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# A Review on Network Lifetime Enhancement based on Sink Relocation in WSN

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*Abstract*— Recent advances in micro manufacturing innovation have empowered the advancement of minimal effort, low-control, multifunctional sensor hubs for remote correspondence. Various detecting applications have additionally turned into a reality thus. These include natural observing, interruption recognition, battlefield surveillance. In a wireless sensor system (WSN), how to conserve the limited power assets of sensors to amplify the system lifetime of the WSN as far as might be feasible while performing the detecting and detected information reporting errands or tasks, is the most basic issue in the network design. In a WSN, sensor hubs convey detected information back to the sink by means of multihopping. The sensor nodes close to the sink will for the most part expend more battery power than others; subsequently, these hubs will rapidly channel out their battery vitality and abbreviate the system 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.

*Keywords*—Energy-aware routing, mobile sink, sink relocation, wireless sensor network.

## Introduction

A WSN consists of little estimated sensor devices, which are furnished with constrained battery power and are capable of wireless communications.

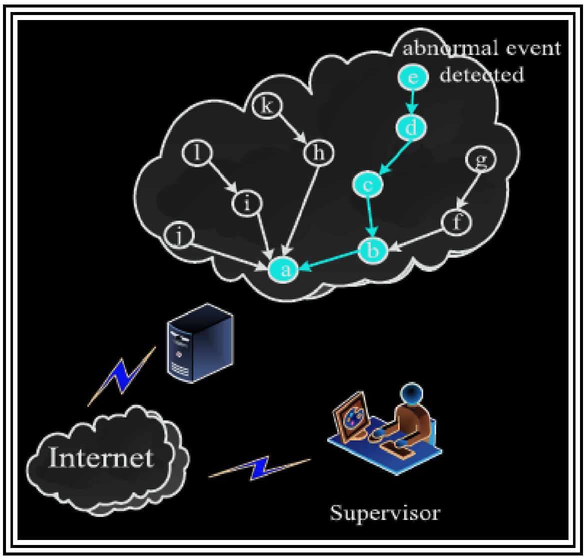


**Figure1:** An operating scheme of a WSN.

When a WSN is deployed in a sensing field, these sensor nodes will be responsible for sensing abnormal events (e.g., a fire in a forest) or for collecting the sensed data (temperature or humidity) of the environment. In the case of a sensor node recognizing a strange occasion or being set to periodically report the detected information, it will send the message hop-by-hop to an exceptional node, called a sink node. The sink node will then inform the supervisor through the Internet. An operating scheme of a WSN as shown in Figure 1, sensor node e detects an abnormal event and then it will send a warning message to the sink to notify the supervisor via a predetermined routing path, say $P_{ea} = e - d - c - b - a$. Note that the routing path may be static or dynamic, depending on the given routing algorithm.

The applications of WSNs are broad, such as weather monitoring, battlefield surveillance, inventory and manufacturing processes **[1] [5]**. In general, due to the sensory environments being harsh in most cases, the sensors in a WSN are not able to be recharged or replaced when their batteries drain out of power. The battery drained out nodes may cause several problems such as, incurring coverage hole and communication hole problems.

## Literature Review

Consequently, a few WSN contemplates have occupied with planning effective strategies to save the battery force of sensor hubs, for instance, outlining obligation cycle booking for sensor hubs to let some of them intermittently enter the rest state to ration vitality power, be that as it may, not hurting the working of the detecting occupation of the WSN **[6] [8]**; planning vitality proficient steering calculations to balance the utilization of the battery vitality of every sensor hub **[9] [15]**; or utilizing some information accumulation method to total comparable tangible information into a solitary datum to decrease the quantity of transmitted messages to broaden the system lifetime of the WSN **[16] [17]**. Note that the greater part of these methodologies can coincide in the working 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 **[18] [24]**. Although this approach can extend the network lifetime of a WSN, the relocation of sensor nodes will also expand their battery energy. A compromise approach is to use a mobile sink to relocate its position instead of relocating the sensor nodes **[25] [31]**. As shown in the left part of Figure 2, the sensor node a near the sink will quickly drain out its battery power after relaying several rounds of sensed data with reported tasks being performed by other sensor nodes, and consequently the WSN will die. We call node *a* a hotspot. In the case of the sink being capable of moving, before the hot spot node a drains out all of its battery energy, the sink can move to another position to relieve the situation of heavy energy consumption of node *a*.

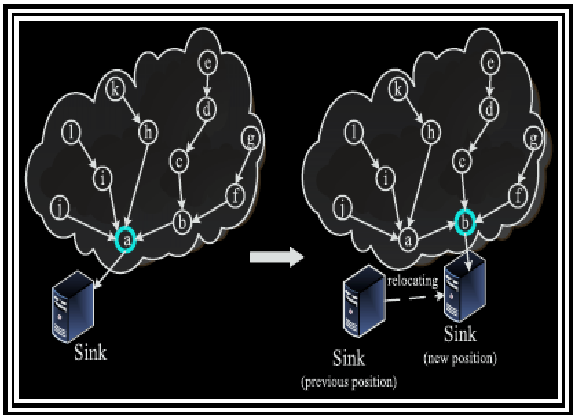


**Figure 2:** Sink relocation of a WSN.

As in the example of the right part of Figure 2, the sink relocates its position from the nearby node *a* to node *b*. In such a way, the role of the hot spot will be interchanged from one node to another node and consequently the network lifetime will be extended.

According to sink relocating or migrating scheme to guide the sink when and where to move to. Some scientific execution investigations are given to exhibit that the proposed sink migrating plan can draw out the system lifetime of a WSN. We have additionally directed reproductions to examine the execution of the EASR technique against a few conventional techniques by numerical reproduction. The association of this paper is as per the following. In the following area we will quickly portray some foundation identified with the considered issue, which incorporates the vitality model of a WSN, the energy efficient directing plan that will be consolidated into the EASR plan, and the related works of sink movement.

## Energy-Aware Sink Relocation Method

In the EASR strategy, we join the procedure of vitality mindful transmission range changing in accordance with tune the transmission scope of every sensor hub as per its lingering battery vitality. On account of the leftover battery vitality getting low in the wake of performing rounds of message transferring and environment detecting errands, then its transmission extent will be tuned to be little for vitality sparing. Also, the migrating choice made by the sink will take the MCP **[11]** steering convention, (which has been portrayed in the past segment) as the basic message directing with a specific end goal to pick up the value of drawing out system lifetime. Note that the fundamental message directing technique might influence the execution of the whole working plan (the sink moving and the message directing) fundamentally as the parameters of the directing calculation fluctuate. In spite of the fact that the EASR strategy can be fused with any existing steering technique, we picked the MCP as the basic steering technique to confine the above impact subsequent to the main parameter of the MCP is the same as the choice parameter of the proposed EASR technique; that is the residual battery energy of the sensor hubs shown in Figure 3.

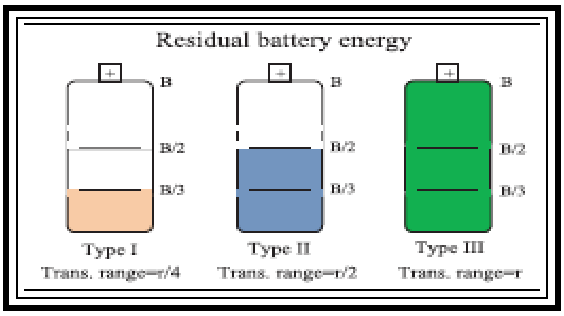


**Figure 3:** EASR Transmission Adjusting Mechanism

The EASR consists of two components, the energy-aware transmission range adjusting and the sink relocation mechanism.

## Energy-Efficient Load Balanced Routing Protocol (Maximum Capacity Path))

As examined already, with a specific end goal to drag out the system lifetime of a WSN, vitality sparing is the key outline issue. Steering convention plans of message reporting in a WSN can for the most part be arranged into two classifications: static directing and dynamic directing. For the static steering sort, when as the message reporting ways are resolved, every sensor hub will report its detected information along the foreordained way to the sink whenever (for instance, the tree appeared in Figure 1). Then again, an element directing convention may change the directing ways in every transmission round as per the current condition of the sensor hubs' leftover battery vitality. Due to the way that the element directing conventions can adjust the heap on every sensor hub, it performs better for system lifetime drawing out than the static steering conventions. In past paper utilize an dynamic routing protocol, called Maximum Capacity Path (MCP), as the hidden directing convention of the proposed sink migration strategy. The MCP is proposed by Huang and Jan **[11]** and has likewise been shown to perform well in delaying system lifetime in a WSN. In the following to illustrate the procedure steps of the MCP routing algorithm.

A WSN and its current residual battery energy state of sensor node can be modeled by a capacity graph G = (V, E), where set V denotes the collection of sensor nodes and E denotes all of the possible direct communication between sensor nodes. And let $r: V \rightarrow R^{+}$ be the residual battery energy function to represent each sensor's residual battery energy. For example, as shown in Figure 3(a), node s stands for the sink with infinity energy due to the fact that it can plug in to a power line or is equipped with an extremely large capacity battery compared to that of the sensor nodes. The value that is associated with node a is equal to 50, which stands for the current residual battery energy of sensor node a. The MCP mainly consists of three procedure steps. They are,

1) layering graph G into a layered network N
2) determining the maximum capacity path for each sensor node
3) routing performed and residual energy updated.

The MCP will iteratively perform the above three steps for each round of message reporting. Detailed operations for layering the graph in the first step are as follows. Let level number $L_v$ with respect to each sensor node v ∈ V denote the shortest path length from v to the sink s. For the example in Figure 4(a), since the shortest path length from nodes g and h to node s are both$4, L_g = L_h = 4$. The layered network N can be obtained from graph G by deleting the edges (u, v) ∈ E such that$L_u = L_v$. For example, as shown in Figure 4(a), since $L_a = L_b = 1$ and $L_g = L_h = 4$ then edges (a, b) and (g, h) will be deleted from G. Then the layered network N obtained from G is a directed graph, such that for all of the remaining edges (u, v) ∈ E after the deleting operation, the directed edge (u, v) from node u to node v, if $L_u = L_v + 1$. Figure 4(b) shows the resulting network obtained from G in Figure 4(a).

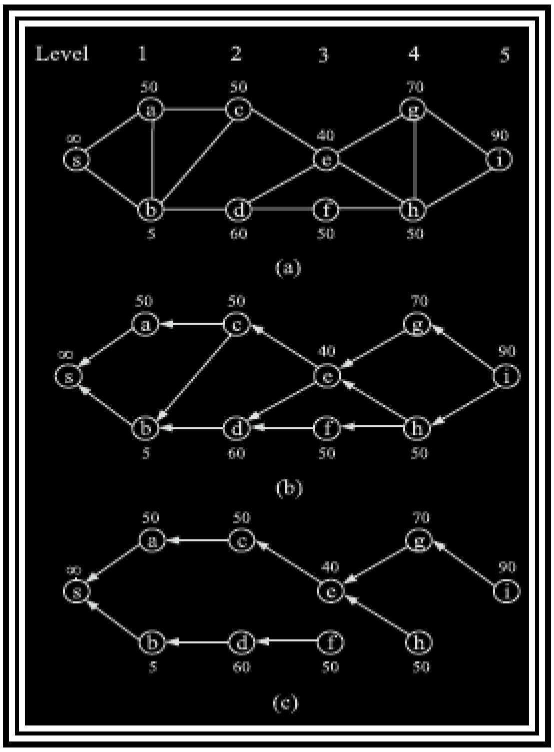


**Figure 4:** An illustration of the MCP routing **[11].**

Let $P_{us} = u, u_1, u_2, \dots, u_1$, s be a path from node u to the sink s in N. And we let the capacity $c(P_{us})$ of path Pus be the minimum value of residual battery energy in path $c(P_{us})$; that is, $c(P_{us}) = min\{\ r\ (u),\ r(u_1), r(u_2), \dots, r(u_1)\}$. Let $P_{us}^*$ be the maximum capacity path with the maximum capacity value among every path from node u to s. The resulting graph of the union of each maximum capacity path $P_{us}^*$, $\forall u \in V$ will be the routing paths for message reporting. For example, Figure 4(c) shows the resulting maximum capacity paths obtained from the layered graph N of Figure 4(b). The above operations are the second procedure steps of the MCP. Now, as a sensor node u detects an abnormal event or has sensed data to report to the sink node s, then the message will be relayed along the maximum capacity path $P_{us}^*$to s. For example, the maximum capacity path $P_{gs}^* = g, e, c, a, s$.After the message relaying from node g to s along path $P_{gs}^*$ , the residual battery energy of each sensor node in the path is updated accordingly. The above three procedure steps will be repeated for each transmission round until one of the nodes drains out its battery energy.

## Conclusion

The depleting speeds of battery vitality of sensor hubs will altogether influence the system lifetime of a WSN. Most scientists have expected to outline vitality mindful routings to preserve the utilization of the battery vitality to draw out system lifetimes. A relocatable sink is another methodology for dragging out system lifetime by abstaining from staying at a specific area for a really long time which might hurt the lifetime of adjacent sensor hubs. his approach can not only relieve the burden of the hot-spot, but can also integrate the energy-aware routing to improve the execution of the delaying system lifetime. According to previous approaches a energy-aware sink relocation method (EASR), which adopts the energy-aware routing MCP as the underlying routing method for message handing-off. Theoretical analysis is given in this paper to illustrate that EASR can draw out the system lifetime of a WSN.

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