Secure and Efficient Cost Aware Routing Protocol for Wireless Sensor Networks

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Abstract: Wireless Sensor networks are the collection of various tiny and small sensor nodes which are lightweight in nature and they are really deployed in very random in nature so that the monitoring is very hard to perform. To avoid such kind of issues we prepared an effective and efficient technique which will resolve those problems and contribute to form a healthy wireless sensor networks (WSNs), to do this we have to take a look for two very important and conflicting issues those are probabilistic based on random walking and energy balance control. Here we took the strategy of non-uniform energy deployment to signify the message delivery ratio and lifetime and those two are taken under the exactly same security requirement and resources of energy. In this paper we proposed a CASER protocol which concludes or provides an exclusive tradeoff between the energy balance and efficient routing and can also be increases the lifetime of the nodes present in sensor networks in all the scenarios significantly.

Keywords: Routing, Security, Delivery ratio, Simulation, Energy balance, Deployment, Energy efficiency.

I. INTRODUCTION

In the world of networking to monitor the environmental or physical conditions say sound, pressure and temperature, we used a group of nodes which are distributed across the network is known as wireless sensor networks, we can also say that a large group of sensors which are scattered to collect or store the anonymous data and also the typical environmental data is called as wireless networks. The various sensor nodes are controlled by the network to easily monitor and control the physical environments using less energy in various locations. They have a wide variety of applications such as gathering sensing related information, structural monitoring, climate monitoring and weather monitoring in various distant remote locations using sensor nodes [1,2] and sensors. We can easily define the sensor network as a collection or gathering of huge number of sensor nodes [3] in the network of computers. These huge amount of sensor devices are very tiny and also not very costly so that they are easily procured and deployed in mass, so that the related parameters like bandwidth and speed are limited. We have a wide area of sensors now a days for example microphone, pressure, thermal etc. The route of the sensor node in the wireless sensor networks [3] to gather the sensory information, communicating with other sensor nodes and also performs some processing too. Responsiveness, scalability, routing methods, lifetime, maintenance, coverage, data collection and latency are the various characteristics which are present in the wireless sensor networks. Routing is the most important term in the world of networking so that routing performs the selection of the best path to deliver the data packets to their destinations to perform this securely and appropriately, we have a wide variety of routing algorithms as well as mechanism which are used to route the data accordingly. For both the architectural requirements and the applications these routing protocols and routing mechanism are really considered as the sensor nodes characteristics.

Wireless Networks:

We can define the wireless sensor network as a mechanism of transport between various devices and the so called traditional wired networks. Now a days we have a wide variety of wireless networks but can easily be categorized into three kinds according to their range of coverage. The wireless local area network (WLAN) covers HiperLAN, 802.11 and various others. Wireless wide area network (WWAN) are going to include, the technologies which covers wide areas those are GSM (Global System for Mobile Communications), Mobitex and 2G Cellular, whereas technologies like Infrared and Bluetooth comes under the wireless personal area network (WPAN). If we are talking about all these technologies then comes under the conclusion that all these comes under the word "TETHERLESS" that means the waves which are electromagnetic in nature are used to send and receive the various information. These technologies which are wireless nature uses various wavelengths having the range of radio frequency band upto and above the infrared band and thus covers a huge portion of the electromagnetic spectrum, till 9kHz and also allocate thousands of GHz's to lowest frequencies. Hence we can move from infrared spectrum to visible spectrum.

II. SYSTEM ARCHITECTURE FOR WIRELESS SENSOR NETWORK

As we all know that the sensor nodes available in the wireless sensor networks can communicate with each other directly or by using intermediate nodes. Here in the wireless sensor networks an IP based protocol can be used to deploy the sensor nodes and hence all the nodes that are present in the network are unable to communicate with each other, this is done due to changed routing in the scenario. The communication is done using the sink node via internet by the sensor nodes and hence all the data that has been collected by the sensor nodes can now be delivered to sink node.

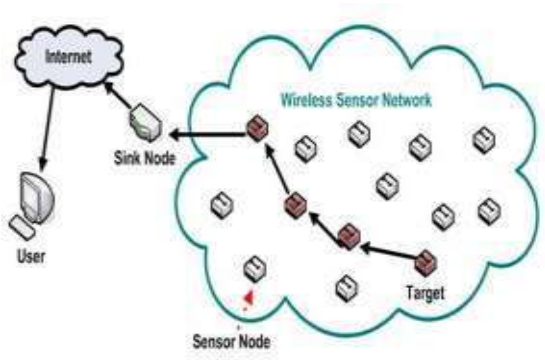

Figure 1. Architecture for Sensor Network

In this kind of network huge numbers of unattended and untethered sensor nodes are combined together. As we know that energy is the most important concerns so that these nodes consumes very less energy resources which proves this design very important for wireless sensor networks. The second most important aspect other than energy is the routing, so that the protocol which is designed properly which guarantees very low energy consumption and very high message delivery ratio, apart from that it also balances the energy consumption of the whole wireless sensor networks and hence it really enhanced the lifetime of the sensor network.

IV. ROUTING ALGORITHMS

As we all know that there are a huge variety of routing protocols available, but for our ease we classify the wireless sensor network protocols into two types which are as follows:

1. **Based on Layers :**

(a) Physical Layer: Synchronization scheme, FEC, modulation scheme and data encryption schemes are performed within it.

(b) Data link layer: This layer going to cover network MAC based protocols, collaborating MAC based and minimum energy consumption network called as SMECN.

(c) Network Layer:

- Protocols like COUGAR, ACQUIRE, flooding, directed diffusion, SPIN, Sequential assignment routing, gossiping, constrained anisotropic routing, Rumor routing comes under it and covers in data centric protocols.
- Term as PEGASIS for information system for power efficient gathering, energy away technique for energy efficient sensor networks protocol used like LEACH, APTEEN and TEEN, all these are covers under hierarchal protocols.
- The protocol which uses minimum energy consumption in the network like GEAR (Geographical and energy aware routing), SMECN and MECN.

(d) Transport Layer: RMST (Reliable multi segment transport), PSFQ and ESR that is the event to sink reliability comes under the transport layer and used widely.

(e) Application Layer: Protocol such as SQDDP and sensor query, TADAP and sensor management protocol like SMP covers in application layer so that all these protocols are very important and also reliable.

2. **Based on network Architecture:**

- Unified network protocol (UNPF) is a framework which is layered in nature.
- Data handling protocol like LEACH comes under this clustered category.
- GHT, directed diffusion, sequential assignment routing, rumor routing, cost-field approach, flooding, SPIN i.e. sensor protocol for information using negotiation and gossiping comes under this data dissemination protocols.
- Binary scheme, directed transmission, chain based three level technique and PEGASIS comes under this data gathering and handling.
- Frequency division multiple or hybrid time division multiple access, SMACS and CSMA comes under the medium access control.

3. **Brief description of various protocols based on routing in wireless sensor networks (WSN):**

Algorithm: Each node that is going to receive a packet must have to broadcast and by this the packet is not the destination for it [4,5] and thus maximum hop count is to be achieved.

Advantage: This method is very reliable, the delays [5] is very less or say nil due to flooding convergence and rate of message delivery is highest and fastest.

Disadvantage: Gossiping, implosion, overlapping, inefficient energy, resource blindness, broadcast storm.

SPIN: This SPIN protocol is known as sensor protocol for information via negotiation. To address the lack of flooding [6] we use spin protocol so that it uses the technique of resource adoption and negotiation. In this apart from raw data the data about data that means meta-data is send into the network using the above protocol, so that there are three types of messages actual data (DATA), request for actual data (REQ) and advertisement for meta-data (ADV) comes under SPIN protocol.

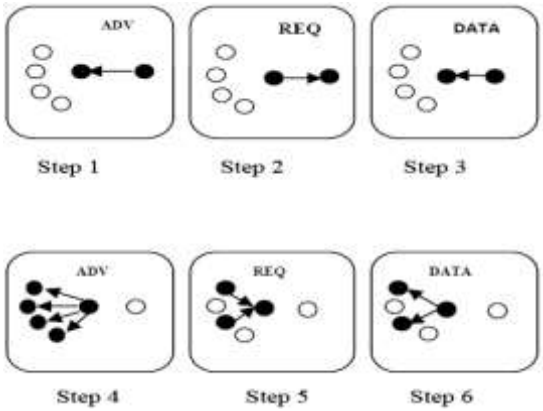

Figure 2. Messaging used in SPIN

V. ROUTING PROTOCOL CHALLENGES

1. **Quality of Services:** To provide quality services the transmission of data must be carried out in a specific moment and within time frame decided that's why the applications involved in sensor networks are really time sensitive. Latency issue occurs due to longer elapse time of sensed data and might be irrelevant. The data to be transmitted is the quality details focused on the lifetime of the sensor network applications are based on energy preservation.

When reliable data delivery [8] and timely delivery required thus we used QoS routing for surveillance system and monitoring system is critical missions and hence it is the major area of research. In wireless sensor networks both of the area of concerns delay QoS and reliability uses multipath routing and this is potentially used in the existing works. In an efficient manner the nodes are going to select and also the priorities and selects the forwarding sets of credentials and hence guarantees the quality services and decreases the energy consumption. However this approach suffers from a significant energy cost. In here for QoS provisioning they provides geographic opportunistic routing (GOR) with delay constraints and end-to-end delay in the existing wireless sensor networks (WSN's), they have thus analyzed the problems occurred in the GOR routing for provisioning QoS for multi constrained in wireless sensor networks to improve the efficiency of QoS.

2. Energy Consumption: Routing protocols are used to send and receive the information in an efficient manner in wireless sensor networks so that one of the major issues while working with WSN's is the energy consumption. As we all know that having one of the limitations as energy resources of the sensor nodes, the data which is going to be send or transmitted must be received by the receiver with huge occurrences hence we may use various routing matrices which are relevant fir this such as shortest path algorithm and that's why novel energy efficient routing matrices has been developed so that various associated reasons for the consumption of energy should be investigated in wireless sensor networks (WSN;s).

In such area of researches the proposed protocol which are energy efficient to minimize the energy consumption known as GSTEB [7]. For processing information a routing tree is constructed by general self-organized tree based energy balance routing protocol, by GSTEB, which is a energy efficient protocol. In this protocol, by assigning the root node the base station transmit or broadcast their selection message to other sensor nodes expect itself, and at the end energy node chooses or selects their parent. Improved performance has been noticed while performing simulating GSTEB, other than various different protocols which are efficient in balancing energy consumption.

3. Power Management: In wireless sensor networks managing power is one of the major concerns, so that an optimal control approach for providing the power management and solve the various related problems has been explained whose aim is to maximize the lifetime of the wireless sensor networks. At the sensor nodes energy sources such as batteries are not really assumes to be ideal, in place of that behaving like a energy consumption model which is dynamic in nature and thus signifies the non-linear and linear nature of actual batteries [11], are covered under optimal and energy allocation technique.

Now this optimal approach shows that with respect to battery model this is an optimal policy and working under really fair and robust conditions

4. Lifetime of networks: The availability of resources and the WSN topology in various paths

of collection of data in the form of tree may vary as in the consumption of energy in different nodes, thus this will be having an impact to the overall networks lifetime [10] and hence it would conclude in efficiency and scalability. For maximizing the network lifetime [9] an advanced routing technique which is energy balanced in nature based on the factor forward-aware (FAF-EBRM) has been proposed. In the proposed method known as FAF-EBRM is going to be used to provide high quality of services, improved network lifetime and also used in balancing the consumption of energy. By doing various kind of experiments or simulation we closely observes and compares the efficiency and the performance between energy efficient Unevent clustering (EEUC) and LEACH and FAF-EBRM, and reaches on the conclusion that FAF-EBRM outperforms EECU and LEACH in the terms of the networks lifetime and consumption of energy.

VI. RELATED WORK

Instead of using flooding in the region of target for the geographic attributes, the request is thus disseminates by the so called SINK node in the GEAR (Geographical and energy aware routing). Based on the learning cost and estimated cost each of the sensor nodes present in WSN's forwards the messages to its adjacent or we can say precisely to the neighbouring nodes. At that time the dummy messages are mixed with the valid messages and transmitted to archive the source-location privacy.

When these dummy messages are sent over the network they not only increases the network collision but also result in consumption of significant sensor energy in adequate amount and thus delivery ratio of the packets has been reduced, better approach in which each of the valid messages are transmitted from the actual source of origination to the various phantom nodes or sources via designated path using any one of the following technique known as hop-based technique or by using sector based approach using the so called phantom routing protocol [13]. The header is responsible to store the sector or the direction of the message. In that scenario the actual source and the phantom source are situated in different locations which are away from each other. The Sector information or the directions which are stored in the header of the message are obtained by the adversaries once the message is captured.

A potential mechanism is proposed by the Ameer A.Abbasi [14] to divide or partition the network into blocks which will cause failure of nodes. To re-establish the connectivity we can use one of the highly effective recovery methodologies to autonomously reposition a subset of the actor nodes, these recovery schemes are going to impose very high overhead of node relocation. To remove these deficiencies, (LeDiR) Least-Disruptive topology Repair algorithm is used. In this algorithm we consider a view of nodes in which a recovery plan is going to invite about the network, and strictly ensures that there is no extended path between any pair of nodes which relocates the minimum number of nodes present.

G.Wang [15] discovers an important issue while designing sensor networks on deployment of sensor nodes. This will provides or evaluates sensor protocol which is distributed in nature for mobile sensors. The protocol thus calculates the sensor positions after discovering the coverage holes, when the sensors moved and hence limited movement of sensors from densely deployed to sparsely deployed areas. We used diagrams known as Voronoi for design three sensors deployment protocols Minimax, VOR and VEC and thus coverage holes are discovered.

S. Yang [16] provides a comparative study that the monitoring area for the coverage depends on the proficiency of sensor networks, so that to balance the workload of sensors, the wireless sensor networks are deployed and it is necessary. Whenever the sensors nodes are moving from the unbalanced state to a balanced state are deployed for the movement assisted node. To minimize the various different parameters that includes coverage rate, total number of moves, communication / computation cost and total moving cost are suitably used to optimize the various problems. A unique problem known as the communication holes in the wireless sensor networks is addressed and to achieve a more balanced state, SMART protocol is developed and thus used for disseminate and scan.

X. Li [17] introduced an metric of evaluation to archive the focused coverage for a point of interest having a wide coverage radius. In mobile sensor networks there is a more important research based on the self deployment sensor that deals with the self directed coverage information. The Greedy Rotation-Greedy (GRG) and Greedy Advance (GA) are the two protocols which provides the purely localized solution that are going to be very rigid to the failure of nodes and the work that has to be done regardless of the network partition. The algorithm covers the point of interest that has been moved along with locally computed triangle tessellation. The nodes are continuously come close to each other greedily to the point of interest in Greedy advance where as in GRG whenever their greedy advance is get blocked the sensor nodes are rotated around the TT vertex and point of interest.

VII. PROPOSED SYSTEM

An efficient and geography based secure cost aware secure routing protocol (CASER) is proposed for the

wireless sensor networks (WSNs) without flooding, there are potentially two routing strategies that we are going to use in the same framework as that are deterministic routing and random walking. The requirements to distribute these two strategies are determined by the security that is very specific. This scenario is similar to the case of US mail delivery using the USPS, so that regular mail are cheaper than the costly express mails, however a faster mail delivery can be achieved. Under adversarial attack this proposed protocol is going to provide a highly secure option of delivery of the message that has been potentially increases the delivery ratio of the message in the wireless sensor networks (WSNs) with an extension the proposed protocol of routing is analyzed by the most secure quantitative analysis.

Proposed System Advantage:-

1. The time delay is adequately reduced.
2. It is efficiently going to balance the consumption of energy.
3. The life time of the wireless sensor nodes are potentially maximized.
4. A more secure and faster delivery of messages.

Packages:

1. Suitable module for control of energy balance.
2. Highly secure module for enhanced security.

In energy consumption that has been caused by the sensor nodes that are having relatively very low levels of the energy and that has been regulated and controlled while using the energy balance control module. In the other hand the security levels are going to control the strategies of the random walking probabilistically or the selection of the shortest path routing.

VIII. CONCLUSION

A highly secure and real efficient routing protocol of cost aware secure routing for the wireless sensor networks has been proposed which is efficiently going to increase the lifetime of the network and energy consumption has been balanced. Various multiple routing strategies has been supported by our proposed cost aware secure routing in message forwarding that is going to increase the routing security and also extend the lifetime of the wireless sensor networks. In this the proposed protocol has an extra ordinary routing performance both in terms of routing path distribution and energy balance for the routing path security and that has been proved both as per the analysis that has been done theoretically and also captured as in the performance in the simulation. The lifetime and the delivery number of messages under the energy development which are non-uniform in nature by more than our times and these are archived by our simulation and the analysis, so that in this we also proposed a scheme which maximizes the sensor lifetime in a non-uniform manner.

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