www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 4 Issue 8 Aug 2015, Page No. 13681-13684

An Enhancement on EASR Method for Sink Relocation in Wireless Sensor Network

[1]Bahjasra A. , [2]Asha G.

[1] M-Tech Student, Computer Science and Engineering, MES college of Engineering
Malappuram, Kerala, India
bahjayoosaf@gmail.com

[2] Assistant Professor, Computer Science and Engineering, MES college of Engineering
Malappuram, Kerala, India
ashasreejesh@gmail.com

Abstract: ***In a wireless sensor network (WSN), how to conserve the limited power resources of sensors to extend the network lifetime of the WSN as long as possible while performing the sensing and sensed data reporting tasks, is the most critical issue in the network design. In a WSN, sensor nodes deliver sensed data back to the sink via multi hopping. The sensor nodes near the sink will generally consume more battery power than others; consequently ,these nodes will quickly drain out their battery energy and shorten the network lifetime of the WSN. Sink relocation is an efficient network lifetime extension method, which avoids consuming too much battery energy for a specific group of sensor nodes. Energy Aware Sink Relocation (EASR) is a sink relocation mechanism for mobile sinks in WSNs. The mechanism uses information related to the residual battery energy of sensor nodes to adaptively adjust the transmission range of sensor nodes and the relocating scheme for the sink. The EASR scheme mainly focuses on when the sink will be triggered to perform the relocation process and where to move to. Here routing is based on remaining energy of the sensor nodes in the path. To achieve this type of routing, here used Maximum Capacity Path (MCP) Algorithm. Sink Relocation mechanism consists of two parts. The first is to determine whether to trigger the sink relocation by determining whether a relocation condition is met or not. The second part is to determine which direction the sink is heading in and the relocation distance as well. By adding clustering to the topology of the EASR scheme the delay in the transmission can be reduced. Also the neighbouring nodes of the sink are not always be busy. So the network lifetime can also be increased.***

Keywords: ***Wireless Sensor Networks (WSN), Sink relocation, Sensor Nodes, Sink Repositioning Techniques, EASR, MCP***

1. Introduction

A Wireless sensor networks (WSNs) consist of small sized sensor devices which are capable of wireless communication. The key advantage of using these small devices is that it does not require infra structure such as electric mains for power supply and wires lines for internet connection to collect data nor need human interaction while deploying. The sensor nodes can monitor the environment by collecting information from their surroundings and work cooperatively to send data to the sink for analysis. There may be single or multiple sink in the network[1]. The sensor nodes are usually scattered in the sensor field as shown in Figure 1.1. In Wireless Sensor Network most important issue is energy consumption. Replacing or recharging batteries of sensors is not such an easy task. The sensed data transmitted directly to the sink for smaller network and for larger network through multi hop communication. The sensor nodes near the sink will generally consume more battery power than others; consequently, these nodes will quickly drain out their battery energy and shorten the network lifetime of the WSN. The battery drain out nodes may cause several problem such as incurring coverage hole and communication hole problems. Thus, several WSN studies have engaged in designing efficient methods to conserve the battery power of sensor nodes, for example, designing duty cycle scheduling for sensor nodes to let some of them periodically enter the sleep state to conserve energy power, but not harming the operating of the sensing job of the WSN; designing energy-efficient routing algorithms to balance the consumption of the battery energy of each sensor node ; or using some data aggregation methods, to aggregate similar sensory data into a single datum to reduce the number of transmitted messages to extend the network lifetime of the WSN. The other energy conserving approach is to use mobile sensors to adjust their locations from a region with a high level of total battery energy of nodes to a low energy region. A compromise approach is to use a mobile sink to relocate its position instead of relocating the sensor nodes.

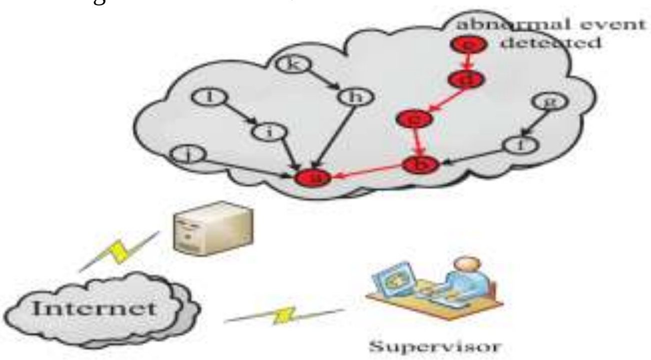


Figure 1: Wireless sensor network

2.Related works

Researchers are always been conducted to improve the network lifetime of the wireless sensor network of by sink relocation. There are several sink relocation method for conserving the battery energy of the sensor and increase the network lifetime of the network. Some of such innovative approaches are described here.

Sumit Kataria et. al [2] introduced sink nodes relocation method which is performed by using the bio-inspired Digital Hormone Model. Through this method the sink nodes are being guided to move in an intelligent way towards the optimal location, which basically improves the network lifetime and reduces the energy imbalance.

Amir Mollanejad et. al [3] presented a dynamic optimum method for base station replacement so that can save energy in sensors and increases network lifetime. He used genetic algorithm to solve positioning problem and considered energy and distance parameters for finding BS optimized position.

TAN Chang-geng et. al [4] introduced a moving scheme for the sink based on local residual. In the scheme, the sink periodically moves to a new location with the highest stay-value defined by the average residual energy and the number of neighbours. The scheme can balance energy consumption and prevent nodes around sink from draining their energy very quickly in the networks.

Leila Ben Saad et. al [5] proposed a new scalable multi-sink heuristic algorithm (Hop) which regularly moves the sinks towards the distant nodes. This approach is based on number of hops. 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.

2. Proposed work

In this section a new sink relocation method is introduced which is the enhanced version of EASR method for sink relocation , proposed by C. Wang et. al. The EASR method we incorporates the technique of energy-aware transmission range adjusting to tune the transmission range of each sensor node according to its residual battery energy. In the case of the residual battery energy getting low after performing rounds of message relaying and environment sensing tasks, then its transmission range will be tuned to be small for energy saving. Moreover, the relocating decision made by the sink will take the MCP(Maximum Capacity Path) routing protocol, as the underlying message routing in order to gain the merit of prolonging network lifetime. Note that the underlying message routing method may affect the performance of the entire operating scheme (the sink relocating and the message routing) significantly as the parameters of the routing algorithm vary. Although the EASR method can be incorporated with any existing routing method, the MCP is chosen as the underlying routing method to limit the above influence since the only parameter of the MCP is the same as the decision parameter of the proposed EASR method, that is the residual battery energy of the sensor nodes. The proposed EASR consists of two components, the energy-aware transmission range adjusting and the sink relocation mechanism that are described as follows.

3.1 Energy-aware transmission range adjusting

In general, a larger transmission range set for a sensor node will increase the number of neighbours and consequently enhance the quality of the energy-aware routing; however, it also bring the drawback of longer distance message relaying, which will consume more battery energy of a sensor node. On the contrary, for a shorter range of communication, although it does not help too much for routing, it can conserve the usage of the residual battery energy. In the proposed method, the transmission range adjusting will depend on the residual battery energy of a sensor node. The sensor nodes are classified into three types by the healthy state of their battery and adjust their transmission range accordingly. Let B be the battery energy value when the battery energy is full in the beginning and r(u) denotes the current residual battery energy of a sensor node u ε V . In the case of $0 \leq r(u) < B/3$(and $B/3 \leq r(u) < B/2$), then sensor node u belongs to type I (and II) sensor node and set its transmission range to $\gamma/4$(and $\gamma/2$), respectively, where γ denotes the initial transmission range of a sensor node. For the case of $B/2 \leq r(u) \leq B$, the sensor node u is very healthy for its battery energy (type III node) and set its transmission range to γ . Intuitively, a 'healthy' sensor node can adapt a larger transmission range to shorten the routing path, while a sensor node with only a little residual battery energy can tune the transmission range to be small to conserve its residual energy. Thus an adaptable transmission range adjusting mechanism can enlarge the lifetime of a sensor node and the network lifetime.

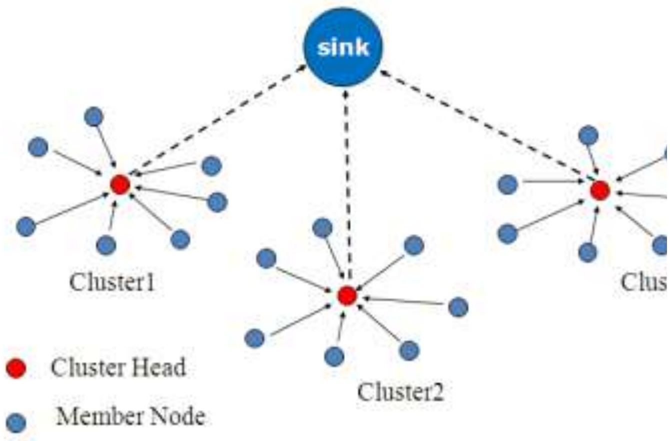
3.1 Sink Relocation Mechanism

This mechanism consists of two parts. The first is to determine whether to trigger the sink relocation by determining whether a relocation condition is met or not. The second part is to determine which direction the sink is heading in and the relocation distance as well. For the relocation condition ,the sink will periodically collect the residual battery energy of each sensor node in the WSN. After the collecting process is completed, the sink will use the MCP routing protocol to compute the maximum capacity path c(P*us) with respect t o each sensor neighbour u of sink s. For each maximum capacity path P*us ,we denote the maximum capacity value with respect to P* us as c(P*us). Let the collection of the sensor neighbours of s be N. Then the relocation condition will be met when one of the following conditions occurs: (1) when one of the capacity values c(P_us) with respect to the sensor neighbour u in N drops below B/2; or (2) the average residual battery energy of the neighbour set drops below B/2 which means the residual energy of the nearby sensor nodes of the sink become small or the residual energy bottleneck of some routing paths falls below a given threshold (B/2). Then the sink relocation mechanism will be performed to relocate the sink to a new position, which can enlarge the network lifetime. In the case of the sink having to relocate, it will firstly determine the positions of the moving destination. The moving destination has 4 candidate positions, SC1 ; SC2 ; SC3 ; andSC4 , which are located in the right, up, left, and down direction distance away from the current position of the sink. Let the neighbour subset Ni with respect to each moving destination candidate SCi($1 \leq i \leq 4$) be the collection of sensor nodes that is located within the circle cantered at node SCi with radius , respectively. Let a weight value wi that is associated with each neighbour subset Ni , $1 \leq i \leq 4$be wi = min(c(P*us)|u ε Ni), where c(P*us) denotes the maximum capacity value of (P*us) .Then, the relocating position SCi will be chosen from SC1 ; SC2 ; SC3 and SC4 , such that the weight value wi with respect to SCi is the maximum value among wi($1 \leq i \leq 4$). Now thev sink s will relocate itself to positionSCi . Intuitively, the weight value wi of a candidate position represents the residual energy lower bound among the bottleneck value of the routing paths to the sink when the sink relocate itself to the candidate position SCi . Thus the EASR method will drive the sink to the candidate position with the greatest wi value among the four candidate positions by adopting 'healthy' routing paths to transmit the message to enhance the network lifetime. After the sink relocates to the new position, the above processes (the residual battery energy collecting, the relocating condition checking) will be iteratively performed. In the case of the relocation condition once again beingmet, then the relocation process will also be invoked again.

3.2 Enhancement on EASR method

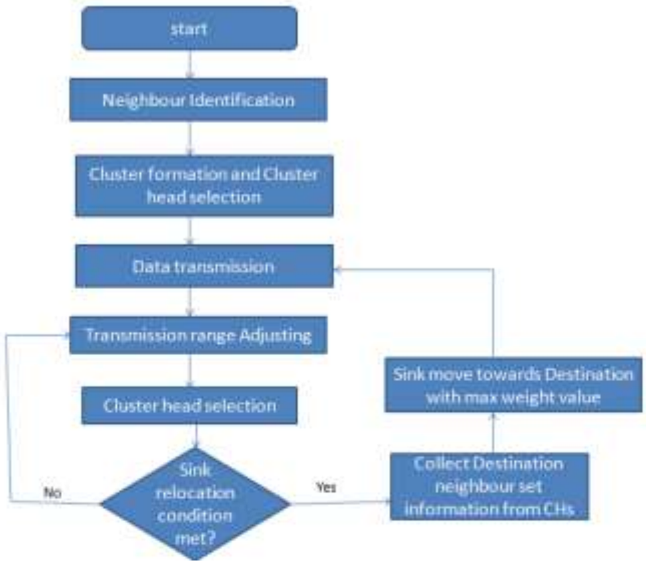
In the existing EASR method the nodes the neighbouring nodes or hotspots of the sink may become the bottle neck nodes. The hotspot nodes are always busy, since each nodes in the network send the data through multi hopping via these hotspots. Although the EASR method increases the network lifetime there is some delay occurs. Once the sink decides to relocate the sink has to collect the energy informations from the neighbour set of candidate position. After that only the sink can calculate the weight value of the each neighbour set and move towards the maximum weighted neighbour set. This may cause some delay in the network.
The modification is done by adding clustering in the topology. So that delay can be minimized. Each cluster contains a cluster head and this cluster head will collect the datas from its cluster members and then cluster head will send these datas together to the sink. The following section describe the detailed modification steps.

3.2 Cluster Formation



The cluster formation consist of three steps.

- Sink collects information regarding location of all the nodes in the network. Depending on the density and geographical layout of the network, it virtually divides the network into zones as shown in the figure. The objective behind this method is to ensure uniform selection of Cluster Heads (CHs) throughout the layout of the network.
- Initially, the node which is randomly choose as a cluster head because each node have same energy level. After the first round the nodes which have highest energy than other nodes in each zones is become Cluster heads.
- Once the CHs are formed, it broadcasts Advertisement message to all the other nodes in the network. the other sensor nodes send Join-Request message to nearest CH based on Received Signal Strength Indication (RSSI)from CHs.



3. Results and Analysis

The project is implemented using NS2.35. Here 37 nodes are randomly distributed in a 1600 x 800 area. The sink is mobile and other nodes are static. The nodes are grouped into clusters each cluster consist of a cluster head. The nodes detecting the abnormal events send data to their cluster head and then the cluster head collectively send the data to the sink. When the relocation condition met sink move to the maximum energy area. The proposed technique An Enhancement on EASR method is compared with the existing EASR method. Energy consumption ,delay and throughput are used as parameters

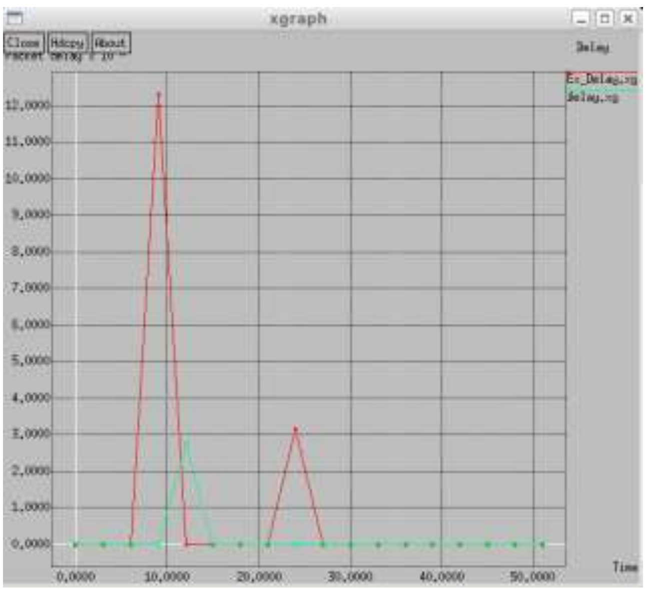


Figure 3: Time performance comparison

DOI: 10.18535/ijecs/v4i8.11

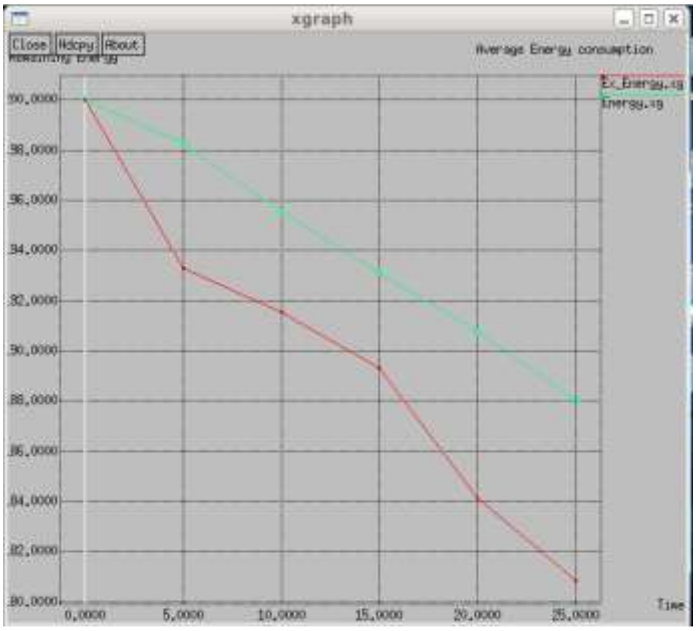


Figure 4: Delay(Existing Vs Proposed)

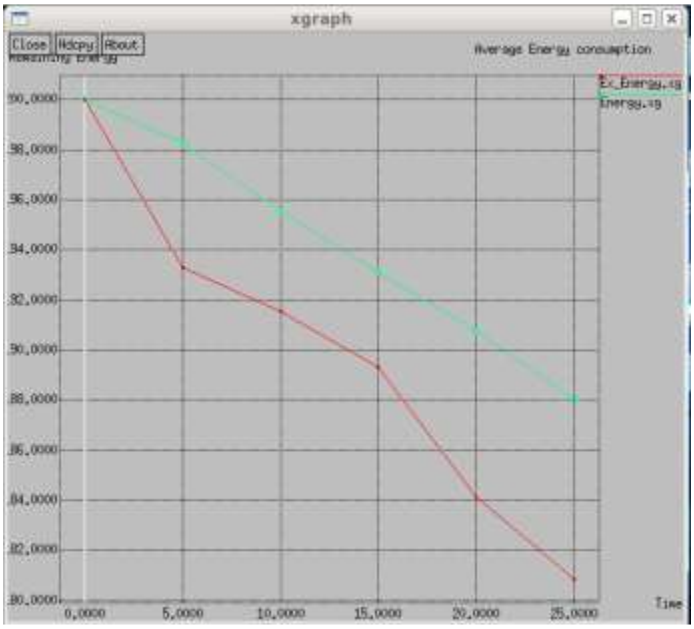


Figure 4: Throughput(Existing Vs Proposed)

5. Conclusion

The experimental results conclude that the proposed method produced better results compared to the existing EASR method. The EASR approach can not only relieve the burden of the hot-spot, but can also integrate the energy aware routing to enhance the performance of the pro- longing network lifetime. EASR adopts the energy aware routing MCP as the underlying routing method for message relaying.The network lifetime increases due the conservation of energy but some delay occurs since the sink has to collect the energy information from the nodes of destination directly. In the proposed work by applying clustering, the sink can collect information from cluster head instead from each node. So as a result the delay and packet drop can be reduced. The network lifetime and throughput also get enhanced by the new method.

References

[1] M. Marta and M. Cardei., "Using sink mobility to increase wireless sensor networks life- time" IEEE World of Wireless, Mobile and Multimedia Networks,Page(s):1-10, 23-26 June 2008.

[2]S. Kataria and A. Jain., "Bio Inspired Optimal Relocation of Mobile Sink Nodes in Wireless Sensor Networks," Emerging Trends in Communication, Control, Signal Processing and Application IEEE,Page(s)1-6, 2013.

[3] A. M. Leili , M. Khanli and M. Zeynali., "DBSR: Dynamic base station Repositioning using Genetic algorithm in wireless sensor network," In IEEE Second International Conference on Computer Engineering and Applications, Page(s):521-525, Vol 2, 2010.

[4]T. Chang-geng, X. Ke, W. Jian-xin and C. Song-qiao, "A sink moving scheme based on local residual energy of nodes in wireless sensor networks," J. Cent. South Univ. Technol,Springer,16: Page(s)0265-0268, (2009)

[5]L. B. Saad and B. Tourancheau., "Towards an E_cient Positioning of Mobile Sinks in Wireless Sensor Networks inside Buildings," New Technologies, Mobility and Security(NTMS), International Conference IEEE,Page(s)1-5, 20-23 Dec 2009.

[6]C. Wang, J. Shih, B. Pan, and T. Wu., "A Network Lifetime Enhancement Method for Sink Relocation and Its Analysis in. Wireless Sensor Networks," IEEE SENSORS JOURNAL, VOL. 14, NO. 6,Page(s): 1932 - 1943,June 2014