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SINK RELOCATION FOR NETWORK LIFETIME ENHANCEMENT IN WSN: A SURVEY

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ABSTRACT
Wireless sensor networks are used to monitor physical or environmental conditions like temperature, pressure, sound etc.Increasing the lifetime of wireless sensor networks is a major challenge because the nodes are equipped with low power battery. TheEnergy efficient routing is used for increasing the lifetime of sensor nodes through maximizing the overall performance of the nodes. Generally in routing algorithm best path is chosen for transmission from source to destination,but if the same path is used for a long period of time for quick broadcast time the nodes in the designated path will fdevelop drained fast. This paper discusses about the different methods used for increasing the lifetime of wireless sensor networks.

INDEX TERMS: sensor node, wireless sensor networks, routing.

I. INTRODUCTION

Wireless sensor networks (WSNs) are self-configuring ad-hoc networks creates an intelligent environment, consisting of a collection of compact sized and inexpensive spatially distributed sensor devices widely known as motes as shown in Fig. 1 below.

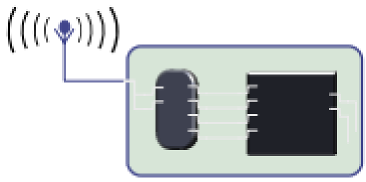

Figure 1: Wireless Motes

Wireless Ad-hoc Network (WANET) is a decentralized network that does not rely on existing infrastructure, such as routers or Wireless Access Points (WAP) in wired networks, which leads to certain technical challenges,

(i) No central entity
(ii) Limited range of wireless communication
(iii) Mobility of participants
(iv) Battery-operated entities.[11], [12].

An alternative conception in MANET, capable of making wireless communication possible using radio signals due to recent technological advancements in MEMS, has created a pathway for low cost multi functionality sensor nodescommunicating for short distances with low power utility among the nodes that are densely deployed and works cooperativelyto study, observe, monitor the environmental variations and also understands the physical parameters of environment, thereby providing a bridge between the real and/or and virtual worlds. In its place of focuscommunication on humans, it emphases on interacting with environment where Network is embedded in it and nodes in the network are equipped with sensing and actuation to influence environment. When a WSN is deployed in a sensing field, it has the ability to observe the previously unobservable environment, at a fine resolution over large spatiotemporal scales. These sensor nodes facilitates the information in case of a sensor node detecting abnormal event (e.g., a fire in a forest) and for collecting the sensed data (temperature or humidity) or being set to periodically report the sensed data of the environment through a gateway that provides connectivity between wired world and distributed nodes. It will send the message hop-by-hop to a special node called sink or to gateway nodes that are distributed locally. These systems process the information data gathered from such multiple nodes and can communication with the administrator bodies like Civil, Government entity. [13], [14].

1.1 Energy Aware Sink Relocation

In this section, we discuss the strategy based on Energy-Aware concepts of Sink Relocation (EASR). The recommended contrivance (EASR) uses Materialistic Evidence related to residual energy of sensor nodes,dynamicadjustment of transmission range between sensor nodes and in addition the relocating scheme for sink. [15-17]Furthermore the efficient network lifetime extension method by sink relocation, which avoids too much energy consumption for a particular group of sensor nodes, has been discussed. [18-20].

In EASR, a Re-locatable sink helps in prolonging the lifetime of the network by avoiding nodes remaining at a certain location for a long time which reduces the lifetime of nearby sensor nodes. The EASR has two parts (i) energy aware transmission range adjusting and (ii) sink relocation.

If a sensor node has large transmission range then its number of neighbors will be more, (i) If the transmission distance is long, then it will consume more battery energy of the sensor node and (ii) If the range of the node is less it does not help too much routing and it can conserve the residual battery energy. A node with more residual energy can be usedfor a larger transmission range in order to reduce the routing path, whereas a node with less energy can limit itstransmission range to be small to conserve energy. Thus an adaptable transmission mechanism can enhance the lifetime of a sensor node and network as well. Sink relocation occurs when the energy level of the nearby sensor node of the sink becomes small and sink will relocate to a new position which surges network lifetime. [21-22]

1.2 WSN Architecture

The Network as shown in Fig. 2, consists of many sensor nodes along with the source node, intermediate nodes and sink also called as network participants. Network participants can be classified into three types (i) **Sources of data:** Measure data, and report them. (ii) **Sinks of data:** receives data from WSN, Example: PDA, gateway. (iii) **Actuators:** Controls device based on data, customarily also known as sink.

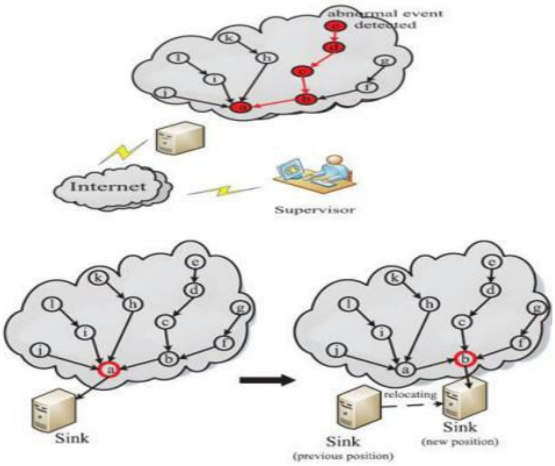

Fig. 2: WSN Architecture

The source starts transmitting data to the sink through intermediate nodes all the data reaches through the intermediate node to the sink. When the battery power of the sink becomes low, by using hotspot the sink is relocated the nearby sensor node and the source will send the date to that sensor node. Since the sink is relocated to the nearby sensor node which acts as sink this method is called as Sink Relocation method. Using Credit and Behavior algorithm [25], [26] the malicious node is also removed from the network, while the data is being transmitted to the sink simultaneously. In the

proposed system architecture, source starts transmitting data through the intermediate nodes to the sink. Sink is located at a particular position and receives the data and processes it.
When the battery level becomes low, sink is relocated to the sensor node which lies in the range of sink. Now the source starts sending data through the intermediate nodes A and B and reaches the sink. In this relocation process there is no loss of residual energy and the packets are also delivered to the sink without any packet loss.

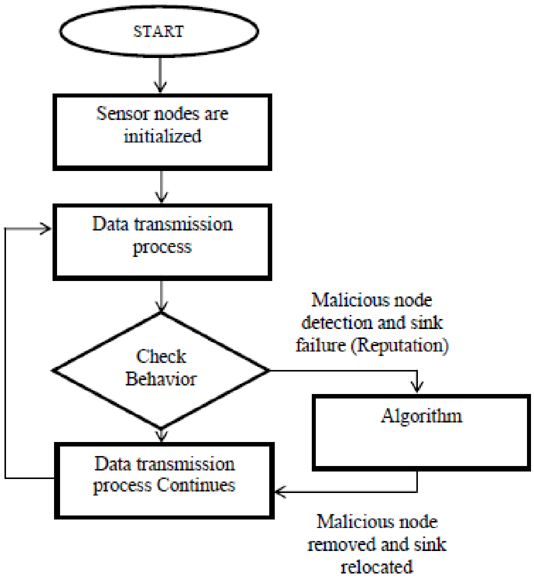

Fig. 3 Flow Chart

There are basic four mechanisms in a sensor network: (1) an association of circulated or localized sensors; (2) an interconnecting network (3) information cluster and (4) a central point for computing resources like handling data correlation, event trending, status querying, and data mining.
As shown in Fig. 3 Flow chart, Sensor nodes in the network are initialized. Network consists of many source and intermediate nodes and a sink. Sink which is at the receiver end, collects all the data from source. Source nodes start sending the data via intermediate node to sink. During the data transmission process, the behavior of the sensor nodes is being monitored. While the data is transmitted from the source nodes the credit and behavior algorithm is implemented on the intermediate nodes. It starts crediting the nodes as either a good node or malicious node. If the node is found to be good node then data transmission takes place continues and deliver to the sink. If the node isfound to be malicious node then data transmission does not take place and it causes sink failure. By using thisalgorithm malicious node is removed from the network and sink is relocated. It also enhancement of the single hop algorithm where the sink is relocated to the nodes that are one hop distance only. It relocates the node that is one hop distance in its transmission range.

II. Literature Survey

G.S.Sara [1] discussed the method of sink mobility scheme, usually routing process in a mobile network is very complex and it becomes even more complicated in MWSN as the sensor nodes are low power, cost effective mobile devices with minimum resources. Current research mechanisms have controlled to the strategy of numerous efficient routing protocols for MWSN but still there are many unresolved problems like retaining the networkconnectivity, reducing the energy cost, maintaining adequate sensing coverage etc. This paper addressed the various issues in routing and presented the state of the art routing protocols in MWSN. The routing protocols were categorized based on their network structure, state of information, energy efficiency and mobility.
H.R.Karkvandi [2] proposed one category of sink relocation which discusses about the two main challenges ahead of an ad-hoc, sensor-based, battery operated monitoring system known as wireless sensor network (WSN) such as lifetime-aware routing and desired sensing spatial coverage (SSC).

Depending on the application, a necessary SSC level is essential to comply with the needed surveillance quality. On the other hand, network lifetime is of a major concern due to limited energy available to each sensor node. Formerly proposed lifetime-aware routing algorithms have usually defined lifetime as the duration before the first node runs out of energy. This criterion is not consistent with real-world WSN, where a number of sensors are likely to "die" due to hardware failures, natural impacts. The proposed EE-SRS rectifies these limitations.

The relocation of the sink is based on Unbalanced energy consumption is an inherent problem in WSNs, characterized by multi hop routing and a many-to-one traffic pattern. This uneven energy efficiency can significantly reduce network lifetime. A new routing method for WSNs extend network lifetime using a combination of a fuzzy approach and an A-star algorithm which is given by **I.S.Alshawi [3]**. To provethe effectiveness of the proposed method in terms of balancing energy consumption and maximization of network lifetime.

Y.Yang proposed [4] the mechanism based on optimization algorithm. Sensors have limited energy source and the sensor network is expected to be functional for a long time, so optimizing the energy consumption to prolong the network lifetime becomes an important issue. In static sensor networks, if sensors are uniformly deployed, sensors near the sinks die first. This is because besides sending their own sensed data, they also participate in forwarding data on behalf of other sensors located farther away from the sink. This uneven energy consumption results in network partitioning and limitation of the network lifetime.

ZhengBing Zhou et al. [5] (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.

PunyashaChatterjee et al. [6] (2015)proposed a technique for deployment of multi sink in the network. A given bound D is taken for cluster diameter and accordingly a distributed greedy cluster formation algorithm is used to construct predefined number of clusters in the network. The lifetime of network is inversely proportional to diameter of cluster and cost depends upon number of clusters that is sinks. With this approach the cluster diameter less than bound D and the delay of network is reduced.

Francesco Restuccia et al. [7] (2015)proposed a technique for optimizing network lifetime of WSN where the sink mobility is uncontrollable and mobile sinks are randomly deployed with QOS condition. Swarm Intelligence Based Sensor Selection Algorithm optimize lifetime of network and encounters the defined QOS constraint. With the help of SISSA bounds for energy utilization, number of message exchanged and convergence time are derived. SISSA is scalable as well as energy efficient.

Omer Cayirpunar et al. [8] (2015)proposed a framework called Mixed Integer Programming to specify different mobility design on wireless sensor network lifetime. The sensor nodes broadcast the data traffic to static base station which is useful for prolonging the network lifetime. Some nodes reduce their energy level sub optimally. Base station mobility is suggested as cure for suboptimal energy reduction. When the relocation of base station carried out burden of transferring the data is shared by huge set of nodes. From which the suboptimal energy dissipation can be reduced.Results shows that Gaussian and Spiral patterns for mobility gives enhancement in network lifetime better than randompattern for mobility of base station.

DeepaV.Jose et al. [9] (2015)proposed an energy efficient routing protocol to increase the network lifetime of WSN. For maintaining the life of network the way available is to use the energy effectively. Protocol stack composed of various layers. Each layer has different capabilities to increase the network lifetime. This proposed technique will discuss the role of network layer this layer having very important role in routing. Communication consumes more energy as compare to sensing and processing. Mobile Assisted Algorithm is approach using mobile sinks.

Chu-Fu Wang et al. [10] (2014)proposed Energy Aware Sink Relocation mechanism for the mobile sinks. There are various protocols available which are used to enhance the network lifetime. Sink relocation is method in which the sink is relocated instead of staying in one location. When sink stay in particular location it can be dangerous for lifetime of nearby sensing node. EASR method also integrates the energy aware routing resulting in enhancing the performance and also prolongs the network lifetime.

III. CHALLENGES

1. The battery drained out nodes may cause several problems such as, incurring coverage hole and communication hole problems.
2. Another problem in WSNs is buffer overflow in every node, which occurs if the sum of the amount of data it generates and the amount of data it receives from upstream nodes exceeds its transmission throughput.
3. The major challenge in designing the Wireless Sensor Networks (WSNs) is to reduce thepower consumption of each sensor nodes and thereby increasing the network lifetime.
4. The major challenge in WSN is to conserve the constrained battery resources of sensor network.
5. The main problem in wireless sensor network is their lack of energy supply.

IV. APPLICATION OF WSN

1. The application of wireless sensor network consists of a wide variety of circumstances such as environmental observation, intrusion detection, and battlefield surveillance.
2.WSNs are used in various applications, which includes surveillance in battlefield, manufacturing technologies, inventory and weather forecasting etc.
3. 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 neither collect data nor need human interaction while deploying.
4. The WSN has many applications and due to the sensor, batteries power gets drain out so it becomes difficult to recharge or replace the batteries.
5. Sensor nodes which are deployed in particular region to perform any application of wireless sensor network must consume energy at same rate.

V. DISSCUSSION

In above numerous works in literature survey accessible by numerous Authors, we examine about various or many present research idea in terms of concept of the Energy-aware routing, mobile sink, sink relocation and wireless sensor networks.The Wireless Sensor Network (WSN) is an emerging field for the researches in the current scenario. Transferring data from source node to destination is the most important task in the wireless sensor network. The Mobile nodes also have limited battery power which is a challenge for node to long time survival in network. Main drawback for the any wireless sensor networks is limited energy available to nodes because of the small size of the batteries they use as source of power. Balancing the route of the data transfer is one of the techniques that can be used to minimized sensor nodes energy consumption during operation. Life of network is directly proportional battery power in mobile nodes. The most important issue of the Wireless Sensor Network is to increase the network lifetime. Wireless sensornetwork contains one static sink node and the sensor nodes consume lot of their energy for evaluating data packets,specifically those that are available in the neighboring region of the sink node. Sensor nodes disperse their energyrapidly due to many to one traffic pattern and at the end die. This irregular transmission pattern is known as hotspotproblem that happens to increase more and more as the number of sensor nodes increase. The concept of mobile sink has been recently introduced for WSNs in order to improve the network lifespan and overall performance of WSNs as it moves the burden of energy consumption from the sensor nodes to sink nodes, which are usually considered to have unconstrained energy source and greater computational power.

VI. CONCLUSION

In this paper we have studied the existing methods and their implementations for energy enhancement. Present work largely emphasized on the lifetime enhancement by energy conservation. Static and mobile modes are causes of energy dissipation in wireless sensor network. Mobile nodes generally consume higher energy as compared to static nodes. The parameters considered in existing literature for validation of the work involves end to end delay, throughput and packet delivery ratio. The study indicates that dynamic sink nodes are better in terms of end to end delay which can be minimized at the cost of increase of packet drop ratio.

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