Energy Efficient Cluster Based Algorithm Technique for Wireless Sensor Networks

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Abstract: - Wireless sensor network [WSN] energy efficiency is the most critical task of researchers. Power regulation is a very effective technique for interference minimizing in WSN and energy consumption. WSN with several nodes linked to the network, including transmitting power to measure network output. The energy usage is connected to node size and weight. Aggregation data secure in WSN is a highly challenging activity. In this research paper suggested stable aggregation of data using fuzzy logic, based on clustering techniques. The clustering method is done in a network. The distance power consumed and faith value are measured for each cluster. The stable data aggregation using fuzzy logic techniques (FLT) is based on these parameters. The proposed research work would minimize energy usage to increase the lifespan of WSN.

1. Introduction

Wireless sensor networks are one of twenty-first century's important developments. MEMS and wireless networking technology have made recent advancements in light weight, inexpensive, smart sensors with wireless connection for a variety of military, civilian purpose, including environmental tracking, war surveillance, and industrial process management [1]-[5]. Temperature, light, sound and humidity were all included. Network attacks in the categories of spoofed, modified, (or) replayed, limited forwarded sinkhole, HELLO flood and wormholes attack, Spoofing targets of routing protocol aimed at sharing routing information between nodes. Malicious nodes can fail to transmit such messages to ensure the message for multi-hop networks does not spread. Wireless sensors are one of the most prevalent networks that senses our atmosphere by means of different parameters such as heat, temperature, strain, etc,. Due to the dense deployment of disposable sensor nodes and minimum-cost sensor systems, destruction of such nodes with hostile activity does not affect an operation military and destruction of a conventional sensor conducting an operation [6]-[8].

The transmission between the two nodes minimizes other nodes to boost their efficiency and neglect power controls, which are better than spatial reuse than wireless networks. Adaptive power transfer technologies in wireless sensor networks to maximize network life span [9], [10]. The data from the cluster heads would be sent directly to the sink node. The data from sink nodes for the distance calculation while the cluster head is transmitted through the shortest multi-hop route and the shortest route to the sink node between each cluster.

In order to locate the prevailing node [maximum route number], power transmission strategies boost network efficiency in many respects. In wireless networks, the propagation range can adjust the ranges of each connection [11]-[15]. Capacity reduces as additional nodes are introduced to maximize intervention. Graph theory from a data point to a neighbour's node is redirected through several pathways.

2. Data Gathering For WSN

This paper detects shortest route to relay power from neighbouring network nodes and improve network life through Fuzzy Logic. It consists of three steps for enhancing network capacity using adaptive transmission technologies. Data collection is one of the key sensor node priorities. It includes...
the processing and transfer of sensed data from various sensors to BS. This is the process by which data from multiple sensors may be aggregated to eliminate redundant data from the BS. The different problems in the following categories such as:

- The energy savings in some nodes for the immediate transmission of data to BS.
- Data accumulation to establish clustering strategies to maintain the capability of the sensor.
- Performance is also increased.

The vertices of the network nodes and direct communication between the edges of the nodes are depicted. Sensor nodes (SN) are the maximum flow of the distance measured from one node to the other node. As a network system the combinatorial structure is named the number of vertices in the network is related to the SN. More number of boundaries network that connects the similar vertical pair was considered several sides, and is called a multi-path network is shown in Figure 1.

![Figure 1. Architecture of WSN](image)

The cluster approaches to find shortest way in WSN using graph theory. Three stages of modules are as follows:

i. Distance Evaluation
ii. Energy Evaluation
iii. Shortest Route Evaluation

2.1 Distance Evaluation
The gap of all other nodes in each cluster, using algorithm is evaluated by the A and B of each node in cluster network.

\[ L = \sqrt{\left( A_2 - A_1 \right)^2 + \left( B_2 - B_1 \right)^2} \]  \hspace{1cm} (i)

Where L is distance from \((A_2, A_1)\) and \((B_2, B_1)\) is denoted by Euclidean distance

2.2 Energy Evaluation
The equation (ii) is used to evaluate the energy,

\[ E = E_{\text{int}} - \left( S_t \times R_{tx} + P_r \times T_{tx} \right) \]  \hspace{1cm} (ii)

Where,  
\[ E_{\text{int}} - \text{Energy level at Initial condition for each cluster} \]  
\[ S_t - \text{Node transmitted no. of packets} \]  
\[ P_r - \text{Node received no. of packets} \]  
\[ R_{tx} - \text{Required energy for transmission of Packet} \]  
\[ T_{tx} - \text{Required total energy for each packet} \]

2.3 Shortest Route Evaluation
The energy evaluation and distance measurement centred on their shortest route to relay the data from the CH to the BS by expanding the network life based on their shortest route of transmitting data from CH to the BS by extending the existence of the network. The shortest route approximation using graph representations x and y for two vertices represented by L[x, y]

1. L [x, y] ≤ 0
2. L [x, y] ≥ 0
3. L [x, y] = 0

3. Fuzzy Logic for WSN
The SN is clustered into many clusters with cluster head (CH) and ID. The CH distance calculation and the topology of the packet discovery. The cluster head collects the data of each participant and sets the energy level for the algorithm.

Energy = P * T

The Fuzzy Logic (FL) is eventually used to pick the right aggregation nodes and parameters such as faith value, distance to each and every node and power via CH as input data and FL rules are created. The FL rules regarded as the good node (GN) and bad node (BN) depending on their performance. The good nodes are added to the CH-ID, which is sent to BS. The CH-ID is related to since the nodes are the largest node of the network. Degree of critical input steps and the state of the fluid logic is high. It is elegant on the basis of the norm. The findings are derived from several fuzzy laws with single cumulative results. The blurry sets of A with X rules membership are calculated. Antecedents 1 and 2 are tiny, which implies that they are strong. Fuzzy set membership function (FSMF) for GN and BN in Cluster-ID for distance, power and faith value evaluation are given below,

\[
\text{Distance (L)} = \{ [GN, h], [BN, i] \}
\]
Where,

h- FSMF-GN Cluster-ID for distance evaluation
i- FSMF-BN Cluster-ID for distance evaluation

\[
\text{Power (p)} = \{ [GN, j], [BN, k] \}
\]
Where,

j- FSMF-GN Cluster-ID for power evaluation
k- FSMF-BN Cluster-ID for power evaluation

\[
\text{Faith Value (FV)} = \{ [GN, l], [BN, m] \}
\]
Where,

l- FSMF-GN Cluster-ID for faith value evaluation
m- FSMF-BN Cluster-ID for faith value evaluation

3.1 Neighbour Identification

| Distance D | Power Consumed P | Faith Value F | Consequences |
|------------|------------------|---------------|--------------|
| Low        | High             | Low           | Worst        |
| High       | High             | High          | Worst        |
| Low        | Low              | Low           | Worst        |
| High       | Low              | Low           | Best         |
| Low        | Less             | High          | Best         |
| High       | Less             | Low           | Best         |
| Low        | Less             | High          | Best         |
| High       | High             | High          | Worst        |
The vertices of the network nodes and direct communication between the edges of the nodes are depicted. Sensor nodes are the maximum flow of the distance measured from one node to the other node. The composite system is referred to as a network structure. The number of vertices in the network is related to the source node and height of edges. Two or three of the boundaries of network that connects the same vertical pair are considered several sides, and is called a multi-path network. The majority of the weakest nodes are replaced in the network is discussed in Table-1.

4. Results and Discussion

Network Simulator Version 2, generally known as NS2, is a platform that can be used to model incidents and to analyze the complex existence of communications networks. Wired and wireless network functions and protocols can be simulated using NS2, i.e. routing algorithms, TCP and UDP. In general, NS2 allows users a way to define and simulate network protocols is discussed in Table 2. A node performs two main functions in NS2. It provides packages as a host to the port-attached transport layer agent Specified in the header. NS2 packet configuration Link to its Ns Artifacts downstream only.

A Node does not have to be linked to it Upstream NS Entity (e.g., transportation agent sending A connection upstream). Its upstream NS Entity instead creates a node relation. NS2 default the node is based on static and flat addressing. With flat addressing, any new node has an address Increased by one from the previous generated node. The routing table is determined at once Simulation process start and does not start Shift after that. NS2 hires the shortest Dijikstra Road algorithm for estimating maximal routes for all pairs of Nodes. It’s a host Delivers packets connected to the transport layer agent and the NS2 environment Tcl, script and C++ implementation. Nodes were transmitted one after the other at a given interval. The clustering strategy of relay data to the (BS) is seen in Figure 2.

| S.No | Parameter           | Value   |
|------|---------------------|---------|
| 1.   | Transmitting Power  | 80mW    |
| 2.   | Receiving Power     | 60mW    |
| 3.   | Idle Power          | 8.5mW   |
| 4.   | Inactive Power      | 16.2mW  |
| 5.   | Energy per Individual node | 50J    |
| 6.   | Weighting Parameters | $W_1$ and $W_2$ | 0.6, 0.8 |

Figure 3 shows energy consumption of network and red colour indicates the existing work of energy consumption and also green indicates the proposed work of energy consumption. Throughput secured data aggregation using FLT is shown in Figure 4. Figure 5 shows that the Packet Drop Ratio in secured data aggregation using FLT.

Figure 2. Clustering Techniques of WSN
Figure 3. Average Energy Consumption.
5. Conclusion
The energy consumption rates for sensors in a wireless sensor network differ significantly in compliance with the protocols that the sensors use. Results on energy usage, transmitted and obtained minimum voltage supply required for service, energy consumption impact of power transmission and numerous life time calculation methods of a sensor node are discussed. The activity of sensor nodes is identified and evaluated near to their end of existence.

References
1. G. Arumugam, T. Ponnuchamy, 2015, "EE-LEACH: development of energy-efficient LEACH Protocol for data gathering in WSN", EURASIP Journal on Wireless Communications and Networking ,76, DOI 10.1186/s13638-015-0306-5.
2. Hassan Oudani, Salaheddine Krit, Lahoucine Elmamouni and Jalal Laassiri, 2016, "Comparative Study and Simulation of Flat and Hierarchical Routing Protocols for Wireless Sensor Network", International Conference In Engineering & MIS (ICEMIS), IEEE, pp. 1-9.
3. J. Jia, J. Chen, G. Chang, Y. Wen and J. Song, 2009, “Multi-objective optimization for coverage control in wireless sensor network with adjustable sensing radius”, Elsevier, Computers and Mathematics with Applications, Vol. 57, pp. 1767-1775.
4. T. Qiu, F. Xia, L. Feng, G. Wu and B. Jin, 2011, “Queueing theory based path delay analysis of wireless sensor networks”, Advances in Electrical and Computer Engineering (AECE), vol. 11, no. 2,.
5. X. Zhang, X. Ding, S. Lu and G. Chen, 2009, “Principles for Energy-Efficient Topology Control in Wireless Sensor Networks”, WiCom '09. 5th International Conference on Wireless Communications, Networking and Mobile Computing, IEEE, pp. 24-26.
6. Murat Dener, 2014, “Security Analysis in Wireless Sensor Networks”, International Journal of Distributed Sensor Networks, Vol.10, No.10, pp.303501,.
7. David Martins and Herve Guyennet, 2010, “Wireless Sensor Network Attacks and Security Mechanisms: A Short Survey”, 13th International Conference on Network-Based Information Systems, pp. 313-320,.
8. C. Dhivya Devi and B.Santhi, 2013, “Study on Security Protocols in Wireless Sensor Networks”, International Journal of Engineering and Technology, Vol.5, No.5, pp.200-207,.
9. M. Revathi and Dr. B. Amutha, 2017, “A Survey on Security Protocols in Wireless Sensor Network”, International Journal of Pure and Applied Mathematics, Vol.5, No.5, pp.250-257
10. Fasee Ullah; Masood Ahmad; Masood Habib; Jawad Muhammad, 2011, “Analysis of Security Protocols in Wireless Sensor Network”, 3rd International Conference on Computer Research and Development, DOI: 10.1109/ICCRD.2011.5764156
11. Yifan Hu, Yongsheng Ding, Lihong Ren, Kuangrong Hao and Hua Han, 2015, “An endocrine cooperative particle swarm optimization algorithm for routing recovery problem of wireless sensor networks with multiple mobile sinks”, Information Sciences, Elsevier, Volume 300, pp. 100-113

12. Shusen Yang, Usman Adeel, Yad Tahir, and Julie A. McCann, 2017, “Practical Opportunistic Data Collection in Wireless Sensor Networks with Mobile Sinks”, IEEE Transactions on Mobile Computing, Volume 16, Issue 5, pp.1420 – 1433

13. Mai Abdelhakim, Yuan Liang and Tongtong Li, 2017, “Mobile Access Coordinated Wireless Sensor Networks – Design and Analysis”, IEEE Transactions on Signal and Information Processing over Networks, Volume 3, Issue, pp.172 – 186

14. S. Kannadhasan and R.Nagarajan , 2018, “Performance Improvement of Slot Antenna Using Various Parameters and Band Pass Filter,” 2018 International Conference on Circuits and Systems in Digital Enterprise Technology (ICCSDET), IEEE Press, pp-128-131.

15. Yongmin Zhang, Shibo He and Jiming Chen, 2017, “Near Optimal Data Gathering in Rechargeable Sensor Networks with a Mobile Sink”, IEEE Transactions on Mobile Computing, Volume 16, Issue 6, pp.1718-1729