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Average Energy Efficient Dynamic Cluster Head based WSN using Fuzzy Inference System

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ABSTRACT: In this paper we have used D-Leach protocol along with Fuzzy Based Dynamic Clustering methodology where 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. Simulation is performed in MATLAB R2012b (version 8.0.0.783). The simulation results obtained reveals that our proposed algorithm increases the lifetime and has better energy efficiency.

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 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 build 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 vulnerability about some arrangement. In case the sensor arranges 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

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this reason various impediment shows are proposed [4]. Confinement in remote sensor frameworks is performed by following these 3phases:

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, multilateration, and region are a couple of methodology that is used for distinguishing location. It uses the geometric properties of triangles to process center point zones. Triangulation is gathered into literation and angulation. Multilateration is figured using partition estimations and angulation is processed using edge data. Estimation procedure is to determine the center region using Multilateration ,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 figuring [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 is supported by DARPA.Tidy NetworksInc., is one of the early organizations that created remote sensor arrange items. WSNs are spatially distributed 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].

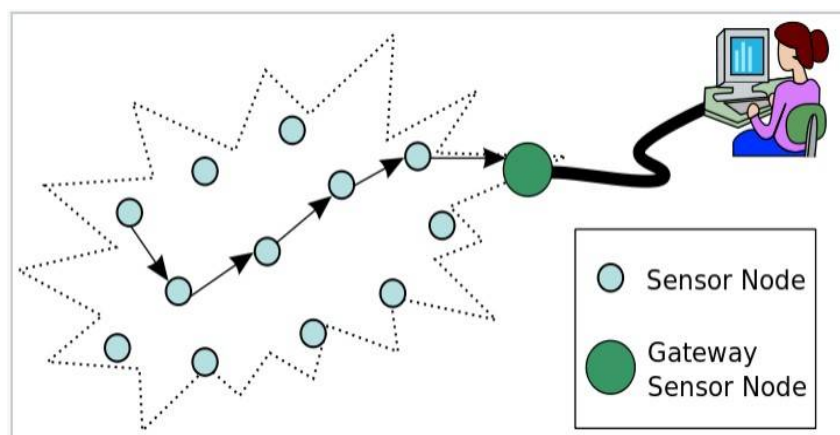


Figure 1: Typical multi-hop wireless sensor networkarchitecture

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III. DYNAMIC 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, K is the expected number of clusters and X and Y are the set of locations of various nodes in the Wireless Sensor Network.

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 with the probability of a node to become cluster head p_{ch} . 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.

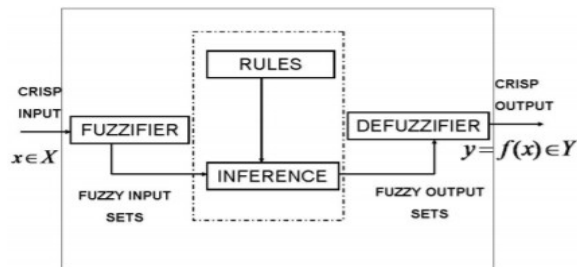


Figure 2: The structure of a fuzzy logic system

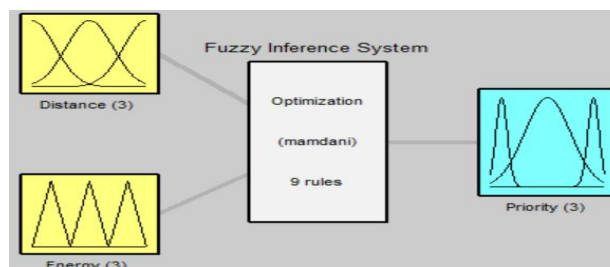


Figure 3: System Optimization of 2 inputs, 1 outputs and 9 rules

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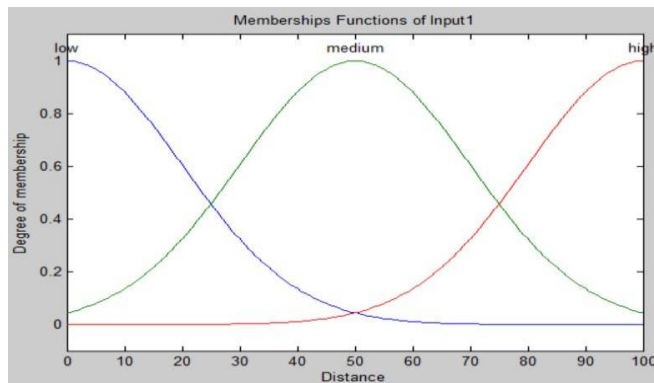


Figure 4: Members Functions of Input1

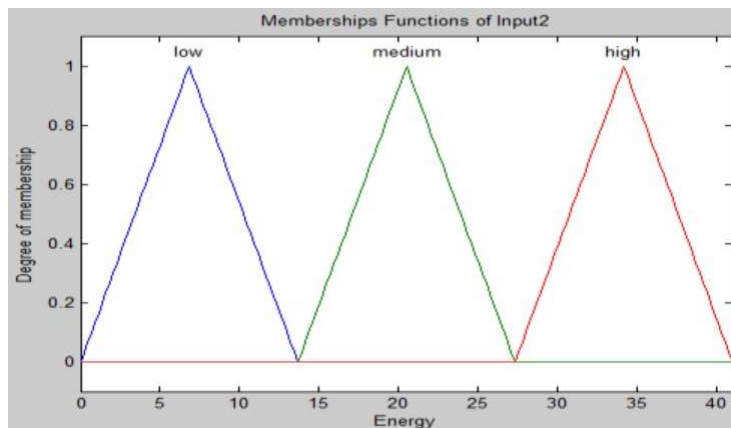


Figure 5: Members Functions of Input2

Fuzzy logic is an augmentation of Boolean rationale managing the idea of fractional truth which signifies the degree to which a suggestion is valid.

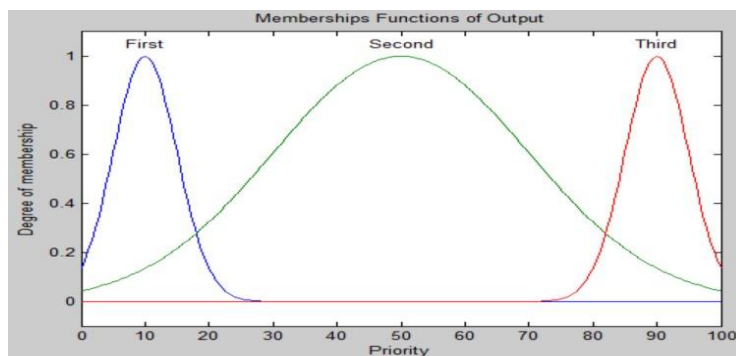


Figure 6: Members Functions of Output1

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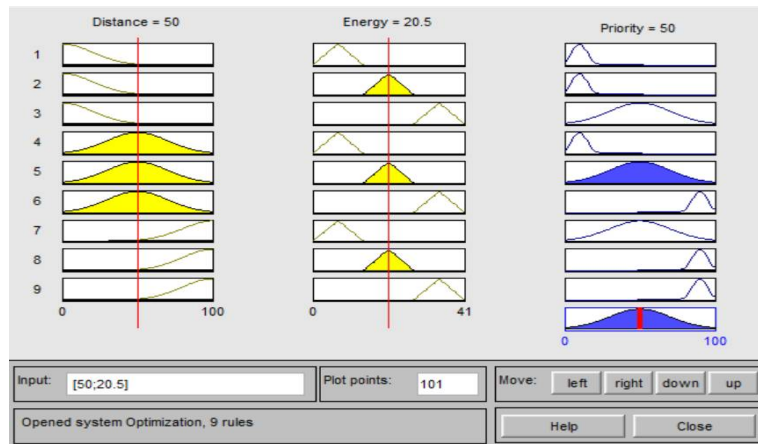


Figure 7: Rule Viewer Optimization

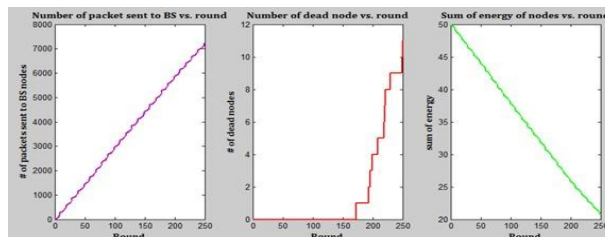
Though established rationale holds that everything can be communicated in parallel terms (0 or 1, dark or white, yes or no), fuzzy logic replaces Boolean truth esteems with a level of truth. Level of truth is frequently utilized to catch the loose methods of thinking that assume a fundamental part in 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 info, a preparing, and a yield arrange. The information arrange maps the data sources, for example, recurrence of reference, regency 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 organizes changes over the joined outcome once again into particular yieldesteem.

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 RESULTS

In this subsection we evaluate the performance dynamic 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.

Round =250



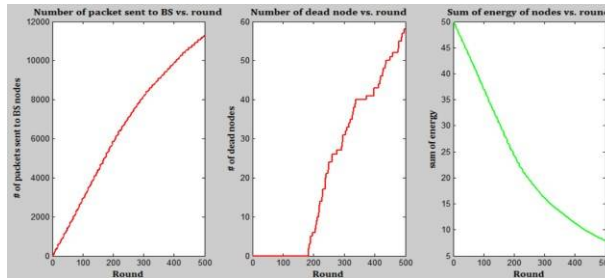
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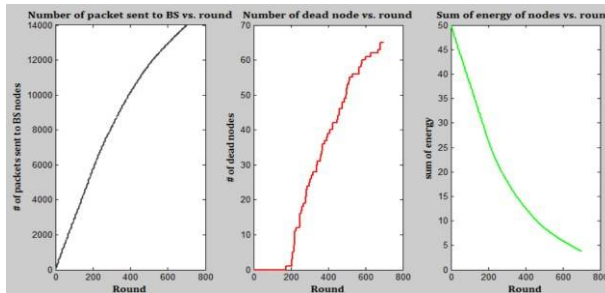
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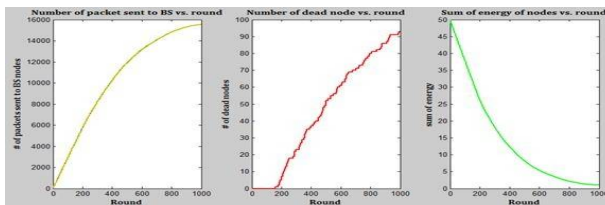
Round =500



Round =700



Round =1000



Round =1200

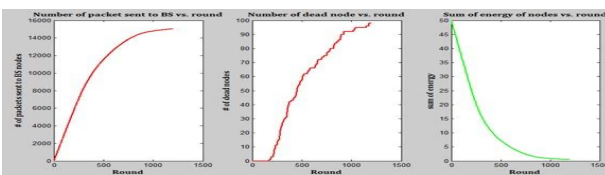


Table 1: Packet Sent to Base Station Node

Round	250	500	700	1000	1200
Packets	7100	11300	14000	15500	15800

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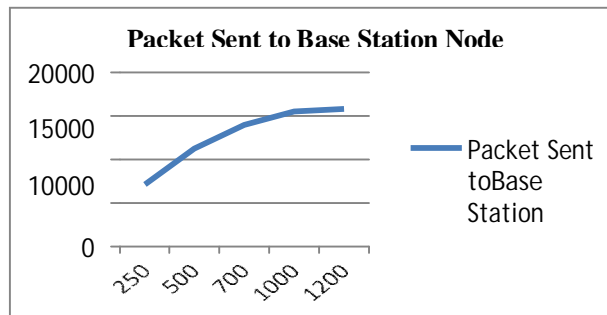


Figure 8: Bar Graph of the Packet Sent to Base Station Node for Different Round

Table 2: Dead Node vs Round

Round	250	500	700	1000	1200
Dead Node	11	58	65	91	93

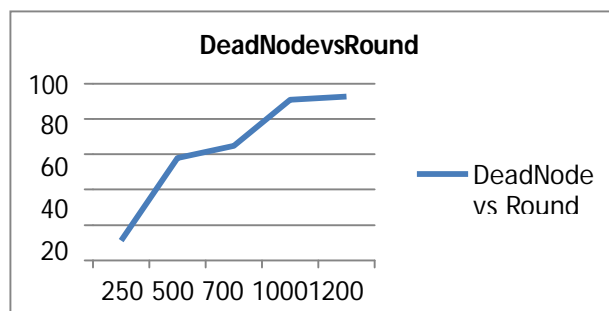


Figure 9: Bar Graph of the Dead Node for Different Round

Table 3: Sum of Energy vs Round

Round	250	500	700	1000	1200
Energy	22	8	4	2	1

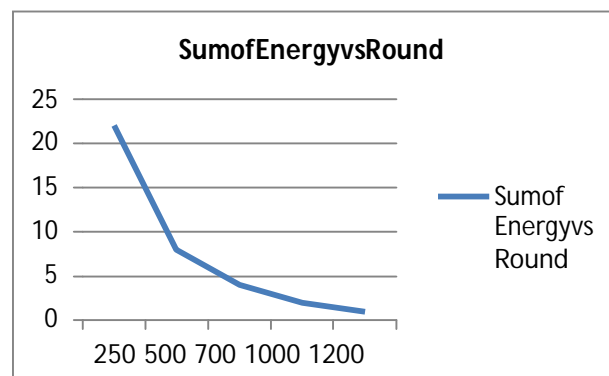


Figure 10: Bar Graph of the Sum of Energy for Different Round

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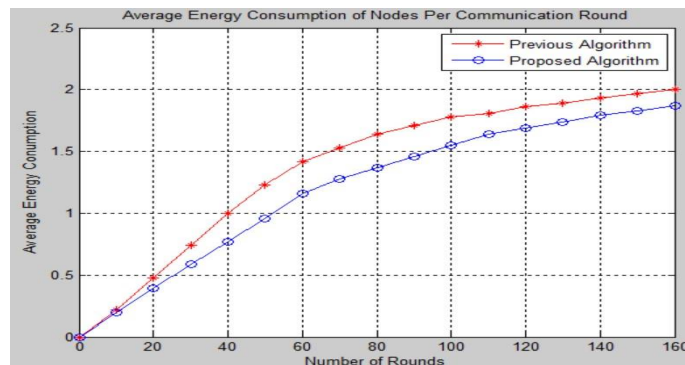


Figure 11: Average energy consumption of nodes per communication round

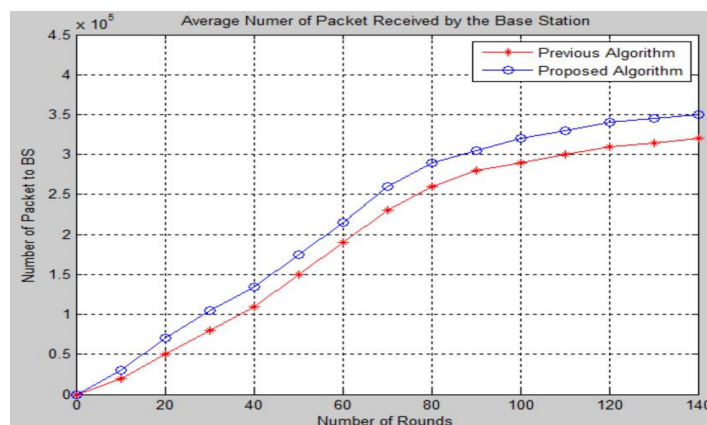


Figure 5.12: Average number of packet received by the base station

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.

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