

Different Cluster Head Selection Approaches of Energy Efficient Protocols in WSN

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ABSTRACT

The Wireless Sensor Network is getting popular topic among various researchers due to its sensor based working criteria. This study is a review to the wireless sensor networks and various clustering in WSN. The network is comprised of sensor node which runs on the basis of allotted energy. If this allotted energy gets depleted then the network stops the working. Thus the clustering approach is developed so that the energy consumption of the node can be reduced and network can perform data transmission efficiently with the enhanced network lifetime. The various clustering protocols such as hierarchical clustering protocols, fuzzy based clustering protocols are defined in this work. This is a sort of review to the work that had been done in past in the domain of energy efficient clustering protocols for wireless sensor networks.

Keywords:- Wireless Sensor Network, Energy, Clustering, Cluster Head.

I. INTRODUCTION

Wireless sensor network (WSN) can be described as group of sensors which when implemented in the sensor field they work to monitor the particular parameters of the environment. This type of network is mainly comprised of various nodes which are operated together to create a wireless network. Components of wireless sensor networks are referred as sensor nodes. The basic sensor node is comprised four types of elements: first element is power unit, second is communication unit, third is processing unit and fourth is sensing unit. In the sensor node, the processing component can collect and process the required information from its neighborhood and is responsible for transmitting as well as receiving the obtained information from one sensor node to other. The transmission and reception component obtain the energy and then operate as per the expectation. The power components are limited in number and are responsible for providing the energy to rest of the components so that the sensor node can operate effectively [1].

In past few years the use of WSNs have been increased and simultaneously the problems related to the energy constrained also raised because we have limited amount of energy stored in the battery. As the working of nodes totally dependent on the amount of energy therefore it is not an easy task to recharge and replace the battery unit. If any node in the network stop operating then it leads to failure of the whole network [2]. In clustering paradigms, sensor nodes clusters are created and all clusters are assigned with a cluster head (CH). In this type of topology, initially all sensor nodes transmit the information to the cluster head selected in their cluster and after that these cluster heads transmits the data to the server of base station. All the sensor nodes in the cluster can transmit and receive data within their respective cluster and therefore it

can be said that the nodes can transmit and receive the information for limited region, hence limited amount of energy is utilized. But in case when the information is transmitted between cluster head and base station then the energy consumed is high.

II. CLUSTERING PROTOCOLS

This section is organized to define the various clustering techniques.

a) Hierarchical Clustering Based Routing Protocols

a) LEACH – C

In LEACH-C, the CH are selected with the help of base station and centralized algorithms. In this the base station has all the information about the location and energy of the nodes. It distributes the CHs in all over the network and hence creates the better clusters. The major drawback of centralized LEACH is that in this it is mandatory to have the information regarding the location of the nodes [3].

b) Fuzzy Logic based Clustering Protocol

This section of the study represents the various strategies to utilize the fuzzy logics for cluster head selection in wireless sensor network. The protocols that are defined in this section prove that the enhanced network lifetime can be achieved along with the minimization of energy consumption.

a) CHEF

The CHEF cluster head selection technique performs the CH selection on the basis of two various parameters like distance and energy of the nodes. The node with the high amount of residual energy and local optimality is elected as a cluster head. It has been noticed that the CHEF has 22.7% more efficiency in comparison to the LEACH. In various research works, the parameters like energy, concentration and centrality

of the nodes were selected as the input parameters for fuzzy system. Energy can be used for defining the available energy of the nodes, concentration can be used for measuring the number of connections to the nodes and centrality is a parameter which is used to measure that how central the nodes is [4]. These parameters can lead to the enhancement to the lifetime of the network. The drawback of this protocol is that it uses the GPS system and sometime fails to update the location in some regions.

b) F-MCHEL

It selects the cluster heads by using the fuzzy rules which are based upon the idea of energy and distance of the nodes. In this the node which possesses the higher amount of residual energy is elected as a master cluster head and get the responsibility to transmit the aggregate data to the BS. It is the improved version of CHEF. It has the more network stability in comparison to the LEACH and CHEF. It works on the consideration of static sink node. Various protocols have been available which can be collaborated with clustering protocols [5]. The fuzzy based clustering protocols works on the basis of the input parameters and thus the performance parameters such as energy, mobility of the nodes etc. But it lacks at the point where the mobility of the nodes increased or decreased and the existence of the network remains same. It is evaluated that the mobility of the network is indirectly proportional to the distance from node to sink node. This issue can resolve by considering the centrality as a parameter to perform the fuzzification.

III. RELATED WORK

Padmalaya Nayak (2015), [1] defined that WSN sets a paradigm of real time based embedded systems along with less complex calculations, communications, storage and power that has been utilized in various application where it is impossible to use or install the traditional network systems. Since the nodes operates on the basis of the initial defined energy. Thus the nodes did not have the capacity for performing any kind of operation if the energy of the nodes gets exhausted once. And these energy batteries are not replaceable and refilled to maintain the longevity of the network. It was considered in this work that the energy is the factor that influences the network's lifetime highly. Thus in order to reduce the energy consumption level, the cluster formation is introduced in the domain of WSNs. For this purpose, LEACH is considered as the most prominent cluster head selection protocol that elects the CH on the basis of the energy. In LEACH a probability threshold is evaluated to select the CH and only CH has the access to transmit the data to the BS. This work proposed a mechanism in which a super cluster head is elected out of the available CHs in the network. Then the super cluster head is the only one which is allowed to communicate with the base station. The proposed

mechanism works along with the FIS thus the SCH elected the fuzzy descriptor i.e. remaining energy, mobility of the sink, and centrality factor of the clusters. Then Mamdani fuzzy system started its processing for electing the SCH. The implementation of the work was done by using the NS2 simulator. And after deriving the results it was proved that the proposed work has better results in comparison to the LEACH with respect to the first dead node, half alive nodes, network stability and enhanced lifetime.

Jyoti Singh (2014), [2] proposed a novel strategy for routing and named as LEACH. In LEACH the clusters are refreshed after a fixed time interval on the basis of the remaining energy and distance. The process of re-clustering and refreshing the network was done in order to perform the equal distribution of the workload to the nodes of the network so that the network lifetime can be enhanced. In proposed work the nodes that are operating currently were on active state and the nodes which are not working were on sleep mode. Hence the energy of the nodes was saved in a smart way by letting the non operational nodes on the sleep mode. The simulation of the proposed work was done using the MATLAB. The LEACH and MOD-LEACH was compared with the proposed work. After getting the results it was observed that the throughput of the proposed work has better values in comparison to the throughput of the traditional work.

J. Gnanambigai, (2014), [3] focused towards the creation of new variety of hybrid routing protocols for WSN. The proposed mechanism was based on LEACH and Q-DIR algorithm. The objective of this work was to overcome the shortcomings of the LEACH protocols and also assured the energy efficient network with the enhanced lifetime. This study also implemented the various energy parameters.

Jia Xu (2012), [4] Proposed a revised clustering scheme that was named as E-LEACHED (Enhanced-LEACH). Whereas in original LEACH protocol the CH selection is done randomly and refreshment of the network is done after a fixed interval, in E-LEACH, the remaining battery power of the nodes was considered to balance the workload of the network and the re-clustering relies upon the size of the optimal clusters. The result section of the proposed work depicted that the proposed work enhanced the network lifetime by 40% in contrast to the LEACH protocols.

Perna (2015), [5] Proposed a novel approach of routing based on static clustering and dynamic CH election technique. It divided the whole network a fix number of sub sections. CH election was done on the basis of the three major parameters i.e. distance from node to BS, degree of the nodes and residual energy of the nodes. Simulations had been done in MATLAB and proved the proficiency of proposed work over LEACH, LEACH-C and DR technique with respect to the energy consumption and network connectivity.

A. Ihsan, (2015), [6] discussed that a lot of protocols have been available and LEACH is considered as a subject of matter under this work. It was depicted that LEACH is a sort

of self organized energy efficient cluster head selection techniques. It is also known as a adaptive clustering protocol which works on the basis of random distribution of the workload on the nodes. It eliminates the excessive energy consumption of the nodes by performing data aggregation. LEACH, LEACH-C and LEACH-F was analyzed in this work.

Pooja A. Vaishnav (2103), [7] gave some of the major application domains and serious limitations of sensor based wireless networks by marked the various factors such as energy of the nodes, bandwidth for the data transmission, storage size and lifetime of the network. The energy factor was considered as the major factor that effects performance of the network. This study represented the different routing protocols along with their demos. LEACH and its various descendents were discussed in this study in the terms of energy efficiency. After evaluating the variants of LEACH, it was observed that the energy requirement for cluster formation and data transmission was reduced to decrease the overall energy consumption level of the network. The centralized approach was implemented to elect the cluster heads. Then the multi hop communication was done for transmitting the data transmission. The aim of the proposed work was to reduce the energy overhead of the nodes in the network. The proposed work was entitled as PV-LEACH.

Sapna Gambhir (2014), [8] presented an enhanced version of LEACH and named it as OP-LEACH and reduced the energy consumption level of the sensor network. Then for the purpose of proving the proficiency of the proposed work over LEACH. The simulation was done by using the OMNET++ simulator.

Table 1: Related Work

Topic	Author	Findings
Data Collection in Wireless Sensor Network	Arun k. Kumar [2010] [17], EZ-ZAIDI Asmaa [2014] [21]	Concluded data-centric, hierarchical and location-based protocols were used to collect the data while reducing the power consumption and load of the data on nodes. Moreover, the nodes which were nearer to the sink were selected as a cluster head.
Design Considerations in Wireless sensor network	Asis Nasipuri et al [2010] [22]	Process of deploying sensor nodes with the consideration of energy consumption,

		extend lifetime of the network and reduction in the network cost were considered for WSN layout problem.
Clustering protocols	Buyanjargal [2009] [18], Shounak Chakraborty [2014] [23]	The algorithm solved the problem of corresponding generation of both periodic and event driven data and improved the ratio of packet transmission, energy consumption delay and fairness in wireless networks as compared to AODV protocols.
Lifetime enhancement techniques in Wireless sensor network	Chu-Fu Wang [2014] [16], Dhanashri V et al [2014] [20]	The technique (EASR) uses the information of remaining battery energy on each node and manages the range of transmission for each and every node and relocates the scheme of sink.
Deployment of node in WSN	Haitao Zhang et al [2012] [29]	The efficiency of WSN is based on the coverage provided by the sensor deployment techniques

IV. CONCLUSION AND FUTURESCOPE

To design an energy efficient network is most tedious task to perform in wireless sensor based network. It has been analyzed in this study that the various authors has been developed an energy efficient wireless network by using energy efficient routing based clustering techniques such as LEACH etc to solve the energy issues along with lifetime and clustering issues.

After having a review to the related work it has been concluded that, in near future more work can be done on the concept selection criteria of cluster head selection on the basis

of different performance parameters like residual energy, distance, centrality of the nodes.

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