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Various Energy Efficient Schemes in WSNS: A Survey

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Abstract: Wireless Sensor Networks (WSNs) can be well-defined as one which can configure itself. It is infrastructure-less networks deployed to observe physical or else ecological surroundings, for instance hotness, sound, tremors, pressure or impurities. All the information is sensed by the sensors which supportively pass the data through the network to a sink where the data can be perceived and investigated. Since these nodes are deployed in unhuman conditions so preserving their batteries is very challenging task. Clustering, described by LEACH protocol, is one of the techniques which helps in increasing their life time. This paper describes recent studies about the clustering approaches that are used to preserve the batteries of sensor nodes to make them work for longer duration of time.

Keywords: WSN, Clustering, LEACH, network lifetime

I. Introduction

Sensor networks are vastly scattered networks of minor, light wireless nodes, installed in huge quantities to observe the atmosphere or system by the dimensions of physical constraints for example temperature, force, or comparative moistness. The sensor nodes are analogous to that of a PC having a processing component, inadequate computational power, restricted memory, small electronics devices, an antenna and a power resource such as a battery. In a classic use, a WSN is disseminated in an area wherever it is intended, to gather data using its sensor nodes [1]. A wireless sensor network encompasses huge quantities of sensor nodes which can transfer information amongst each other by means of radio waves. A sensor node is furnished by sensing plus calculating devices, radio transmitters and receivers besides power modules. The distinct nodes within a wireless network are fundamentally having inadequate resources: they retain inadequate processing speed, storing ability, in addition to less communication bandwidth. Subsequently once the nodes are positioned, they are in authority for organizing by themselves without a suitable network structure. They often make use of multi-hop communication among each other. At that time the sensors begin accumulating required data. Energy depletion is the utmost key feature to decide the life of a sensor network for the reason that generally sensor nodes are powered by battery. The dedicated energy-conscious routing and information collecting rules giving better scalability must be practiced in order that network lifespan is well-maintained at reasonably high levels in such situations [2]. Indeed, combining sensor nodes in clusters has been extensively embraced in the investigating community to fulfil the aforementioned scalability aim and also to accomplish high energy efficacy to extend network lifespan in large-scale WSN surroundings. The analogous tree based routing and information collecting rules suggest cluster-centered organization of the nodes in a way that data aggregation is likely, consequently resulting in noteworthy energy savings. In the hierarchical network organization respective cluster possess a leader, also entitled as cluster head. It regularly accomplishes the distinct responsibilities mentioned above (relaying and aggregation).

The cluster establishment procedure ultimately leads to a two-level pyramid (hierarchy) in which the CH nodes makes the upper level and the member nodes makes the subordinate level. The nodes intermittently pass on their information to the equivalent head nodes. The head nodes combine the information (therefore lessening the overall amount of transmitted packets) and communicate them to the base station straight (one hop) otherwise via midway communication with other head nodes. Though, since the CH transmit continually information to greater distances as compared to the member nodes, they obviously expend energy at greater rates. A communal answer to this issue, so as to poise the energy depletion amongst entire nodes, is to re-elect new CHs from time to time (hence revolving the CH role amongst the nodes) in individual cluster. The figure below shows the clustered wireless sensor network where the base station is located in the middle of the network. The network has been divided into 4 clusters and each cluster head is shown in red color. The nodes sense the data and forward it to cluster head which relays the information to the base station.

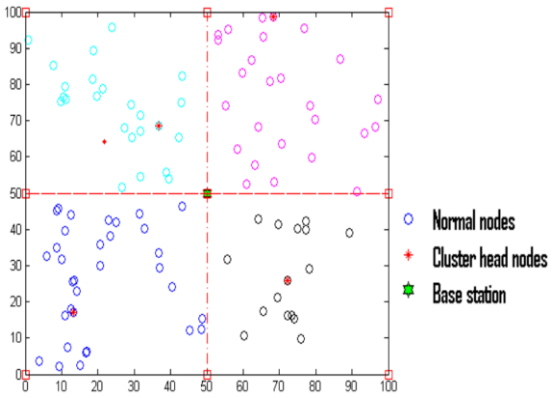

Figure I: Clustering in WSN [9]

In this paper various studies related to growing the lifespan of the network has been discussed. Maximum of these methods include clustering of the network. Section II represents these recent studies and finally Section III shows the conclusion about the paper.

II. Literature Survey

Amjad and Abu-Baker [2016] This paper investigates the energy efficient routing in cluster based WSN by employing a linear formulation for problem of minimizing energy consumption in such network. This formulation considers energy consumption at different sensor nodes within cluster and jointly optimize at different sensor nodes to transmit data through route with minimum energy. Extensive simulation is conducted to evaluate proposed formulation. [4]

Noor Zaman et. al., [2016] proposed a cross layer design methodology was adopted to design an energy efficient routing protocol entitled "Position Responsive Routing Protocol" (PRRP). PRRP is designed to minimize energy consumed in each node by (1) reducing the amount of time in which a sensor node is in an idle listening state and (2) reducing the average communication distance over the network. The result of the projected PRRP was critically assessed in the context of network lifetime, throughput, and energy consumption of the network per individual basis and per data packet basis. The outcomes show a significant improvement in the WSN in terms of energy efficiency and the overall performance of WSN [3].

RATHNA. R et. al., [2012] proposed paper regarding the wireless sensor network for the ecological observations. A Wireless Network entails numerous sensor nodes besides a base station. The amount and kind of sensors in addition to the proposed rules for any kind of wireless sensor network is determined by its use. The sensor information of the network might be light intensity, hotness, force, moistness. Clustering plus transmitting of information are the two parts which are given additional consideration in this paper [5].

Zahra Rezaei and Shima Mobininejad [2012] make analysis on few communication rules intended for sensor networks. Centred on the power failure, numerous tactics are mandatory to analyse, even concurrently, to lessen the power depletion in sensor networks. At a very common level, the authors have recognized two foremost enabling methods viz.: duty cycling and information-driven tactics. Duty cycling is chiefly concentrated on the networking sub-system. The furthermost energy-preserving process is setting the radio transmitter and receiver in the sleep state on every occasion communiqué is unnecessary. Preferably, the radio ought to be switched off the instant there is certainly no extra information is left to transmit plus must be recommenced immediately a fresh data packet turns out to be ready. Like this, nodes substitute amid active and sleep phases subjected to network action. Duty cycle is well-defined as the portion of time nodes are lively through their lifespan. Information driven methods can be used to increase the energy effectiveness [6].

Agam et al., 2014 [7] proposed the self-knowledge technique in which SCHP is used to decrease delay occurs in link permanency issue in SCHP. Each node knows about its neighbours by using its self-knowledge. Receiver will send its receiving capacity and sender will send data according to that capacity. So link becomes more stable. In Self-knowledge technique sender keeps the information regarding its one hop neighbours. All the important parameters like delay, threshold, packet size, energy are considered before sending data to the next node. A minimum criterion is set for all the parameters, among all the neighbouring nodes the nodes satisfying this minimum criterion are considered for the candidates of relay node. Among these nodes the node with lowest delay and maximum energy is chosen as relay node. If this node dies after sometime then the next eligible candidate is chosen as relay node and attempt is made to reconfigure the dead node. This technique provides a better link stability than simple SCHP by avoiding congestion in the link because the sender guides the information conferring to the ability of the receiver to accept. So the time and energy wasted in re-establishing the link that can be lost due to congestion is saved that accounts in increasing the lifetime and reducing the delay.

Sk Kajal Arefin Imon et. al. [8] the creator has proposed a tree arrangement established at the base station is characterized. Contingent upon different components, comprising the nodes' arrangement in WSN and the accessibility of assets, the energy utilization of nodes in various ways of the information accumulation tree might perhaps differ to a great extent, in this way influencing the general system lifespan. This paper discourses the question of lifetime amplification of WSNs in view of information accumulation trees. The authors suggest an innovative furthermore, proficient procedure, named Randomized Switching for Augmenting Lifetime (RaSMaLai), that goes for developing the lifespan of WSNs via load adjusting. Assumed an introductory information accumulation tree, RaSMaLai arbitrarily changes few sensor nodes from their unique ways to different ways with subordinate stack. The authors demonstrate that, beneath fitting settings of the working parameters, RaSMaLai joins with a little time many-sided quality. In light of the idea of limited adjusted trees, the procedure arbitrarily changes the information sending

ways of nodes. They have given a basic yet compelling exchanging procedure that outcomes in a quick merging. They have additionally introduced a disseminate usage of our plan that possesses a little overhead. A broad learning via both recreations and investigations on a genuine WSN test affirmed that their method can altogether increment the system lifespan with a lesser time intricacy as compared to the present cutting edge in an extensive variety of working circumstances.

Seifemichael B. Amsalu et. al. [9] In this paper, a routing procedure named Grid Clustering Hierarchy (GCH) that delivers a proficient energy management for WSNs has been projected. This procedure splits the network into a flexible amount of virtual grids grounded on the present average energy of the network to generate finest clusters in relationship to energy depletion. By means of a typical radio energy dissipation prototype model that is frequently used for replication of WSNs, GCH is replicated in addition, its outcome is paralleled with an eminent routing procedure for WSNs termed LEACH.

The table below summarizes the comparison of the few protocols discussed above:

Table I: Comparison of Different Techniques

Protocol Name	Operation	Focuses on:
GCH	Divides the network into flexible number of grids on the basis of residual energy of the network.	Improving the lifetime of the network.
RaSMaLai	Uses the load balancing to achieve energy efficiency by switching some nodes to paths having less load.	Improving network lifetime
SCHP	Focuses on choosing the relay nodes for routing on the basis of lowest end to end delay and highest residual energy.	Improving network lifetime and reduces delay.
PRRP	Reduces energy consumption by reducing communication distance between cluster head and its members. Selects CH on the basis of residual energy, distance from sink and distance from the member nodes.	Improving energy Efficiency of the network.

Conclusion

This paper presents the recent studies regarding the important issue in wireless sensor networks, i.e. energy efficiency. It has been found that energy efficiency is mainly achieved through clustering of the sensor nodes. The authors have used various measures to select the cluster heads and in one of the studies the authors have also used grid base clustering scheme. In this work they have considered three levels of gridding done according to the residual energy of the network. In future, we would like to modify the grid based clustering scheme to further enrich the performance of the network.

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