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A New Energy Efficient Routing Scheme for Data Gathering

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Abstract: Sensor network consists of low cost battery powered nodes which is limited in power. Hence power efficient methods are needed for data gathering and aggregation in order to achieve prolonged network life. However, there are several energy efficient routing protocols in the literature; quiet of them are centralized approaches, that is low energy conservation. This paper presents a new energy efficient routing scheme for data gathering that combine the property of minimum spanning tree and shortest path tree-based on routing schemes. The efficient routing approach used here is Localized Power-Efficient Data Aggregation Protocols (L-PEDAPs) which is robust and localized. This is based on powerful localized structure, local minimum spanning tree (LMST). The actual routing tree is constructed over this topology. There is also a solution involved for route maintenance procedures that will be executed when a sensor node fails or a new node is added to the network.

Keywords: Power Efficient Protocol, Minimum Spanning Tree, Topology network.

I. INTRODUCTION

Wireless sensor networks are a new technology for collecting data about the natural or built environment. They consist of nodes comprising the appropriate sensors along with computational devices that transmit and receive data wirelessly. The nodes work independently to record environmental conditions. Each cooperates with its neighbours to wirelessly transmit their readings via an ad-hoc network. It is applicable to the locations where communication is difficult, or where it is difficult to provide power to the node.

According to protocol operation ,routing protocols are classified as multipath-based, query-based,negotiation-based Quality of Service (QoS)-based, or coherent based.

In flooding, a node sends out the received data or the management packets to its neighbours by broadcasting, unless a maximum number of hops for that packet are reached or the destination of the packets is arrived.

In Gossiping , nodes can forward the incoming data/packets to randomly selected neighbor node. SPIN avoids the drawbacks of flooding protocols mentioned above by utilizing data negotiation and resource adaptive algorithms.

Directed diffusion is another data dissemination and aggregation protocol. It is a data-centric and application aware routing protocol for WSNs. LEACH is a self-organizing, adaptive clustering-based protocol that uses randomized rotation of cluster-heads to evenly distribute the energy load among the sensor nodes.

PEGASIS (Power-Efficient GAthering in Sensor Information Systems) is a greedy chain-based power efficient algorithm . Also, PEGASIS is based on LEACH . GEAR (Geographical and Energy Aware Routing is a recursive data dissemination protocol WSNs. It uses energy aware and geographically informed neighbor selection heuristics to rout a packet to the targeted region.

II.EXISTING SYSTEM

In [1], *Haibo Zhang and Hong Shen* presented a solution to maximize network lifetime through balancing energy consumption for uniformly deployed data-gathering sensor networks and formulated the energy balancing problem as the problem of optimal allocation of

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transmitting data by combining the ideas of corona-based network division and mixed-routing strategy together with data aggregation. They presented the solutions for balancing energy consumption among nodes both within the same coronas and within different coronas. For that they first propose a localized zone-based routing scheme that guarantees balanced energy consumption among nodes within each corona. We then design an offline centralized algorithm with time complexity O(n) (n is the number of coronas) to solve the transmitting data distribution problem aimed at balancing energy consumption among nodes in different coronas. The approach for computing the optimal number of coronas in terms of maximizing network lifetime is also presented. Based on the mathematical model, an energy-balanced data gathering (EBDG) protocol is designed and the solution for extending EBDG to large-scale data-gathering sensor networks is also presented.

In [2] *Ivan Stojmenovic and Xu Lin* described several localized routing algorithms that try to minimize the total energy per packet and/or lifetime of each node. The proposed routing algorithms are all demand-based and can be augmented with some of the proactive or reactive methods reported in literature to produce the actual protocol. These methods use control messages to update positions of all nodes to maintain efficiency of routing algorithms. These control messages also consume power and the best trade-off for moving nodes is to be established. The focus of this paper was to examine power consumption in case of static networks. The method was tested only on networks with high connectivity and their performance on lower degree networks remains to be investigated. Based on experience with basic methods like GEDIR, improvements in the power routing scheme to increase delivery rates or even to guaranty delivery and are necessary before experiments with moving nodes are justified. Power efficient methods tend to select well positioned neighboring nodes in forwarding the message while the cost efficient method favors nodes with more remaining power. The node movement, in this respect, will certainly assist power aspect of the formula since the movement will cause the change in relative node positioning.

In [3] *Jae-Hwan Chang and Leandros Tassiulas* proposed algorithm which is shortest cost path routing. Information obtained by the monitoring nodes needs to be routed to a set of designated gateway nodes. In these networks, every node is capable of sensing, data processing, and communication, and operates on its limited amount of battery energy consumed mostly in transmission and reception at its radio transceiver. If we assume that the transmitter power level can be adjusted to use the minimum energy required to reach the intended next hop receiver then the energy consumption rate per unit information transmission depends on the choice of the next hop node, i.e., the routing decision. They formulate the routing problem as a linear programming problem, where the objective is to maximize the network lifetime, which is equivalent to the time until the network partition due to battery outage. Two different models are considered for the information-generation processes. One assumes constant rates and the other assumes an arbitrary process. A shortest cost path routing algorithm is proposed which uses link costs that reflect both the communication energy consumption rates and the residual energy levels at the two end nodes. The proposed algorithm is a shortest cost path routing whose link cost is a combination of transmission and reception energy consumption and the residual energy levels at the two end nodes.

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In [4] *Jennifer C. Hou, Lui Sha, and Ning Li* proposed a minimum spanning tree (MST)-based algorithm, called local minimum spanning tree (LMST), for topology control in wireless multihop networks. In this algorithm, each node builds its LMST independently and only keeps on-tree nodes that are one-hop away as its neighbors in the final topology and analytically prove several important properties of LMST such as the topology derived under LMST preserves the network connectivity and the topology can be transformed into one with bidirectional links (without impairing the network connectivity) after removal of all unidirectional links. Results shows that LMST can increase the network capacity as well as reduce the energy consumption.

III.PROPOSED SYSTEM

A special route discovery packet is broadcasted by the sink and when a node receives that packet, it decides its parent according to the information in the packet. After selecting the parent, it rebroadcasts the packet. Three different methods are used to construct tree: first parent path method , nearest minimum hop path method , and shortest weighted path (i.e., least cost) method .

In data information phase, each sensor node periodically senses its nearby environment and generates the data to be sent to the sink. However, before sending it directly to the parent node, it will wait all the data from its child nodes and aggregate the data coming from them together with its own data, and then, send the aggregated data to the parent node. There may be a chance of collision while sending data. So that, by using appropriate ways we can reduce traffic loads.

The tree must be recomputed at specified intervals. Since the computation depends on the remaining energy of nodes, each time the computation takes place and a different and more power-efficient plan is yielded. In our case, we handle this requirement by broadcasting a new ROUTE-DISCOVERY packet with a new sequence ID. Apparently, in order to utilize the power-aware methods, each node must know the remaining energy levels of its neighbors. In order to exchange the remaining energy levels, we use HELLO messages. So, at the beginning of each recomputation phase, the nodes advertise their remaining energy levels. After that, ROUTE-DISCOVERY packet with a new sequence ID can be broadcasted by the sink. Also consider traffic load by using appropriate way.

Each ROUTE-DISCOVERY packet has three fields a sequence ID which is increased when a new discovery is initiated by the sink, an optional distance field which shows the cost of reaching the sink, and an optional neighbor list field which is the list of the neighbors of the sending node in the chosen topology. It holds the minimum number of hops or minimum energy cost to reach the sink, respectively. The neighbor list field must only be used if the LMST topology is chosen. But an important point to mention is that in our approach, since the LMST computation is combined with the route computation, no extra messages are used for negotiation among LMST neighbors.

We compare the comparison of Energy Consumed, Network Lifetime, node lifetime and number of nodes.

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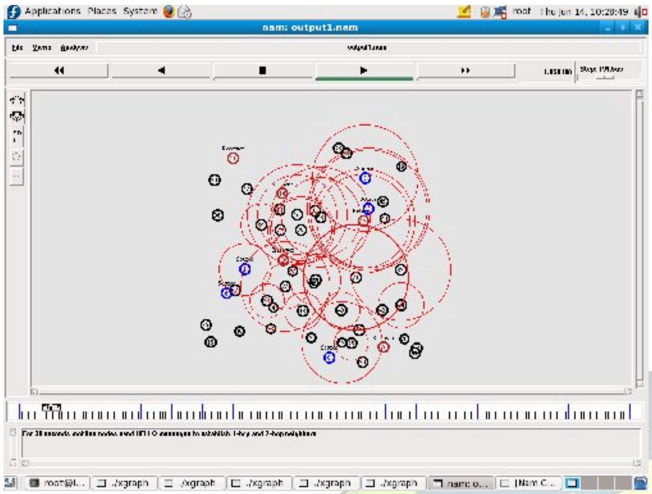

Fig.1. Network coverage

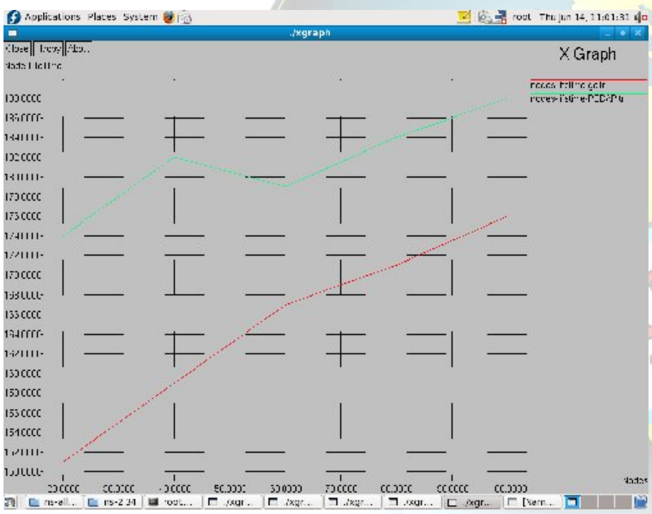

Fig.2. Simulated graph

IV.CONCLUSION

Sensor network consists of low cost battery powered nodes which is limited in power. Hence power efficient methods are needed for data gathering and aggregation in order to achieve prolonged network life. However, there are several energy efficient routing protocols in the literature; quiet of them are centralized approaches, that is low energy conservation. This paper presents a new energy efficient routing scheme for data gathering that combine the property of minimum spanning tree and shortest path tree-based on routing schemes. The efficient routing approach used here is Localized Power-Efficient Data Aggregation Protocols (L-PEDAPs) which is robust and localized. This is based on powerful localized structure, local minimum spanning tree (LMST). The actual routing tree is constructed over this topology. There is also a solution involved for route maintenance procedures that will be executed when a sensor node fails or a new node is added to the network.

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