A NETWORK LIFETIME AND SINK LOAD MINIMIZATION FOR NP- LOWER ENERGY ADAPTIVE SINK RELOCATION (LEASR) IN WIRELESS SENSOR NETWORKS

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ABSTRACT : 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. Lower Energy Aware Sink Relocation (LEASR) 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 NP-LEASR 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 LEASR 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 neighboring nodes of the sink are not always being busy. So the network lifetime can also be increased.

Keywords: WSN, EASR, sensor nodes, heterogeneous, NP-completeness, etc.

I.INTRODUCTION

A wireless sensor network (WSN) consists of a large number of small sensor with limited energy source. Prolonged network lifetime, scalability, node mobility and load balancing are important requirements for many WSN applications [11]. The various applications that wireless sensor networks play a vital role is environmental monitoring, intrusion detection, battle field, military applications and so on. WSN comprises of little measured sensor gadgets, which are outfitted with restricted battery control and are skilled of remote interchanges.

At the point when WSN is deployed in a detecting field, these sensor hubs will be in charge of detecting remarkable event (e.g., a flame in a woods) or for gathering the detected information (temperature or stickiness) of the environment. The wireless sensor node which detects an abnormal event will send the information to the exceptional hub, called a sink hub, through the multi hop transmission. All in all, because of the tangible situations being brutal by and large the sensors in a WSN are not ready to be energized or supplant when their batteries channel out of force. The battery depleted out hubs might bring about a few issues. In this manner, a few WSN contemplates have occupied with outlining effective strategies to moderate the battery force of sensor hubs, for instance, planning obligation cycle planning for sensor hubs to let some of them occasionally enter the rest state to save vitality power, yet, not hurting the working of the detecting employment of the
WSN [1]; outlining vitality effective directing calculations to equalization the utilization of the battery vitality of every sensor hub [4]; or utilizing some information collection strategies to total comparable tangible

information into a solitary datum to lessen the quantity of transmitted messages to expand the system lifetime of the WSN [5].

Figure 1 shows the sensing and forwarding of the information detected by the sensor node which is then routed to the sink node A through the route e – d – c – b – a. The sink will then forward the message through to the supervisor through the Internet. The WSNs are most widely used in climate change monitoring such as temperature, pressure, humidity etc., and also combat zone observation, stock and assembling forms and so on [1].

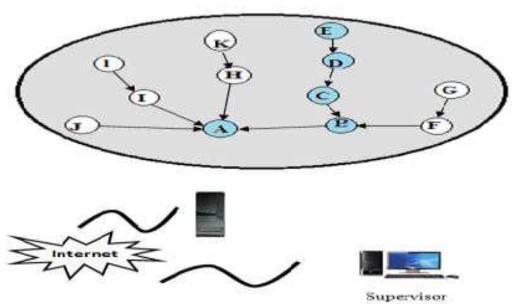

Figure 1: working scheme of WSN

The large portion of these methodologies can exist together in the working of the WSN. The other vitality rationing methodology is to utilize portable sensors to alter their areas from a district with a high level of aggregate battery vitality of hubs to a low vitality locale [5], [6]. Despite the fact that this methodology can expand the system lifetime of a WSN, the migration of sensor hubs will likewise grow their battery vitality. A bargain methodology is to utilize a versatile sink to migrate its position as opposed to moving the sensor hubs [7], [10].
As appeared in the first part of Figure 2, the sensor hub a close to the sink will rapidly deplete out its battery power in the wake of handing-off a few rounds of detected information with reported assignments being performed by other sensor hubs, also, hence the WSN will kick the bucket. Hub is called a hotspot. On account of the sink being fit for moving, sometimes recently the problem area hub a channels out the greater part of its battery vitality, the sink can move to another position to improve the circumstance of overwhelming vitality utilization
of hub A.

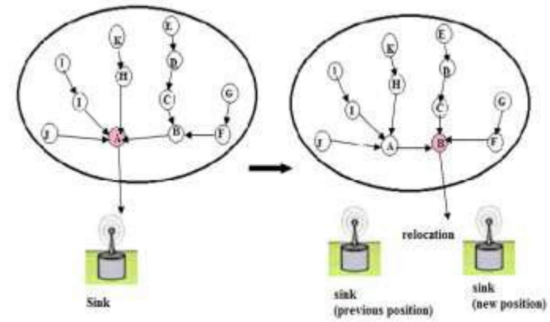

Figure 2: Relocating position of sink in WSN

The Figure 2 shows the migration of the sink from its position of hub A to the adjacent hub A. In such a way, the part of the hot spot will be operated starting with one hub then onto the next hub and hence the system lifetime will be developed. A few examination works have proposed systems for the sink migration approach [7], [10]. These studies can be generally characterized into two classifications, the foreordained sink versatility way [7] and independent sink development [8], [10].
In this paper, a sink relocation mechanism in extension over the network Lifetime which avoids too much of consuming battery power is analyzed. The nodes which are nearer to the sink will generally requires more battery power, hence, these nodes will quickly drain out their battery power. The sink relocation scheme explained in this paper uses the Energy Efficient Sink Relocation Scheme (EE-SRS) for mobile sink in Wireless Sensor Network. This sink relocation scheme decides "when and where to move the sink" that is based on the threshold values of the parameters.

II.LITRATURE REVIEW

Shashidhar Rao Gandham et al. (2003) proposed energy efficient and network lifetime enhancement method for network by deploying multiple mobile stations. The lifetime of sensor network is divided into equal period of time called round. At start of round the base station is relocated. Flow based routing is used for energy-efficient routing. New location is determined by integer linear program. Multiple base stations improve the lifetime of the network.

Z. Maria Wang et al. (2005) proposed a method for fairly balancing the energy utilization among the nodes. This linear program generates the problems of finding the stopping time and movement of the sink that get maximum time. This method increase whole network lifetime reducing energy consumption.

Wei Wang et al. (2008) proposed the study of mobile relays which are having appropriate resources and static sensors. Mobile relays having more energy than static sensors. Relays moves around dynamically and helps to lessen the burden of sensors which are having more network traffic and lifetime of sensor can be increased. The dense network with one relay node improve lifetime as compare to static network. Joint mobility routing algorithms also enhance the network lifetime. The main benefit of this approach, it require number of nodes have aware to location of mobile relay. Mobile relay approach is effective as compare to static energy setup methods.

Shuai Gao et al. (2011) proposed a scheme called Maximum Amount Shortest Path (MASP). This scheme conserves the energy and increase the throughput of the network. Zone partition scheme based two phase communication protocol is design for implementation of MASP scheme. MASP is for path constrained, mobile sink. There is mapping between sub sink and nodes which leads to maximum data collection by sinks and to balance energy utilization. MASP enhances the energy efficiency.

Wang Liu et al. (2012) proposed a Mobility Assisted Data Collection model in which the parameter like mobile sink, velocity of mobile sink and journey path of the mobile node is included. Many other MADC schemes does not discuss about the factors like throughput ability which is maximum data gathering rate & lifetime which will be related with certain data gathering rate. This approach explores behavior of WSN with respect to one and more mobile sink. Result shows network with mobile sink performed well as compare to network with static sink. MADC parameter can also be adjusted to enhance data gathering rate and lifetime is increased.

Farzad Tashtarian et al. (2013) proposed a theory for controlling the mobility of sink in event-driven application to bring out the extreme lifetime of WSN. In event driven applications the mobile sink with limited velocity has to gather the catches data from particular group of sensor nodes. This problem is NP hard. This approach is more effective for controlling the mobility.

V. Devasvaran et al. (2014) proposed a protocol which is energy efficient, for WSN exhibit mobile base station. This protocol is based on clustering approach. The roles of nodes within the cluster are changed. So that the burden of cluster head for transferring the data to base station should be reduced.

ZhengBing Zhou et al. (2015) proposed a three phase energy heuristic technique. Firstly, the network area split into grid cells. These grid cells are equal in geographical area. The grid cells allocate to clusters by k-dimensional key algorithm. The energy utilization of every cluster is similar when they gather data. The size of cluster is modifying by assigning grid cells in them. Energy expenditure of sink motion is taking into account. Therefore, the consumed energy in every cluster is roughly stabilized by considering energy utilization in data collection, sink motion. The technique result in perfect grid splitting in a restricted time repetition and the lifetime of network is increased.

III.PROBLEM STATEMENT

When the sink relocation is sensible, where the sink has to be placed and how the data traffic has to be handled during the sink's movement is the most basic issue. Given the traffic distribution and network state at that time, sink relocation must be based on the motivation by the inefficient pattern of energy depletion or an intolerable increase in the missed deadlines whenever real time packets are used. If such condition is detected, then to enhance the network performance the sink should identify the most suitable location.

Finding an efficient strategy for optimal sink location is complex and it is NP hard problem. Two characteristics of sink that are responsible for complexity are as follows,

1. The sink can be moved to immeasurable possible positions, which is the first responsible characteristic for complexity.

2. Every temporary discovery solution of sink location requires the construction of new multi-

hop network topology to confirm that the current temporary solution is qualify able than previous temporary solution. The mathematical expression for this problem necessitates more parameters such as positions of all deployed sensors and state parameters like energy level and transmission range. For a network with large number of nodes, the pursuance of exhaustive search will be impractical.

Further, when the sink is moved multiple times, the optimization process has to be repeated for the dynamic nature of the network makes the sensor state and sources of data variant.

IV. SYSTEM MODEL

A set of sensors is spread throughout an area of interest to detect and possibly track events/targets in this area. The sensors are battery-operated and are empowered with limited data processing engines. The mission of these sensors is dynamically changing to serve the need of a command center. A sink node, which is significantly less energy-constrained than the sensors, is deployed in the physical proximity of sensors. The sink is assumed to know the geographical location of deployed sensors. Sensors are discovered through repeated beacons or through surveying the area of interest [5][6]. The sink is responsible for organizing the activities at sensor nodes to achieve a mission, fusing data collected by sensor nodes, coordinating communication among sensor nodes and interacting with the command node. The sink node sends to the command node reports generated through fusion of sensor readings, e.g. tracks of detected targets. The command node presents these reports to the user and performs system-level fusion of the collected reports for overall situation awareness. The system architecture for the sensor network is depicted in Fig. 3.

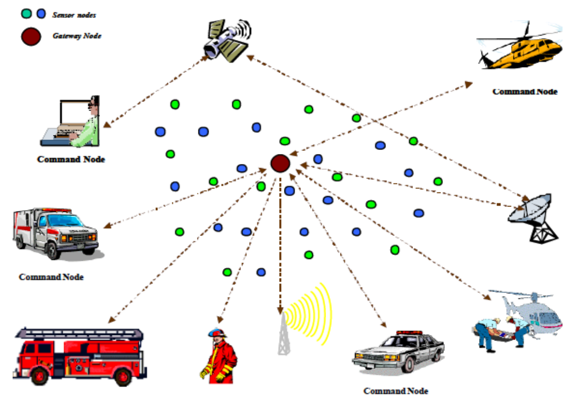

Fig. 3: Three-tier sensor network architecture

V. PROPOSED IMPLEMENTATION

In order to enhance the performance of our proposed protocol, we have simulated our protocol using MATLAB. We have considered a wireless sensor network with 100 nodes distributed randomly in 100m X 100m field. An intelligent node is deployed in another region of the sensing field. The BS is located away from the sensing field. Both intelligent node and BS are made stationary after deployment.

NP-Energy-Aware Sink Relocation **(NP-EASR) Method**

In the EASR method, we incorporate 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 LEACH protocol, (which has been described in the previous section) 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, we chose the LEACH as the underlying routing method to limit the above influence since the only parameter of the LEACH is the same as the decision parameter of the proposed EASR method; that is the residual battery energy of the sensor nodes. The existing

EASR consists of two components, the energy-aware transmission range adjusting and the sink relocation mechanism that are described as follows.

PSEUDO CODE

Algorithm for Proposed NP- LEASR

γ = Initial transmission range

B = Initial battery energy

r (u) = Current residual battery energy

t = Transmission range

i = No of iteration per nodes

n = Total no of nodes

N_n = No of specific nodes

V = the set of sensor node in the wsn

N = the neighbor set of s with γ

Now, suppose we have a Nn in r(u) and a V the set of nodes with γ that fulfill the two conditions.

{

* transmission range adjusting */

While true

{

If (0 ≤ r(u) < B/3) then

$t = \gamma^i / E_n^i$;

else if (B/3 ≤ r(u) B/2) then

$t = \gamma^i / E_n^i$;

else if (B/2 ≤ r(u) < B)

$t = \gamma^i$

}

{

While (true)

{

/ data collecting /

Determine the communication graph G of the wsn after performing the transmission adjusting in each sensor node ;

Compare the maximum capacity path p^*_{us} and its maximum capacity value c (P^*_{us}) $\forall$ ε V;

/* collecting the residual energy

r (u) $\forall_u$ ε v ;

if (($\exists_u$ ε N, C (P^*_{avg}) * 10 log (P_{random}) *10 log (P_{random}) < B/2 or $\sum_{n \varepsilon N}$ r(u) / N < B/2) or

$\sum_{n \varepsilon N}$ r (C_{HEAD}) *100

then

Compute the neighbour set

N_1, N_2 ………. N_n

Subset N_i ($1 \le i \le N_n$)

for each assignment n ∈ {1, . . . , Nn} for all j ∈ XP^* with ij ∈ Eo do

{

Store r (u) in the table of signatures for Nn

}

if

{

n u(i) = 0 or i = t

then {determine a signature u_i = (1 ,….Nn)}

}

End while (true) loop

}

VI.RESULT

The capability to receive a packet during an impact can provide a number of significant assistances for wireless networking, with higher throughput, lower end to end delay and improved spatial reuse. The time of average jitter intermission amongst the time of making a question in the requester and the time of getting requested data thing from the data source.

Table 1.Simulation Parameter (Input) -: Below mentioned is simulation parameter that we configure in our proposed simulation:

Parameters	**Value**
No of nodes, n	100
N/w size X × Y	100 × 100
Receiver Energy, ERX	50nJ
Transmitter Energy, ETX	50nJ
Free space Energy Consumption, E_{fs}	.01nJ
Multipath Energy Consumption, E_{mp}	.0013pJ
Initial Energy, E_0	0.5J
Data Aggregation Energy, EDA	5nJ
Percentage of advanced nodes, m	0.1, 0.2& 0.3
Multiple of normal node energy, a	1, 2, 3

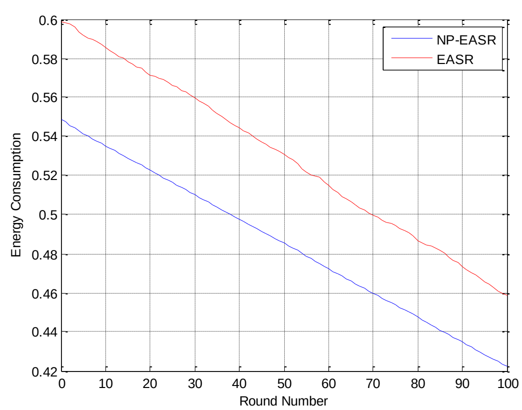

Figure 6.1:Energy consumption of EASR and NP-EASR

Fig 6.1: shows the Energy Consumption varying the sensor nodes. The sensor node consumes power for sensing, communicating and data processing. More energy is required for data communication than any other process. Power is stored either in batteries or capacitors. More the sensor nodes save energy more will be the lifetime of the WSN. Upon comparing the existing system (EASR), the energy is saved more in our proposed system (NP-EASR).

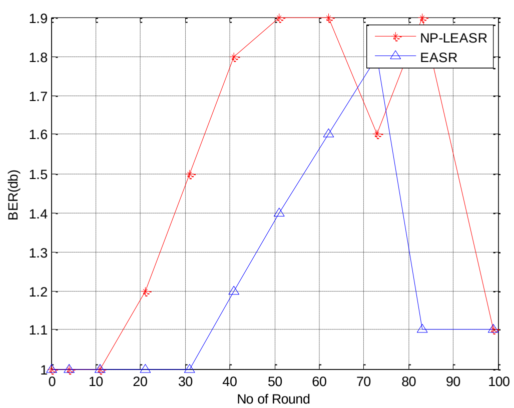

Figure 6.2:Bit error rate (BER) of EASR and NP-EASR over no of round

In order to validate a receiver sensitivity, BER has been adopted and used as a basis for evaluation; however, with data-oriented radio communications having been globally deployed with error correction schemes embedded, PER is now practically used a receiver sensitivity evaluation, which is equivalent to BER. In telecommunication transmission, the bit error rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission, usually expressed as ten to a negative power. For example, a transmission might have a BER of 10 to the minus 6, meaning that, out of 1,000,000 bits transmitted, one bit was in error. The BER is an indication of how often a packet or other data unit has to be retransmitted because of an error. Too high a BER may indicate that a slower data rate would actually improve overall transmission time for a given amount of transmitted data since the BER might be reduced, lowering the number of packets that had to be resent.

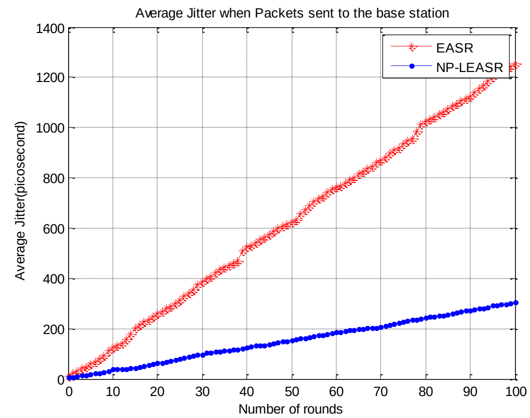

Figure 6.3:Average jitter of EASR and NP-EASR over no of round

Figure 6.3: shows the comparative results of jitter with varying the energy level of the sensor nodes in the network. Jitter refers to the delay which is the amount of time delayed by the sink node to forward the data to the base station. Delay is expressed in units of time, usually milliseconds in wireless sensor networks. When compared to the existing system (EASR) the delay is low in the proposed system (NP-EASR). The delay in delivering the data to the base station by the sink node is less in the proposed system because the sink node relocates in an efficient way and collects the data in lesser time than the existing system.

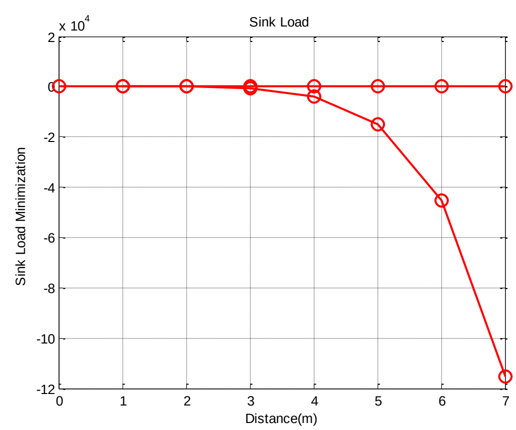

Figure 6.4:Sink load minimization over distance

An allocation problem for networks formulated with the objective of minimizing the load of each cell in the system subject to the constraint that each user meets its target rate.

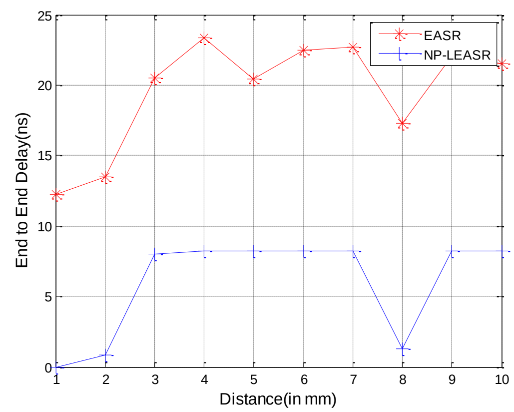

Figure 6.5:End to End delay (ns) of EASR and NP-EASR over distance

Base congestion control on traffic measured only at end points (A and B). - Lower congestion control performance, lower overhead for routers, good scalability. - Used in Ethernet because of simpler implementation. The results of simulation show that the proposed works more proper than standard EASR. We can see that the End to End Delay in proposed NP-EASR is less than existing method. Also, proposed method has more success during node population increment.

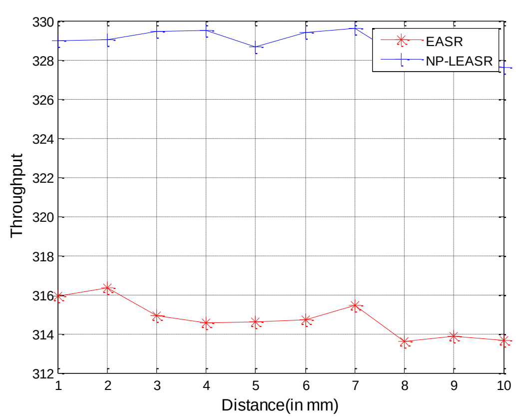

Figure 6.6:Throughput of EASR and NP-EASR over distance

Fig.6.6 shows the throughput comparison by varying the number of sensor nodes. Throughput refers to the number of packets delivered to the base station by the sink node at any instance of time. When compared to the EASR the throughput is high in the NP-EASR. It traverses through the shortest path inside the sensing field and collects updated data on time and hence delivers more number of packets at any instance of time to the base station.

VII.CONCLUSION

The experimental results conclude that the proposed method produced better results compared to the existing NP-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 LEACH 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.

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