AN OPTIMAL CH SELECTION TECHNIQUE TO IMPROVE LIFETIME OF WSN

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ABSTRACT

Abstract— Wireless sensor network (WSN) [1] is a self-organized network composed of hundreds or thousands of nodes has been observed tremendous growth in the use of Wireless sensor networks (WSN) in the last decade. WSNs behave like an interface between the virtual and physical worlds. The Sensor nodes sense the changes in external environment and send the collected data to the sink nodes in the network called Base Station (BS). The performance of the wireless sensor networks gets affected by the limited battery lifetime of the sensor nodes. Various clustering and power management protocols have been specifically designed for WSN to reduce energy consumption by the node. Many improvements are being made day by day in the basic clustering protocols. This paper represents a survey on the recent clustering protocols in wireless sensor network (WSN).

Keyword:- *Wireless Sensors Network, clustering algorithms, Energy Efficiency*

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1. INTRODUCTION

WSN are spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively sends the data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one or several sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. Sensor nodes work together to complete the task in time and to provide information accurately. Sensor nodes sense the external environment or application area and send the data to base station located inside or outside the network via single hop or multi-hop. Sensor nodes work with some limited resources like battery power, memory and bandwidth etc. Wireless sensor networks lifetime depends upon battery power of nodes as every node operation consumes energy, hence node goes out of energy. And it is not possible to recharge or replace the battery of nodes. Therefore, efficient energy consumption by the nodes is the prime design issue for wireless sensor network from the circuitry of sensor nodes to application level to network protocols. [2]

Clustering algorithms are considered energy efficient approaches for wireless sensor networks. Clustering divides the nodes into independent clusters and each cluster elect their own cluster heads. Nodes send the collected data to respective cluster head; cluster head (CH) applies data fusion/aggregation to reduce the collected data to some useful

information and sends aggregated data to base station (BS). Communication between two nodes is the main energy consuming process that depends upon the distance between the two nodes. Clustering avoids long distance communication between two nodes and only cluster heads are communicating to base station (BS). To load balance the network, the cluster head is rotated among all nodes. [3]

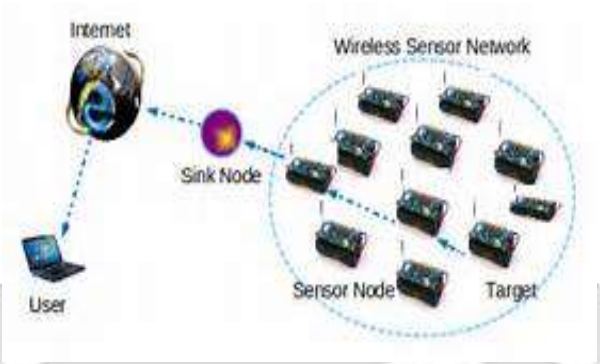

Fig.1: Wireless Sensor Network Architecture [4]

2. DESIGN FACTORS OF WSN

There are various challenges which affect the wireless sensor network (WSN) these are:

1. Node deployment:

Node placement in WSNs is application-dependent and can be whichever manual or randomized. In manual placement, the sensors are manually allocated and data is routed across predetermined paths. Though, in random node placement, the sensor nodes are dispersed randomly, crafting an ad hoc routing infrastructure. The node deployment in wsn should in such way that the communication between nodes never failed. So to maintain the proper communication between these nodes an excellent routing protocol is required.

2. Fault tolerance:

Some sensor nodes could block due to lack of domination, physical damage, or environmental interference. Individual nodes are liable to unexpected failure with a much higher probability when compared with other type of network. The network should keep alive information dissemination in spite of failure.

3. Scalability:

Sensor network is made up hundreds or thousands of nodes. The designed Protocol should be able to work to such high degree of nodes and take advantage of such high density of networks. So the routing protocol should not limit with the fixed nodes. But it should operate with large number of node and should be varies with the network size.

4. Coverage:

In WSNs, every single sensor node obtains a precise think of the environment. A given sensors think of the nature is manipulated in both scope and accuracy; it can only cover a manipulated physical distance of the environment. Hence, distance coverage is additionally a vital design parameter in WSNs.

5. Power consumption:

WSN is made up of thousands of nodes and these nodes are energy restricted and cannot replaceable and rechargeable. WSN lifetime depends on these nodes energy and every nodes operation consumed some energy. So an efficient energy consumption by the node is the main design issue in WSN.

6. transmission media:

In WSN the sensor nodes are wirelessly connected to each other so it is very important to maintain wireless connection between them. The transmission medium between sensor nodes is radio waves or infrared waves. The communication medium between these sensor nodes should be universally presents, it should not bound with any standards and should not require any license to operate.

3. APPLICATIONS

WSN is very useful in many applications some important applications of WSN are explain as:-

a) Military Applications:

Since wireless sensor networks are based on the dense deployment of expandable and low-cost sensor nodes, destruction of some nodes by warlike actions does not affect a military operation as much as destruction of a traditional sensors, which makes sensor networks concept a better. Some of the military applications of wireless sensor networks are approach for battlefields examples:-

1.Monitoring forces, equipment and inspect the area.
2.Battlefield surveillance
3.Activities of opposing forces and terrain
4.Biological, Nuclear and chemical attack detection and reconnaissance

b) Health Applications:

Some of the health applications of sensor networks are providing interface for the disabled; integrated patient monitoring; drug administration in hospitals; diagnostic; monitoring the internal processes and movements of insects or other small animals; monitoring the human physiological data; and tracking the location of doctors and patients inside a hospital.

c) Home Appliances:

As technology advances, smart sensor nodes can be engaged in appliances, such as, refrigerators, vacuum cleaners, micro-wave ovens, and VCRs. These sensor nodes inside the indoor devices can interact with each other and with the external networks via the Internet or Satellite. These sensors allow end users to manage home devices locally and remotely more easily.

d) Environmental Applications:

Some of the environmental applications of these sensor networks include tracking the movements of birds, insects and small animals; monitoring the environmental conditions that affect crops; chemical/ biological detection; disease detection; precision agriculture; biological, pollution, and environmental monitoring in sea, soil, and atmospheric contexts; forest fire detection; pressure monitoring; meteorological research such as; flood detection; bio-complexity mapping of the environment; and pollution study.

4. LITERATURE REVIEW

Fei Song et al., 2008 [5] Proposed a trust-based LEACH (low energy adaptive clustering hierarchy) protocol which provide secure routing, while preserving the essential functions of the original protocol. The decision-making scheme is based on the decision of trust, that evaluated separately and dynamically for the different decisions by basic situational trust. The situational trust was maintained by a trust management module integrated with a trust-based routing, having novel technique in trust update model and cluster-head-assisted monitoring control.

Wei Wang et al., 2009 [6] In order to increase the WSN's lifetime, a refined protocol named LEACH-H (hybrid cluster head selection LEACH) is proposed. In the first round of Leach-H, the base-station (BS) selects a cluster head (CH) set through adopting simulated annealing algorithm; in the followed rounds the cluster heads (CHs) will select new cluster heads within same cluster. This will not only solved the problem that the cluster heads are unevenly distributed in LEACH, but also helps to maintain the characteristics of distribution. The energy consumed by the network is cut down and the lifetime of WSN is extended in Leach-H.

Wu Xinhua et al., 2010 [7] Presented the pollination based optimization algorithm also called OLEACH-C give the improvement of LEACH-C protocol. The PBO algorithm is utilized for clustering in WSN. The node with maximum remaining energy will be selected as a cluster head. If the two nodes have the same energy then cluster head (CH) will be selected based on distance. The node that has minimum distance from the base station will be selected as CH. LEACH-C protocol selects the best CHs that provides a routing optimization with the minimum energy consumption and minimum cost of communication links between nodes within each cluster.

Mortaza Fahimi Khaton Abad et al., 2011 [8] Prolonged network lifetime, scalability, and load balancing are important requirement for many sensor network applications. Clustering sensor nodes is an effective technique for achieving these goals. In this work, introduce an energy efficient clustering algorithm for sensor networks based on the LEACH protocol. LEACH (Low Energy Adaptive Clustering Hierarchy) is one of popular cluster-based structures, which has been widely proposed in wireless sensor networks. LEACH uses a TDMA based MAC protocol, and in order to maintain balanced energy consumption. The proposed protocol adds feature to LEACH to reduce the consumption of the network resource in each round.

Ningbo Wang et al., 2012 [9] Proposed an effective version of LEACH protocol in extending the lifetime of wireless sensor networks. LEACH-R protocol is an improvement of LEACH protocol. LEACH-R improves the selection of cluster-head (CH) and proposed to choose relaying node as compare to LEACH. Residual energy of the nodes is considered during selection of cluster-head (CH), so the possibility of low-energy nodes being selected as cluster-head is reduced. Based on both residual energy and distance from base station, relaying node is chosen from cluster heads to become the relay node between base station (BS) and other cluster-heads.

Parul Bakraniya et al., 2013 [10] Wireless Sensor Network is the collection of large number of sensor nodes, which are technically or economically feasible and measure the ambient condition in the environment surrounding them. The difference between usual wireless networks and WSNs is that sensors are sensitive to energy consumption. Energy saving is the crucial issue in designing the wireless sensor networks. Here a modified algorithm for Low Energy Adaptive Clustering Hierarchy (LEACH) protocol is proposed. The modified protocol called "Kmedoids-LEACH protocol (K-LEACH) for clustered WSN" is aimed at prolonging the lifetime of the sensor networks by balancing the energy consumption of the nodes. The proposed protocol uses the kmedoids clustering algorithm for uniform clustering and Euclidean distance and maximum residual energy (MRE) is used to select the cluster head (CH). The performance of K-LEACH as compare of the LEACH protocol is much better.

Chunyao FU et al., 2013 [11] Due to the limitation of nodes energy in wireless sensor networks, energy efficiency is an important factor that is considered when the protocols are designed. As a typical representative of hierarchical routing protocols, LEACH Protocol played an important role in the uneven energy distribution that is caused by the randomness of cluster heads (CHs) forming, this paper proposed a new improved version of LEACH protocol i.e (LEACH-TLCH) which was intended to balance the energy consumption of the entire network by selecting two cluster heads within same cluster. And improve the lifetime of the network.

Ravi Kishore Kodali et al., 2014 [12] Proposed a hierarchical clustering based routing protocol for the heterogeneous wireless sensor network. The proposed protocol named as Universal - Low Energy Adaptive Clustering Hierarchy (U-LEACH) is energy efficient protocol showed a significant reduction in the energy consumption by the sensor nodes. In U-LEACH, the selection of Cluster Head (CH) depends on the initial and the residual energy of the nodes. In a particular cluster, the transformation of information between the nodes takes place by forming a chain, started from the farthest node from the base station (BS). Data aggregation has also been applied successfully to slam down the energy consumption.

Richa Garg et al., 2014 [13] Proposed an algorithm called genetic algorithm is an optimization technique that generate possible solutions to optimization problems. Optimization is the central to any problem involving whether in engineering or economics. This result shows that genetic algorithm provides more optimal solution. Genetic algorithm performs the number of iterations and produced possible number of solutions called initial population. Genetic algorithms solve the problems step by step and produced next generation. All evolutionary algorithms including Genetic Algorithm can find near optimal solution.

Laith Mohammad Qasim et al., 2015 [14] Genetic algorithms are usually used in information retrieval systems (IRs) to enhance the information retrieval process, and to increase the efficiency of the optimal information retrieval in order to meet the users need. The improvement of adaptive genetic algorithms helps to retrieve the information needed by the user accurately, reduces the retrieved relevant files and excludes irrelevant files. Here problems embedded in this process, attempted to find solutions such as the way of choosing mutation probability and fitness function, and crossover test collection on mathematics used two proposed adaptive fitness function, mutation operators as well as adaptive crossover. The process aimed at evaluating the effectiveness of results according to the measures of precision and recall. Finally, the study concluded that we might have several improvements when using adaptive genetic algorithms.

5. CONCLUSION

After having gone through different literatures published on the topic of energy conservation in WSN. Mainly energy consumption in CH is due to its sending and receiving and aggregation operations. Although LEACH is best protocol amongst all the routing protocols to increase the energy efficiency of WSN still it needs to be improved ,here in future efforts we will implement a technique for the cluster head selection which not only provides optimal cluster head solutions but also increase the energy efficiency in WSN.

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