated amongst the nodes through this approach. For forwarding the data towards the base station, each cluster head performs direct communication. The lifetime of WSN is extended using the clusters. 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.

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