

Energy Efficient Technique of Wireless Sensor Networks: A Review

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Abstract - The wireless sensor network is the decentralized type of network in which sensor nodes can sense information and pass it to base station. The sensor nodes are very small in size due to which energy consumption is the major issue. In this review paper, various techniques are reviewed which reduce energy consumption of wireless sensor networks. The general techniques which reduce energy consumption of networks are the clustering techniques.

Index Items- WSN, Clustering, LEACH, SEP

I. INTRODUCTION

The deployment of large number of sensor nodes within a particular area in order to gather important information and send it to the base station is known as a wireless sensor network. Each node acts as a transmitter as well as a router within this network. The environment is controlled with the help of these nodes. The important data related to what activities are being performed in the surrounding area is gathered and then forwarded to the base station in order to make further processing. Generally, a network that includes sensors that use wireless links for communication is known as Wireless Sensor Network (WSN). The batteries that are present within the nodes have limited capacity and the refilling of power within these nodes is impossible. Due to this reason, the nodes might cause failure in the network due to which the topology of network might also change. The reorganization of network might require more cost further [1]. There are numerous routing techniques proposed by several researchers such that the lifetime of network can be increased. The hierarchical routing protocol amongst all the protocols divides the network into small groups. A cluster head (CH) is chosen for each group in order to monitor and control the group. In order to transmit the important information which is gathered by the nodes present in the clusters, the CH is responsible. The data is further transmitted to the base station in compressed form. On the basis of types of application or the objectives of the network, there are various types of communications performed within the WSNs. Generally, clock-driven, event-driven and query-driven are the three different types of communications that occur within these networks. The networks in which the sensors collect and transmit the data at constant periodic intervals include clock-driven communications [2]. For particular receiver or collector, such periodic transmission can be destined. The “snapshots” of the field that is required to be sensed are gathered by the sensors.

Temporal and spatial information relevant to the field is generated with time through these snapshots. Through the events and queries, the query-driven or event driven communications are generated within the networks. Within the sensor network, such various types of communications can be seen collectively [3]. In all the scenarios, the amount of energy available within the sensors is the major factor that determines the lifetime of the sensor as well as the network as it defines the time duration of a sensing task. Thus, the efficient utilization of energy is a major concern when examining these networks. The techniques generated cannot simply be applied to these networks and they are selected as per the properties they have. The sensing, computation as well as radio operations that include transmission and receiving of data are the three different types of activities that consume higher energy within the sensor node. The highest amount of energy consumed amongst these three activities is by the radio operations. Thus, the amount of time that is being utilized while transmitting and receiving the data is to be minimized by the energy efficient mechanism. The receiving of data accumulates higher energy is comparison to transmitting within the nodes. Most of the power of nodes is consumed by the process of listening to the channel idly and overhearing of packets. Before deploying the networks to the application fields, the amount of power consumption is to be evaluated by the developer in order to get an estimate [4]. With the help of this mechanism, the lifetime of an application can be estimated and thus, various mechanisms can be utilized in order to enhance the lifetime of the network. In order to do so, the sensor nodes that are dead can be replaced from the network. The periodic measurement of the left battery within the sensor node is the best manner through which the power consumption can be evaluated on the physical hardware. However, there are many challenges that arise within this process. Modeling is another way through which the power consumption can be evaluated within these networks. The evaluation as well as simulation of these models can be done by analytically evaluating these models [5]. Even though there are less accurate results provided by modeling, the flexibility as well as agility in order to evaluate the complex situations is provided by the designers. In order to evaluate the complex situations within the networks without involving within the actual scenario, modeling provides flexibility and agility for the designers. There are numerous advantages of the evaluation of WSN applications at higher level amongst which the time needed to perform analysis is the most important one. The sensing data can be gathered in numerous ways. Direct transmission is the simplest way amongst them in which the collected information is transmitted by each sensor towards

the remote receiver [6]. Any type of communication amongst the sensors is not required here. Multi-hop routing is the second type of approach which can be utilized within these networks in order to reduce the consumption of energy. Clustering is another kind of approach which is utilized within the networks for reducing the energy being consumed. Here, clusters are generated with the neighboring sensors in dynamic manner.

II. LITERATURE SURVEY

Imen Ben Arbi, et.al (2017) proposed a nonlinear time-series forecasting technique is based on the modal of Self-Exciting Threshold Autoregressive (SETAR) in the wireless sensor networks [7]. It is the dual combination of the prediction framework and vibration data for the process of investigation. It is utilized to measure the value of both node sink and source. Instead, of complex nature of vibration data it shows the energy saving up to 73% using panStamp technology. Author proposed this technique to overcome higher energy consumption rate used in the process of the communication.

LiLi, et.al (2011) proposed a data fusion technology utilized in the wireless sensor network for the analysis of principal and their significance [8]. On the basis of the routing protocols, many researchers studied the basis of the data fusion method and obtained results are utilized to compare the energy consumption and average time delay of several algorithm fusion. As per performed experiments, it is concluded that it is required to choose an appropriate data fusion method of wireless sensor networks.

Hemant Kumar R, et.al (2016) proposed that sink node deployed in the network that is dynamic in nature [9]. All the sensed data is collected by the sensor nodes and routed towards the sink. A dynamic route is established towards the sink that is maintained and updated. Author discussed the functionality of both the dynamic sink and mobile sink. Data is collected by the dynamic sink node and performance is compared with mobile sink node. The performance parameters to compare the dynamic sink and mobile sink was latency and energy. As per performed experiments, it is concluded that dynamic sink shows better performance as compared to mobile sink in terms of high energy efficiency.

Pramod D. Ganjewar, et.al (2015) presented a threshold based data reduction method used in data pre-processing is considered as the optimal data reduction technique [10]. For the transmission of the data from sensor node to sink node, higher rate of energy is consumed. Therefore, in order to mitigate the higher energy consumption and also reduce large amount of data from sensor node this proposed technique is very useful. It is applicable on all the applications of WSN. On the basis of results, it is concluded that the proposed method give better performance in terms of energy consumption and network lifetime.

Saleh Bouarafa, et.al (2016) proposed a novel simple approach in order to create an optimal topology in the field of Wireless Sensor Networks [11]. In order to enhance the WSN, the fundamental network topology has been utilized in this network. On the basis of the simulation results, it is concluded that the proposed method shows its effectiveness as it give better performance in terms of energy consumption rate and network lifetime.

Tadanori Matsui, et.al (2016) proposed a network Energy Consumption-oriented Route Selection (ECORS) method used in the application of the wireless sensor network in order to collect the environmental data to provide services [12]. This method has been utilized to improve the network lifetime and energy consumption rate. In order to provide the energy resources in the network, the design of the wireless network should be effective. On the basis of simulation results, it is concluded that proposed method show effective results as compared to existing as it extend the lifetime 2.03 times more than fixed.

Alireza Firuzbakh, et.al (2013) proposed a LEACH protocol, a clustering based method which collects the data from sensors of clusters and in order to decrease the data redundancy in each cluster it tries to reduce the data transmission and energy consumption [13]. As the wireless sensor networks are suffering from energy constrained, careful resource management is necessary. Few functions are utilized by the aggregation operation in clustering, that alone cannot provide data redundancy. On the basis of the obtained results, it is concluded that proposed method increase the network lifetime which reduces data redundancy via clustering algorithms and gridding.

III. TABLE : COMPARISON OF DIFFERENT TECHNOLOGIES

Author's Name	Year	Description	Outcome
Imen Ben Arbi, Faouzi Derbel and Florian Strakosch	2017	A nonlinear time-series forecasting technique is proposed based on the modal of Self-Exciting Threshold Autoregressive (SETAR) in the wireless sensor networks.	Author proposed this technique to overcome higher energy consumption rate used in the process of the communication.
LiLi, Li Wei-jia	2011	A data fusion technology utilized in the wireless sensor network for the analysis of principal is proposed.	As per performed experiments, it is concluded that it is required to choose an appropriate data fusion method of

			wireless sensor networks.
Hemant Kumar R, Ramakrishna KT	2016	A sink node is deployed in the network that is dynamic in nature. All the sensed data is collected by the sensor nodes and routed towards the sink.	As per performed experiments, it is concluded that dynamic sink shows better performance as compared to mobile sink in terms of high energy efficiency.
Pramod D. Ganjewar, Sanjeev. J. Wagh, Barani S.	2015	A threshold based data reduction method that is used in data pre-processing is considered as the optimal data reduction technique.	On the basis of results, it is concluded that the proposed method give better performance in terms of energy consumption and network lifetime.
Saleh Bouarafa, Rachid Saadane, Driss Aboutajdine	2016	A novel simple approach is proposed in order to create an optimal topology in the field of Wireless Sensor Networks.	On the basis of the simulation results, it is concluded that the proposed method shows its effectiveness as it give better performance in terms of energy consumption rate and network lifetime.
Tadanori Matsui, Hiroaki Nishi	2016	A network Energy Consumption-oriented Route Selection (ECORS) method is proposed which is used in the application of the wireless sensor network in order to collect the environmental data to provide services.	On the basis of simulation results, it is concluded that proposed method show effective results as compared to existing as it extend the lifetime 2.03 times more than fixed.
Alireza Firuzbakh, Asgarali Bouyer	2013	A study related to LEACH protocol is proposed which is a clustering based method which collects the data from sensors of clusters and in order to decrease the data redundancy in each cluster it tries to reduce the data transmission and energy consumption.	On the basis of the obtained results, it is concluded that proposed method increase the network lifetime which reduces data redundancy via clustering algorithms and gridding.

IV. OBSERVATIONS

The Ns2 is the tool which is used to analyze performance of LEACH protocol and LEACH protocol under the fault conditions. The performance of the LEACH protocol and LEACH protocol under the fault condition in terms of number of dead nodes and number of packets transmitted to base station

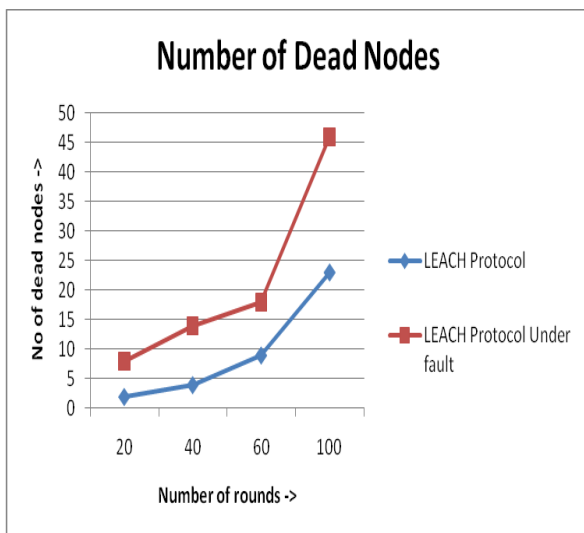


Fig 1: Number of dead Nodes

As shown in figure 1, the energy consumption of the LEACH technique is less as compared to LEACH with fault technique. It is analyzed that number of dead nodes are less in the proposed technique

Table 1: Number of dead nodes

No of Rounds	LEACH Protocol	LEACH Protocol Under Fault
20	2	8
40	4	14
60	9	18
100	23	46

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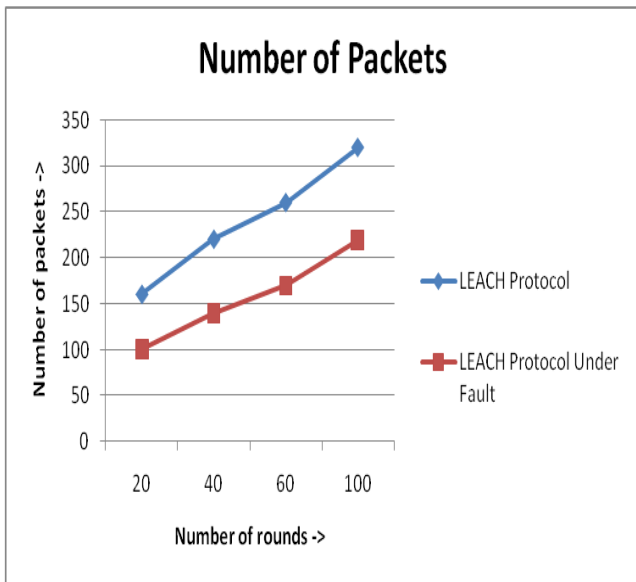


Fig 2: Number of Packets

As shown in figure 2, the number of packets send to base station is compared between LEACH protocol and LEACH protocol with fault. It is analyzed that more number of packets send in the LEACH protocol

Table 2: Number of packets

No of Rounds	LEACH Protocol	LEACH Protocol Under Fault
20	160	100
40	220	140
60	260	170
100	320	220

As shown in Table 2, the number of packets send to base station is compared between LEACH protocol and LEACH protocol with fault. It is analyzed that more number of packets send in the LEACH protocol

V. CONCLUSION

In this paper, it is concluded that wireless sensor networks is the decentralized type of network in which energy consumption is the major issue which reduce network efficiency. To increase lifetime of the sensor networks clustering approach is applied in the network. The clustering technique can be improved to improve network efficiency. In future the technique will be proposed which reduce chances of fault in wireless sensor networks

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