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Efficient Load Balancing and Extending Lifetime Using Neighbor Coverage Based Self-Organizing Tree-Based Protocol

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ABSTRACT
Wireless Sensor Networks (WSN) also called Wireless Sensor and Actuator Networks (WSAN) are structural distributed self-sufficient sensor to monitor physical or environmental conditions such as temperature, sound, pressure etc...and to cooperatively pass their data through the network to a destination. WSN consists of sensor nodes with finite battery processing capability and limited non-rechargeable battery power. Energy consumption in WSN is a noticeable issue in networks for sing improving network lifetime. It is essential to develop an energy aware routing protocol in WSN to reduce energy consumption for improving network lifetime. While this project addresses the issue of battery power and lifetime of the network. To improve the network lifetime enhanced by Neighbor Coverage Self-Organizing (NCSOTR) tree-based routing protocol through load balancing. NCSOTR algorithm is used to transfer the data from one path to that neighbor path with higher load balance. NCSOTR routing protocol is used to achieve longer network lifetime and reduce the convergence time.
Keywords: - Data Collection Tree, Load Balancing, Network Lifetime, Wireless Sensor Networks, Neighbor Coverage Self-Organizing Routing Protocol.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are enlarge being deployed in a wide variety of applications that range from environmental monitoring to security surveillance, and from event detection to healthcare. Sensor nodes are small battery-powered devices with wireless communication capabilities and very limited resources. They operate unattended, as they may be randomly deployed over the sensing area due to the roughness of the terrain or even the inaccessibility of the physical environment. In most scenarios, sensed data are reported to a data collection point (called *sink*) by organizing the WSN into a *data collection tree.*

Due to the limited energy budget of sensor nodes, energy conservation is one of the most important challenges in WSNs. The commonly adopted energy conservation approaches rely on techniques such as efficient duty cycling, data aggregation, and load balancing. Unlike the first two approaches, schemes based on load balancing explicitly aim to organize the network topology in a way that balances the data forwarding load of sensor nodes.

It has been shown that only a handful of nodes may determine the network lifetime. Since such nodes are responsible for a large share of the total traffic, their energy depletion is extremely critical. This is particularly relevant in application scenarios that mandate reliable collection of all data, such as networked industrial control and cyber-physical systems. Thus, it is of most importance to extend the lifetime of the network by spreading the energy consumption as uniformly as possible. The lifetime of WSNs is defined in different ways in the research literature. Our work addresses lifetime maximization of data collection trees and considers the network lifetime as the time elapsed until the first node in the network depletes all of its energy. This definition is application-independent and, thus, is suitable for diverse scenarios. Accordingly, our work aims at maximizing lifetime by building an energy- efficient data collection tree.

Approaches based on load balancing seek to maximize the network lifetime by creating a *balanced data collection tree*. Such a tree needs not to be static, but can rather be dynamically updated based on the nodes' residual energy. This method poses two major challenges. The first is *scalability*, as load balancing in dense WSNs with a large number of nodes may require significant resources, in terms of both running time and communication overhead. The second challenge is *efficiency*, as dynamic load balancing schemes need to converge to a data collection tree that effectively extends the network lifetime. This paper specifically addresses these challenges by proposing a novel and efficient randomized approach to load balancing in WSNs.

The major contributions of this paper are as follows. First, we propose a novel neighbor coverage routing protocol, called Neighbor Coverage Self-Organizing (NCSO), to extend the network lifetime based on the concept of *bounded balanced* trees. NCSO applies controlled exploration of data collection trees to find the most balanced ones, thus maximizing the network lifetime. Second, we analytically show that NCSO converges with a running time that is significantly lower than that of other approaches to load balancing in WSNs. We also design a distributed version of our proposed technique, called On-Off Scheduling. Through an extensive performance study that includes simulation of large-scale scenarios on a WSN, we also show that the proposed NCSO routing protocol and its distributed version are both scalable and efficient. Specifically, they outperform the existing state of the art in a wide variety of conditions, including diverse traffic patterns and node densities,under different definitions of network lifetime.

II. RELATED WORKS

In [10] Ozlem Durmaz Incel,Amitabha Ghosh,Bhaskar Krishnamachari, and Krishna kant Chintalapudi discussed False data collection in a tree based WSN. The main concept of the scheduling techniques perform for collecting data is used by Time Division Multiple Access(TDMA). In order to guarantee tight-time scheduling and high overall network throughput under high load conditions. TDMA-based MAC protocol, the total time duration of communication is divided into a fixed number of time slots. The algorithm is to construct degree constrained tree and capacitated spanning tree in order to reduce the number of bottleneck nodes for scheduling purposes. The main focus of this algorithm to reduce the schedule length. But the adjacent channel interference cannot always be ignored.

In [4] X.Xu,X.Y.Li,X.Mao,S.Tang and s.Wang introduces Delay efficient algorithm for data aggregation in WSN.In multihop WSN using data aggregation scheduling problem to minimize the delay. The distributed algorithm produces a collision-free schedule for data aggregation in WSN.Data aggregation is critical to the network performance in WSN and aggregation scheduling is a feasible way to improve the quality.one of the issue in distributed scheduling must need fast algorithm in data aggregation to solve the large dense problem.

In [5] J.Liang,J.Wang,J.Cao,J.Chen and M.Lu discover An efficient algorithm for constructing maximum lifetime tree for data gathering without aggregation in WSN. Data gathering is a broad research area in WSN.The lifetime of the network is defined as the time until the first node depletes its energy. A key challenge in data gathering without aggregation is to conserve the energy consumption among nodes so as to maximize the network lifetime. The algorithm can be challenged as to construct a min-max weight spanning tree, in which the bottleneck nodes have the least number of descendants according to their energy. The main issue of the efficient algorithm problem is NP-complete. Another disadvantage of the network topology can change dynamically i.e some nodes die. When they exhaust their energy or are broken, a tree should not be used for a long lifetime.

In [15] D.Luo,X.Zhu,X.Wu and G.Chen introduce Maximizing lifetime for the shortest path aggregation tree in WSN.It can be used to find the shortest path tree with the maximum lifetime in-network aggregation. The advantage of the data aggregation is to find an optimal shortest path tree with the maximum lifetime. One of the main issue when the node density is varied the overhead increase linearly.

In [6] Gaurav S.Kasbekar,Yigal Bejerano and Saswati Sarkar discover Lifetime and coverage guarantees through distributed coordinate-free sensor activation in WSN.The help of this techniques is designed a polynomial-time used by distributed algorithm. One of the significant in distributed algorithm can achieve maximum lifetime. The major disadvantage in distributed algorithm is network lifetime ends once one of the intersection points does not belong to the K-coverage target field.

In [14] SK Kajal Arefin Imon,Adnan Khan,Mario Di Francesco and Sajal K.Das introduce Energy efficient Randomized switching for maximizing lifetime in tree-based WSN.The RaSMaLai algorithm used to extend the lifetime of the network through load balancing. The algorithm can be used to randomly switch some sensor nodes from their original path to other paths with lower loads. The main disadvantage of the algorithm is to increase the convergence time and battery replacement.

III. PROPOSED SYSTEM

A. Neighbor Coverage Based Self-Organizing Routing Protocol

Neighbor coverage based self-organizing routing protocol (NCSOTR) can be used to send the values to the root node (sink).The routing protocol can perform the nodes are chosen through the load balance and the choosing node can transmit the values to the neighbor of the node. It can be used to improve the lifetime of the network and also used for replacement of the battery. When the battery dies then the nodes are the failure so the battery can be replaced.

SYSTEM ARCHITECTURE

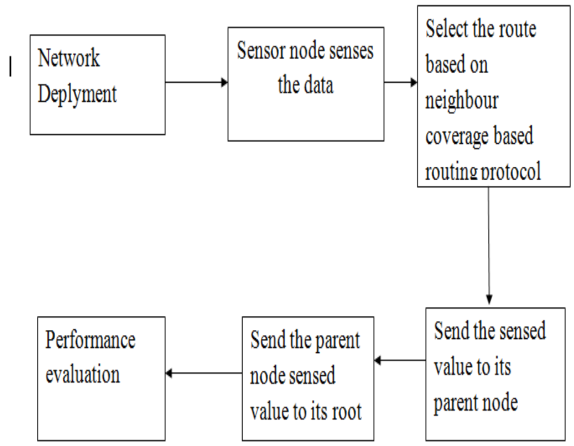


Fig 1 System Architecture

In Fig1 shows to describe first, the nodes can be formed randomly in a tree topology. It can deploy N sensor nodes. Each sensor node senses the data from a child node to root node. Second, the node can be selected by according to the minimum load balancing then it can choose the 315eighbour node for that child node. Then the third step it can senses the value and send to its parent node. Finally, the sensed value can be sent to root node. When all the nodes entered in the sleep state mode. Then it can receive all the values in the receive mode and transmit the response message to all the nodes in the transmit mode.

D. ***Network Deployment Using*** *Tree* ***Topology***

The N sensor nodes are deployed randomly with a tree topology. A set of edges representing the communication between the sensors. The sink node is the final destination. Each sensor node senses the information and transmits their corresponding parent node. Then the parent node sends the information finally to the sink node.

B. Routing Module Using Neighbor Coverage Based Self-Organisation Tree Protocol

The protocol provides near optimal routing path like the reactive routing protocol as well as to maintain the advantage such as n route discovery overhead and little memory consumption for the routing table. NCSOTR enhances the path efficiency by only adding the 1-hop 315eighbour information. NCSOTR exploits the 315eighbour nodes by focusing that there exit the 315eighbour nodes shortcutting the tree routing path in the mesh topology. The routing path selection in NCSOTR is decided by an individual node in a distributed manner and that applies the different routing strategies according to each node status.

C. Data Collection

A data collection round is a process through which the sink collects data from all sensor nodes. Accordingly, the data reception rate of sensor root node is defined as the amount of data receives from its children in a data collection round. Similarly, the data generation rate of a sensor node is the amount of data generated by in a data collection round. The transmission rate is the amount of data transmitted by in a data collection round as well. The energy loss rate of a node indicates the amount of energy that consumes in a data collection round. For all nodes are denote the units of energy consumed for data transmission and reception, respectively.

D. Performance Evaluation

1) Network Lifetime:

The time interval from the start of network operation until the death of the last alive sensor.

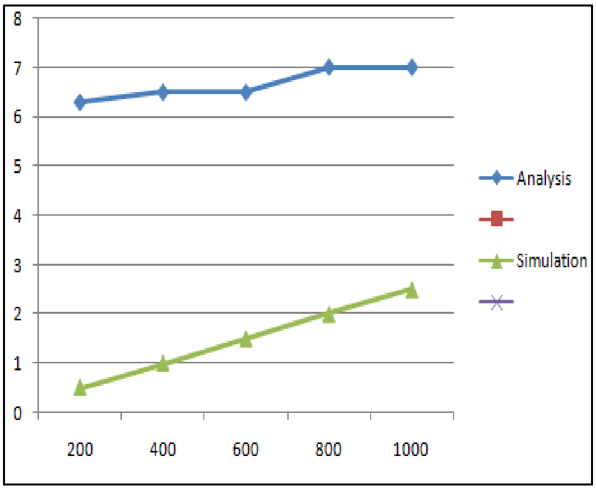
2) Throughput :

It measures the total rate of data sent over the network, including the rate of data sent from child to the parent and the rate of data sent from the nodes to the sink.

3) Packet Drop Ratio:

It measures the robustness of protocol and is calculated by dividing the total number of dropped packets by the total number of transmitted packets.

IV. SIMULATION RESULTS



Number of sensors

Fig:2 Comparison of analysis and simulation

In the above graphs are plotted in X-axis and Y-axis. The X-axis shows that the number of sensors and the Y-axis shows that the number of switches. In the graph represented for analysis and simulation. The analysis will be increased in the network size is large and each node has more neighbors. The increase in the average number of switches becomes almost flat for networks with more than 700 nodes in both scenarios. And the growth rate of the switching is very slow.

ENERGY EXPENDITURE

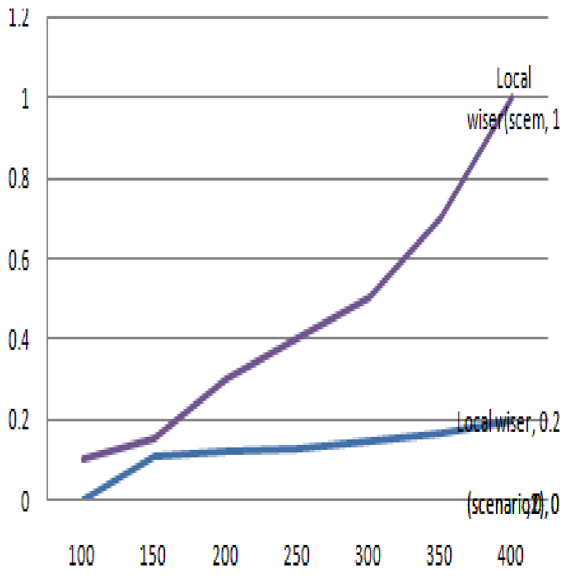


Fig 3: Lifetime of the energy expenditure

In the above graph, the energy expenditure of the routing protocol, i.e, local wiser are scenario1, scenario2.The X-axis represented the number of sensors and the Y-axis represented the energy expenditure. The scenario1 will be increased in the energy power but the scenario2 will be decreased in the energy power.

V. CONCLUSION AND FUTURE WORK

The proposed routing protocol scheme that enhances the network lifetime of WSN. By using the NCSOTR method can be established the battery power. The result of WSN routing scenario supports the effectiveness and performance of the scheme which improves the throughput and packet delivery ratio and slightly increases the overhead. To characterize the switching probability as a function of the different network in order to reduce the convergence time and also slightly decreased the time complexity.

In future work, geography-based secure and efficient Cost-Aware secure routing protocol (CASER) for WSN without relying on flooding. CASER allows messages to be transmitted using two routing strategies, random walking and deterministic routing in the same framework. It has two advantages: (i) It ensures balanced energy consumption of the complete sensor networks so that the lifetime of the WSNs can be maximized.(ii)CASER protocol supports multiple routing schedule based on the routing requirements, including fast message delivery and secures message delivery to prevent routing trace back attacks and malicious traffic jamming attacks in WSNs.

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