An Enhanced Packet Gathering and Secure Multicast Routing Scheme in Wireless Sensor Networks

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Abstract:

Wireless Sensor Networks consists of group of self organizing, light weight sensor nodes that are used to cooperatively monitor physical or environmental conditions. Each Sensor node in a WSN is equipped with sensing, computing and communication elements. The Wireless Sensor Networks detects and estimate event features from the collective information provided by sensor nodes. In sensor network, sink node is available in cluster network. It has to control the communication process from cluster Member node to Cluster Head node. The sink node will get updated by its location in the network. The Proposed packet gathering and multicast routing Scheme is used to improve the packet gathering approach for each cluster head in wireless sensor network. The node coverage level is monitored and the packet gathering assessment level is obtained. The proposed scheme achieves better performance in terms of efficient routing, googd throughput, network life time and low delay network performance metrics than previous schemes based on simulation results.

Keywords- *Warless Sensor Networks, Packet Gathering, Multicast Routing, Sink Transpose Encircling*

DOI Number: 10.14704/nq.2022.20.13.NQ88276 Neuro Quantology 2022; 20(13):2221-2226

I. INTRODUCTION

Wireless Sensor Networks (WSN) comprises of motes interacting with the physical environment and collaborate among each other to provide data to the end-users. These motes are small devices with limited processing, communication and memory. Multicasting plays an important role in providing network connectivity and robustness to withstand malicious attackers. In the presence of node mobility environment, the prediction of node position is difficult to find. It may lead to more consumption of resources. Sink node speed carried is a primary method in wireless sensor environment since the sensor base node emerges regularly through various packet collector or cluster head, administrators and nodes. The multipath communication is one of the network methods to achieve the best presentation in conditions of trustworthiness and transmission rate of packet accepting. Security protocols are required to add secure authentication features for the base routing protocols. Attckers may arise from inside or outside the network. It is required to ensire genuine members which hold authorized keys at any time. While deploying security features, overhead and energy consumption becomes a bigger vtask to manage. It should be effectively reduced to achieve successful packet transmission.

II. Related Work

Kim, Choonyong, et.al,(1) presenting a multi-route organization method for the following sink node velocity. The method energetically designs multi route next to the travelling route of a sink node. It obtains the route restriction method depending to the sink's position alteration for decreasing energy usage. The experimental output indicates the present wrk seems beter than the previous scheme route organization in conditions of trustworthiness and energy effectiveness.

Chang, Jau-Yang,et.al, (2) presents energetic categorization scheme which has been used to produce a group based communication environment for the sensor nodes by utilizing the hierarchical construction and numerous hop notion. The present work provides a well-organized choice to produce the routing path. The energy usage is minimized and the lifespan of the network is improved for the sensor nodes by controlling the network load.

Bose.S, X. Ajith et.al.(3) present that the packet preparation is the compulsory procedure in a wireless environment, to provide steadiness of the network. This also reduces the packet latency. In energy efficient grouping method, the blast rate based on node assortment is the new growth. The communication node is chosen considering the blast rate among the group header node and the base station node. Singh, Ripudaman, Brijesh K.Rai, et.al., (4) Proposed JRAM combined path finding and MAC method for minimizing the communication latency in multi to single message concept for the sensor network. It presents a novel method to offer alteration to a node to be successful in communication. it allows a sink node to accept the data packets fro neighbour nodes in he similar rotation and improves the communication efficiency.

Thejaswi & Harish [5] found a detailed review of sensor networks and secure data aggregation concept in WSN. The relationship between dat aggregation and security requirements of WSN was analyzed briefly and presented in a clear manner. Secure data aggregation was summarized at the destination. Thenral & Sikamani [6] presented Angle based Multicasting Routing Algorithm for Wireless Mesh Networks with guaranteed performance. It provides routing efficiency and minimum energy consumption during route maintenance. Metin Ko & Ibrahim Korpeoglu [7] presented a packet traffic load based sink movement algorithm based on the distribution of packets in a given topology. This algorithm was extended based on the distance between the nodes and then packets are transmitted to obtain energy balanced algorithm. Hung & Phan Thi [8} focused on analysis of energy efficient routing algorithm based on Selection Cluster Head and Dijkstra Alogrithm. A shortest between cluster head and cluster member was determined to provide low cost communication and low power consumption. The distance between cluster head and base station is considered and reduced to satisfy the criteria for energy consumption.

In [9], author presented reliable and stable cooperative approach for Vehicle Ad hoc Networks (VANET). Before route discovery mechanism, the signal strength, remaining energy and the length of queue was calculated during load and transfer process. The collaborative message was captured and passed in all routing protocols to adjust final routes to select data with more reliability.. *S.*Saira Banu, and R.Dhanasekaran [10] proposed a New Multipath Routing Approach (NMRA) for increasing the energy efficiency in WSNs. In WSNs, the best route is being determined by choosing efficient strategy to forward the data to the base station. Due to that, the node consumes more energy unnecessarily. In this method a New Multipath Routing Approach was developed which attains energy model, maintenance of optimal energy path, multipath construction phase to make a correct balance between network life time, energy consumption and throughput to the sensor nodes.

III. Implementation of Proposed Scheme

A. Concept of Proposed Multipath Routing

The concept of proposed multipath feature is towards broadcasting the traffic load among two or more routes. Load delivery is to avoid the congestion problems in the network and to increase data throughput rate. The proposed multipath system in figure1 uses multi-path routing in order to select the route with the best maximum data throughput rate.

B. Determination of Path Stability

In order to reduce the effect of DoS attacks, Data tampering and Eavesdropping, the stability of path is undertaken here.

Path stability includes the link cost, link quality and bandwidth of the link. The link cost function is used by the node to select the next hop during the path search phase. Let N_b denote the neighbor set of node b, node b will choose the next hop by following the criterion.

$$L_{ct} = \arg\min_{l \in N_b} \left\{ \left(1 - \frac{e_{j,remaining}}{e_{j,init}}\right)^{[\delta(1 - \frac{(\Delta dh+1)}{d_{oe}})]} \right. \quad (1)$$

where d_{oe} is the distance in hops between node o and sink e; d_{ke} is the distance in hops between node k and sink e; Δdh is the difference between d_{oe} and d_{ke}; $e_{j,init}$ is the initial energy level of node j; $e_{j,remaining}$ is the remaining energy level of node j; and δ is the weight factor and $\delta > 1$. Note that $(\Delta dh+1) \in \{0, 1, 2\}$ and $(1-e_{j,remaining}/e_{j,init}) \in [0, 1]$. The link cost function takes both the node energy level and hop distance into account. Suppose $e_{j,remaining}$ remains constant. In this case, the link cost increases when $(\Delta dh+1)$ increases. On the other hand, suppose $(\Delta dh + 1)$ remains constant. In this case, the link cost increases as $e_{j,remaining}$ decreases. The weight factor δ adjusts the priority. A large δ gives more weight to the node energy than to the hop distance.

Link quality is determined from received signal strength value and signal to noise ratio value. Signal to Noise Ratio influences the bit error rate that a packet is successfully transferred. Here we include the packet dropping ratio for determining the path quality. It is defined as the number of packets dropped to the total number of packets received in the particular link. Bit Error Rate is inversely proportional to the SNR. The SNR is derived as

$$SNR = \frac{S_R}{\sum_{i \neq R} P_u + N_K} \quad (2)$$

In case if the disjoint network occurs, the load balancing is required. Here, there are M disjoint paths between a source node S and a sink node D. The requested data rate to be arrived at the sink node D via all these multipaths is R bits/sec. Let f_j be the data rate allocated to path j. For a path j, the product of the path cost p_j and the data rate allocated f_j gives the path cost rate w_j.

$$\Phi(\bar{f}) = \frac{\left(\sum_{j=1}^{M} f_j p_j\right)^2}{M \sum_{j=1}^{N} (f_j p_j)^2} \quad (3)$$

where the vector denotes the traffic rates allocated to all available routes and f_j is the traffic flow allocated to path j.

The idle period of the wireless channel is a key parameter to determine the average bandwidth which is determined by the traffic travelling along the mobile nodes as well as their neighbor nodes. During that period the mobile nodes can successfully transmit data packets.

$$Avg_{bw} = Max_{bw} \otimes \left(\frac{Idle_t}{Initial_t} \right) \otimes L_q \quad (4)$$

Where L_q is the link quality.

C. Location based Multicast Rioting Protocol

In this phase multicast tree is constructed based on the position of mobile nodes. The multicast group message is added b with group ID and the redundant nodesn for all multiast groups will be removed from the multicast tree. The parent nodes update their child node locations by sending Request Join Messages The Routes are established from multiple source and destination. If any node falls into the category of high mobilitu, it will be isolated

In Wireless Sensor Network environment, a base station node performs communication within node and target node. The Routing Path will be assigned and does not consider the unwanted activities of sensor nodes. Since the path allocation is done, the characteristics are changes. The nodes are moved out of the coverage range and get collapsed for the neighbor node allocation. Before initialing the communication process from cluster member node to cluster head the location of nodes and assessment level in the node is monitored. The base station gts its position updated in any irection in the nentwork. Due to the out of coverage of cluster member nodes from group an inefficient communication and the packets are dropped during communication period.

The Sink Transpose Encircling Scheme is applied to enhance the data packet gathering for all the cluster head, present in the Wireless Sensor Networks.

The encircling Scheme is designed with the use of gathering proportion assessment level to make efficient packet broad casting. To achieve the choice for patient gathering assessment the coverage level of sensor nodes is observed. When the gathering assessment is minimum, it attains inefficient packe gathering and when it is maximum the efficient packet gathering scheme is implemented to improve thr performance of network lifetime and minimize the end to end delay.

d. Algorithm of Sink Transpose Encircling Approach

i) The path is allocated without considering thr coverage range.
ii) The cluster head will be ready to gather data packets.
Iii) The Sink Transpose Encircling Approach is implemented.
iv) The gathering assessment level is analyzed.
v) If the gathering assessment level is minimum it rejects the assessment nodes.
vi) If maximum it selects the gathering assessment nodes and increases the network life time

The clutter members will have crossed their circle limit and they are replaced out ot the coverage range from normal routing path of the cluster. K is the sink node, c is the coverage node and p is the data packets.

$$K = c + p \qquad (5)$$

The path is scheduled by the cluster head node and the cluster head is selected by using narrow route approach which identifies sink node , coverage node and packe gathering. The best node for relaying data packets is selected which is nearer to cluster head and has sufficient resources for communication. The efficient routing path is created using cluster nodes. The coverage node c, Auxiliary Cluster An and cluster Member (CM) is related by $C = Au\,(CM)$ (6)

e) Sink Transpose Encircling Scheme

The sink node constructs the shortest tree path using a voucher packet transmission inits neighbor node. The sensor nodes which accepts voucher packet, contributes on path construction. The highest value of timeslot is bordered by timeslot at the high range which depends on neighborhood of the authority of the base station node. The neighborhood of authority for any base station depends on the sink node interconnection when the sensor node is fixed.

During the voucher transmit, the sensor accepts hidden acknowledgement if intermediate node for path allocation. Sensor node changes its position during the broadcast at regular time gap. The sensor nodes which participate in data aggregation transmits a voucher data packet at regular intervals in neighbouring node to provide a reply to oiys energy. The interruption of connection in single position does not involve the communication process and each data is sent to sink among the various routes.

Depending on the sink position the voucher packets are transmitted through different paths to sink node. The nodes situated within coverage region, contains less possibility of individual sensor nodes after different paths. An intermediate node breakdown contains an alternating intermediate to create the link. Very small number of modes contain to remain in the subsequent transmission of voucher packets.The damage cluster is indicated by each protector node to identify the breakdown of its intermediate cluster node.The risk condition of cluster damage is repeated to the sink node by focusing packets with its Input to the source node of the cluster.The coversge level of each node is monitored and provides routing path. The gathering proportion assessment leval is analyzed of all sensor nodes The coverage level of each node is monitored and for each node the rutting path is provided. Sink node position is altered in any direction. The coverage range for communication node is measured and if the voucher packet gets success the node performs communication using that path. If voucher packet is not success the node will not use the communication path and continus to find next available

f) Analogy of Gathering Proportion Level

The Gathering proportion assessment level is analyzed for all the sensor nodes in the network. The data packet gathering level of cluster head is analyzed and the better Communication path is selected. If gathering proportion is high. Cluster head gather data packets through that path and if gathering proportion is low, It Rejects that routing pathThe network life time is improved.

IV. PERFORMANCE EVALUATION

The proposed protocol is simulated with network simulator tool (NS 2.34) version. The simulation tool languages are C++ and Tool Command Language (TCL). Only 150 nodes are deployed in 1200 x 1200 sq.m network simulation area. Mobility model is Random walk model to simulate the packet with the size of 80 bytes. The simulation settings are tabulated below.

Table1. Simulation and Settings parameters

No. of Nodes	150
Area Size	1100 x 1100 m^2
Mac	802.11
Radio Range	120 m
Simulation Time	100 sec
Traffic Source	Constant Bit Rate (CBR)
Packet Size	80 bytes
Protocol	Dynamic Source Routing

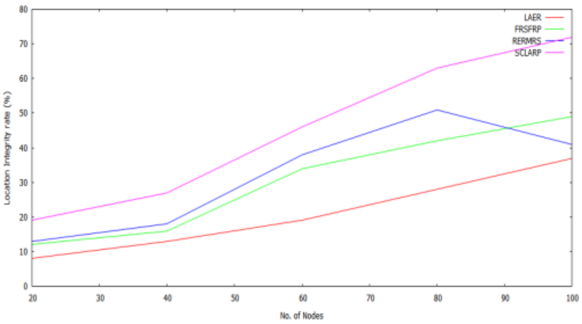

Figure 2. Location Integrity Rate Vs Number of Nodes

The Figure 2 illustrates the performance of location integrity rate while varying the number of nodes participated in the network. Location identity of node is transferred without alteration or modification.

The Figure 3 illustrates the performance of node authentication ratio versus number of nodes

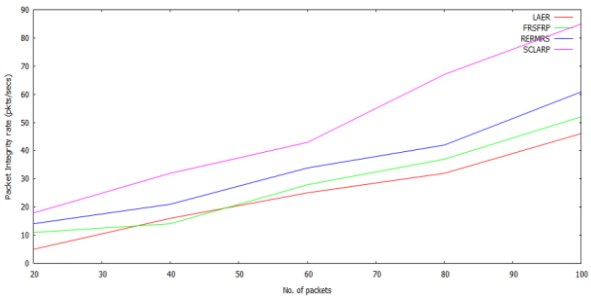

Figure 3. Node Authentication ratio Vs No. of Nodes

CONCLUSION

In this research work, an Enhanced Packet Gathering Scheme and Secure Multicast Routing Scheme is developed for wireless sensor networks The Proposed packet gathering and multicast routing Scheme is used to improve the packet gathering approach for each cluster head in wireless sensor network . The node coverage level is monitored and the packet gathering assessment level is obtained.It obtains the decision for packet gathering assessment level that is measured at every time slot used for a particular node to perform communication.. The proposed scheme achieves better performance in terms of efficient routing, good throughput, network life time and low delay network performance metrics than previous schemes based on simulation results**.**

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