Low Cost Light Weight Sink Relocation Mechanism for WSN

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***Abstract*— Generally in an exceedingly Wireless sensing element Network, sensing element nodes deliver detected information back to the sink via multi-hopping. The sensing element nodes close to the sink can typically consume additional battery power than others; consequently this node can quickly drain out their energy and shorten the network period of the Wireless sensing element Network. Sink relocation is associate degree economical network period extension methodology, that avoids overwhelming an excessive amount of energy for a particular cluster of sensing element nodes. During this paper, we tend to propose moving strategy referred to as Energy aware sink relocation for mobile sinks in Wireless sensing element Networks. The projected mechanism uses the residual energy of sensing element nodes to regulate the transmission vary sensing element and to relocate the sink. Theoretical and numerical analyze ar given to point out that the Energy aware sink relocation methodology will extend the network period of the Wireless sensing element Network considerably. NS2 simulation result shows projected structure improve period with efficiency.**

***Index Terms*-Wireless sensor networks, mobile access coordinator, Network lifetime, Node deployment, cluster head.**

I. Introduction

A Wireless detector network may be a large-scale network that has to be organized in Associate in Nursing applicable manner, especially for knowledge aggregation. the information aggregation method is meant to balance the load and thereby to increase the network life. The node clump algorithmic rule to be a good method of organizing a network into a connected hierarchy. in a very node-clustering algorithmic rule, several nodes square measure collective to make a bunch. This theme sometimes operates in 2 phases:

- Node cluster setup and
- Cluster maintenance

In the node cluster step up phase, cluster heads square measure designated among these nodes within the network exploitation varied choice schemes, as shown in table one. when the CHs are designated, alternative nodes that square measure stressed with every CH kind clusters. Nodes that don't seem to be a CH square measure known as non-CH nodes. Each CH, acting as a router, transfers knowledge collected from non-CH nodes to the sink node. Within the cluster maintenance part, the cluster configuration is also modified when the initial cluster is ready up owing to node movements or topology changes. Associate in nursing example of node cluster structure is shown in fig.1.

The cluster head node can lose additional drive than a non-cluster head node as a result of it transfers knowledge over longer distances. Hence, to distribute the load uniformly among all the nodes, the network should re-cluster itself sometimes, choosing energy abundant nodes to function CHs. therefore the network can accomplish energy potency, scale back channel rivalry and scale back packet collisions, leading to higher network output underneath high load.

Table 1: Different cluster-head (CH) selection schemes.

CH selection scheme	Characteristics
Stochastic CH election(Heinzelman et al.,2002)	A node is randomly selected without inclusion of the remaining energy level available in each node.
Weighted clustering algorithm(Xuegong et al.,2002)	A node is randomly selected based on its energy level and distance; the number of times the node was selected as the CH is also considered.
Deterministic CH election(handy et al.,2002)	A node is randomly selected with the inclusion of the remaining energy level available in each node.
CH election technioques for coverage preservation(soro and heinzelman,2009)	A node was selected based on a set of coverage-aware cost metrics that favor nodes deployed in densely populated network areas.
Centralized and distributed CH selection(tillapart et al.,2004)	The sink node determines nodes metric(CH) of all nodes in the cluster by taking into account the nodes remaining energy and the total sum of squared distance to every node in the same cluster.
CH selection using fuzzy logic(ki m et al.,2008)	A node was selected based on fuzzy if-then rule.

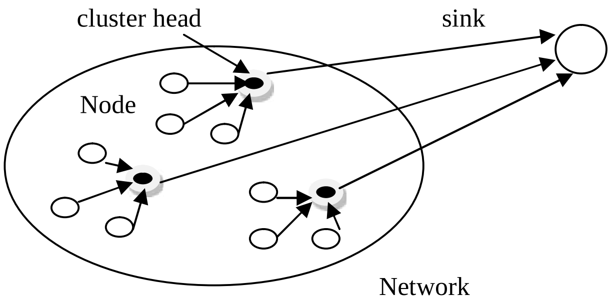

Fig. 1: Example of a node-clustering structure in a WSN

II.RELATED WORK

MC-WSN may be a class-conscious and heterogeneous network, wherever device nodes (SNs) square measure set into clusters every is managed by a cluster head (CH) that routes the sensors' information to a mobile access purpose (MA) through a strong center cluster head (CCH) or a hoop cluster head (RCH) [1], [2]. Every device communicates directly with its corresponding CH and isn't concerned within the routing procedure. a strong center cluster head (CCH) is utilized within the middle of every cell, and K powerful ring cluster heads (RCH) square measure placed on a hoop of radius Rt. underneath traditional operation, RCH and CCH communicate straight to the MA. If for any reason, associate degree RCH cannot establish a communication with the MA, it may transmit through different RCHs nearer to the MA. All nodes at intervals a distance Ro from the CCH route their knowledge to the MA through the CCH. All different nodes route their knowledge to the MA through the closest RCH. When receiving the information of the sensors, the MA delivers it to a Base Station (BS).

In the MC-WSN design, the MA coordinates the devices and resolves the node readying issue further because the energy consumption downside of wireless sensor networks. Additional specifically, the MAs square measure accountable for: (i) deploying nodes; (ii) replacement and recharging nodes; (iii) detection malicious sensors, then removing and replacement them; (iv) grouping the knowledge from sensors and causing it to a Bachelor of Science. Every MA traverses its cell primarily for replacement or recharging low-energy device nodes and cluster heads, further as removing the malicious nodes. The recharging may be performed during a wireless manner [3]. The MA moves physically for knowledge assortment solely within the case once the routing methods don't work.

VSNs encompass small SNs referred to as camera nodes, that combine the image device, embedded processor and wireless transceiver [4], [5]. Pictures square measure captured and extracted by the camera nodes. The embedded processor performs further image process operations like compression or perhaps image characterization to form choices supported the pictures. This processed representational process knowledge is then finally sent to the acceptable destination within the network that forwards the representational process knowledge to the bottom station or sink. The convenience of readying and therefore the capability to speak via wireless links created them engaging in several applications, like watching system [6], intrusion detection [7] and other people following [8].

We elaborate the theme of our protocol. the most plan of our protocol is mistreatment the special correlation to with efficiency build and update the information assortment tree. Whenever the mobile user transfers and changes the virtual sink to access the network, a brand new knowledge assortment tree may be with efficiency created by regionally modifying the antecedently made knowledge assortment tree within the network. Supported such a comment, within the following section, we have a tendency to gift the look components of 3 parts in our protocol: 1) knowledge assortment Tree format, 2) knowledge assortment Tree change, and 3) knowledge Routing.

The ubiquitous knowledge assortment downside thought-about during this paper essentially differs from ancient knowledge assortment issues in static settings. during a static device network, associate degree optimum knowledge assortment tree is typically designed to assemble the network-wide knowledge. The information assortment tree is mounted and serves to with efficiency deliver data to the static sink [9], [10], [11],[12], [13], [14]. Within the presence of user quality and therefore the demand of omnipresent knowledge entree, however, the information assortment tree made at one purpose is typically not comfortable because the mobile user moves. To with efficiency deliver network-wide knowledge to the mobile user, the information assortment tree has to be created or updated from time to time in line with the mobile user's movement.

We study a wireless device network delineated by the graph, G = (N,L), wherever N may be a set of the device nodes M and L may be a set of the network links connected with the device nodes. we have a tendency to assume that network traffics square measure initiated within the supply nodes, and square measure destined to a standard sink node mistreatment multi-hop transmission. the trail between the supply node and therefore the mutual sink node is assumed to be permanent. For simplicity, we have a tendency to assume that the transmit power of the device node is adequate to one another. Finally, we have a tendency to assume that the device node within the WSN cannot transmit and receive at the same time to avoid the self-interference [15].

In this section, we have a tendency to review some connected works projected by researchers to search out a correct routing tree for knowledge assortment in wireless device networks. The foremost general tree traversal techniques square measure Depth-First Search (DFS) and Breadth-First Search (BFS) ways [16]. DFS visits the kid nodes before visiting the sib nodes; i.e., it traverses the depth of the tree before the breadth. During this case, tree structure appearance additional sort of a path or a tall thin tree with solely few limb and leaf. BFS is another technique for traversing a finite afloat graph that visits the sib nodes before visiting the kid nodes. In different words, they obtained tree typically appearance additional sort of a star or a bushy tree with little depth and comparatively sizable amount of branches.

A.Woo projected MintRoute [18] protocol, that is that the hottest tree-based routing protocol. MintRoute uses a sink-based interrupted beacon, referred to as a route publicity, to construct and maintain a tree. Route advertisements square measure originated at sink and square measure forwarded by each node that receives them so as to hide the whole network.

O. Younis proposed HEED (hybrid energy efficient distributed clustering) protocol [17], in which cluster head selection is based on two parameters. A primary parameter (node residual energy) is used to excellent an initial set of cluster heads, and a secondary parameter is used to break ties.

The concept of Bubbling Mechanism is used in our new approach. Actually when in WSN a Cluster Head (CH_{hl}) transmits more data to the GN, it dissipates its energy very quickly and will die in a very short while. Now if there is any other neighbour Cluster Head (CH_u) who is not transmitting at all or transmitting in a very low rate then to reduce the power consumption of CH_{hl} we reduce the transmission range of CH_{hl} and expand the transmission range of CHu so that the OSNs those were in the transmission range of, will now be in the transmission range of CHu. Thus CH_{hl} get the chance of regaining its energy through Energy Harvesting [19]. After CH_{hl} regains its energy, the transmission range of CH_{hl} and CH_u will be reset to their normal transmission range. With this mechanism the power saves of CH_{hl} is much higher, almost 10 times, with respect to slight increase in total power consumption of system.

Most of the prevailing literature has leveraged governable sink quality to optimize the lifespan of WSNs. for instance, in [21] the matter of most lifespan in WSNs was investigated by considering the twin impact of sink quality and routing. As regards to increasing network lifespan beside QoS constraints, the authors in [22] geared toward finding a flight for the MS, subject to constraints on the potential sojourn locations of the MS and most delay on information delivery. In [23] a framework was planned for increasing the lifespan of a WSN subject to delay and energy constraints by taking advantage of sink quality. On the opposite hand, the most turnout and lifelong of a WSN was studied in [20], during which the info assortment is performed victimization governable quality of MSs.

III. PROPOSED WORK

In this section a replacement sink relocation methodology is introduced that is that the improved version of EASR methodology for sink relocation, The EASR methodology we have a tendency to incorporates the technique of energy-aware transmission vary adjusting to tune the transmission vary of every sensing element node permitting to its residual battery energy. within the case of the residual battery energy obtaining low once playacting rounds of message sending and surroundings sensing tasks, then its transmission vary are going to be tuned to be little for energy saving. Moreover, the relocating call created by the sink can take the MCP (Maximum capability Path) routing protocol, because the original message routing so as to realize the advantage of prolonging network lifespan. Note that the underlying message routing methodology could have an effect on the performance of the complete package (the sink relocating and therefore the message routing) considerably because the parameters of the routing formula vary. Though the EASR methodology are often combined with any existing routing methodology, the MCP is chosen because the underlying routing methodology to limit the higher than influence since the sole parameter of the MCP is that the same because the call parameter of the planned EASR methodology, that is that the residual battery energy of the sensing element nodes. The planned EASR consists of 2 elements, the energy-aware transmission varies adjusting and therefore the sink relocation mechanism that area unit outlined as follows. In general, a bigger transmission vary set for a sensing element node can increase the quantity of neighbors and then enhance the standard of the energy-aware routing; but, it conjointly bring the downside of longer distance message relaying, which is able to consume a lot of battery energy of a sensing element node. On the various, for a shorter varies of communication, though it doesn't facilitate an excessive amount of for routing, it will conserve the usage of the residual battery energy. Within the planned methodology, the transmission vary sterilization can depend upon the residual battery energy of a sensing element node. The sensing element nodes area unit classified into 3 varieties by the healthy state of their battery and change their transmission vary consequently. 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 example of $0 \le r(u) < B/3$(and $B/3 \le r(u) < B/2$), 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 represents the initial transmission range of a sensor node. For the case of $B/2 \le r(u) \le B$, the sensor node u is very healthy for its battery energy (type III node) and set its transmission range to γ . Automatically, 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 protect 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 cause the sink relocation by determining whether a relocation condition is met or not. The second part is to determine which direction the sink is caption 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 gathering process is completed, the sink will use the MCP routing protocol to compute the maximum capacity path c (P*us) with respect to each sensor neighbour u of sink s. For all 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 form will be met when one of the following conditionsoccurs: (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 droplets below B/2 which means the residual energy of the nearby sensor nodes of the sink become small or the residual energy bottleneck of particular routing paths falls below a given threshold(B/2). Then the sink relocation mechanisms will be performed to relocate the sink to a new position, which can expand the network lifetime. In the case of the sink consuming to relocate, it will firstly determine the positions of the affecting destination. The moving destination has 4 candidate positions, SC1; SC2; SC3; and SC4, which are located in the right, up, left, and down way distance away from the current position of the sink. Let the neighbor subset Ni with respect to each moving destination applicant SCi ($1 \leq i \leq 4$) be the collection of sensor nodes that is located within the circle run at node SCi with radius, respectively. Let a weight value wi that is related with each neighbour subset Ni, $1 \leq i \leq 4$be wi = min(c (P*us) |u ε Ni), wherever c (P*us) denotes the maximum capacity value of (P*us). Then, the relocating position SCi will be select from SC1 ; SC2 ; SC3 and SC4 , such that the weight value wi with respect to SCi is the maximum value between wi($1 \leq i \leq 4$). Now they sink s will relocate itself to position SCi. Intuitively, the weight value wi of a candidate position denotes the residual energy lower bound among the bottleneck value of the routing paths to the sink when the sink relocate itself to the applicant position SCi. Thus the EASR method will energy 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 improve the network lifetime. After the sink relocates to the new position, the above processes will be iteratively performed. In the case of the relocation condition once again being met, then the relocation process will also be appealed again.

3.2 Enhancement on EASR method

In the existing EASR technique the nodes the neighbor nodes or hotspots of the sink will become the bottle neck nodes. The hotspot nodes area unit continually busy; since every node within the network refers the information finished multi hopping via these hotspots. Though the EASR technique will increase the network time period there's some delay happens. Once the sink selects to relocate the sink should collect the energy information's from the neighbour set of candidate position. Then solely the sink will calculate the eight worth of the every neighbour set and move towards the utmost weighted neighbour set. The modification is completed by adding agglomeration within the topology. In order that delay may be decreased. Every cluster contains a cluster head and this cluster head can collect the data's from its cluster members and so cluster head can send these data's along to the sink. The following section describe the detailed modification steps

3.3 Cluster Formation

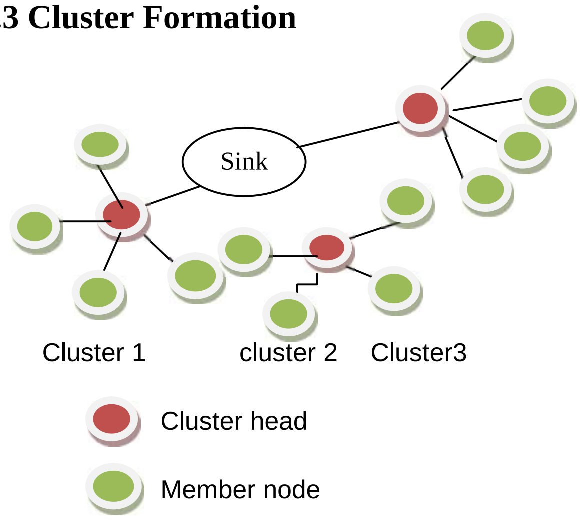

Fig. 2: Example for cluster formation

- 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 areas 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 selects as a cluster head because each node has same energy level. After the first round the nodes which have highest energy than other nodes in each zone is become Cluster heads.
- Once the CHs are formed, it broadcasts Advertisement communication 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.

IV. RESULT AND DISCUSSION

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.

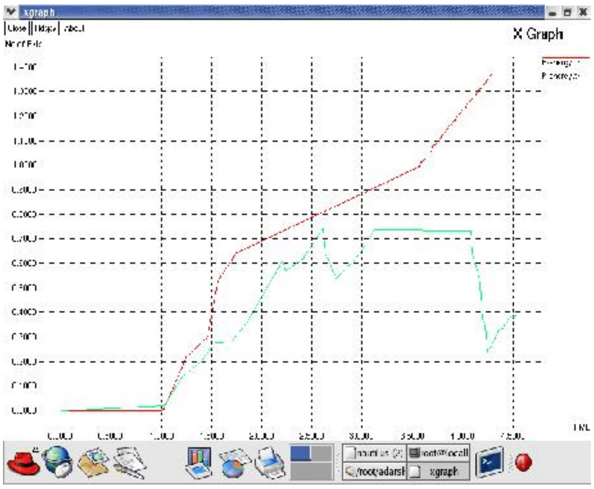

Figure 3: performance comparison (Energy)

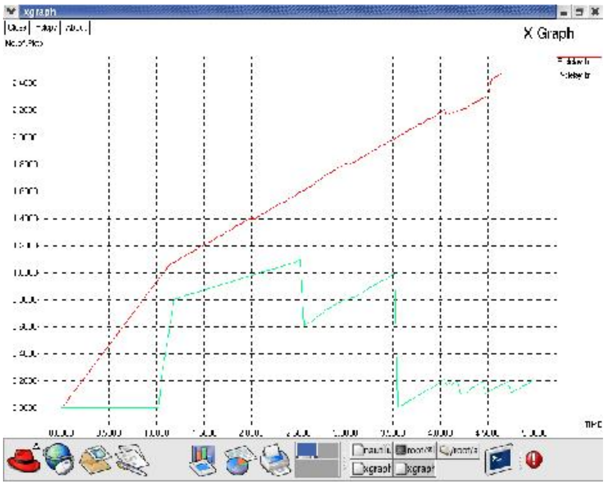

Figure 4: Delay (Existing Vs Proposed)

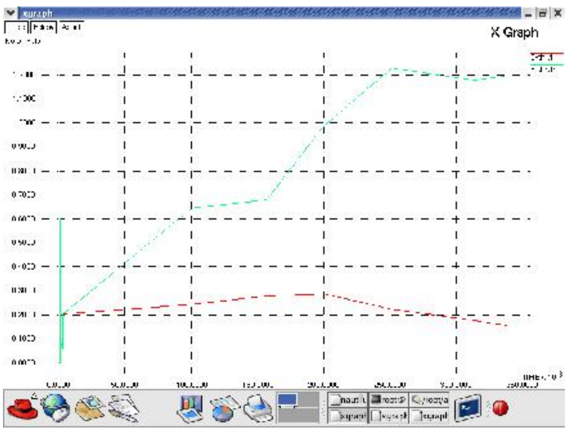

Figure 5: Throughput (Existing Vs Proposed)

V. CONCLUSION

The experimental results conclude that the planned technique made higher results compared to the prevailing EASR technique. The EASR approach cannot solely relieve the burden of the hot-spot, however can even integrate the energy aware routing to reinforce the message delaying. The network time period will increase due the conservation of energy however some delay happens since the sink needs to collect the energy info from the nodes of destination directly. Within the planned work by applying clump, the sink will collect info from cluster head instead from every node. Therefore as a result the delay and packet drop is reduced. The network time period and turnout conjointly get increased by the new technique.

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