Energy-power Efficient Dynamic Cluster Head Leach Protocol based WSN using Fuzzy Inference System

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Abstract-The collection of enormous amount of homogenous sensor nodes forms the Wireless Sensor Network. These sensor nodes have restricted battery power and memory and so the limited amount of energy is considered as the major issue. To overcome this issue several mechanisms were proposed, among them clustering is a popular way which minimizes the consumption of energy in the sensor nodes and thus the life span of the Wireless Sensor Network can be increased. Grouping the sensor nodes in an energy efficient and distributed approach is considered as the important issue in clustering.So in order to triumph over these issues, a Fuzzy Based Dynamic Clustering (FDC) in Wireless Sensor Network is proposed. A fair comparison is done between this proposed algorithm and some existing algorithms. The simulation results obtained reveals that our proposed algorithm increases the lifetime and has better energy efficiency and secure rate of packet delivery.

Keywords—Wireless Sensor Network, Fuzzy Logic System, Packet Delivery Ratio, Dead Node, Energy

I. INTRODUCTION

A Wireless Sensor Network (WSN) involves spatially coursed independent sensors to screen physical or natural conditions, for instance, climate conjecture, examination of normal, barometrical weight, etc and it passes their data by using framework to the pined for region. The present frameworks are bidirectional, furthermore these frameworks have the enabling capacity to control sensor works out. The redesign of remote sensor frameworks was induced by military applications, for instance, security in battlefield,and in like manner used as a piece of many industrialized and purchaser applications, for instance, mechanical procedures,screening and control,health checking, etc. In the future, repudiating to built up frameworks, WSNs are significant just if sensor centers think about nature incorporating them.Each sensor could simply screen its area and keep on sending the assembled data to the sink center. In any case, the conceivable profitability of WSNs lies in its ability to compare the accumulated data in time and in space [1].

The locational information expect a urgent part in extension, association reason, coordinating information, locational advantage, target following and defend activities in remote sensor frameworks. The limitation information is crucial where there is a vulnerabilityabout some arranging. In case the sensor arrange is used for viewing the temperature in a structure, it is clear to know the definite region of each center point [2,3]. On the unpleasant, if the sensor arrange is used for viewing the climatic condition in a remote timberland, sensor center points may be spread out in the region by means of plane and the different region of most sensors may be dark. A control computation can use all the open limitation information from the bits to figure all of the positions. Centers are sent with a Global Positioning System (GPS), anyway this is an extravagant course of action the extent that volume, money and influence consumption.For this reason various impediment shows are proposed [4]. Confinement in remote sensor frameworks is performed by following these 3 phases:

1. Partition estimation - This stage incorporates estimation frameworks to assess the relative detachment between the center points [4].

2. Position count - It contains estimations to figure the bearings of the dark center concerning the zone of known hook center points or other neighboring center points. Triangulation, multi-lateration, and region are a couple of methodology that are used for distinguishing location.It uses the geometric properties of triangles to process center point zones. Triangulation are gathered into lateration and angulation. lateration is figured using partition estimations and angulation is processed using edge data. Estimation procedure is to determine the center region using lateration ,expel information from 3 reference centers is required and using angulation, 2 point estimations and 1 separate information is required [5].

3. Restriction estimations - It chooses how the information concerning divisions and positions are controlled, with a particular ultimate objective to allow by far most of the centers of WSN to assess their position. In a perfect world the imprisonment estimations may incorporate counts to reduce the errors.In this paper, go free confinement

figuring specifically MAP-M&N and meta-heuristic computation Tabu Search was proposed nearby MAP-M&N and the ordinary goof in impediment was examined using these figurings [6, 7].

II. WIRELESS SENSOR NETWORK

Wireless sensor systems (WSN), are like remote specially appointed systems as in they depend on remote availability and unconstrained development of systems so sensor information can be transported remotely. Once in a while they are called clean systems, alluding to minute sensors as little as tidy. Shrewd clean is a U C Berkeley venture supported by DARPA. Tidy Networks Inc., is one of the early organizations that created remote sensor arrange items. WSNs are spatiallydistributed self-ruling sensors to screen physical or natural conditions, for example, temperature, sound, weight, and so on and to agreeably go their information through the system to different areas. The more present day systems are bi-directional, likewise empowering control of sensor movement. The advancement of remote sensor systems was roused by military applications, for example, war zone reconnaissance; today such systems are utilized as a part of numerous mechanical and shopper applications, for example, modern process observing and control, machine wellbeing checking, et cetera [8, 9].

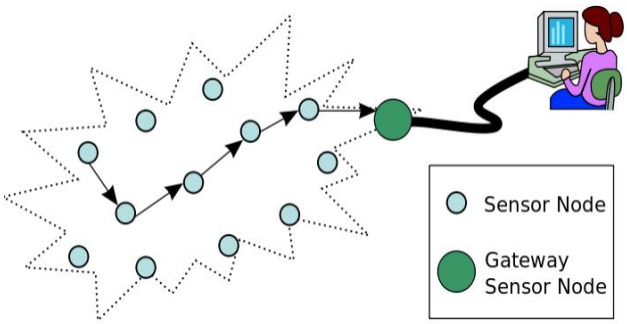

Figure 1: Typical multi-hop wireless sensor network architecture

Application:-

Region Monitoring:- Area checking is a typical use of WSNs. In territory observing, the WSN is sent over a district where some marvel is to be checked. A military case is the utilization of sensors identify adversary interruption; a regular citizen illustration is the geo-fencing of gas or oil pipelines.

Social insurance checking:- The sensor systems for therapeutic applications can be of a few sorts: embedded, wearable, and condition installed. The implantable medicinal gadgets are those that are embedded inside human body. Wearable gadgets are utilized on the body surface of a human or exactly at nearness of the client. Condition inserted frameworks utilize sensors contained in the earth [10]. Conceivable applications incorporate body position estimation, area of people, general checking of sick patients in healing facilities and at homes. Gadgets implanted in the earth track the physical condition of a man for nonstop wellbeing finding, utilizing as information the information from a system of profundity cameras, a detecting floor, or other comparative gadgets. Body-zone systems can gather data around a person's wellbeing, wellness, and vitality consumption. In medicinal services applications the security and genuineness of client information has prime significance. Particularly because of the joining of sensor systems, with IoT, the verification of client turn out to be all the more difficult; in any case, an answer is displayed in late work [11].

Ecological/Earth detecting:- There are numerous applications in observing natural parameters,[10] cases of which are given beneath. They share the additional difficulties of brutal situations and decreased power supply [11].

Air contamination observing:- Wireless sensor systems have been conveyed in a few urban communities (Stockholm, London, and Brisbane) to screen the centralization of perilous gasses for residents. These can exploit the impromptu remote connections instead of wired establishments, which likewise make them more versatile for testing readings in various zones.

III. DYMANIC CLUSTER HEAD SELECTION

In this paper, a clustering algorithm based on clustering is proposed to solve the heterogeneity caused by random selection of LEACH protocol cluster head. First, the k-Medoids clustering algorithm is used to divide the nodes of the whole network area into several classes, and then select the first cluster head and the second cluster head in the cluster.

The first cluster head is used to send the data of the cluster to the sink node and to receive the message sent by the sink node to the cluster. The algorithm allocates the energy consumption of a cluster head to two cluster heads to reduce the excessive use of a node.

Considering E as the set of energy of all the N nodes, Kis the expected number of clusters and X and Y are the set of locations of various nodes in the Wireless Sensor Network the algorithm for cluster head selection in EELEACH-C works as follows:

Algorithm CH-Selection (E, N, K, X, Y)

1. Asc - sort(E)

2. i = 1

3. **while**I ≤ N **do**

4. **if**(E_i>=E_{Avg} and i<= k) **then**

5. Eligible(i) = True

6. **else**

7. Eligible(i) = False

8. **end if**

9. i=i + 1

10. **end while**

11. **if**($dist_i$>distj and Eligible (i)) **then**

12. CH_i=CM_j

13. **end if**

14. **return**(CHi , CHj)

Here, we explain in detail our new energy efficient EELACH-C protocol whose goal is to increase the longevity of the network. Let us assume that all the sensor nodes are equipped with equal amount of initial energy.

We assume that all nodes are distributed uniformly over the sensor field. Our approach is to assign a weight wito the probability of a node to become cluster head pch. This weight must be equal to the initial energy of each node divided by the residual energy. Only nodes which are having the highest weights will be eligible to become a cluster head (CH) in next round. The probability of a member node (CM) to be the node to die first is less than the probability of an already chosen cluster head node to die. Simulation results attest our expectation.

IV. FUZZY INFERENCE SYSTEM

The Fuzzy Logic Algorithm is lit up by the intense capacity of fluffy rationale framework to deal with vulnerability and uncertainty. Fluffy rationale framework is notable as model free. Their enrollment capacities are not founded on factual dispersions. In this paper, we apply fluffy rationale framework to streamline the directing procedure by some foundation. The principle objective is planning the calculation to utilize Fuzzy Logic Systems to extend the lifetime of the sensor systems.

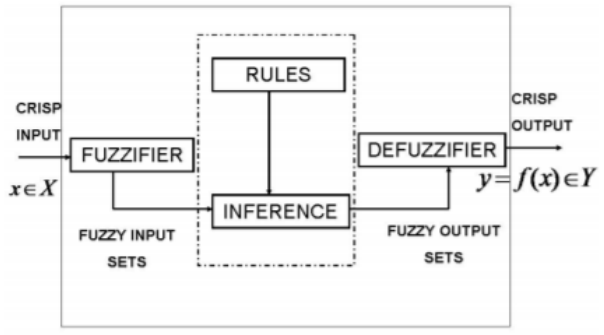

Figure 2. The structure of a fuzzy logic system

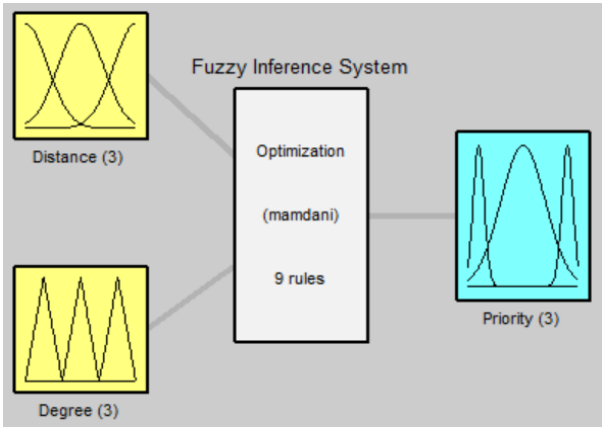

Figure 3: System Optimization of 2 inputs, 1 outputs and 9 rules

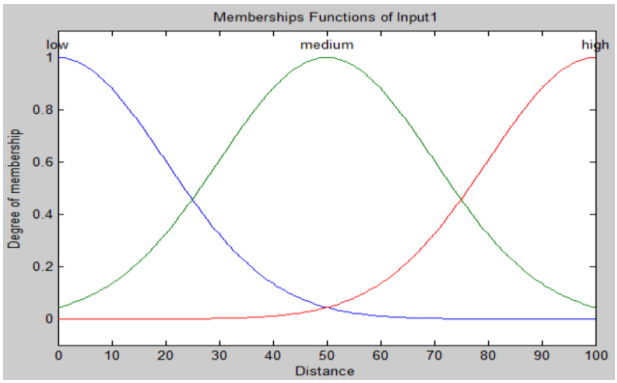

Figure 4: Members Functions of Input1

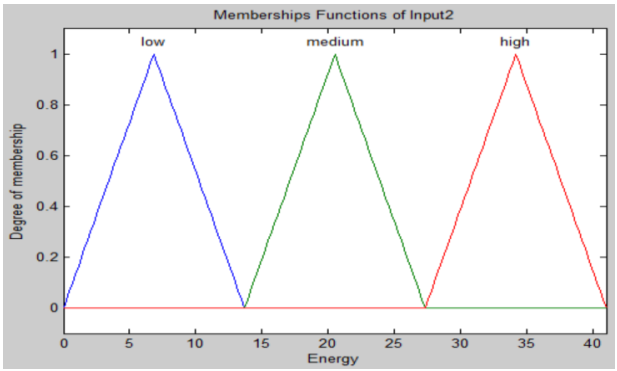

Figure 5: Members Functions of Input2

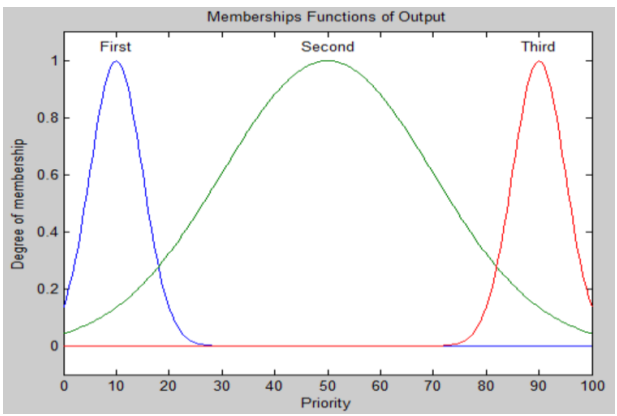

Figure 6: Members Functions of Output1

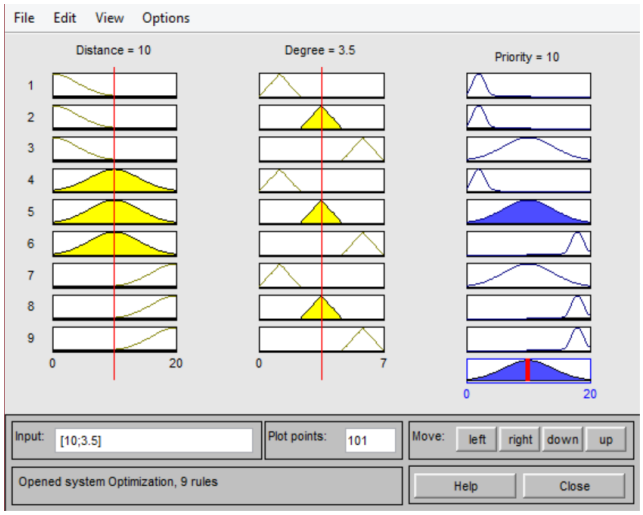

Figure 7: Rule Viewer Optimization

Fuzzy logic is an augmentation of Boolean rationale managing the idea of fractional truth which signifies the degree to which a suggestion is valid. Though established rationale holds that everything can be communicated in parallel terms (0 or 1, dark or white, yes or no), fuzzylogic replaces Boolean truth esteems with a level of truth. Level of truth is frequently utilized to catch the loose methods of thinking that assume a fundamental part in the human capacity to settle on choices in a domain of vulnerability and imprecision. Fluffy Inference Systems (FIS) are adroitly exceptionally basic. They comprise of an info, a preparing, and a yield arrange. The information arrange maps the data sources, for example, recurrence of reference, recency of reference, et cetera, to the suitable enrollment capacities and truth esteems. The preparing stage summons each fitting principle and produces a relating result. It at that point joins the outcomes. At long last, the yield organize changes over the joined outcome once again into a particular yield esteem.

If (LS=HIGH) and (LC=HIGH) and (PD=HIGH) and (NH=LOW) then Cache

If (LS=LOW) and (LC=HIGH) and (PD=LOW) and (NH=HIGH) then No Cache

Where,

LS = Link Strength

LC = Link Capacity

PD = Packet Delivery

NH = Number of Hops

V. SIMULATION RESULT

In this subsection we evaluate the performancedynamic cluster head selection using fuzzy system in terms of:

Packet delivery ratio (PDR): The proportion of successful data packets delivered to the destination compared to the total generated data packets.

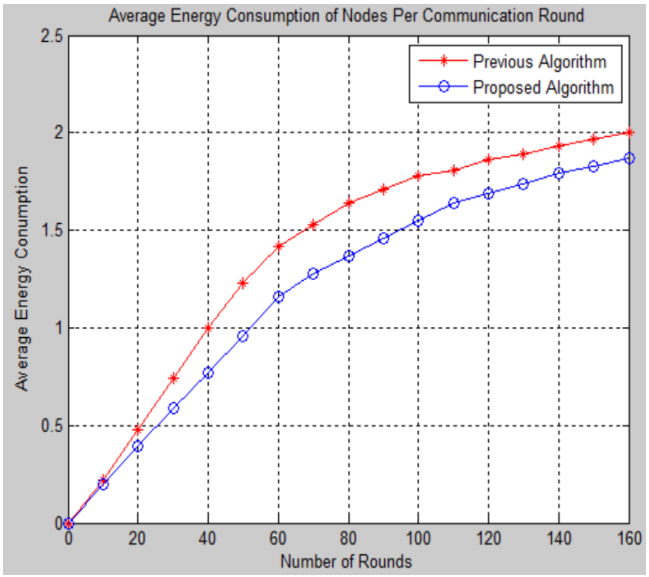

Figure 8: Average energy consumption of nodes per communication round

The areas that cover a set of dense CNs are called compromised regions (CRs) andapparently, they are a greater threat to the networks than single CNs.The Compromised Nodes (CNs) can be identi_ed by deploying reputation systems into the networks. The basic idea of these schemes is to identify the CNs by analyzing their abnormal behaviors. A concomitant challenge is how to deliver the packages intelligently to avoid being captured by the CNs.

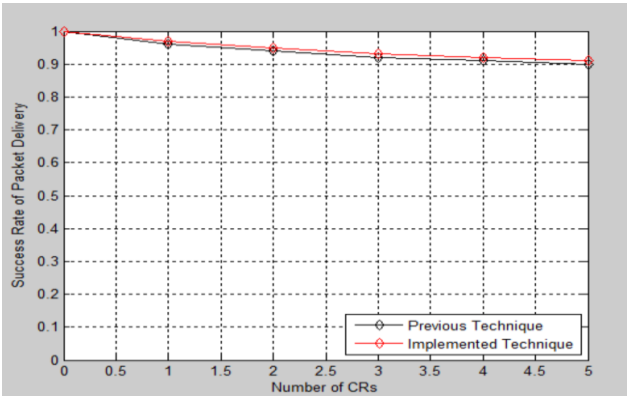

Figure 9: Number of CRs vs Success Rate of Packet Delivery

Table 1: Performance Comparison of Implemented Approach

Parameters	Previous Approach	Proposed Approach	Improvement of Previous Approach
Average Energy	2.0 J	1.89 J	5.5%

Packet Received by the Base Station	320000	350000	8.57%
Success Rate of Packet Delivery	90%	91.4%	2.14%
Total Data Transmission	430000	460000	6.52%

VI. CONCLUSION

In this paper, a Tabu search and Fuzzy Inference System based routing algorithm for wireless sensor network is proposed to increase network stability, data rate, link strength, communication efficiency, and decrease data loss.

Fuzzy Based Dynamic Clustering in Wireless Sensor Networks (FDC) is proposed. Simulation results shows that the proposed algorithm is much better than existing algorithm in terms of energy efficiency and lifetime of the network.

REFERENCES

[1] RohitPachlor and DeeptiShrimankar, “LAR-CH: A Cluster-Head Rotation Approach for Sensor networks”, IEEE Sensors Journal, Volume 18, Issue 23, PP. No. 01-08, Dec.1, 2018.

[2] M. Bheemalingaiah and M. M. Naidu, “Performance Analysis of Power -aware Node-disjoint Multipath Source Routing in Mobile Ad Hoc Networks”, IEEE 7th International Advance Computing Conference, PP. No. 361-371, IEEE 2017.

[3] DoganYildiz, SerapKaragol and OkanOzgonenel, “A Hyperbolic Location Algorithm for Various Distributions of a Wireless Sensor Networks”, Smart Grid and Cities Congress and Fair (ICSG), 5th International Istanbul, PP. No. 451-459, IEEE 2016.

[4] Alexandros Ladas, Nikolaos Pavlatos, NuwanWeerasinghe and Christos Politis, “Multipath Routing Approach to Enhance Resiliency and Scalability in Ad-hoc Networks”, Ad-hoc and Sensor Networking Symposium, PP. No. 01-06, IEEE 2016.

[5] Pengwu Wan, BenjianHao, Zan Li, Licun Zhou, Mian Zhang, "Time differences of arrival estimation of mixed interference signals using blind source separation based on wireless sensor networks", IET Signal Processing, vol.10, issue 8, pp.924-929, 2016.

[6] Mohammadi K., Alavi O., Mostafaeipour A., Goudarzi N. And Jalilv and M., "Assessing different parameters estimation methods ofWeibull distribution to compute wind power density", ELSE VIER Energy Conversion and Management Journal, Vol.108, pp. 322-335, 2016.

[7] Miriam Carlos-Mancilla, Ernesto López-Mellado, and Mario Siller, “Wireless Sensor Networks Formation: Approaches and Techniques,” Journal of Sensors, vol. 2016, Article ID 2081902, 18pages, 2016.

[8] Park S. Y. and Lee J. J., "Stochastic Opposition-Based Learning Usinga Beta Distribution in Differential Evolution", IEEE Transactions On Cybernetics, vol. 46, Number 10, pp.2184-2194, October 2016.

[9] Osama Ennasr, Guoliang Xing and Xiaobo Tan, " Distributed Time-Difference-of-Arrival (TDOA)-based Localization of a Moving Target", in Proc. IEEE 55th Conference on Decision and Control (CDC), pp. 2652-2658, IEEE 2016.