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Network Lifetime Enhancement Method for Sink Relocation and its Analysis in Wireless Sensor Networks

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ABSTRACT: The two main challenges in Wireless Sensor Network (WSN) is Lifetime-aware routing, Sensing Spatial Coverage (SSC) and extending the network lifetime while performing the sensing and sensed data reporting task using multi-hopping method are restricted due to the reason power resource management of sensors. The proposal introduces many favours like highest enduring battery power, minimum number of hops, and minimum traffic loads by determining an optimal routing path between source and destination. Also **sink node Relocation rate of occurrence improves the efficiency of wireless sensor networks. Using the Aware Sink Relocation (EASR) we propose a Credit and Behavior algorithm (CBA) to construct shortest routing paths considering message as well as energy complexities. In terms of message cost and space cost and energy saving, this algorithm is proven to be more efficient than previous solutions because determines the shortest paths in a single execution.** In order to improve the lifetime of sensor networks **CBA** has been extended to move the sinks by knowing the positions of Sinks and Sensors. The sink based on residual energy and nearest hop count, will relocate the sink. The main advantage of this protocol over the existing protocol is that this protocol drops the node if it is found to be malicious and when the current cluster head has lost enough energy, it relocates the sink.

KEYWORDS: Wireless Sensor Networks (WSN), **Energy Aware Sink Relocation (EASR), Credit and Behavior Algorithm (CBA),** Sensing Spatial Coverage (SSC), Routing, Sink and Sensor.

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.

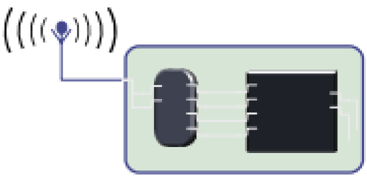

Fig. 1Wireless Motes

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.[1], [7].

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 nodes communicating for short distances with low power utility among the nodes that are densely deployed and works co-operatively to 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. Instead of focusing interaction on humans, it focuses on interacting with environment where Network is embedded in it and Nodes in the network are

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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. [2], [4].

II. LITERATURE REVIEW

One of the most important issues to be aware of Sensors in WSN are, (i) Sensors are usually battery operated and are impractical to replace or recharge therefore energy must be spared so as to network life for longer possible period.(ii) Have a limited transmission range and on board processing capacity like memory, processing, energy and power. Henceforth Conservation of power in sensors to extend the network lifetime of the WSN remains a critical task. 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 power than others; consequently, these nodes will quickly drain out their energy and shorten the network life time of the WSN. Multi-hop relaying is the foremost intention for the energy hole problem where sensors relay on traffic. Thus multi hop relaying upshots in unbalanced energy disbursement over diverse parts of the fields. [3], [17].

III. ENERGY AWARE SINK RELOCATION

In this paper, 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. [14-16]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. [19-21].

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 used for a larger transmission range in order to reduce the routing path, whereas a node with less energy can limit its transmission 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. [8-9]

Our proposed system gives more life time to WSN than the existing one. It increases the availability of all sensor nodes. The packets loss and the delay is minimized by using this algorithm. Sink is effectively relocated to the nearby available sink. Malicious node can be easily detected and easily removed from the network. Long range communication is possible. Link failure and path break are prevented. [6], [13]

IV. SINK REPOSITIONING TECHNIQUE

Since Repositioning the sink during the regular network operation is challenging, technique for an unconstrained traffic has been adopted which checks for sensor nodes that are just one hop away and for hops which are relaying in high traffic. Then the optimal location for the sink is calculated by testing the impact of repositioning, thereby the total transmission power of the sensors for the previous and next sink positions is assessed and compared. The sink will be moved to a next position if the overhead is justified.

While the sink starts to move towards its next location, the algorithm checks for the sensor nodes that are one hop away from the sink in order to determine connectivity with the sink. If the sink is in reachable position then the last hop

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sensor nodes will adjusts its transmission power such that the sink can receive messages appropriately until reaching the next intermediate position. On the other hand if the sink goes out of the transmission range then it will look for a sensor node to relay the data further.

Such nominated sensor node should be in a reachable position to both the sink and the last hop sensors and in turn should possess ample amount of energy. Subsequently this sink will update the routing table and notify the other sensors and then move ahead to the next location. The down fall is there are chances of communication failure due to loss of energy, moreover the algorithm is used only to relocate the sensor nodes which are one hop distance but it cannot detect whether it is a good node or malicious node. Link failure is more common and path break occurs. Long range communication is not possible. [14-16], [19-21], [22-24].

V. WSN ARCHITECTURE

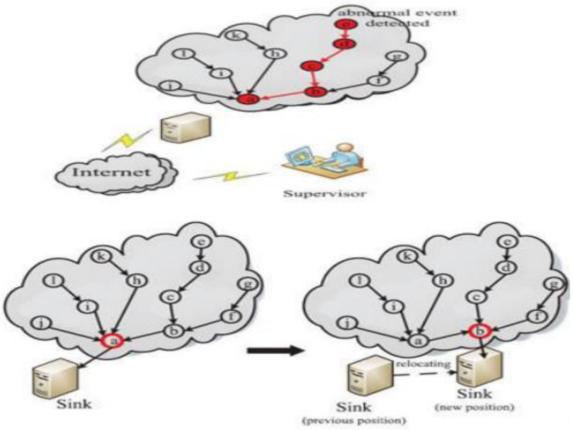

Fig. 2WSN Architecture

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.

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 [12], [18] 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.

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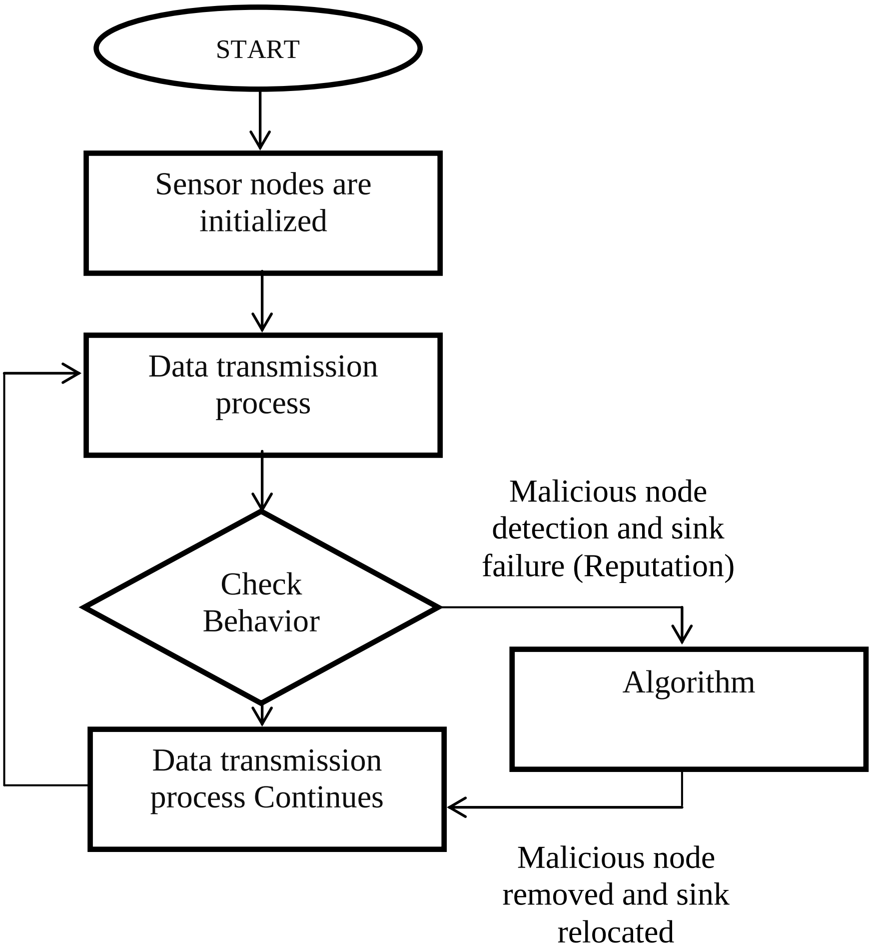

Fig. 3Flow Chart

There are four basic components in a sensor network: (1) an assembly of distributed 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 is

found to be malicious node then data transmission does not take place and it causes sink failure. By using this algorithm 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.

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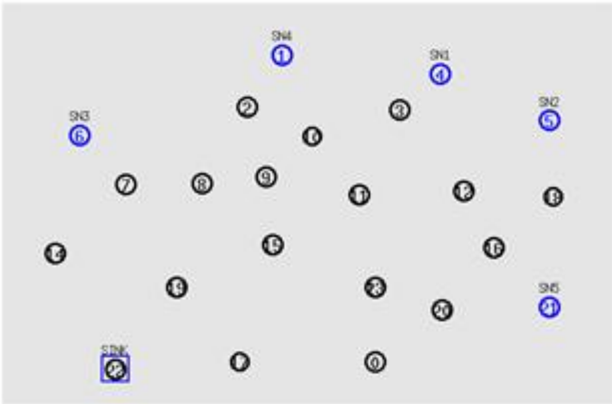
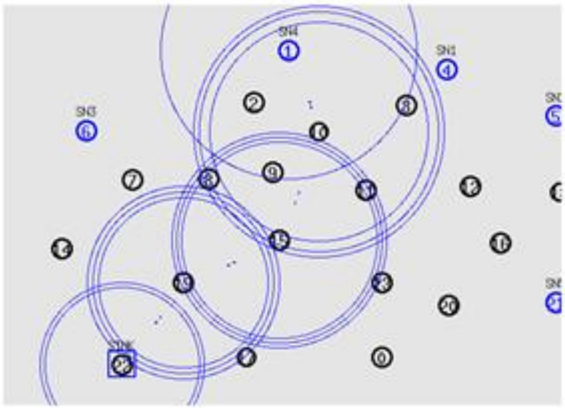
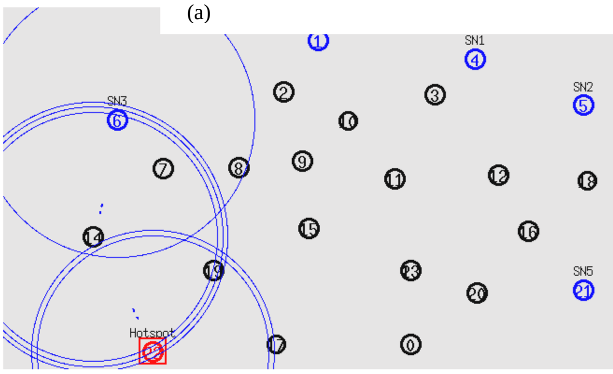
VI. RESULTS AND DISCUSSION



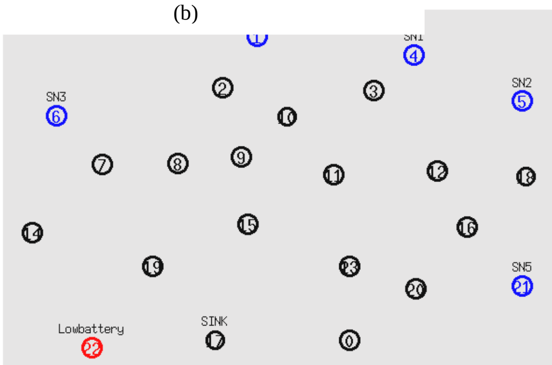
(a)



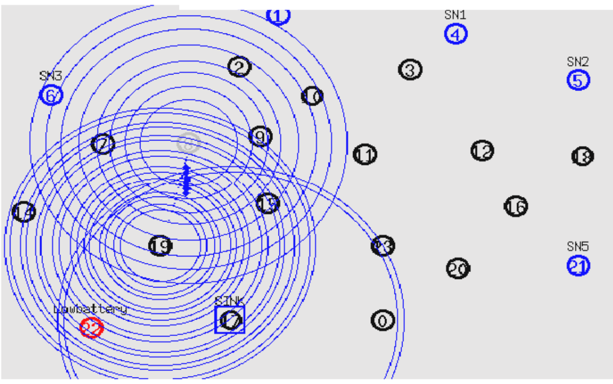
(b)



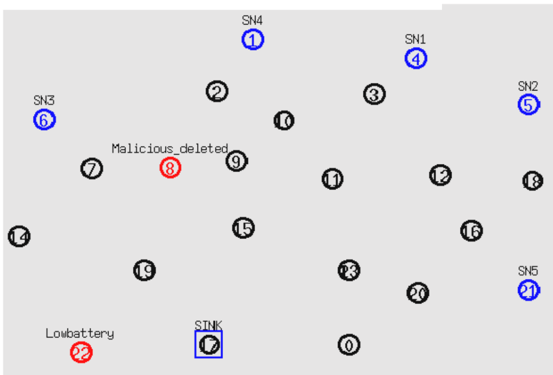
(c)



(d)



(e)



(f)

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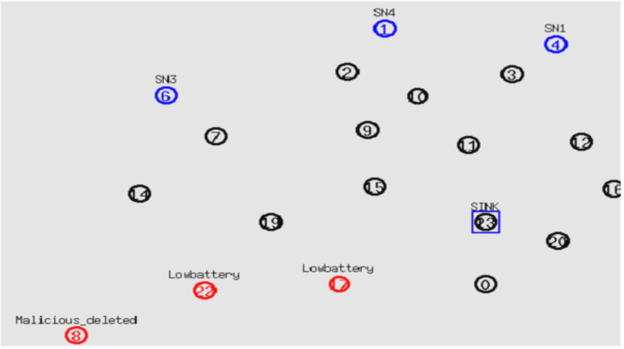
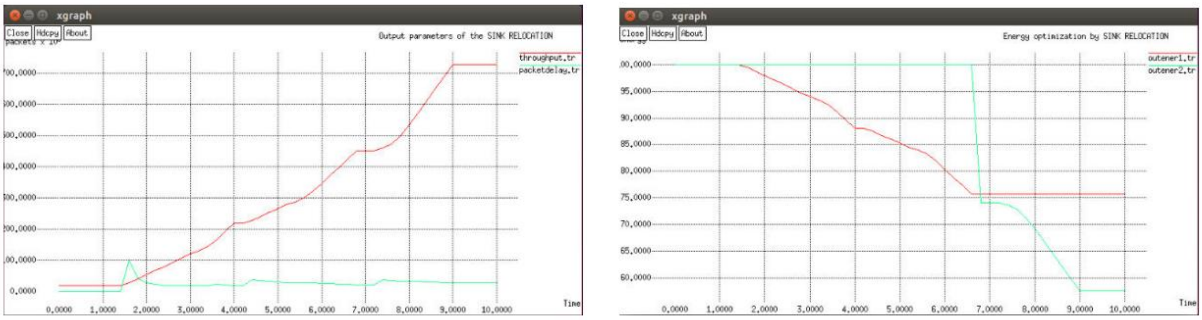


(g)

Fig 4 (a) Multiple sensor and intermediate nodes with sink (b) Multi hop data communication to sink node (c)Sink relocation positioning (d) Sink Relocated (e) Packets being dropped from node 8 (f) Malicious node detected (g) Malicious node removed from the Network and relocated Sink

In Fig 4 (a) N-number of sensor nodes along with the intermediate nodes and the sink is shown. All the blue circles are indicated as sensor nodes, black circles are indicated as intermediate nodes and black circle surrounded by blue box is Sink.In Fig 4 (b)illustrates Data is being sent to the sink through the intermediate nodes. SN4 is sending the data to the node 22 which is the sink through the nodes 10, 9, 15, 19. The data is stored in the sink. Similarly all other sensor nodes will find the shortest path to send their data to the sink using the available intermediate nodes. Fig 4 (c) displays the node 22 which is the sink in red color with hotspot label, it means that the charge of the sink has been reduced to the minimum threshold level so with the help of hotspot the sink will relocate its position in order to prevent the loss of data coming from the sensor nodes and in Fig 4 (d), the sink is being relocated from the node 22 to node 17. This is because the charge of the node 22 has drained and indicates low battery level. Now the node 17 will act as the sink and all the sensor nodes will send their data to the relocated sink through intermediate nodes. Fig 4 (e) shows some of the packets have been dropped from the node 8, which is detected as a malicious node by using the CBA.In Fig 4 (f), the node 8 is labelled and Malicious deleted, which is detected as a malicious node by using the CBA. In this case, the node 8 is being removed from the network and the process continues with the remaining nodes in the network. And in Fig 4 (g), the node 17 which was the sink has been drained off and it is labeled as Low battery, so with the help of hotspot a new sink is being relocated namely node 23.



(a) (b)

In Fig 5 (a) and (b)throughput [25] as a function of size of the packets transmitted by nodes is illustrated, whichrepresents the number of bits (of the payload) per second correctly received by the sink when all the 25 nodes try to access the channel and transmit their packets, assuming that nodes transmit packets of the same size.

VII. CONCLUSION AND FUTURE WORK POTENTIALS

In Wireless sensor networks (WSNs) a relocatable sink is approach for prolonging network lifetime by avoiding staying at a certain location for too long which may harm the lifetime of nearby sensor nodes. WSNs are used in many applications to gather sensitive information which is then forwarded to an analysis center. The flexibility, fault tolerance, high sensing fidelity, low-cost and prompt utilization of sensor networks create numerous and application

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areas for remote sensing. Conversely Resource precincts have to be taken into account when designing a WSN infrastructure in fact, we need to define the most suitable technology to be used and the communication protocols to be implemented (topology, signal processing strategies, etc.). These choices depend on different factors, above all the application requirements. The proposed sink relocation process which will reduces the energy consumption and increases the network life-time, and saves the energy level of sensor nodes which is illustrated in the simulation results withenhanced performance in terms of throughput in the network. In future we encourage more insight into the problems and more development in solutions to the open research issues. Though our proposed model is computationally simple, our future work includes finding communication overhead and modeling other malicious behavior patterns to make the distributed system more reliable. Also, we plan to find the best trusted route among the many trusted routes from source to destination and also various types of routing protocols can be used and some techniques can be combined to improve the efficiency of the network by applying our proposed model. Many researchers are currently engaged in developing the technologies needed for different layers of the sensor networks protocol stack. Moreover we plan to extend the approach to allow for an event mobility-aware method. Security in Wireless Sensor Network is vital to the acceptance and use of sensor networks.

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