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A Network Lifetime Enhancement using Multi Heuristic Algorithm in WSN

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Abstract - In wireless sensor network, the power resource conservation of sensors are limited so to extend the network lifetime of the WSN as long as possible while performing the sensing and sensed data reporting task, this is mainly serious problem in the network design. A sensor node delivers the sensed data back to the sink via multi-hopping method. The existing EASR method to enhance the large scale networks for avoiding the drawback of sensor nodes sending additional info about their residual energy, due to this more energy will be lost. Multi-sink heuristic algorithm has been extended to move the sinks in order to improve the lifetime of large scale sensor networks. Each sink knows its own position, others sinks positions and the locations of all the sensors. From the number of hops to reach the nearest sink, it is possible to estimate which sensors are distant and may have more residual energy. The sink knows its residual energy so it calculates the nearest hop count, after the calculation minimum hop count location will relocate the sink.

Keywords- Wireless Sensor Networks (WSN), Multi-sink heuristic, Energy aware sink relocation, Sensor.

I.INTRODUCTION

A wireless sensor network (WSN**)** defines spatially distributed autonomous sensors to monitor physical cooperatively pass their data through the network to a major position. The enlargement of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as business process monitor and control, mechanism of strength monitor. InWSN 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 the size of a grain of dust, although functioning "motes"(demo video) of genuine microscopic dimensions have yet to be created. has typically several parts: a radio transceiver with an internal antenna. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning of genuine microscopic dimensions have yet to be created.

Sensor nodes are distributed in a sensor field to observe a phenomenon of interest (i.e., environment, vehicle, object, etc.). Sensor nodes in the sensor field form an ad hoc wireless network and transmit the sensed information (data or statistics) gathered via attached sensors about the observed phenomenon to a base station or sink node. The sink node relays the composed data to the remote requester (user) via an arbitrary computer communication network such as a gateway and associated contact network. while unusual applications require special communication network infrastructures to efficiently transfer sensed data, WSN designers can optimize the communication architecture by determining the appropriate topology (number and distribution of sensors within the WSN) and communication infrastructure (e.g., gateway nodes) to meet the application's requirements. An infrastructure-level optimization called bridging facilitates the transfer of sensed data to remote requesters residing at different locations by connecting the WSN to external networks.

II.RELATED WORK

Wireless sensor network survey has suggested that a wireless sensor network (WSN) has important applications such as remote environmental monitoring and target tracking. It has been enabled by the accessibility, particularly in modern existence, of sensors that are less important, cheaper, and intellectual. These sensors are operational with wireless interfaces with which they can communicate with one another to form a network. The intend of a WSN depends extensively on the appliance, and it necessity consider factors such as the position, the application's propose objectives, and cost, hardware, and system constraints.

Current Trends in Wireless Sensor Network Design [1] has suggested that self-organizing nature of sensor networks, their independent procedure and probable architectural alternatives make them suitable for different data-centric applications. Their wider recognition seems to be increasing on the horizon. To present an overview of the current state of the art in the field of wireless sensor networks and various open research issues and provide an insight about the latest developments that need to be explored in greater depth that could possibly make this emerging technological area more useful than ever.

A Distributed Coverage- and Connectivity- Centric Technique for Selecting Active Nodes in Wireless Sensor Network [2] have suggested an efficient technique for the selection of active sensor nodes in dense sensor networks. The active node variety method is designed at providing the highest possible coverage of the sensor field, i.e., the inspection region. It also assures network connectivity for routing and information dissemination. To first show that the coverage-centric active nodes selection problem is NP-complete and to present a distributed approach based on the concept of a connected dominating set (CDS). Prove that the set of active nodes selected by our approach provides full coverage and connectivity and also describe an optimal coverage-centric centralized approach based on integer linear programming.

A Node Scheduling Scheme for Energy Conservation in Large Wireless Sensor Networks [3] has suggested in wireless sensor networks. The main design challenges are to obtain long system lifetime without scarifying system original performances (sensing coverage and sensing reliability. Provide enough sensing reliability in many applications. It can reduce system overall energy consumption, therefore increasing system lifetime, by identifying redundant nodes in respect of sensing coverage.

Efficient Algorithms for Maximum Lifetime Data Gathering and Aggregation in Wireless Sensor Networks [4] has suggested that consider a network of energy constrained sensors that are deployed over a region. Each sensor periodically produces information as it monitors its vicinity. The basic operation in such a network is the systematic gathering and transmission of sensed data to a base station for further processing. During data gathering, sensors have the ability to perform in network aggregation (fusion) of data packets en route to the base station. The lifetime of such a sensor system is the time during which we can gather information from all the sensors to the base station. A key challenge in data gathering is to maximize the system lifetime, given the energy constraints of the sensors. The severe energy constraints and limited computing resources of the sensors, present major challenges for such a vision to become a reality and to take advantage of the fact that the base{station is aware of the locations of the sensors and have sufficient processing capabilities to compute efficient data gathering schedule(s) for the sensors.

III.MULTI-SINK HEURISTIC ALGORITHM

Multi-sink relocation method overcomes the single sink relocation method. The multi-sink heuristic algorithm has been delivered best way to move the sinks in order to improve the lifetime of large scale sensor networks. The approach is based on number of hops and consists in relocating periodically the sinks towards the distant nodes. The difference between strategy and what was already proposed is that there is no need for the sensors to drain their energy in sending additional information about their energy level. Each sink knows its own position, others sinks positions and the locations of all the sensors. There is no need for the sensors to drain their energy in sending additional information about their energy level. Each sink knows its own position, others sinks positions and the locations of all the sensors. Therefore, from the number of hops to reach the nearest sink, it is possible to guess which sensors are distant and may have more residual energy. Consider a network of energy constrained sensors that are deployed over a region. Each sensor periodically produces information as it monitors its vicinity. The basic operation in such a network is the systematic gathering and transmission of sensed data to a base station for further processing. During data gathering, sensors have the ability to perform in network aggregation (fusion) of data packets en route to the base station. The lifetime of such a sensor system is the time during which we can gather information from all the sensors to the base station. A key challenge in data gathering is to maximize the system lifetime, given the energy constraints of the sensors

A. ***Node deployment***

In order to deploy sensors and sinks inside buildings and the following assumptions for the network model. To assume N static sensors located in a square grid (LxL) with cells of the same size. All sensors have a limited initial energy $e0$ (J) and a fixed transmission range r (m) equal to the distance between two nodes (i.e, cell size). A time-driven application is considered where each sensor regularly generates the same amount of data gr (bit/s). M sinks keep moving in the grid from one node to another one until the network lifetime end. The network lifetime is defined as the time until the first sensor dies (i.e, it uses up its residual energy). The sinks should stay at a certain location for at least duration of time T (sojourn time). At the end of this duration, they can change their locations.

B. ***Path Selection***

The traveling time of sinks between sensor nodes is considered negligible for analytical simplicity. The sensor nodes which are not co-located with any sinks inside the grid relay their generated data via multiple hops to reach the nearest sink using the shortest path routing protocol. In routing protocol, only the two paths along the perimeter of the rectangle, i.e., paths 1 and 2. These two routes are considered equivalent. An ideal MAC layer with no collisions and retransmissions is assumed. Only the energy consumption for communication is considered. Let eT (J/bit) be the energy consumption coefficient for transmitting one bit and eR (J/bit) be the energy consumption coefficient for receiving one bit.

C. ***Sink Selection***

The sinks are placed at their optimal locations in terms of hop counts. Then, for each sensor, the number of hops to reach the nearest sink is computed. Next, the nodes are sorted with decreasing number of hops in order to determine the distant nodes from the sinks. Afterwards, the first sink will be relocated at the farthest node. The second sink will be relocated at the following distant node but respecting the condition that the number of hops between the two new locations must be upper than minimum number of hops minhop. The third sink is relocated with the same manner in such way the distance between the three new positions of sinks is upper than minhop. The remaining sinks are relocated with the same way. All the chosen positions of sinks at each period are saved in a list. In the case that the selected positions of sinks where already chosen in previous periods, the algorithm chooses as the first sink location a node which has not been chosen before and determines the locations of the other sinks. If all sensor nodes where already visited by the sinks, the chosen list is emptied. The same operations are repeated at the beginning of each new period T.

*D. **Network Lifetime***

The efficiency of that proposed scheme, to evaluated its performances by making a comparative study with four other schemes. The following schemes were implemented:

1) Static: Static sinks placed in optimal locations
2) Periphery: Sinks moving in the periphery of the network
3) Random: Sinks moving randomly
4) Hop: Sinks moving according to our algorithm
5) Opt: Sinks moving according to ILP solution

Improve the network lifetime when the number of sinks increases. Because, using more sinks reduces the average path length between the sensors and sinks and enables to achieve less traffic load to the nodes which extends the network lifetime. Nevertheless, the Hop scheme leads to longer network lifetime than all other schemes.

*E. **The Energy Distribution***

The nodes neighboring the sinks locations have relatively higher energy consumption compared to most of the others because they have to receive and relay all other neighbors' data in addition to their own data and leads them to consume more energy. The higher percentage of energy consumption is concentrated around three nodes in the grid which are the locations of the sinks whereas the others sensors have a lower amount of energy consumption. When the sinks move on the periphery of the network the highest energy consumption occurs in nodes closest to the boundary of the network while the others nodes especially in the center consume less energy.

V. RESULT AND DISCUSSIONS

In order to investigate the performance of the EASR scheme, conducted several simulations in four different scenarios which will be described later. The compared methods are the EASR, One-Step Moving scheme and the stationary sink scheme. The stationary sink scheme assumes that the sink is not capable of moving and remains stationary at all times. In the simulations, the proposed method and the other two compared methods all adopt the MCP routing protocol as the underlying routing for message reporting.

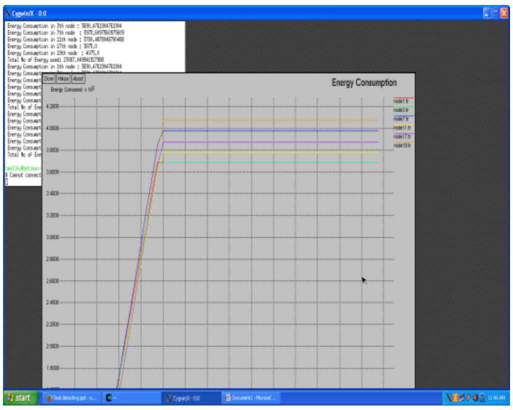

Fig 1.1 Energy consumption

The comparison factor is the network lifetime of a WSN, for which the network lifetime is defined to be the number of message reporting rounds performed before the first sensor node drains out its battery energy. The simulation environment settings are as follows. Assume that the sensor nodes are all stationary after the deployment, but the sink is capable of moving except for the stationary sink scheme. The transmission range of the sensor nodes and the sink are fixed for the One-step Moving scheme and the stationary sink scheme, while the transmission range is tunable in the EASR method. The energy depletion during the execution of the message reporting is according to the first order radio model and the resulting network lifetime performance of algorithms by varying the number of sensor nodes, the initial battery energy of the sensor nodes, the size of the simulation areas, and the transmission ranges, respectively. In each simulation instance, conducted the experiment 100 times and then took the average value of the comparison factor (the network lifetime)

VI. CONCLUSION

Planned a competent result to enlarge the lifetime of large scale WSNs. The proposed heuristic algorithm regularly moves the sinks towards the distant nodes, based on number of hops, prevents from sending additional information about the energy level of each sensor and evaluated the performance of our algorithm by simulation in a network with thousands of sensors and compared it with others schemes: Static, Periphery, Random and Opt. The results show that it extends significantly the lifetime of the network and balances notably the energy consumption among the nodes. The major goal is to enlarge the network lifetime and the upcoming exertion is to develop the protocol as well as compare it with other routing protocols used in the wireless sensor network.

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