Efficient and Secure Routing Protocol for Wireless Sensor Network

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Abstract :

Advances in Wireless Sensor Network Technology (WSN) have provided the availability of small and low-cost sensor with capability of sensing various types of physical and environmental conditions, data processing and wireless communication. In WSN, the sensor nodes have a limited transmission range, and their processing and storage capabilities as well as their energy resources are limited. Triple Umpiring System (TUS) has already been proved its better performance on Wireless Sensor Networks. Clustering technique provides an effective way to prolong the lifetime of WSN. In this paper, we modified the Ad hoc on demand Distance Vector Routing (AODV) by incorporating **Signal to Noise Ratio (SNR)** based dynamic clustering. The proposed scheme Efficient and Secure Routing Protocol for Wireless Sensor Networks through SNR based dynamic Clustering mechanisms (ESRPSDC) can partition the nodes into clusters and select the Cluster Head (CH) among the nodes based on the energy and Non Cluster Head (NCH) nodes join with a specific CH based on SNR Values. Error recovery has been implemented during Inter cluster routing itself in order to avoid end-to-end error recovery. Security has been achieved by isolating the malicious nodes using sink based routing pattern analysis. Extensive investigation studies using Global Mobile Simulator (GloMoSim) showed that this Hybrid ESRP significantly improves the Energy efficiency and Packet Reception Rate (PRR) compared to SNR unaware routing algorithms like Low Energy Aware Adaptive Clustering Hierarchy (LEACH) and Power-Efficient Gathering in Sensor Information Systems (PEGASIS).

Key words— Wireless Sensor Networks, Routing Protocol, Signal to Noise Ratio, Dynamic Clustering, Intruder detection.

Introduction :

Sensor network wireless network is widely considered as one of most essential technology for the twenty-first century. The sensing electronics measure ambient conditions associated with the surroundings surrounding the sensors and rework them in to an electrical signal. in many WSN programs, the deployment of sensor nodes is carried out in an advert-hoc fashion with-out cautious planning and engineering. in the past few years, an in depth studies that addresses the ability of collaboration among sensors in records gathering and processing and inside the coordination and control of the sensing activities have been carried out. however, sensor nodes are confined in strength deliver and bandwidth. Deactivation of only one sensor node may disrupt coverage or connectivity and hence may reduce stability on this sort of programs. consequently, all of the deployed sensor nodes in WSN must be active throughout operational lifetime. however, sensor nodes are generally equipped with one-time batteries and maximum of the batteries are of low energy. because of this, every sensor node ought to effectively use its available electricity a good way to enhance the lifetime of WSN. exceptional strategies are used for green usage of this low available power in a sensor node. Clustering is the sort of most widely recognized techniques. Li et al [1] have investigated the joint strength Allocation (PA) issue in a class of MIMO relay systems. by using the use of the potential and the imply-square mistakes (MSE) as optimization criterion, two joint PA optimization issues had been formulated. because the cost features derived directly from the capacity and the MSE could result in nonconvex optimization, changed fee capabilities similar to a convex trouble of the supply and the relay electricity weighting coefficients had been developed. the important thing contribution of the proposed method lies within the discovery of a good certain for the capacity and the MSE that simplifies the joint source and relay energy allocation right into a convex hassle. A wonderful characteristic of the new approach is that the power allocation within the supply and that within the relay are at the same time ideal for any given power ratio of the 2 devices. It changed into studied in [2] that the joint electricity allocation problem for multicast structures can reap better information charge. To address the nonconvex optimization hassle, a high-SNR approximation is employed to regulate the original cost characteristic with a purpose to obtain a convex minimization problem, where the approximation is proven to be asymptotically most suitable on the high-SNR regime. As an opportunity, an iterative set of rules has been evolved through utilising the convexity property of the value characteristic with appreciate to a part of the whole energy coefficients. Considering the low complexity of the bodily layer network coding within the multi-forged machine, the lattice based network coding that uses the proposed joint strength allocation schemes has been suggested .In this paper, we've got developed a Hybrid efficient and comfortable Routing Protocol through SNR based dynamic Clustering mechanisms (ESRPSDC), that is a combination of SNR, primarily based dynamic Clustering and routing pattern primarily based security mechanisms. We did a quick comparison of ESRPSDC with LEACH and PEGASIS, two of the popular routing protocols. The relaxation of this paper is organized as follows In phase 2, the related paintings is briefly reviewed and mentioned. Then we describe our community version, adversary model and notations used throughout in this paper in phase three. Some of the previous clustering techniques are: Distributed Clustering Algorithm (DCA) [3], Spanning Tree (or BFS Tree) based Clustering [4], Clustering with On-Demand Routing [5], Clustering based on Degree or Lowest Identifier Heuristics [6], Distributed and Energy-Efficient Clustering [7], Adaptive Power-Aware Clustering [8], Power-Efficient Gathering in Sensor Information Systems (PEGASIS), Power Efficient and Adaptive Clustering Hierarchy (PEACH), Optimal Energy Aware Clustering Algorithm for Cluster establishment (ACE), Hybrid Energy-Efficient Distributed Clustering (HEED).

Model of Hybrid SNR based Dynamic Clustering

a. Initialization

As shown fig 1, after the deployment of the nodes, the bottom station broadcasts a request (REQ) message to every node .whilst the nodes have acquired the REQ, they're equally divided in to clusters relying on the number of nodes and its sensing variety. every cluster frames its very own cluster identity and the cluster desk (CT) as shown in desk 1.

Table 1. Initial Cluster Table

Cluster ID	No. of active nodes	No. of sleep Nodes	CH with its Energy (Joules)	Next CH
1	8	3	Null	Null
2	6	4	Null	Null

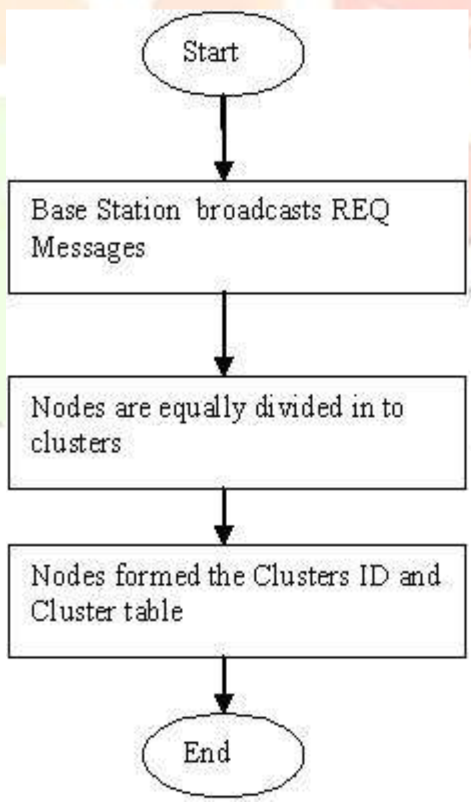

Fig 1. Initialisation phase .

b. Energy based CH selection

Each Cluster institution can select its own cluster head primarily based on its power. amongst, all the nodes within the cluster, the node, which is having the very best energy, had been chosen as CH [9]. the subsequent highest energy node is chosen as next CH, so that in the subsequent iteration if the CH losses its power the subsequent CH turns into the current CH. The glide chart is shown in Fig.2.the threshold defined in equation 1.

$$T_i(n) = \frac{(P \times C)\,(U_i - d(n,BS))}{(1-P)\,(r \bmod 1/P)\,(U_i - L_i)} \left[\frac{E_{cur}(n)}{E_{min}(n)}\right]^K .$$

where **P** is the desired percentage of the cluster heads. **r** is the current round. **Z** is the set of nodes, which have not been CHs in the last **1/P** rounds.

C is the constant factor between zero and one. Ui is the upper limit of level-i. ‗Li' is the lower limit of level-i.

d(n, BS) will be the distance between node n and base station.

$E_{cur\,(n)}$ is defined as the current energy of node n.

$E_{min\,(n)}$ will be the initial energy of node **n** and the value of **K** will be between zero to three.

The updated cluster table is shown in table 2.

Table 2.Updated Cluster table

Cluster ID	No. of active nodes	No of sleep nodes	CH with its energy (Joules)	Next CH with its energy (Joules)
1	8	3	N6/5	N8/4.5
2	6	4	N4/6.5	N5/6

c. SNR based CH selection by NCH nodes

In many cases, those nodes, that are allotted in sparse regions [10] or at the edge of a network, couldn't immediately communicate with cluster heads due to difficulty on their radio ranges. There are trade offs amongst connectivity, electricity usage, and verbal exchange latency. In our work, communique among a cluster head and a node past the radio variety of the cluster head has been done through intermediate nodes (1-hop member nodes) which provide relaying provider based totally on their SNR value. If everyday node will receives a cluster head state message from the CH node and not belonging to any other cluster than it'll send a verify message to CH node. Now the everyday node becomes a 1-hop node. it will create its own id and send a kingdom message to its neighbors within their vicinity. If a Non Clustered Head (NCH) node receives a kingdom message from a 1-hop member node, it will declare itself as a 2-hop member node. the two-hop member node additionally chooses its very own identity, that's m byte random integer brought on the quit of the chosen 1-hop member node's identity.

d. Data forwarding through Inter cluster routing

After that, each cluster head creates a TDMA time table for its cluster individuals. This facts is broadcasted returned to the nodes within the cluster. once the clusters are created and TDMA schedule is constant, records transmission can begin. Each cluster member may be grew to become off until the node's allocated time. every node sends records to its cluster heads with minimum transmission electricity. This energy is estimated by received sign strength of the commercial message, so thatstatistics transmission uses a minimum quantity of power. whilst all of the statistics has been received from the cluster members, then cluster head node carry out records aggregation feature to compress the records right into a single sign. After a certain time the next spherical, start. After the cluster formation, the cluster heads broadcast the mixture facts to the following evel. At the following level, the nodes aggregate their data and sends to their cluster heads. on this way, the cluster heads on the final degree transmit the final facts to the BS.

e. **Identifying the intruder**

Commonly, the attacked location might also contain many nodes and the intruder nodes aren't necessarily positioned on the middle of the region [11] in a multi-hop sensor network. therefore, it's miles necessary to in addition locate the precise intruders and isolate them from the network. this can be accomplished thru studying the routing pattern within the affected place. We now reveal a technique for amassing the community drift information, which facilitates the routing pattern evaluation. First, the base Station (BS) sends a request message to the community. The message includes the IDs of the affected nodes, and is flooded hop by using hop. For each node receiving the request, if its identity is there, it should reply to the BS with a message, which includes its personal identity, the identification of the subsequent hop node, and the cost for routing, Example, hop-matter to the BS. word that the following-hop and the cost could already be stricken by the assault, subsequently, the reaction message must be transmitted along the opposite direction inside the flooding, which corresponds to the original course with no intruder. The BS can then visualize the routing pattern by using constructing a tree the usage of the collected next hop facts. be aware that the place invaded by means of a sinkhole assault has a unique routing sample, wherein all community visitors flows in the direction of the equal destination, that is, the intruder Sink hole (SH).

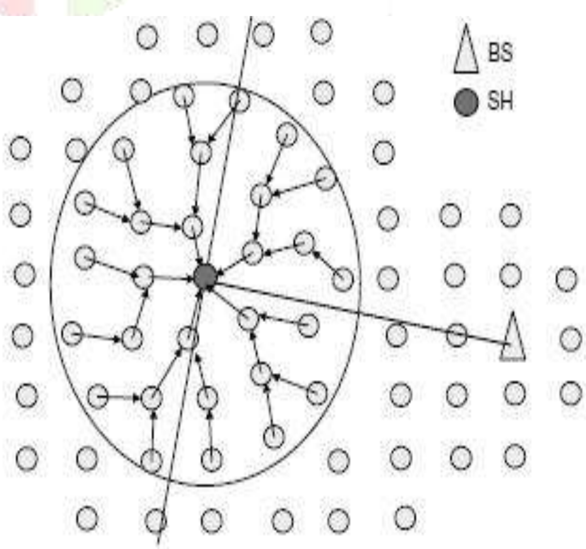

Fig 4. Pattern of the attacked area

Conclusions :

The energy efficiency of a candidate path is seriously dependent on the packet errors price of the underlying hyperlinks, when you consider that they without delay have an effect on the power wasted in retransmissions. evaluation of the interplay among error rates, quantity of hops, and transmission energy tiers well-knownshows numerous key results. it's been shown in [12] that for dependable electricity-efficient communication, the routing algorithm must recollect both the space and nice (e.g., in phrases of the hyperlink error fee) of every link. as a result, the value of selecting a specific link must be the overall transmission electricity (inclusive of feasible retransmissions) had to make certain eventual error-free delivery, and now not just basic transmission electricity. that is in particular crucial in realistic multi hop wireless environments, where packet loss fees may be high. In this paper, routing protocols for electricity green data collection thru SNR primarily based dynamic clustering were proposed. The community model based totally on energy degrees had been advanced along side the mathematical formulae for deciding on the cluster head. The evolved model become simulated the use of GloMoSim. We have studied in detail about the simulation consequences of power intake of cluster heads, percent packet shipping ratio and end-to-quit delay. Our future research might have focused about the optimization of our algorithm in order to effectively consume the energy of all nodes and improve the network lifetime. We shall extend our algorithm to heterogeneous WSNs.

The process of isolating the intruder or the compromised node could increase the number of hop count, which would further increases the delay in data delivery. Hence, node replacements strategies have to be analysed carefully. In addition, we need to calculate the amount of overhead involved in our proposed scheme.

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