A Circular Cache Layer Based Caching Algorithm in Wireless Sensor Network

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Abstract— This technique proposes Circular Cache Layer Based (CCLA) Algorithm to divide the load of query from single cluster head1. All sensor nodes are commonly resource constrained and have limited amount of energy .In wireless sensor networks, BS (Base Station) is generally set away from the target area like base research. In base research single CH transmits data directly to BS. Single CH(cluster head) there is heavy load on CH because CH broadcast query to all nodes in cluster, receive data from nodes ,aggregate data, amplify signal and transmit to base station. So sensor nodes become dead after working as CH but in proposed technique there are two cluster heads CH1 and CH .CHs are not stationary means CHs changes within cluster according to available battery .CH2 is responsible for collecting data from sensor nodes, store this data and transmit to CH1 when required.CH2 contain data time bounded interval according to TTL (time to live) process CH1 transmit information to BS. This technique provides load balancing. In this research calculate average energy of CHs and number of time rounds in which sensor nodes become dead. Simulation results comparing with previous protocol prove that our new algorithm is able to extend the network lifetime observably.

Index Terms—About four key words or phrases in alphabetical order, separated by commas.

I. INTRODUCTION

WSNs (Wireless sensor networks) consist of large numbers of distributed nodes that are generally randomly deployed in region of interest. In typical, each node is equipped with one or more sensors, embedded processors, low-power radios, memory, power supply and sometimes mobility module, location module and actuator as well. While these nodes are tightly constrained in terms of battery power and random deployment in target areas; make it almost impossible to recharge/replace the dead battery. In order to prolong the network lifetime, energy efficiency protocols should be designed for the WSNs. Efficiently organizing sensor nodes into clusters is useful in reducing energy consumption. Many energy-efficient routing protocols are designed based on the clustering structure, e.g. LEACH (Low-Energy Adaptive Clustering Hierarchy), ENCM (Expected Number of Cluster Members clustering algorithm), and EECS (Energy Efficient Clustering Scheme).

Energy efficiency is the main concern in WSNs, but also it should be gained with balanced distribution in whole network space. Balanced distribution of energy in whole network will lead to balanced death of nodes in all regions preventing from lacking network coverage in a rather large part of the network. Especially for homogeneous sensor networks, balance strategy plays an important role to maximize the network lifetime.

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To narrow difference and prolong the networks lifetime, we propose a CCLB (Circular Cache Layer Based) clustering algorithm which is closely related to ENCM in Wireless Sensor Networks according to the CH election phase. Our difference is mainly in the cluster formation phase, in Intra Cluster communication heads and CCLB has two cluster heads.

A. CIRCULAR CACHE LAYER BASED CACHING ALGORITHM IN WIRELESS SENSOR NETWORK

In this paper, our motivation is to find an appropriate degree of balancing the load of every CH and prolongs network lifetime. Some previous algorithm discussed on this matter like LEACH, EECS and ENCM.

A. AVERAGE ENERGY CONSUMPTION

It is necessary to acquire the average value of energy consumption by a single CH before the algorithm statement. To estimate the mean energy consumption we use an energy consuming equation

Equation of Energy consumption for receiving message

$$E_{Tx}(l,d) = \left[lE_{elec} + lE_{fs}d^2\right]$$

Equation of Energy consumption for receiving message

$$E_{Rx}(l) = E_{Rx\_elec}(l) = lE_{elec}$$

Where E_{Tx} and E_{Rx} denote the transmitter and receiver circuit energy consumption per.

This Equation for calculating energy dissipated in CH during single frame

$$E_{CH} = lE_{elec}\left(\frac{N}{i} - 1\right) + lE_{DA}\frac{N}{i} + l\varepsilon_{amp}d^4_{toBS}$$

l=number of bits in message, d_{toBS} distance to base station and E is energy.

***B. ALGORITHM*. :** This research proposes a protocol is more like ENCM. Simulation parameters, number of sensor, location of base station are same as in ENCM. Our difference is in the cluster formation phase and election of cluster heads.There is two cluster heads CH1 and CH2 in each cluster. .CH2 is responsible for collecting data from sensor nodes, store this data and transmit to CH1 when required.CH2 contain data time bounded interval according to TTL (time to live) process.CH1 transmit information to BS. This technique provides load balancing.

C. ELECTION OF HEAD1 In every cluster single sensor node is selected as cluster head1. Cluster head1 is sensor node which can communicates with base station means that this node is responsible for transferring information to and from base station. In this proposed algorithm developed for selecting single sensor node as a cluster head1.. Different nodes are selected as a cluster head1 which sensor node has maximum battery power and minimum distance from base station Battery power is fixed for every sensor node because all sensor nodes are homogenous,

$$CH_1 = \left(\max \sum_{j=1}^{j=n} b_{(i,j)} * W_1 + \min \sum_{j=1}^{j=n} d_{(i,j)} * W_2 \right)$$

W_1 variable having value .8 and W_2 variable having value
ere B stan for battery, D for distance from base station
.2 Equation for finding distance between cluster node and cluster head

$$d = \sqrt{(BS_{ix} - CH_{ix})^2 + (BS_{iy} - CH_{iy})^2}$$

I=number of Cluster, N=number

D. ELECTION OF HEAD2 In every cluster single sensor node is selected as cluster head2. Which sensor node within same cluster is at minimum distance from cluster head1 is elected as a cluster head2.

Equation for electing cluster head1

$$CH_2(i) = Min(d)$$

Equation for finding distance between cluster node and cluster head of nodes per cluster.

$$d = \sqrt{(CN_{ix} - CH_{ix})^2 + (CN_{iy} - CH_{iy})^2}$$

II. SIMULATION AND RESULTS

Simulation setup

Parameter	Value
Area of Network	100m*100m
Number of Nodes	400
Position of BS	(50,200)
E_{Tx}	50 nj/bit
E_{Rx}	50 nj/bit
packet size	2000 bit
Initial energy	0.5 j
E_{amp}	100 pj/bit/m2
Mt	2

Table1

Where ETx and ETx denote the transmitter and receiver circuit energy consumption per bit. Eamp accounts for the effect of amplifier, antenna and carrier frequency with a prescribed bit error rate (BER).And Mt further accounts for the number of transmitting antenna based on Eamp.

III. RESULTS

The proposed algorithm is evaluated under different scenarios to check their efficiency in the WSN. The various factors that influence the design of WSN are evaluated and analyzed to study their impact on the desired results. This chapter includes the performance evaluation parameters, various factors that affect performance and the obtained results in detail.

Figure presents the number of nodes alive when using clustering protocols. This result is closely related with the network lifetime of the wireless sensor networks. In the case of network adopting LEACH (with 5% of the nodes being cluster heads), the first event where a node runs out of energy occurs after 612 rounds, whereas in the case of ENCM it occurs after 932 rounds. But in our proposed algorithm CCLB (Circular Cache Layer Based) first sensor nodes dead at 1650 (appox.) rounds. So result is far better than previous algorithms LEACH and ENCM.

Diagrams in the form of graph shows number of alive nodes decreases with time. x-axis presents alive nodes and y-axis presents time rounds. In this diagram result of new algorithm is compared with previous algorithms. LEACH shown by green colour, ENCM shown by red colour and new algorithm CCLB (Circular Cache Layer Based) shown by blue colour.

Results in figure 1 show that CCLB(Circular Cache Layer Based) can be well close to the appropriate degree of balancing the load of every CH and prolongs network lifetime by large difference against LEACH (Low-Energy Adaptive Clustering Hierarchy) and ENCM (Expected Number of Cluster Members clustering).

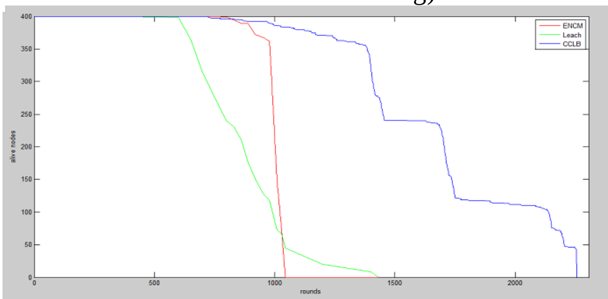

Figure 1

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