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REDUCING THE ENERGY CONSUMPTION IN WIRELSESS SENSOR NETWORKS USING SINK RELOCATION MECHANISM

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ABSTRACT

Base Station (BS) location and physical topology of a network play an important role in a Wireless Sensor Networks (WSN) because the BS position governs the lifetime of networks. Optimizing the topology reduces the issues that arise due to the location of the destination node. During network formation, some nodes have tends to have that have longer distance to BS. In this case, data has to travel a longer distance to reach a BS. The node failure in WSN occurs majorly due to the exhaustion of the battery and replacing this is a difficult task. Therefore, these long transmissions have effects on network's lifetime by wasting node's energy. This can be overcome by relocating the BS using a clustered WSN. This proposed approach discussed about all possible locations to find the optimal position of BS in Low energy Aware Clustering hierarchy (LEACH) which is an energy-efficient protocol and shows the effects of BS Location in the WSN and the obtained results are compared with the original Leach and Leach-B

Keywords: wireless sensor networks (WSN), sink relocation, lifetime, protocol, battery exhaustion.

1. INTRODUCTION

Wireless Sensor Network is a network that connects two or more terminals that is distributed across various physical or environmental conditions. A WSN consists of a number of nodes that communicate over antenna. The nodes are small in size with short supply of memory, power and energy. These help to detect the parameters of the geographical location with great accuracy. As they can be used in many real-world applications it is considered to be the best among the sensing networks in the present day. Research works are being carried out to solve major problems in engineering due the popularity of the WSNs.

Developing new designs to manage the energy supply that are capable of reducing the network lifetime is essential. They must be applied to the networks with large number of nodes that pose various challenges in network deployment. Routing is also a major concern in WSN as the sensor nodes have constraints on the energy supply. These routing problems can be solved with the help of various algorithms. Routing protocols and tactics that include data aggregation and clustering can minimize the energy consumption and latency.

By using cluster, the data transmission obtains the stability and also reduces the energy consumption which increases the lifetime of the network. Cluster-based WSN consist of a head node noted as Cluster Head (CH). Data aggregation takes place inside the cluster by collecting data from the leaf nodes. The aggregated data is then transmitted to the BS. The LEACH protocol is widely used to bring balance in the energy consumption. LEACH rotates the CHs randomly on each cycle so that the energy is drained out slowly by improving the transmission rate. But providing security to these protocols is a challenging task as the CHs are changed periodically.

Secure LEACH protocols like SecLEACH, GS-LEACH, and RLEACH are used to provide the trusted data distribution. Symmetric and asymmetric key management are used to solve the problems such as orphan node problem and give digital signatures to protect the node data. IBOOS scheme is used to reduce the computational and storage cost of the signature processing. The proposed system uses cluster based energy efficient routing protocol and to provide efficiency in the delivery of packets. Sink relocation mechanism is used to reduce the energy consumption.

2. RELATED WORK

Wilawan Rukpakavong *et al*. [11], analyzes about many factors causing the different lifetime periods, such as battery types, models, brands, self-discharge, discharge rate, ageing, charge cycles and temperature. They also propose the formulae and processes for dynamic node lifetime estimation which is implemented and evaluated. Chu-Fu Wang *et al* [3] discusses the about the concept by adjusting the transmission range of the sensor node according to the residual battery energy. Based on theoretical and numerical analysis for network lifetime using sink relocation is done.

Honggang Li *et al*. [5] discusses schemes on how to extend the battery's lifetime. A battery-friendly lazy packet scheme is designed to draw smoother and lower current for minimizing battery charge consumption. This algorithm performs better in extending lifetime of battery-operated sensor nodes and minimizing battery charge consumption. Several research works have been done on the sink relocation mechanism [1]. Furthermore, Different energy is required for different programs that will vary the lifetime distinctly as the temperature changes [12].

Battery power-consuming schemes such as pulse position modulation (PPM) and frequency shift keying (FSK) are used to analyze and compare the power efficiency of batteries [15]. Optimal transmission power is calculated and the nodes are automatically configured by altering the protocol [14]. Compressing Sensing (CS) based measurement is used to analyze the processing and

communicating data between the nodes and comparison between the recent approaches is also done by taking sample numerical values [8]. The node's availability and capability to sense based on the required Sensing Spatial Coverage (SSC) that are implemented for different scenarios which shows significant improvement in lifetime [9]. The battery's lifetime is calculated for parameters with different combinations. This gives a clear idea about a battery's lifetime in various environments and also about its depletion rate [10].

3. PROPOSED SYSTEM

One of the factors affecting quick death of CH includes the distance (CH, BS)) between BS and CH. If the BS is far away from the CHs, direct transmission will require large transmission energy, since distance (dist (CH, BS)) will be sufficiently large. The method is not so effective if the distance is too large, this may cause the energy of the nodes to drain faster and the overall life-time of the WSN is shortened.

However, if the BS is within the sensing region, the performance could be optimal since the BS is the only data reception point and the cost function of data aggregation energy is minimized on the total energy of the network. In this regard, having the location of the BS within the sensing region can result to an optimal setting compared with having the BS located outside the sensing region. The work is explained in a process of events as follows,

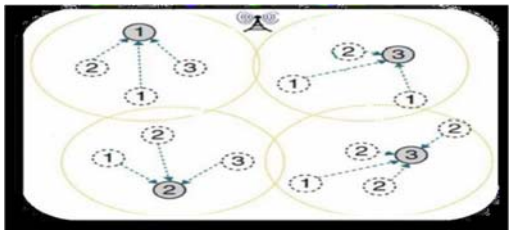

Figure-1. CH (1, 2, 3, 4) transfer data to relocated BS (BS-loc4 -> BS-loc1).

A. Network formation

The network is designed dynamically and deployed across a network, the nodes. The nodes are displayed in the dimensions consisting of direct transmission to all the nodes.

B. Cluster head selection

The sensor node and sink are set at larger distance, the group of nodes form a cluster and node with higher energy level is selected as cluster head.

C. Sink relocation

This mechanism adjusts the transmission range of sensor nodes with the help of the information from residual battery energy and relocating scheme for the sink. Thus it reduces the cost of transmission in network and improves the network data delivery rate.

D. Determining the energy consumption

In order to obtain a high energy efficient power routing, the nodes with higher energy level are selected as forwarding node for efficient data routing. The minimum number of hop nodes with efficient power aware routing is determined for data transmission from source to sink. The performance analysis of the existing and proposed work is examined through graphical analysis.

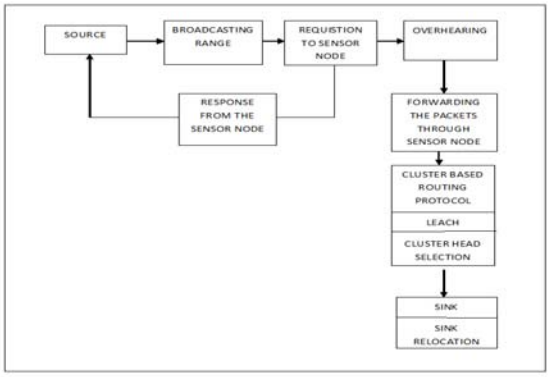

Figure-2. Architecture diagram.

4. SIMULATION

NS2 is used to implement the proposed work. The simulation set up is arranged using 50 nodes. The MAC protocol used is IEEE 802.11.Table-1 shows the simulation parameters.

Table-1. Simulation parameters.

Parameter	Value
Simulator	Ns2 - 2.3x
Number of nodes	50
Simulation Time	15 min
Packet Interval	0.01 sec
Simulation Landscape	1000 x 1000
Background Data Traffic	CBR
Packet Size	1000 bytes
Queue Length	50
Initial Energy	100 Joules
Transmission Range	100 Kbytes
Node Transmission range	250 m
Antenna Type	Omni directional
Battery Range	100 Watts
Mobility Models	Random-waypoint (0-30 m/s)
Routing Protocol	Unicast Protocol
MAC Protocol	IEEE 802.11

5. RESULTS AND DISCUSSIONS

A. Selection of cluster heads

The process of prolonging the lifetime of the network is a process that has complexities reduced by the use of sink relocation mechanism. The nodes that are grouped are aggregated as follows:

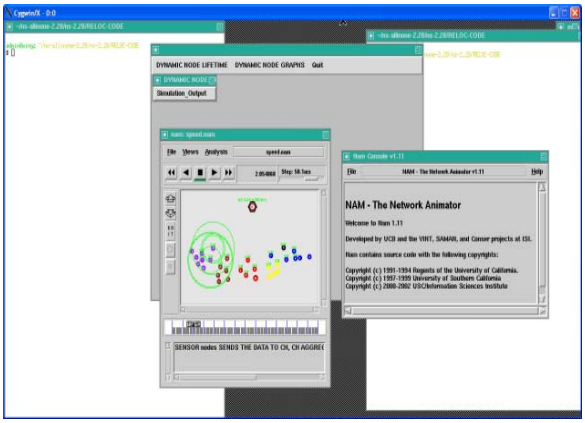

Figure-3. Assigning cluster head.

The nodes are grouped together to form a cluster and the cluster head is assigned. The red hexagon denotes the BS and the remaining similar colours are the nodes that are in a same group. The sensor nodes send data to the cluster head. The node members of the each cluster end send data to the BS. Once all the data are forwarded the BS is relocated to a new one.

B. Throughput in network

Analysis of these is represented through various graphs. As the time increases throughout also increase from the Figure-4.

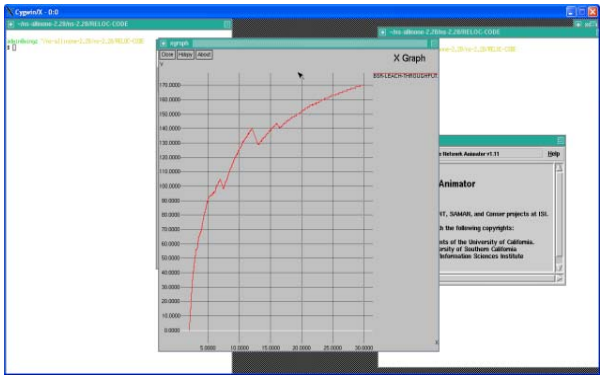

Figure-4. Throughput in network.

The graph shown above is the BS Relocation using the LEACH protocol. It shows the time taken to relocate the BS and the energy consumed by it.

6. CONCLUSION AND FUTURE WORK

The proposed a sink relocation process which will reduces the energy consumption and increases the network life time, the energy efficient leach is modified to perform the data aggregation process and saves the energy level of sensor nodes.

The simulation results are shows that better performance in terms of throughput in the network.

As a future work various types of routing protocols can be used and some techniques can be combined to improve the efficiency of the network.

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