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Analysis of Various Autonomous Sink Relocation Mechanisms for Wireless Sensor Networks based on Node Density for Improving Network Lifetime

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Abstract: Wireless Sensor Networks are used to monitor physical or Environmental conditions like Temperature, Pressure, sounds etc...Increasing the lifetime of Wireless sensor network is a major challenge because the nodes are provided with low battery energy [1, 2, 3, 4, and 5]. Energy is a critical resource parameter in Wireless Sensor Network. Utilizing energy in an efficient manner is an essential task in Wireless Sensor Network. To conserve the limited power resources of sensors and to extend the network life time of the WSN as long as possible is the most critical issue addressed in the recent researches, while performing the sensing and sensed data reporting tasks, in the network design. The sensor readings have to be collected from sensor nodes to one or more data collection sites (sinks) via multihopping. The sensor nodes near the sink will consume the more battery power rather than others; accordingly these nodes (hot spot) quickly drain out their battery energy and shorten the life time of Network. Sink relocation is an efficient network lifetime extension method, which avoids consuming too much of battery energy level for sensor nodes. This paper analyses the energy conservation of battery energy level for various autonomous relocating sink mechanism.

Keywords: Wireless sensor networks, mobile sink and Sink relocation, autonomous sink, Node Density.

I. INTRODUCTION

A group of sensor nodes forms as a network to sense few physical parameters in the sensing field where they deployed is called as Wireless Sensor Network(WSN),these sensed data have to be reported to the centralized node(SINK) from which the data can be utilized by the user. The communication link between centralized node and the user will be based on a structured network such as internet; on the other hand communication between wireless sensor network and centralized node will be Adhoc in nature. Usually these networks are data centric type of network rather than network centric, since each data sensed are essential and significant. In general WSN's are energy starving, resource constraint network. It needs certain features such as resilience, mobility, heterogeneity and scalability. This paper concentrates on the flat network architecture, in which all the nodes play the same role and self organised as a network. Since it is large in number individual identifier would not be apt which this leads to data centric nature of network. Usually the node nearer to the sink will drain out earlier (Hotspot) and leads the network failure [e.g.2, 3, 4 and 5]. The best way to overcome this short come is to relocate tm ,m m he sink from one place to another place using an algorithm. The relocation of the sink can be done in two different ways either by pre defined path or autonomous movement. This paper analyses the network life time for various sink relocation mechanisms based on node density.

II. SCENARIO AND RELATED WORKS

a. **Related works:** Network lifetime is the very promising parameter that endorses the metric of the WSN. Increase in node density reduces the Lifetime in the static network, but in dynamic network, moving scheme consumes energy which reflects in the lifetime. This paper presents comparison of autonomous moving schemes in the perspective of node density, transmission range and simulation area against network lifetime.

b. **Simulation Setup:** The wireless sensor network is formed in NS2 version 2.28 with planned routing that adheres with 802.15.4 standard and appropriate MAC layers. The positions of the each node are pre determined and the network formed is flat type architecture. The deployment of this network is assumed to be uniformly distributed.

III. AUTONOMOUS MOVING SCHEMES

a. **HUMS – Half-quadrant-based-moving strategy [4]:** In HUMS strategy, the sink moves proactively in the direction of the node that has the maximum residual battery energy to balance energy consumption among all sensor nodes. To make moving assessments with HUMS, the energy mower needs each data packet reported by the sensor contain two collections of information in addition sensed data: one consists of the residual energy of the sensor node and the position of the sensor node that has the highest residual battery energy among the nodes practiced by the packet, and the other is composed of the residual battery energy and the position of the node that has the lowest residual battery energy among the nodes practiced by the packet. Sensor nodes on the transmission path of the reported data packet can update the information of either of the two collections according to the comparison results between their own residual battery energy and that recorded in the data packet. If their residual energy is greater than the record of the highest energy in the first collection, they will swap the position and energy information in the first collection with their own. Similarly, if their residual energy is lower than the record of the lowest energy then they will replace the information in the second collection.

b. **One Step [3]:** The One-step Moving Scheme initially evaluate a position for the destination of moving, which can be found by the total residual battery energy of the sensor nodes in the network. When a moving destination is found, the One-step moving scheme will drive the sink to directly move to the destination regardless of the distance. Hence, the sink will move into the transmission range of the Moving Destination to force it to spend much energy on sending data for other nodes, which is advantageous to balance the energy consumption among all the sensor nodes.

c. **Multistep [2]:** The Multistep autonomous scheme initially evaluate a position for the destination of moving, which can be found by the total residual battery energy of the sensor nodes in the network. When a moving destination is found, In the Multi-step moving scheme the sink will move its position iteratively from one intermediary moving destination to the other, and the distance of each moving step will be bounded to the transmission range of the sink. In the multistep moving scheme, the sink decides its moving direction according to the Moving Destination node, the location and the energy information of its neighbor nodes within two hops. Therefore, the multi-step moving scheme does not require the data packets to carry the information of the nodes with the lowest residual energy.

d. **EASR [5]:** Energy Aware Sink Relocation mechanism uses a new scalable multi-sink heuristic algorithm (Hop) which regularly moves the sinks towards the distant nodes and may have more residual energy. Based on this, the proposed mechanism will adaptively adjust the transmission range of sensor nodes and the relocating scheme for the sink in accordance. The proposed method will adapt maximum capacity path (MCP) [4, 5,] routing protocol is used to identify the maximum capacity path with respect to each sensor nodes neighbor of the sink. For each maximum capacity path maximum capacity value is identified. If maximum capacity value falls below a threshold value, then Sink relocation will occur. This technique guide the sink when and where to move to. Therefore for the reduction of energy consumption of nodes, this approach trades data delivery latency.

IV. RESULTS AND DISCUSSION

a. Numerical analysis

Number of Node with Network Lifetime - The Number of nodes with network lifetime parameters are involved in four mechanisms, i.e. Multi step, one step, HUMS and EASR, these are compared and values are tabulated in the table. the starting count of number nodes 50 to 250 common for four mechanisms, the first Multistep and one step network lifetime is increased 97500 to 100000(s) with number nodes 50 and 100 to 150 nodes network lifetime is decreased, In HUMS network lifetime is zero when nodes counting started at 50, again 100 to 150 nodes the network life is increased 75000(s),in EASR methods using the same number of nodes but network lifetime performance is average 40000 to 45000(s). the HUMS an d EASR mechanism there is no decrement in network lifetime and multi and One-step is best from EASR and HUMS. Increasing the Node density with network life, each mechanism given averaged network lifetime.

Table: IV.1

No of Node	**Network Lifetime**			
	Multistep	***One-step***	***HUMS***	***EASR***
50	97500	100000	0	40000
100	81000	87500	75000	39000
150	82500	88000	62000	41000
200	72000	70000	61000	43000
250	71000	72500	60000	45000

Network Lifetime with Number Nodes

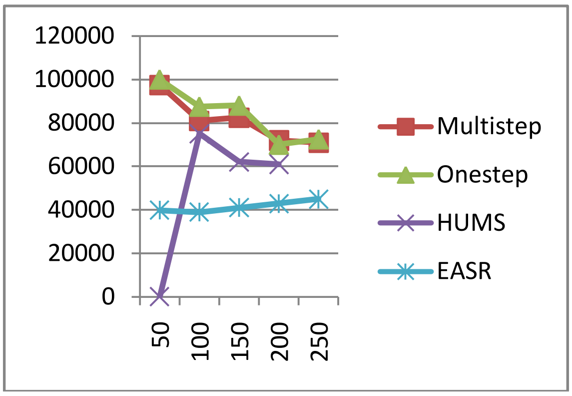

Figure: IV.1 Number of Nodes

Transmission range (m) with Network Lifetime - The transmission range with network lifetime parameters are involved in Three mechanism, i.e. Multi step, one step and EASR, these are compared and values are tabulated in the table, the starting transmission range is 20(m) common for three mechanisms, the first multi step and EASR is increased 650000 to 1152000 (rounds) in One step methods there is no change, the transmission range is 25(m) network lifetime is decreased for multi step and EASR methods and ones step is increased 66000 to 680000. The one step scheme is given the better performance from other two methods.

Table: IV.2

Trans. Range	Network Lifetime		
	Multistep	onestep	EASR
20	650000	66000	1152000
25	62000	680000	136800
30	730000	750000	1728000
35	69000	800000	2088000

Transmission range (m) Vs Network Lifetime

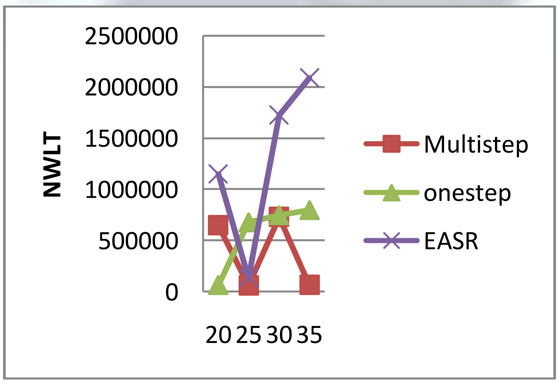

Figure: IV.2 Transmission range (m)

Simulation Area (m) with Network Lifetime - The simulation area with network lifetime parameters are involved in four mechanism, i.e. HUMS,EASR, one step and multistep, these are compared and values are tabulated in the the simulation area range from 100 to 250 meters for all four mechanism, In one step and multistep the simulation area 100 to 150(m) with the network lifetime is 250000 to 270000 (r),the HUMS 150 to 200(m) network lifetime is 110000 to 850000(r) increased, again its decreased. Another EASR the simulation area 100 to 150(m) with the network lifetime is

35000 to 31000(r). Here one-step, HUMS methods are decreased and multistep and EASR are maintained the normal network lifetime from other two mechanism.

Table: IV.3

Sim.A(m)	Network Lifetime			
	HUMS	**EASR**	**Onestep**	**Multistep**
100	120000	350000	250000	180000
150	110000	300000	270000	150000
200	850000	330000	220000	130000
250	500000	310000	220000	100000

Network Lifetime Vs Simulation Area (m)

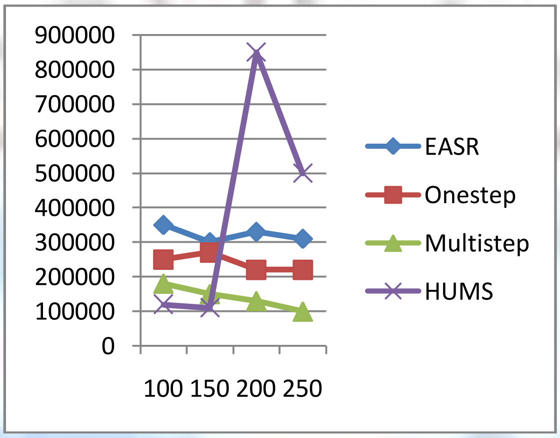

Figure: IV.3 Simulation area (m)

V. CONCLUSION

This paper reports the functionalities of few autonomous moving schemes. The network seems to exhibits the characteristics reported in the part IV.

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