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Analyze an Energy-efficiency Algorithm based on On-demand Load Balancing and Cluster Head for Wireless Sensor Networks

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ABSTRACT

Wireless sensor networks in the cluster algorithm use multi-hop style of communication, close to the sink node of the cluster head node transmit a lot of data which led to extreme energy consumption, the node is simply failure, at last network partitioning. This paper introduces the concept of the presents a on demand-based load balancing with cluster head algorithm for wireless sensor networks for energy-efficiency.

KEYWORDS: Wireless Sensor Networks, energy efficient, coverage, network lifetime

INTRODUCTION

In the modern Era, wireless sensor network technology becomes an emerging field in wide range of applications such as environment monitoring, battlefield surveillance, monitor of human physiological data, and etc. Low cost sensors with limited power sources can be deployed in differing places for differing usages, and they are able to sense temperature, fluid levels, humidity and other attributes. It is generally not cost effective to recharge the batteries of the sensors deployed on distinct environments; sensors are designed to carry limited irreplaceable power sources. Because of, sensor network lifetime will rely on the corresponding batteries of sensor nodes. If node energy depletion, the route will be failure. Blind spot inherent in the network will cause the system to split up. Therefore, the design of effective energy balance strategy is important to extend the network life cycle.

ISSUES

Wireless sensor networks usually use the energy principle of giving priority. It needs to consider the energy consumption of the node and energy balance of WSN. Hierarchical routing protocols have been proven to be effective in saving energy in all nodes, the network is divided into cluster head nodes and common nodes. Common node is responsible for data collection and sends it to cluster head node, cluster head node within the cluster receives the data sent by ordinary nodes, fusions and then transmits to the sink node, this algorithm is called clustering algorithms. Representative clustering algorithms is LEACH, PEGAGIS, and HEED.

In LEACH cluster algorithm, cluster head node generates and distributes network, sensor nodes are nothing to do with the uneven distribution of sensor nodes. Clustering algorithm uses multi-hop communications, close to the sink node of the cluster head node forwards a lot of data which led to the excessive consumption of energy and the nodes in its own is easy to lapse, thus known as network partitioning. Density gravity is using a clustering algorithm may result in cluster head node, the node sparse are with little or no situation. Node traffic aggregation may arise in some aggregation.

ENERGY AWARE HIERARCHICAL ROUTING ALGORITHM

Since WSN has energy constraint problem, to improve the network life time, it is required that each node should spend minimum energy during routing the packet. Clustering is one of the techniques that can be used to minimize traffic by performing data aggregation and thereby lots of processing overhead of nodes can be reduced. Instead of giving same energy to all nodes, we have Heterogeneous network in which some nodes have extra energy than others.

The major flaw of Energy Aware Hierarchical Routing Algorithm (EAHP) routing algorithms is concerned with the one-to-one connection between the cluster head and the participating sensor nodes in the cluster. It prevents the growth of the cluster size, thus reducing the scalability of the algorithm. Lastly, energy hole removing mechanism has been incorporated to overcome energy holes' drain problem. The proposed routing algorithm aims at establishing multiple paths in a cluster network. Besides the multiple paths, it also introduces a heuristic function to select an appropriate path. EAHP scheme has three phases, which are cluster formation, initializing phase, and sleep /awake setting up phase.

A. Parameters Initializing Phase

Initially the nodes are randomly deployed in a given scenario. For the nodes generated, their positions and energies are randomly assigned and displayed. The position of the sink is at the center of the network. Energy of all the nodes is equal while the energy of the sink is unrestrained.

B. Cluster Formation

Once the nodes are deployed, the base station sends out packets and determines the position of nodes – sensor node having higher threshold energy creates a concentric cluster around them. Thus clusters are formed. Neighbor discovery takes place after the deployment of nodes. Beacon messaging, k-of-n approach and ping are the commonly used neighbor discovery methods. After cluster creation and neighbor discovery each node. Once clusters are created after neighbor discovery each node decides whether it should take the role of cluster head for the current round. Using the Cluster head selection algorithm, CHs are selected from the available nodes. Selected CHs broadcast advertisement message to all its neighbor nodes to form clusters. Distributed randomized time slot assignment algorithm allows different nodes to share the same frequency channel by dividing signal into different time slots. Aggregated data from all the cluster nodes will be transferred by the cluster head to the advanced node which in turn reroutes the information to the base station.

C. Sleep/Awake Setting

The energy-hole removing mechanism is proposed in the EAHP protocol by introducing sleep/awake setting technique. Energy of each node is calculated after cluster formation .The node is ready and active for communication if and only if the energy of the node (Eo) is greater

than the threshold value (Eth) or the node moves towards sleep mode . Each node sets the sleeping scheduling according to the Eth.

Parameter	Definition	Value
X	x-axes Distance at	400 meter
Y	y-axes Distance at	400 meter
N	Total nodes	100 Nodes
E0	Total energy of network	1 j
P	Probability of cluster head	0.5
ERX	Receiving Energy dissipation:	0.0013/pj/bit/m4
Efs	free space model Energy dissipation:	10/pj/bit/m2
Eamp	power amplifier Energy dissipation:	0.0013/pj/bit/m4
Eele	Electronics Energy dissipation:	50nj/bit
ETX	transmission Energy dissipation	50/nj/bit
EDA	Aggregation Energy dissipation	5/nj/bit
d0	Reference distance	sqrt(Efs/Emp)
Sn	Number of sleep nodes	10 Nodes
M	Percentage of advanced nodes	0.1
Rmax	Number of rounds	4500

To calculate the Eth, used the following equation.

$Eth = ((ETX + EDA) \times D) + (Eamp \times D \times d^4)(2)$

Where D is the length of data packet and d is the distance between extreme distance node and sink. In order to increase stability period nodes will switch one after another to active mode from sleep mode if the number of sleep nodes greater than 10.

SIMULATION RESULTS AND ANALYSIS

The proposed approach is simulated with widely adopted simulation environment, MATLAB 2016a. The WSN is represented by 100 sensor nodes that are deployed in 400 x 400 m^2 square regions. Location of the base station set at the center of selected square region. The initial energy is 1J for each sensor node; Table 1 described input parameters in detailed. The measured simulation outputs are compared over the measured results of the state-of-the-art protocol, E-MODLEACH, MOD-LEACH, TEEN, DEEC, SEP, and LEACH. The comparison between the simulation results of the proposed protocol and other protocols are performed based on three performance metrics that include, network lifetime, number of CHs and the number of packets received

A. Number of CHs

The number of cluster heads has an impact on the energy efficiency of WSNs. If the number of CHs increased, the energy consumption also increases and if the number of CHs minimized, the lifetime of network also decreases. So, in successive rounds, the stability of the CH numbers around an optimum number is required to get balanced energy consumption. It clearly shows that number of nodes that become CH in proposed scheme is greater initially and then remains same as rest of the algorithms. Because proposed scheme uses same equation for CH election as used in LEACH and MOD-LEACH.If probability to become CH increase, then number of CH increase and energy consumption increases. So it is better that we choose probability to become CH in the range of 5 percentages.

B. Network Lifetime

Life time of network is defined as the maximum amount of time between the first dead node and the last dead node. Fig 3 and Fig 4 shows the number of alive nodes for each round and the number of dead nodes for each round; it shows that first node and last node becomes dead earlier in LEACH and MOD- LEACH when compared to EEAHP due to a lesser number of CHs and energy hole removing mechanism.

C. Number of packets at the base station

In the proposed approach, received number of packets at the base station is more than the numbers of packets received at the base station when compared to other algorithms.

CONCLUSION

An Energy Aware multi-Hop Hierarchical Routing Algorithm for Wireless Sensor Networks to enhance lifetime of the networks with the help of energy heterogeneity is presented. In this proposed approach, a different cluster head appointment mechanism has been adopted by modifying the cluster head election threshold which increases lifetime of WSN. It also act as an efficient sleep and awake schedule used for removing energy hole problem and thereby increasing stability period. According to simulation results and analysis, the proposed algorithm gives better performance compare to all existing routing algorithms. Simulation results proves that proposed algorithm performs better than existing state-of-the-art algorithms such as LEACH, TEEN, DEEC, SEP, and MOD-LEACH in terms of stability period, lifetime and packets to base station.

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