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Review to Improve Network Lifetime in Wireless Sensor Networks

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Abstract: A wireless sensor network (WSNs) is a network consisting of various sensor nodes in the network. The application are health monitoring, environmental management, security and military, etc. Constraint for the network of wireless sensor nodes is the size of node as it is very small and has limited processing capability with low battery power. The data collected by the sensor nodes are transmitted to the sink nodes in the wireless sensor network. Transmitted information is collected to the base station which may act as a station for data aggregation that stores all the collected data and transmit further for more operations. With the help of data aggregation we can reduce the energy consumption by eliminating the redundant data, the implosion and overlap of data among the nodes in the network. For era of development in the field of the improvement in the energy of wireless sensor networks (WSN) data aggregation is an excellent technique. This paper reviews about the techniques of data aggregation efficiently for the energy conservation in the network.

Keywords: Wireless sensor network, data aggregation, multiple sink, lifetime of node

1. Introduction

One of the typical types of applications of wireless sensor networks [1] can be Monitoring. Wireless sensor network (WSN) is a collection of large number of nodes randomly deployed in the wireless area for the purpose of sensing information in various applications. Due to the advancement in the fields of technical and feasibility in economical field for technology to work with WSN to deploy various nodes according the need to perform operations. The nodes in the wireless network have the ability to communicate with the surrounding nodes in order to exchange the messages or sending message to the base station. A base station may be near or far away from the sensor network area and generate the useful information. Sensor nodes consume energy while transmitting the data. If distance is more from the sink it consumes more energy. Sensor nodes is made up of various components such as a sensor, a computational and processing unit, a memory unit, a limited power battery as a source of energy for the sensing the data and allow transmission to other node. The power of the batteries consumption is the constrain as it is of limited size and the batteries are irreplaceable, since situations are not always feasible to replace these batteries due to deployment in some remote areas. The network lifetime of a WSN is needed to maintain in order to exchange of messages to various nodes and sensing the data accordingly which basically depends on deployed sensor nodes and techniques used for the transmission of the data. So, the most dominating issue in a wireless sensor network is to control energy consumption in the network of the sensor nodes. In order to control the consumption a large network is divided into number of small chunks called clusters and each cluster has its own cluster head, cluster head is responsible for communicating with base station and cluster members send their data to cluster head and save their energy. Once the cluster head (CH) chosen by the base station they will get their ID and CH broadcasts this ID in a network. Sensor nodes receive the ID and based on their own calculation and distance, sensor nodes reply to one ID and join that as a cluster member. At a time one sensor node can only be member of one cluster.

Consumption of energy is due to useful or wasteful operations [2]. Energy consumption during transmission is considered to be useful, reception and data aggregation. While construction of routing tree, retransmission of data, overhearing etc. comes under wasteful operations. If distance is more from the sink it consumes more energy.

The lifetime of a sensor network can be defined by any of the two definitions: 1. till the nodes die in the network from the time of the start of the operations of sensing.

2. The network operation starting time in the network to the time last node dies in the network.

The networks effectiveness can be determined by the coverage provided by the sensor deployment scheme. The number of sensor node required to be deployed is a critical decision for wireless sensor networks [3]. The pre requirement of the node deployment positions is determined. Basic properties of a WSN, such as coverage, connectivity, cost and lifetime [4] can define certain property of WSN which number and placement of sensor nodes can determine. The shape of the monitoring region helps to achieve maximum coverage, reduced cost of deployment, and reduced number of sensors. Selecting a proper way for the transmission along with the scheme for the node deployment in proper shape of area for the energy consumption.

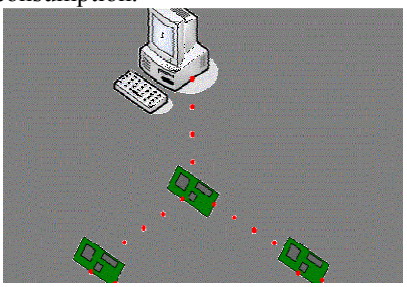

Figure1.1. Wireless sensor network

Impact of data aggregation in WSN

In this paper we have a propensity to discuss the two main factors that have an effect on the performance in wireless sensor network through data aggregation, strategies like energy consumption and transmission of data. Data aggregation is that the strategy, in which aggregation of data from the various nodes in the network and is collected to the single node through the function for reduction of consumption and delay in the message to the sink node. With the existence of this method we tend to save the energy within the network. Delay is that the latency connected with aggregation knowledge from nearer sources might have to power back at intermediate nodes so as to combine them with knowledge from supply that square measure farther away. Basically aggregation technique supported the position of the sources within the network, variety of sources and also the network topology. If the examine the factors, we tend to think about the two models of the supply placement. The event radius model and random supply model. The modeling says us that wherever the supply square measure clustered close to one another or located at random, vital energy gains square measure attainable with knowledge aggregation. These gains square measure greatest once the number of sources is massive, and once the sources square measure located comparatively near one another and much from base station. The modeling through, conjointly looks to the recommend that aggregation latency may not be negligible.

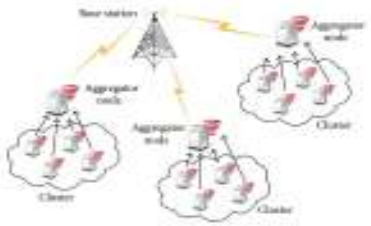

Figure2.1. Data aggregation

2. Impact of Multiple sink

And this leads to the result that the direct neighbor nodes of the sink burden heavier loads than other nodes [2]. As the size of a wireless sensor network scales up, the continually increasing loads of the neighbor nodes of the sink turn the area around the sink a hot spot. Severe congestions and packet loss may be caused. Moreover, the energy of the sink's neighbor nodes may be exhausted rapidly. This unique phenomenon is called funneling effect and how to mitigate the funneling effect is an important challenge to the WSNs research community [2]. Many techniques, e.g., MAC protocol design [3], multiple sinks [4, 5], mobile sinks [6, 7], distributed congestion control algorithms [8, 9], and data aggregation techniques [10, 11], have been proposed to cope with the funneling effect problem in wireless sensor networks. Multiple sinks technique is also an effective approach to deal with the funneling effect problem. Yet the introduction of multiple sinks does not mean the elimination of funneling effect problem. Suppose in a WSN with multiple sinks, if the loads of the sinks are not balanced, the funneling problem still exists around the sink with heavy load. So the unevenness of the loads among the sinks may cut down the actual benefit brought by multiple sinks. To realize the potential advantage of multiple sinks, load balancing technique is strongly needed. By distributing the loads evenly to all the sinks, the energy consumption can be averaged and then the expected network lifetime can be prolonged.

Load balancing for WSNs with multiple sinks has been researched in previous work. Inspired by the idea of gravitational field, a routing method for WSNs with multi-sinks is proposed in [12]. Using linear programming approach, Kim et al. studied in

[13] how to optimize the placement of multiple sinks and how to route traffic for all nodes. By analogy to electrostatic theory, Kalantari et al. studied in [14] the optimal routing design problem of multi-sink sensor networks. These papers mainly focus on how to distribute the loads among the sinks. However, they do not consider the problem of balancing the loads of the direct neighbor nodes of the sinks. In a multi-hop WSN, the neighbor nodes one hop to the sinks burdens the heaviest traffic. These nodes play a critical role in the network, because once these node run out of their energy, the sinks will lose connection with the whole network [15]. Unfortunately, unlike the energy-unconstrained sinks with consistent energy supply, these nodes are generally energized by batteries. So these nodes are highly energy-constrained, and the energy of these nodes is critical resource of the sensor network. The lifetime of a WSN is strongly dependent on the number and energy of the direct neighbors of sinks.

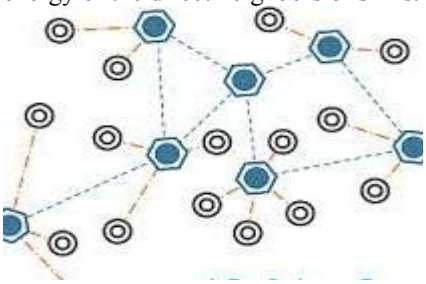

Figure3.1. Multiple sink

4. Related work

The major task of a wireless sensor network deal with the collection of required data from surrounding or the desired one chosen for monitoring information , and then it transmit that collected data to the base station. For transmission of data to the base station there are many ways. Base station collect the information send from the source, but when the location of base station is far away, there is high consumption of energy can be seen in transmission. Thus the network will lose their sensor nodes very quickly. Also change can be seen in the consumption due different transmission distance for each sensor node due to positioning of nodes in an area. Transmitting information can also be done through clustering; individual node consumption is reduced. For energy balancing and energy consumption problem many protocols as been designed.

Hierarchical routing protocol famous for energy consumption is LEACH proposed by [6]. Clustering approach based first and famous designed protocol to improve network efficiency. In the network, different cluster are designed from sensor nodes. A cluster head is selected from the cluster to act as router to base station. The CHs selection is adaptive based up on their residual energy.

In this paper [7] in order to define and find the lifetime (LT) of a sensor, a fuzzy based model is propose. Three parameters are considered for calculating the lifetime, : the remaining battery power (RPS), sleep time rate (STR) and transmission time rate (TTR). Internal batteries power the sensors. Te values decide whether the nodes are alive, dead or have medium power.RPS value decide the node lifetime i.e., RPS = 0 indicates “dead almost”, RPS = 0.5 indicates “medium power” and RPS = 1 indicates “full power”. Sleep time is zero for the cluster head so performance is evaluated for STR = 0, 5 and 10 STR = 5 for participating and sensors which remain away STR = 10. From the simulation results, the effect of STR is directly proportional to LT. As the TTR increases, LT decreases because energy consumed is more. A sensor with high RPS will have longer LT.

This paper [8] proposes to enhance the lifetime LEACH-ERE a Fuzzy Logic based protocol in WSN. To reduce the lifetime of the network Cluster head node selection is done in each round. Parameters on which this protocol was designed are Energy, Density, Centrality and speed of mobile node. LEACH-ERE with more remaining energy first of all selection is done of the cluster head and secondly rotation is performed of the cluster head in a periodic manner. This is done for each cluster to consume and thereby enhance the lifetime of the network. Values are calculated using fuzzy logic using the defined parameter in the cluster for the cluster head and the remaining nodes in the network and mobility to the cluster node is defined. A Fuzzy based LEACH-ERE helps to select efficient cluster head.

Sensor nodes while transmission possibly produce redundant data and which may consume energy though communication, data fusion [9] is used for the energy saving. For energy efficiency cluster-based routing protocol is designed. Energy for the cluster head is probably more as compared to the rest members of the cluster. As WSN deals with large and distributed network, to improve the lifetime use of the mobile relay or sink [10]. For heavily loaded mobile nodes more energy is added, whereas it does not fit for static network. Transmission range

distribution optimization [11] help to achieve energy balancing for static multi-hop to certain extent. However, Perillo et.al.[12] assume that node's transmission range is unlimited. The broadcast nature of the wireless medium [13] increases transmission reliability which the opportunistic routing theory helps to define, neighbors play an important role participate in data from given addressed node to other using forwarding techniques. In [14], Mao et. Al. studies the problem of energy consumption and optimizes it by selecting and prioritizing forwarder list.

For the multi hop ad-hoc mobile networks designed protocol is Dynamic source Routing (DSR) protocol [15]. Route maintenance and route discovery two mechanisms which allows nodes to discover and maintain routes to an arbitrary destination. On demand routing protocol on which DSR completely works as it help to overcome overhead on packets are remain zero when the nodes do no perform any operation respect to each other [16]. For optimizing packets needed for transmission through DSR but on comparison with LEACH network lifetime is more as compared to DSR. Hence for the energy efficient network LEACH is chosen.

Techniques for Network Lifetime in WSN

An optimization search algorithm Genetic algorithm (GA) [17] natural selection based algorithm .GA uses genetic operators such as selection, reproduction, crossover, and mutation, during the search process. The added advantage of GA optimal results are obtain over the over conventional approach. GA is a search method which works in global network and optimization method. Results obtained are faster as survival of the fittest.

Cluster deployment

The proposed algorithm consist of four phases viz. sensor deployment, setup and path determination phase, data optimization and data transfer phase as described below.

1) Sensor Deployment

Deploy the sensor nodes in the defined topology.

Area is divided into squares to form clusters for the nodes .nodes are counted for the cluster.

Clustering can be even and uneven. Even clustering defines that the cluster size will remain same for the whole network whereas in uneven may vary.

2) Setup phase and path determination phase

Cluster head is chosen and nodes are initialized at center. Path is determined as cluster head will transfer the message to base station and head is chosen by using the midpoint formula. Energy level of cluster head is max and it will broadcast message to rest of nodes that head is defined and consumed energy at that level is least. To transmit data nodes IDs are defined so as to define pat and ease to recognize each other for the transmission. Sensed data by sensor nodes is transmitted to the cluster head via single hop. The data which is received from all of the nodes to the cluster head is allowed to perform the operation of data filtering and transmit it to the base station. This helps CH to have high energy level as compared with every other node in the cluster.

3) Data optimization phase

Id's are assigned and energy to all the nodes remain same.

4) Data transfer phase and analysis

Left over of cluster head is checked and seen that the energy consumption is more by using cluster head.

Technique data aggregation used for energy consumption while transmitting data to multiple nodes. Fermat point plays an important role in consumption of energy trough median of polygon having shortest distance from all the vertices of polygon [3]. Data when travelled through shortest point leads to minimize energy use in the network and improve network lifetime. Data transmit through Fermat node which may be Fermat point or the node near Fermat point, an imaginary point.

Data aggregation technique is used with the Fermat point concept reduces the transmission number in the network which depends on the sources available in the network and the Ferment point in the network.

1. Source Node sends data from nodes in the network to Fermat Node.

2. Fermat Node helps to send the data which is aggregated one and Encryption to the node who act as Fermat node.**3.** Sink node collect the data and Decrypt that.

4.A check is maintain when data reaches wait for defined second is done before transmitting it to sinks and if time within limit cross then new node for data aggregation is selected and again same process is repeated.

5. Exit.

5. Conclusion

Wireless sensor Network collection of sensor, which are deployed in network for collecting the real time data. These sensor nodes continuously work in sensing. The base station is basically receiving signals and processing data. In whole process of exchanging of data from certain nodes to destination node the consumption of energy is lot more as the size of node is limited and hence life time of sensor network get effected by that.

In this paper, to improve the network lifetime is considered reduction of energy consumption is with help of multiple sink deployment using various routing protocol function. Multiple sink in the network deployed according as nearby nodes will collect information and aggregate it to that sink and processes to the next sink if found in the area defined for the wireless sensor network and shape defined for the network too help to reduce the consumption of energy as the distance matter for nodes in the network where the operation is being performed. It encourages better utilization of the node energy as transmission is minimize by using greedy the approach of data to transmit in network. As transmission of data through multiple sink using data aggregation remove the data redundancy as aggregation help to remove implosion and overlap of data leads to increase the network lifetime.

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