CERTAIN INVESTIGATIONS ON HIERARCHICAL ROUTING -LEACH PROTOCOL

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ABSTRACT

In Wireless sensor networks, the biggest issue in routing protocol is delay efficiency due to the insufficient energy resources of sensors. The delay consumption of the sensors is overhang by data transmission and reception. Therefore, routing protocols designed for WSNs should be as delay efficient as possible to prolong the lifetime of individual sensors, and hence the network lifetime. In this paper, we have observed Leach is a less energy adaptive clustering hierarchy protocol which is cluster based sensor networks decrease system delay and reduce energy consumption. Leach is a cluster based protocol many transmutation are done in wireless sensor network. The primary aim is to give security in wireless sensor network. This paper describes LEACH protocol, their energy efficient green routing and its techniques.

Keyword : *Wireless sensor networks,Delay Guaranteed,Leach,WSAN*

1.INTRODUCTION

Wireless sensor networks are also called wireless sensor and actuator networks (WSAN), are spatially designed to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. to coordinately pass their data through the network to a desired location.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 comprises of several hundreds or even thousands of nodes, where each node is connected to sensors which has typically several parts: a radio transceiver ,a microcontroller, an electronic circuit for interfacing with the sensors and an energy source for energy harvesting. A sensor node might vary in size from small to grain of dust and cost of sensor nodes is similarly variable depending on the complexity of the individual sensor nodes. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network[14]. .

2. ROUTING CHALLENGES IN WSN

Some of the factors that affect the routing protocols are

Node deployment: In WSN node deployment can be either deterministic or randomized. Optimal clustering becomes necessary to allow connectivity and enable energy efficient network operation.

Energy consumption: For the transmission of the signal multi hop routing will be more significance as it consumes less power than normal communication. Main factors that affect the sensor networks is the low power availability which depends upon the battery life time of sensors[14].

Data transfer: The proper transfer of data from the sensors to the connected device without much wastage of energy and it should also maintain route stability can be done only when a proper routing is applied among the network.

Tolerance and scalability: The routing scheme must be scalable to respond to the events,if any sensor or node gets failure due to loss in power should not affect the entire network as this may lead to total malfunction[14].

3.LEACH PROTOCOL

Leach protocol is a TDMA based MAC protocol. The main aim of this protocol is to improve the lifespan of wireless sensor networks by lowering the energy. Leach protocol consists of two phases:Set-up phase,Steady phase

Set-up phase

In the set-up phase, the main goal is to make cluster and select the cluster head for each of the cluster by choosing the sensor node with maximum energy [3].Set-up phase has three fundamental steps:

1. Cluster head advertisement
2. Cluster set up
3. Creation of transmission schedule

During the first step cluster head sends the advertisement packet to inform the cluster nodes that they have become a cluster head on the basis of the following formula:

$$T(n) = \frac{P}{1 - P \times (r \bmod P^{-1})} \quad \forall n \in G$$

$$T(n) = 0 \quad \forall n \in G$$

Where n is a random number between 0 and 1
P is the cluster-head probability and
G is the set of nodes that weren't cluster-heads the previous rounds

Fig 1.cluster head selection [4]

T (n) is the threshold. Node becomes cluster head for the current round if the number is less than threshold T (n). Once node is elected as a cluster head then it cannot become cluster head again until all the nodes of the cluster have become cluster head once. This is useful for balancing the energy consumption. In the second step, non-cluster head nodes receive the cluster head advertisement and then send join request to the cluster head informing that they are members of the cluster under that cluster head. All non-cluster head nodes save a lot of energy by turning off their transmitter all the time and turn it on only when they have something to transmit to the cluster head [2].In third step, each of the chosen cluster head creates a transmission schedule for the member nodes of their cluster. TDMA schedule is created according to the number of nodes in the cluster. Each node then transmits its data in the allocated time schedule [3].

Steady phase

In steady phase, cluster nodes send their data to the cluster head. The member sensors in each cluster can communicate only with the cluster head via a single hop transmission.Cluster head aggregates all the collected data and forwards data to the base station either directly or via other cluster head along with the static route defined in the source code. After predefined time, the network again goes back to the set-up phase.

3.1 ADVANTAGES AND DISADVANTAGES

The various advantages of LEACH protocol are:

1. The Cluster Heads aggregates the whole data which lead to reduce the traffic in the entire network [8].
2. As there is a single hop routing from nodes to cluster head it results in saving energy [5].
3. LEACH is completely distributed as it does not need any control information from the base station as well as no global knowledge of the network is required [5].

Besides the advantages of LEACH [9] it also has some Demerits which are as follows:

1. LEACH does not give any idea about the number of cluster heads in the network.
2. One of the biggest disadvantage of LEACH is that when due to any reason Cluster head dies, the cluster will become useless because the data gathered by the cluster nodes would never reach its destination i.e. Base Station [5].
3. Clusters are divided randomly, which results in uneven distribution of Clusters. For e.g. some clusters have more nodes and some have lesser nodes. Some cluster heads at the center of the cluster and some cluster heads may be in the edge of the cluster [10]; this phenomenon can cause an increase in energy consumption and have great impact on the performance of the entire network [5].

3.2 ATTACKS ON LEACH

Sybil Attack

Most of the peer to peer networks face security threats due to Sybil attack [5]. This attack is the most difficult attack to detect. In this attack, malicious node uses the identity of many other legitimate nodes to gain the data exchanged between the legitimate nodes [6]. It affects the network by dropping vital packets, increasing traffic, lowering network lifetime etc. Encryption and authentication techniques can be used to prevent wireless sensor network from the Sybil attack.

Selective Forwarding

LEACH protocol is also susceptible to selective forwarding attack [7]. In this kind of attack a malicious node places itself in the path where data is exchanged between the two legitimate nodes [5]. It collects the data and instead of forwarding this node drops all the data. It is the case where the malicious node can easily be detected. The worst scenario of this attack is that when malicious node does not discard the entire data, but selectively forwards some of the non-vital information. In this case it is very difficult detect the malicious node.

4.NR LEACH PROTOCOL

Node Ranked-LEACH (NR - LEACH) that enhances the performance of the LEACH protocol.This enhancement is based on distributing the energy load among the sensor nodes by using node rank algorithm (NRA) used to elect the CH.The operation of protocol is divided into rounds. Forming clusters is performed in setup phase which is followed by steady - state phase where data can be transmitted among cluster member nodes, CH and BS. Weight of a node in proposed protocol is controlled by 3 factors: received signal strength, residual energy for each node, and link connections number with other nodes. Distance between sensor nodes and BS and distance among nodes itself influence the energy consumed. These 3 factors reflect the importance of node that can serve large number of nodes successfully in the network and deserved to elect to be one of CHs group[11][12]. Unfair distribution on large number nodes leads to one CH that manages big cluster members; some clusters have small number of cluster members, and the rest of the nodes will not be covered by any CH control. CH that serves large number of sensor nodes will be loaded and die rapidly in comparison with CH that has limited nodes.These ways used to select CHs produced an extra overhead that resulted from additional data transmission, which consumes more power. These shortcomings are successfully handled in our proposed algorithm. BS has an accurate information about each node such as its position, current energy, and connections available to other nodes. In this algorithm, each node is ranked according to its position, residual energy, and its connection links. The selection of CH is based on a rank function. A node that has a biggest rank will be selected as CH[13].

5. CONCLUSION

In the original LEACH protocol[13], the nearest neighbor is chosen by measuring the received signal strength (RSS); the highest RSS is corresponding to the nearest neighbor.In (NR-LEACH), RSS with the residual energy for each node and link connections number with other nodes are considered to rank the nodes. In NR-LEACH, each cluster has its cluster head based on link connections number with other nodes, residual energy, and distance of node from BS. This results in improved throughput by decreasing the packet loss. This algorithm is successful for distribution of CHs and does not require a large communication overhead also, reducing transmission of redundant data to cluster heads.It is noted that NR-LEACH increases the nodes lifetime comparing with other LEACH versions.[13] This enhancement results from the selection of an optimized CH for every cluster, which represents

the actual weight and more suitable node to be a CH.n this way, it reduces the energy dissipation in communication and achieve the purpose of energy saving of the sensor nodes. Nodes remain alive for long time for NR-LEACH because its CH selection algorithm considers link connections number with other nodes, residual energy, and distance of node from BS.

6. REFERENCES

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