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WSN Life Time Maximization using Virtual Backbone and ERPMT Techniques

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Abstract

Our project aim is to increase the lifetime of Wireless sensor network using Virtual Backbone Scheduling and ERPMT method. In VBS Method Instead of creating a single backbone we are creating a Multiple overlapped backbones to work alternatively. This would increase the lifetime of WSN comparably. In ERPMT Method we divide the node energy into two ratios; one for the sensor node originated data and the other one is data relays from other sensors. Our proposed technique is evaluated by using the simulator NS2. The simulation results show that the life time of the network increases at the same time it provides highest system throughput. The performance is evaluated by considering the QoS parameters like data rate, packet loss ratio, Bandwidth, SNR value.

Keyword: Backbone, WSN ,Energy efficient routing, Wireless sensor Network.

Introduction

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes 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. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such asenergy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.[1][2]In computer science and telecommunications, wireless sensor networks are an active research area with numerous workshops and conferences arranged each year.

A single backbone does not prolong the network lifetime. An intuitive idea is to construct multiple disjointed CDSs and let them work alternatively. This approach has been studied in [2] and is formulated as a Connected Domatic Partition (CDP) problem.. In this paper, we propose Virtual Backbone Scheduling (VBS), a novel algorithm that enables fine-grained sleep-scheduling. VBS schedules multiple overlapped backbones so that the network energy consumption is evenly distributed among all sensor nodes. In this way, the energy of all of the sensor nodes in the network is fully utilized, which in turn prolongs the network lifetime.

STG and VSG Based Approximation Algorithm

STG is shown in the below figure, it is a centralize approximation algorithm. The time scale isshown in horizontal which is counted in rounds. The possible states of the backbone nodes arevertically listed in each round. The number of backbone is equal to the number of possiblestates in each round. There is an one to one mapping between state and backbone. Energy isused in 1 round which represents the time laps during each round when consumes energy.

Transition of node is not allowed when there is state depletion in node.initial state is placed at round 0 and is connected with all states in the first round to represent a starting point.

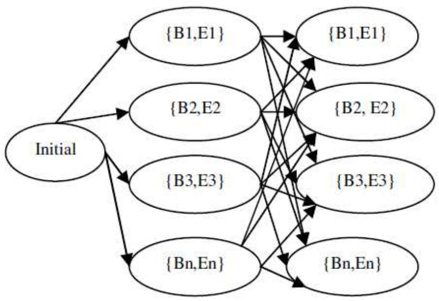
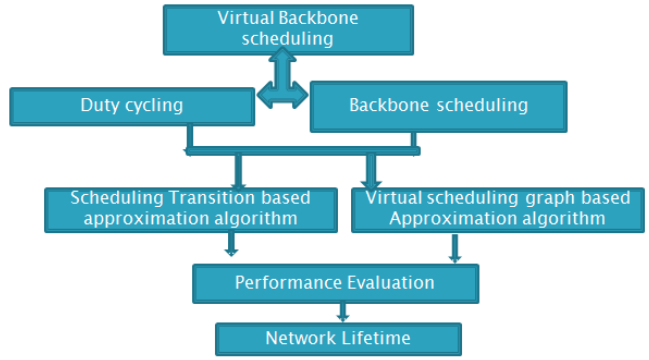


Fig. – 2

Algorithm.1. STG-based algorithm:
1: int CUR ROUND ¼ 0;
2: repeat
3: for each state S do
4: Get the associated energy levels of S;
5: Prune the resultant energy levels using the minðÞ function;
6: Select the energy level with the maximal minimum energy value.
7: Set S's energy level to the energy level with the maximum summation among the resultant energy levels;
8: end for
9: CUR ROUND ¼ CUR ROUND þ 1;
10: until All the energy levels of the states in CUR ROUND are zero;
11: Return the schedule represented by the path ending in CUR ROUND

In searching for the longest path in the STG, we need to record the energy levels of each state. STG Algorithm As stated before, each sensor node consumes a fixed amount of energy" in each round when working as a backbone node. We define a virtual node that corresponds to a sensor node as a node that contains" energy. The original node is called the ancestor. An ancestor of E r energy is divided into d Er " e virtual nodes. The virtual nodes of the same ancestor form a virtual group. Virtual nodes in the same virtual group are indexed. Two virtual groups are neighbors if their ancestors are neighbors in the original graph. The virtual nodes that have the same indexes are connected. A virtual node is isolated if it does not connect with any virtual node of other virtual groups.

Block Diagram



ERPMT Method

Network lifetime is a critical issue in Wireless Sensor Networks (WSNs). In which, a large number of sensor nodes communicate together to perform a predetermined sensing task. In such networks, the network life time depends mainly on the lifetime of the sensor nodes constituting the network. Therefore, it is essential to balance the energy consumption among all sensor nodes to ensure the network connectivity. we propose an efficient routing power management heuristic obtain higher life time and increased coverage areas for network systems. In this we divide the node energy into two ratios; one for the sensor node riginated data and the other one is data relays from other sensors. Our proposed technique is evaluated by using the simulator NS2. The simulation results show that the life time of the network increases at the same time it provides highest system throughput. The performance is evaluated by considering the QoS parameters like data rate, packet loss ratio, Bandwidth, SNR value.

In previous system, the algorithm ideally requires knowledge of the energy level of all other network nodes. This may become a problem in large networks. For this case, we show that periodic, geographically limited broadcasts of the energy level is sufficient to ensure that our algorithm's performance with partial energy information is close to that of the ideal case with complete energy information. The energy consumption for these neighborhood broadcasts is accounted for when computing the network energy consumption in performance comparisons.

In this paper, we introduced a new heuristic which maximize the lifetime of the network as well as preserve coverage as much as possible. What distinguish our work from previous researches is that in order to maximize the life time, we perform a battery power management at the node level, such that the total power of the sensor battery is divided into two parts; the first is dedicated for sending data generated by the sensor itself, while the other is for data relays from other sensors. The division is done in different ways to test each combination effect. By doing this, we gained increased network lifetime and coverage. Our approach can be used along with the existing routing heuristics to gain the advantages from these routing techniques while doing our power management to gain higher lifetime and preserve coverage. For that, we compared ERPMT against two well known routing heuristics OML and CMAX.

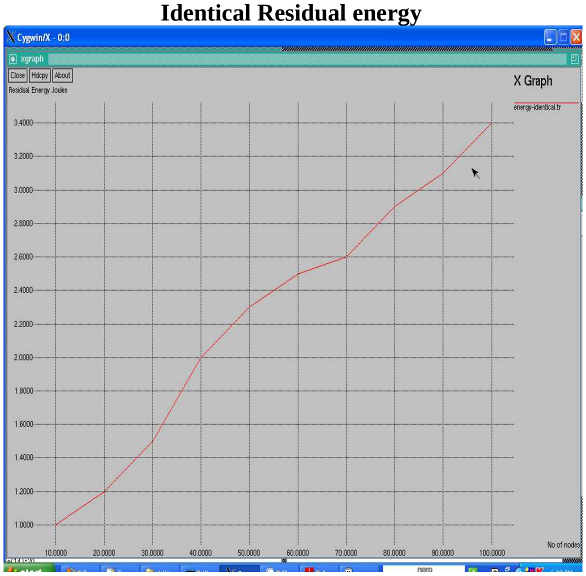
Performance Evaluation

Energy Balance

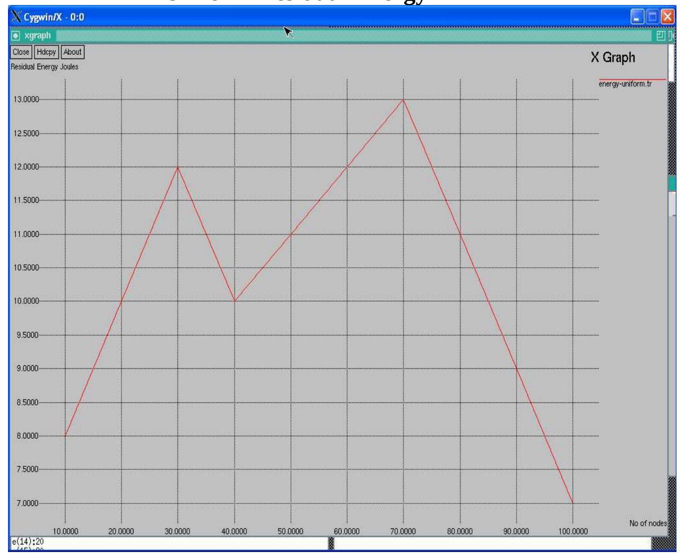
By record the residual energy of all sensor nodes at the end of the lifetime. Fig shows the means and 90 percent confidential intervals of the residual energy running the STG-based algorithm. The networks of the t figure are of an identical initial energy of 100 units.

The networks of the figure have a uniformly distributed initial energy in ½50; 100 . The figure show that the residual energy of all of the sensor nodes is small. The narrow confidential intervals indicate that the energy consumption is balanced.

Identical Residual energy



Uniform Residual Energy



Network Lifetime

Our proposed technique is evaluated by using the simulator NS2. The simulation results show that the life time of the network increases at the same time it provides highest system throughput. Comare to to existing methods VBS and ERPMT increase the network life time.

Hardware and Software Specification

Processor : 1.4 GHz
Pentium IV Processor
RAM : 128 MB
Hard Drive : 10GB
Operating System : Windows XP / Linux.
Tools : ns-allinone-2.28.
Pre-Request Software : Cygwin.
Languages : Tcl/Tk, OTcl, C++.

Conclusion

WSNs require energy-efficient communication to be able to work for a long period of time without human intervention. In this paper, we present a combined VBS and ERPMT method to increase the lifetime of backbone-scheduling and duty-cycling method called VBS. VBS improves upon state-of-the-art techniques by taking advantage of the redundancy in WSNs. Energy efficiency is of paramount importance in wireless sensor networks, as sensors have usually limited energy supply that should be spared so as to maximize the lifetime of the network.

In this paper we discuss the new power management technique (ERPMT) for providing the maximum lifetime and improved coverage to the sensor networks. We have compared the proposed method with existing well known power management techniques such as Online Maximum Lifetime heuristic (OML) and capacity maximization (CMAX). Our simulation result shows that lifetime of the node increases and as a result network lifetime has increased compare to previous techniques.

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