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RESEARCH ARTICLE

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MAXIMUM LIFETIME DATA TRANSMISSION BY MITIGATING ENERGY HOLES IN WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless sensor networks (WSN) have got vast variety of applications in many fields. Many challenges are faced due to the limitation of energy in the sensor nodes since they are battery-powered. This causes problems in routing WSNs, hence developing secure and energy-efficient routing algorithm to guard WSNs and efficiently utilizing the energy of the deployed nodes has become essential. Energy efficiency and sensing coverage are essential metrics for enhancing the lifetime and the utilization of wireless sensor networks. This work deals with power saving scheme more efficiently with corresponding algorithm. One approach to address this challenge is to form a hybrid moving pattern in which a mobile-sink node only visits rendezvous points (RPs) by using weighted rendezvous planning (WRP) algorithm. The fundamental problem in this approach includes data with different delay requirements. Identifying this delay problem and to increase the network life time another approach that is proposed in which multiple mobile sinks are used. This means a mobile sink is required to visit some sensor nodes or parts of a WSN more frequently than others while ensuring the minimization of energy used, and every data are collected within a given deadline. During the data collection technique in mobile sink sensor networks, security is an important factor. Here secure data collection method used with the mobile sink is based on symmetric key cryptography. A wide area network is partitioned into smaller areas where each area is assigned a mobile sink; WRP can be thus run in each area. Experimental result of proposed system provides better reduction of energy consumption than with the existing system.

Keywords— Data collection, mobile sink, scheduling, wireless sensor networks (WSNs).

INTRODUCTION

Wireless sensor networks (WSNs) are highly distributed networks deployed of large number of small, light weight nodes. The sensor nodes have the capabilities like sensing, data processing and communication. Recent applications in wireless sensor networks include target tracking, military applications and also used in measurement of physical parameters like temperature, pressure or relative humidity. In multihop communications, nodes that are near a sink tend to become congested as they are responsible for forwarding data from nodes that are farther away. Thus, the closer a sensor node is to a sink more energy is consumed whereas those farther away may maintain more than 90% of their initial energy. In multi-hop wireless sensor networks (WSNs), each sensor node has the duty to process its own surrounding environment as well as transmitting the packets received from other nodes; therefore, if some part of the sensor nodes is destroyed due to energy depletion it might be disconnected from other nodes causing the network to stop working. Consequently, energy maintenance and management plays a significant role in consistency of these networks. As a result, the sink becomes disconnected from other nodes, thereby impairing the WSN. Hence, conservation of energy problem may be crucial factor for many sensor networks consisting of of sensor devices where battery replacement is very costly or sometimes it become not possible for many cases such as in the battle field monitoring, building maintenance etc. Inorder to continue the network operation for long duration common design considerations must be focused using a form of energy efficient method. In several studies the mobile sink is used for reducing energy consumption. Their benefits depends on the path that is taken by the mobile sink in the delay sensitive applications in which all sensed data must be collected within a given time constraint. A distributed and network assisted sink navigation framework is to balance energy consumption and collection delay by choosing appropriate number of multiple hops. In a distributed and localized solution to decide sinks movements when the movement paths are not predetermined in WSNs supporting multihop communication. With the help of shortest path tree and Rendezvous Based Data Collection methods collect the efficient data and also use the methods of sink mobility to collect the data. A hybrid moving pattern is followed by the mobile sink as it visits the Rendezvous Points (RPs).

A mobile sink moves at the periphery of a sensor field according to an algorithm called weighted Rendezvous Planning (WRP) algorithm. By this method some nodes or part of WSN are not frequently visited due to the inefficient communication and hence network lifetime get reduced. To deal with this problem, a system is proposed with multiple mobile sink nodes in the wide area network. The data to be collected is at a rate that exceeds the storage capacity of the node during the expected battery lifetime of the unit, then the node must be retrieved prior to full battery expenditure or the data must be transmitted to another location. The traveling path of a mobile sink depends on the real- time requirement of data produced by nodes. For example, in real-time applications such as a fire-detection system, environmental data should be collected by a mobile sink quickly. A mobile-sink node may change its position after a certain period of time and select another data collection. In general, limitations such as the maximum number of feasible sites, maximum distance between feasible sites, and minimum sojourn time govern the movement of a mobile sink. Existing method used weighted rendezvous planning (WRP) which is a novel algorithm for controlling the movement of a mobile sink in a WSN. This method focuses on a single mobile sink or source. This leads to inefficient communication, reducing the network lifetime. Because of this problem, some nodes or parts of WSN are not frequently visited. To deal with this problem, the proposed system uses multiple mobile sinks for enhancing energy efficiency under different scale networks. In this WSN is partitioned into smaller areas, where each area is allotted with a mobile sink. Experimental result of proposed system achieves better reduction of energy consumption than with the existing system.

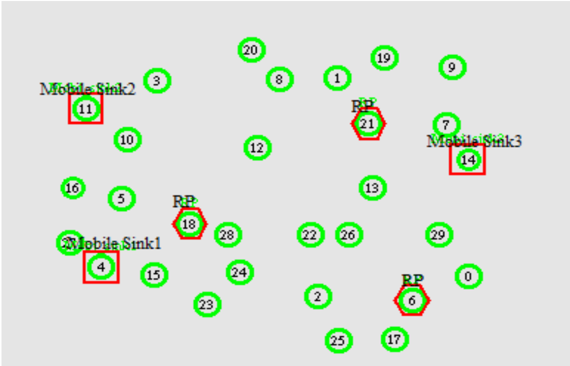

Fig 1. Multiple Mobile sink performing data collection

LITERATURE REVIEW

Energy storage in wireless sensor systems is mainly investigated from 3 aspects: first, using labor-saving hardware pieces particularly in transmitter–receiver block ,second, benefiting from energy-effective algorithm and protocols in software section of the network to take advantage of a balanced energy consumption pattern in all network nodes; otherwise, some parts of the network would dissipate energy sooner than others, and if this part is located in crucial zone the network stops working before the time assigned even if most of the network nodes have high levels of energy. The received data by the nodes of wireless sensor networks (WSNs) should be sent to the sink (base station) for performing calculations and taking the right decisions. The density of data packets near the sink increases due to this, hence the energy of nearby nodes gets depleted more rapidly. This phenomenon is called "Energy-Hole".

Sensor nodes usually have limited energy supply and they are impractical to recharge. The traffic load in sensors is to be balanced in order to increase network lifetime has become a very challenging research issue. For this many algorithms have been proposed recently for wireless sensor networks (WSNs). In the way the sensor networks with one sink nodes that are fixed will often suffer from a hot spots problem since nodes near sinks have got more traffic burden to forward during a multi-hop transmission process. The mobile sink has been used that shows an effective technique to enhance network performance features such as delay, energy efficiency, network lifetime, etc. Stable Election Protocol (SEP), which employs a mobile sink for WSNs with distributing non-uniform node. The selection of cluster heads are decided by the sink is based on the minimization of the associated additional energy and residual energy at each node. The cluster head always selects the shortest path to reach the sink between the direct approach and the indirect approach with the use of the nearest cluster head.

PROBLEM FORMULATION

The work is based on providing secure energy efficient data collection with mobile sink. So that data can be collected in a secure manner and prolong network lifetime. In WSNs sensor nodes are usually placed in hostile and unattended environment where one can read and modify the content of the data packets are transmitted by them. In such a situation many attacks are possible so the node needs to be authenticated before data transmission takes place. Network lifetime is also an important issue in sensor networks. At the time of attacking the node; network does not try to read and modify the packet and if data is read and modified then packets get edited and wrong data will be received by the sink. Due to this problem the authentication of node is essential before data transmission. The concept of mobile sink is used here to prolong network lifetime and overcome the sink neighborhood problem. In mobile sink sensor networks, sink travels over the network to collect data. A protocol is used for critical data transmission and which is the secure protocol to avoid the attack and node authentication is done during data transmission. Securely datas are collected from network and critical data transmission to mobile sink in the sensor networks. Accordingly the objectives are listed follows:

- Energy efficient data collection method
- Secure Protocol for data transmission
- Symmetric key based secure communication

In Wireless Sensor Networks throughput is the average rate of successful message delivery over communication radio. This data will be delivered by the physical or logical link, or passed through certain network nodes. The network throughput is usually calculated in bits per second (bps), and sometimes in data packets per second or data packets per time slot. Lossy links do have significant impact on the maximum achievable throughput. There are some cases, where a network can achieve half of the through put of the corresponding lossless network. Lossy links also affects energy efficiency. Lossy network can only achieve half of the throughput when links are lossless. The life time of sensor network depends on the operation time of individual sensor nodes. Lifetime of wireless sensor networks ends when first node dies in the network A multiple-sink model is proposed for reducing the problem of energy hole via increasing the number of nodes in the network where selection is totally random and dynamic in this approach therefore it may happen with more number of nodes. It consumed more energy in data transmission to base station.

WEIGHTED RENDEZVOUS PLANNING

The mobile sink trajectory and the set of RPs that optimize the energy consumption of sensor nodes are determined using the Weighted Rendezvous planning algorithm (WRP). WRP preferentially designates sensor nodes with the highest weight and assigned as RP. The sensor node with its weight is calculated by multiplying the number of packets that is forwarded by its hop distance to the closest RP on the tour. Thus, the weight of sensor node i can be calculated as

Wi = NFD(i)×H(i,M)

WRP that enables the mobile sink to retrieve all data from RPs within a given deadline by optimizing the energy consumed by sensor nodes. Based on this, sensor nodes that are one hop away from an RP and have one data packet buffered get the minimum weight. Hence, higher priority for assigning as an RP is based on sensor nodes those are farther away from the selected RPs or those have more than one packet in their buffer.

EVALUATION AND PERFORMANCE

The proposed system approach is implemented in WSN with a particular dimension. The total number of sensor nodes used is 30. Over the sensing field the sensor nodes are randomly distributed. The sensor nodes are selected in between the dimension of 0 and 29. The mobile sink is situated outside the sensing field. The energy of the sensor node at the initial stage is set to be 100J. The performance of the proposed system is estimated by the key indicators energy consumption and network lifetime. The planned algorithm makes it possible that multiple neighboring users able to switch to the same channel. The coordination of the multiple users should be acclimated to make connect the users in various time slots. The trade-off between the relay hop count of sensors for natural information gather and the peregrinate length of the mobile information should be quantified. We have a proclivity to orchestrate a polling-predicated theme and relinquish much sensible results. In depth simulations are distributed to validate the potency of the system. The objective is to minimize energy consumption by reducing multihop transmissions from sensor nodes to RPs. This also limits the number of RPs such that the resulting tour does not exceed the required deadline of data packets. Here an enhanced WRP, which is a heuristic method is proposed that finds a near-optimal traveling tour that minimizes the energy consumption of sensor nodes.

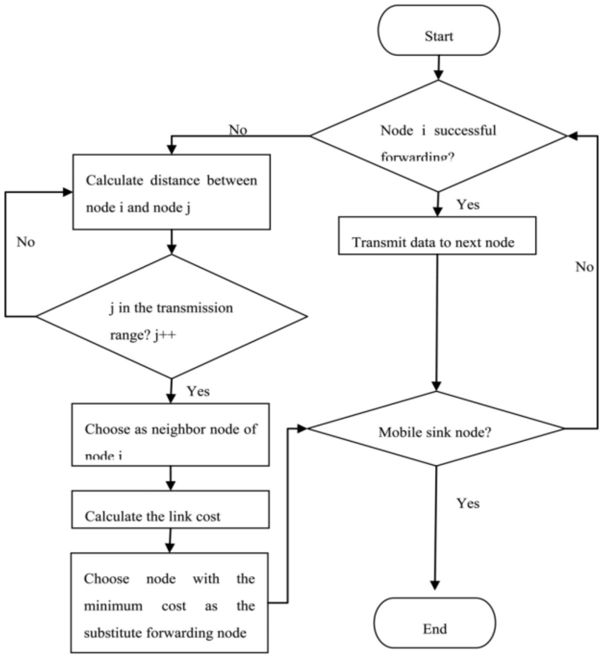

Fig 2. WRP Algorithm

Table 5.1 Simulation parameters

Parameter	Value
Maximum allowed packet delay (D)	100 to 300 seconds
Number of sensor nodes (n)	30
Mobile sink speed (v)	1m/s
Sensor nodes transmission range	20m
Simulation time	50sec
Packet length (b)	1000
Consumed energy in transmitter circuit	42mW
Consumed energy at the receiver circuit	29mW

Apart from that, we have also considered visiting virtual nodes to take advantage of wireless coverage. Our results, which are obtained via computer simulation reduces the energy consumption of tested WSNs by 22%. We also benchmarked WRP against existing schemes in terms of the difference between sensor- node energy consumption that plan to enhance the approach to include data with different delay requirements. By adopting this technique, network lifetime and energy consumption can be ensured. In the proposed system the WRP algorithm is well designed with CHs located in a geographically uniform way, energy consumption is well balanced and reduced, causing a much protracted network lifetime. In many clustering algorithms, some sensor nodes in the same cluster send data directly to the cluster head. At end, performance of the proposed system is analyzed and evaluated with the subsisting system of work. Graph has being recorded from simulations are done, hence it is seen that the consumption of energy is well balanced and reduced by utilizing Multi- sink nodes.

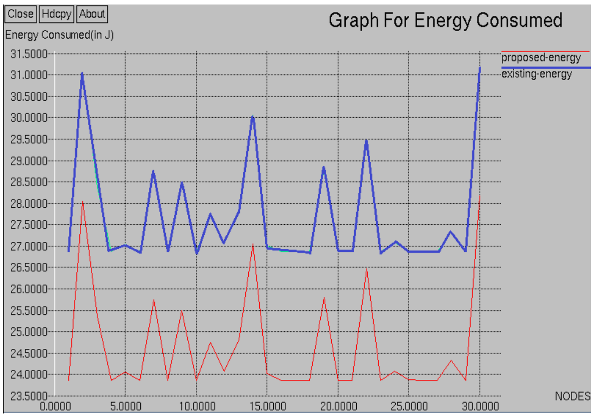

Fig 3. Graph for Energy Consumed

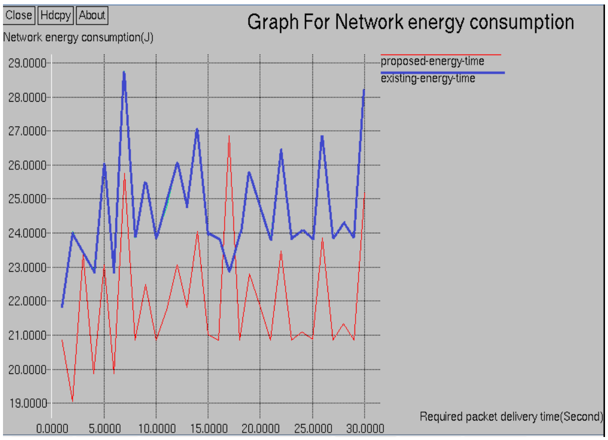

Fig 4. Graph for network energy consumption

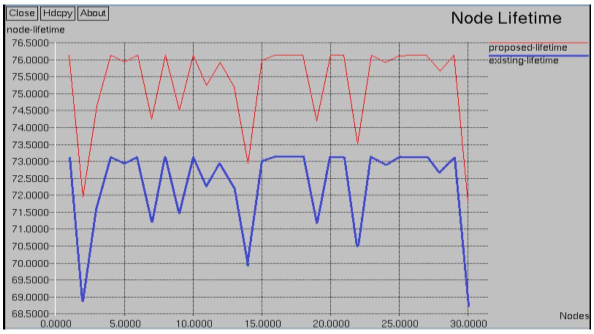

Fig 5. Graph for Node lifetime Vs Nodes

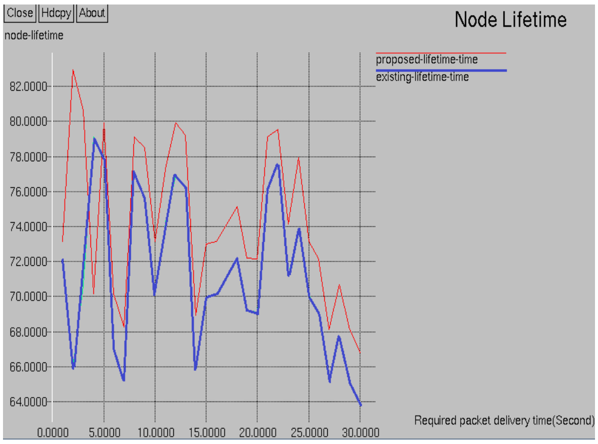

Fig 6. Graph for Node lifetime Vs Packet delivery time

CONCLUSION

In our algorithm we provide security and energy efficiency method for data collection. There are several static methods are available for this which uses different approaches to provide security in resource limited wireless sensor networks. A new mechanism is proposed for secure data collection that is able to avoid external attack and authenticate the node during the data collection process. WRP algorithm is used here for controlling the movement of a mobile sink in a WSN and it is partitioned into smaller areas where each area is assigned a mobile sink and WRP is applied in each area. Energy consumption is reduced here so that data from different nodes are delivered within a given deadline. Secure data collection is proposed that uses a new approach of one hop communication and node authentication based on secure energy efficient algorithms for sensor networks. Simulated the proposed model and compared with the existing system. Communication between sensor nodes and the sink is secured as the sensor data is encrypted using asymmetric key cryptography. At end, performance of the proposed system is analyzed and evaluated with the existing work. Energy consumption is well balanced and reduced by utilizing multiple mobile sink. To effectively organize and manage sensor nodes further it's required to study how to combine clustering technology with sink mobility technology.

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