Review of Design and Implementation of a General Self-Organized Tree-Based Energy-Balance Routing Protocol in Wireless Sensor Network

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***Abstract*—Wireless sensor network (WSN) is a system composed of a large number of low-cost micro-sensors. This network is used to collect and send various kinds of messages to a base station (BS). WSN consists of low-cost nodes with limited battery power, and the battery replacement is not easy for WSN with thousands of physically embedded nodes, which means energy efficient routing protocol should be operated to attempt a long-life work time. To achieve the objective, we need not only to minimize total energy consumption but also to balance WSN load. Reviewer has proposed many protocols such as LEACH, HEED, PEGASIS, TBC and PEDAP. In this paper, we propose a General Self-Organized Tree-Based Energy-Balance routing protocol (GSTEB) which builds a routing tree using a process where, for each round, BS assigns a root node and transmits this selection to all sensor nodes. Subsequently, each node selects its parent by considering only itself and its neighbors' information, thus making GSTEB a dynamic protocol. Simulation results show that GSTEB has a better achievement than other protocols in balancing energy consumption, thus maintaining the lifetime of WSN.**

***Index Terms*— Energy-balance, network lifetime, routing protocol, self-organized, wireless sensor network.**

I. INTRODUCTION

With the advances in Micro-Electro-Mechanical Systems (MEMS)-based sensor technology, low-power digital electronics and low-power wireless communication, it is now possible to produce wireless sensor nodes in quantity at low cost. Although these sensor nodes are not as energetic or proper as their valuable macro-sensor counterparts, we are able to build a high quality, fault-tolerant sensor network by making thousands of sensor nodes work together. Through the cooperation of wireless sensor nodes, WSN collects large amounts of information and sends them to the Base Station (BS). WSN has a wide range of potential applications, including military surveillance, disaster prediction, environment monitoring, etc. Thus it has become one of the most important research fields and has stimulated extensive research interest. Generally, wireless sensor nodes are deployed randomly and densely in a target region, especially where the physical environment is so coarse that the macro-sensor counterparts cannot be deployed. After deployment, the network cannot work properly unless there is sufficient battery power. In general, WSN may produce quite a significant amount of data, so if data fusion could be used, the throughput could be reduced. Because sensor nodes are deployed densely, WSN might generate redundant data from multiple nodes, and the redundant data can be combined to reduce transmission. Many well-known protocols implement data fusion, but almost all of them assume that the length of the message transmitted by each relay node should be constant, i.e., each node transmits the same volume of data no matter how much data it receives from its child nodes .PEGASIS, PEDAP and TBC are typical protocols based on this assumption and perform far better than LEACH and HEED.

II. LITERATURE REVIEW

G. Mankar and S. T. Bodkhe,[1] in this paper the improvement of miniaturized fabrication and battery technologies, the topic of deploying a wireless sensor network which uses microscopic sensors with the abilities of detecting environmental factors and processing data is getting more and more important for different environments and applications. However, the resource condition in a sensor brings out an important issue. The challenges for saving energy and thus extending the lifespan of a sensor are probable. This paper proposes a protocol involving multi-hops and self-organization of routing paths. The method, using time division with reservation scheduling, reduces energy consumption and prevents packet collisions. The routing decision takes the transmission cost, the battery status and the traffic load into consideration. This yields efficient routings and results in energy savings in sensors. The experimental results show that the system's lifespan is extended dramatically while staying robust under different environmental parameters.

M. Liu, J. Cao, G. Chen, and X.Wang,[2] this paper contains the most important issue that must be solved in designing a data gathering algorithm for wireless sensor networks (WSNS) is how to save sensor node energy while meeting the needs of applications/users. In this paper, we propose a novel energy-aware routing protocol (EAP) for a long-lived sensor network. EAP achieves a good performance in terms of lifetime by minimizing energy consumption for in-network communications and balancing the energy load among all the nodes. EAP introduces a new clustering parameter for cluster head election, which can better handle the heterogeneous energy capacities. Furthermore, it also introduces a simple but efficient ways, namely, intracluster coverage to suffer with the area coverage problem. We use a simple temperature sensing application to evaluate the

performance of EAP and results show that our protocol significantly out performs LEACH and HEED in terms of network lifetime and the amount of data reunite.

K. T. Kim and H. Y. Youn, [3] in this paper focuses, the simulation results are taken from except GSTEB.We can find that GSTEB performs better than all other protocols. Both GSTEB and TBC are protocols which require that each node reports the information of its neighbors and they use similar approach to transmit data. For GSTEB, each node needs to report the information of its neighbors 'neighbors, so it needs more memory. But GSTEB can achieve a better performance in energy saving, because each node has more opportunities to choose the nearest neighbor as the parent. Moreover, there are several cluster-heads that need to communicate with BS in TBC.

S. S. Satapathy and N. Sarma, [4] this paper survey Limited battery powers of sensor nodes demand routing protocol for sensor network that consume minimum feasible amount of energy and hence give longer life to the system. In a sensor network, sensor nodes are the potential source of information and they need to send their sensed information to a faraway base station (BS)/Sink. Generally, it needs a fixed amount of energy to receive one bit of information and an additional amount of energy to transmit the same.

W. Liang and Y. Liu, [5] this paper presents Energy-constrained sensor networks have been deployed widely for controlling and surveillance purposes. Data gathering in such networks is often an extensive operation. Since sensors have significant power constraints, energy efficient methods must be engaged for data gathering to drag out network lifetime. We consider an online data gathering problem in sensor networks, which is stated as follows: assume that there is a sequence of data gathering objections, which arrive one by one. To respond to each objection as it arrives, the system builds a routing tree for it. Within the tree, the volume of the data transmitted by each internal node depends on not only the volume of sensed data by the node itself, but also the volume of data received from its children. The objective is to maximize the network lifetime without any knowledge of future query arrivals and generation rates. In other words, the objective is to maximize the number of data gathering queries answered until the first node in the network fails. For the problem of concern, in this paper, we first present a generic cost model of energy consumption for data gathering queries if a routing tree is used for the query evaluation. We then show the problem to be NP-complete and propose several heuristic algorithms for it. We finally conduct experiments by simulation to evaluate the performance of the proposed algorithms in terms of network lifetime delivered.

III. Conclusion

In this paper introduce GSTEB. Two definitions of network lifetime and two extreme cases of data fusion are proposed. The simulations show that when the data collected by sensors is strongly correlative, GSTEB outperforms LEACH, PEGASIS, TREEPSI and TBC. Because GSTEB is a self-organized protocol, it only absorbs a small amount of energy in each round to change the topography for the purpose of balancing the energy absorptions. All the leaf nodes can transmit data in the same TDMA time slot so that the transmitting delay is short. When lifetime is defined as the time from the start of the network operation to the downfall of the first node in the network, GSTEB prolongs the lifetime by 100% to 300% compared with PEGASUS. In some cases, we are more interested in the lifetime of the last node in the network. Some marginally changes are made to make the performance of GSTEB similar to that of PEDAP. So GSTEB is nearly the optimal solution in Case 1. When the data collected by sensors cannot be fused, GSTEB offers another simple approach to balancing the network load. In fact, it is difficult to distribute the load evenly on all nodes in such a case. Even though GSTEB needs BS to compute the topography, which leads to a rise in energy waste and a longer delay, this kind of energy waste and longer delay are acceptable when compared with the energy consumption and the time delay for data transmitting. Simulation results show that when lifetime is defined as the time from the start of the network operation to the downfall of the first node in the network, GSTEB prolongs the lifetime of the network by more than 100% compared with HEED.

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