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Maximizing the life time of Wireless Sensor Network Using unequal fuzzy based clustering

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Abstract - *Wireless Sensor Networks (WSN) has become a key element Technology for living and still actively Works for a wide range of applications. A greater research challenge is the energy-efficient WSN. Techniques of clustering have been commonly used to minimize the Energy usage and prolonging the life of the network. Paper introduces the Fuzzy Logic based algorithm. Unequal clustering, and maximizing Ant Colony (ACO) Routing dependent, WSN hybrid protocol to remove hotspot, and extend the life of the network. This protocol involves the selection of Cluster Head (CH), Inter-cluster routing, and management of clusters. Fuzzy logic picks CHs effectively and splits the network into different group of clusters Based on residual energy, distance from base station (BS), neighborhood size, node degree and node centrality. It Uses ACO-based routing technique to achieve efficiency and reliability for Inter-cluster CH to BS routing For proper balancing of the loads, A modern routing technique is also employed where threshold-based data transmission occurs in the shortest possible way And the data is transmitted periodically in unused Ways. The results of the simulation show that the proposed approach achieves full service life, reduces hot spot problems and balances the Efficiently energy consumption between all nodes.*

Key Words: **Hot spot problem , Fuzzy logic , Unequal clustering , Roting , Wireless sensor networks**

1. INTRODUCTION

WSN is an infrastructure-free network consisting of low cost, compact sensor nodes, for physical monitoring umbrella. Sensor nodes are hundreds to thousands Randomly distributed to the field for sensing the data. WSN plays a vital role in applications like tracking and surveillance environmental monitoring, accurate weather forecasting, Agriculture, mitigation of natural disasters, emergency management, border protection, smart cities .Different physical parameters are observed Temperature ,pressure, humidity, gas, acoustics, vibrations. In WSN, the sensor node is composed Sensors, microcontroller, power unit and communication unit. Delivery: The sensor unit monitors the environment, collects data , processes it and transmits it to other sensor nodes via Contact Device Various protocols for clustering and routing, with common Aspects in the literature were formed to shape the WSN Efficient in Energy. Partitions clustering strategy. The network and adjacent nodes are grouped into clusters. A chief called CH is chosen from the nodes and the remaining nodes are referred to as member clusters. The cluster formation process with an equal number of nodes. Equal clustering is known in a network, whereas with the uneven node counts are known as unfair clustering. One Cluster Head (CH) will be picked from each cluster built on certain parameters. CH carries three duties Operations: Cluster collecting data aggregating data and transmitting the data to BS. The CH acts as a relay to other CHs node for data transfer to BS. The Overall Program Competitive mergers works well and only achieves better results if delivery Nodes are standardized.

2. Related work

The most important problems for optimization in WSN are clustering and routing. Many of the clusters are centered in there have been experimented into routing strategies and a lot of memoranda were created. Digital Intelligence neural networking methods, reinforcement learning, the approaches to swarm intelligence, the evolutionary algorithms and fuzzy logic is used in WSN to answer many design problems including selection of CH, routing, protection, data aggregation, synchronizer. Fuzzy logic is supreme suitable in circumstances with high degree with ambiguity. Hein Zelman proposed a first approach to the clustering named LEACH (Low Energy Adaptive Clustering Hierarchy), the clustering most common and widely cited Technology. This is a distributing protocol in which the CHs are chosen at random in each round. The CH's get the data aggregate into a single packet from its cluster members, and in a single hop way forwards to BS. The first

reactive protocol proposed by Manjeshwar and Agrawal was called TEEN (Threshold Sensitive).Energy Sensor Effective network). It is useful in critical times applications where nodes send information when sensed price reaches a predefined threshold. It does away with periodic transmission that in effect lowers the number data transmission and energy preservation is not technically useful in any case. When value of threshold is not reached, nodes do not transmit data and through sensing, the consumer does not notice the present scenario land. To remove TEEN's drawbacks, proposed a called APTEEN hybrid protocol was proposed. The Nodes in APTEEN are also going to submit data regularly in an energy-efficient way as they reacts to changes in the physical one immediately umbrella.

3. Fuzzy approaches

Fuzzy reasoning has gained more traction in the last days cluster-based routing system framework within WSN. Multitudes protocols that uses Fuzzy logic in network situations is unstable, and is high in uncertainty. Concentration is the number of nodes within a space and centrality refers to the proximity levels of the cluster center. This technique operates in a similar way as LEACH without the selection process for CH. This approach uses space, residual energy to BS as input variables and node width. Better yields performance apart from other algorithms. CHEF is a Fuzzy distributed Related technique that doesn't require global knowledge on the Network.

4. Proposed Model

4.1 Network model

A WSN with n number of sensor nodes is called randomly distributed in the sensing area. Some assumptions are made, and the following are mentioned. After deployment of the nodes and BS are static.

- Such nodes are all homogeneous.
- Nodes do not know the location;
- RSSI (Received Signal Intensity Indicator) is used for calculating the Sensor node distance to BS.
- Death to the node is just due to energy depletion.
- The transmission power of the sensor nodes will vary with energy management according to the receiver gap node.

4.2 Energy model

A simplified type of first order radio is known as the WSN 's Energy model. Energy Consumption for L -bit packet transmission and receipt over a distance d.

$$E_{TX}(l,d) = \begin{cases} l \times E_{elec} + l \times \varepsilon_{fs} \times d^2 & if\ d \le d_0 \\ l \times E_{elec} + l \times \varepsilon_{mp} \times d^4 & if\ d > d_0 \end{cases}$$

$$E_{RX}(l) = l \times E_{elec}$$

5. FUCHAR protocol

The approach proposed is hybrid (proactive, reactive) Unequal clustering protocol as you can see in Fig. 3. The method proposed works in three phases: Creation of clusters, transmission of data phase and step of cluster maintenance. There are 2 levels in the cluster construction process namely selection of CH and formation of clusters. In cluster construction phase, BS runs fuzzy logic to produce balanced clusters. Balanced clusters are achieved by the equal distribution of CHs in the number of neighbors and there would be strong intra cluster contact. So, the size of a cluster will be smaller for higher degree nodes. Node number centrality is also important as it shows how centrally located the sensor node is for communicating with others nodes. Nodes with a higher central value have the higher risk of being CH because it decreases contact gap within the intra cluster. Including those five input parameters are of great importance for efficient selection of CHs and cluster size. Nodes with greater probability of Final CHs and adjacent nodes will become CH enter the cluster with the contact radius CH. In the data transmission process, inter-cluster centered on the ACO multi-hop routing occurs. Most of the existing protocols regularly transmit data entire network. Proper selection of CHs is a very important task in clustered WSN. Fuzzy logic, with five for CH range input variables, namely residual energy, distance from the BS distance from its neighbors, node degree and node centrality utilized are being used. The performance parameters are likely to become CHs, and size of the whole cluster. Two or three Fuzzy in current methods CHs are selected using input variables. But, the remaining resources, distance to Base Station (BS), neighborhood drive, Node degree and node centrality converge metrics and plays an significant role in WSN clustering. Residual energy shows the total energy remaining on the sensor node and BS distance refers to the distance between the sensor nodes and BS. The CHs close BS would be smaller in scale Clusters farther away from it than those. in a

constructive way. It increases the amount of transmitted and sensed data. The data is going to be very correlated. For enhancing energy efficiency Threshold-based (reactive) data transmission is proposed.But, it fails to achieve the network's overall image. The system proposed transmits data in two different situations: threshold-based and periodic data transmission with longer time Intervals. The number of data transmission is reduced using this process, and at the same time the overall picture of the situation is reached, too. The proposed approach implemented a new, ACO-based routing technique. For Single In addition to energy dissipation, it also exploits unused routes shortest itineraries. To achieve proper load balancing, transmission of threshold data uses the shortest paths and the periodic uses unused routes for data transmission. Finally, the maintenance process of the cluster uses cross-level data transmission to boost the Important Network Lifespan.

Fuzzy logic is composed of four stages:

1. Fuzzify input variables: Transform data crisp and maps these to suitable language vector
2. Functions for Membership; triangular and trapezoidal membership feature
3. Fuzzy Rule Base Decision Blocks: Rule Base is set of if-then laws relating to the fuzzy input and output linguistic variables used parameters.
4. Defuzzification: Converts the probability of fuzzy production to a crisp value.

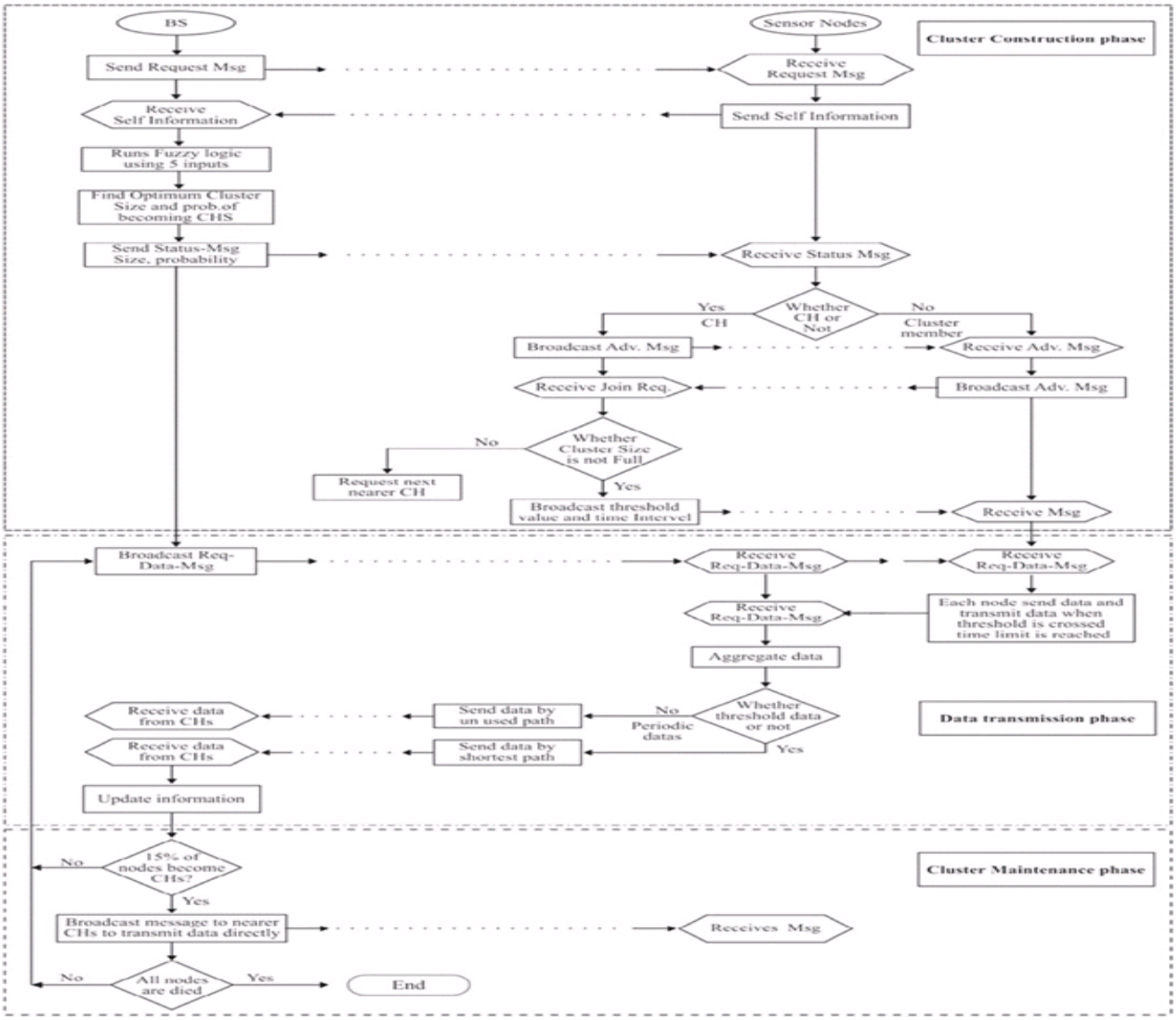

Fig. 1 Working flow of the proposed method

Cluster maintenance phase

Maintenance process of clusters is very important to balance charging between clusters. The groups, after several rounds closer to BS more intercluster traffic is burdened and then quickly expend their resources. So, a sustaining cluster step required for uniform load distribution, elimination hot spot problem and lifetime maximization of the network.In the proposed method operates during cluster maintenance process on two levels: CH and cross-level rotation in a cluster data transfer. CH rotation occurs when CH's residual energy is below a threshold value (15%). When residual energy goes through a threshold price, new CH will be chosen according to the likelihood of to become the time of CH.For uniform load distribution and to render it CHs consume equivalent amounts of energy and cross-level data conveyance is used. When 15 percent of nodes were CHs. In a cluster the BS knows that there are fewer nodes left to serve as CHs. BS sends a message to next point CHs to forward data directly this cycle goes on to all CHs of the next stage located farther from BS. This results in a uniform dissipation of the energy and increases the Lifespan of the network substantially.

Performance evaluation

In this section we propose an overview of the results FUCHAR, which includes the description and simulation according to various success metrics assessment metrics. The metrics for measuring the value of clustering protocols. Examining the following tests are used for efficacy of FUCHAR.

Network lifetime

WSN's lifespan is reflected in many ways. In this work, the number of rounds is described as a lifetime to complete before nodes die. As nodes in the local field results to the same results, first node's death does not occur influence on the entire network service but the data performance starts to decline. By the time half the node dies (HND) the quality of the data in a network starts to get worse. When? The last node in the network dies and the network stops running. The first node die to evaluate WSN's lifespan (FND), die half node (HND), and die last node (LND) Remarked. The three possibilities FND and HND are seen in the Figs 2 and 3 respectively, and the values given in table five. The number of nodes alive over multiple rounds in Figs three examples are shown. Linked 4, 5 and 6 it is clear from fig that the approach proposed delays the first node round death in scenario 1 if compared to LEACH, to , to EAUCF.

Scenario 1: The FND LEACH occurs in rounds 802 and FUCHAR in rounds 1647.

Scenario 2: The LEACH FND takes place

Scenario 3: The FND LEACH occurs in rounds 452 and FUCHAR in rounds 1246.And energy efficiency in 542 rounds and FUCHAR, at rounds 1379.

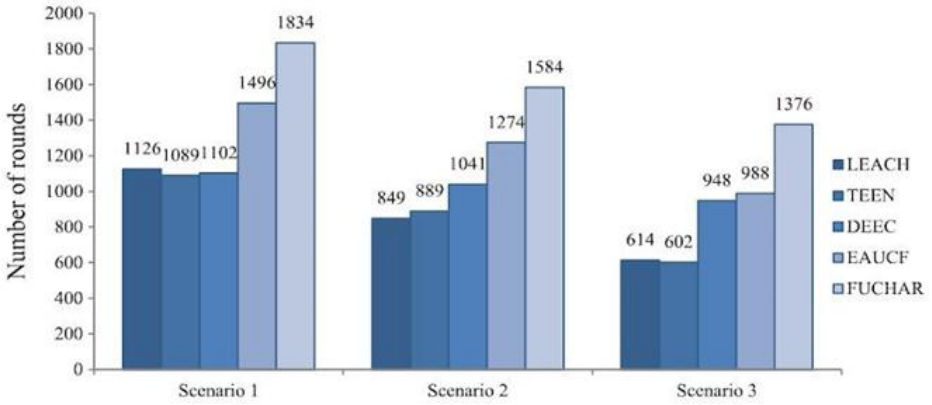

Fig. 3 Half Node Die (HND) for S1, S2 and S3

Table : FND and HND for different scenarios

Algorithm	Scenario 1		Scenario 2		Scenario 3	
	FND	HND	FND	HND	FND	HND
LEACH	802	1126	542	849	452	614
TTEN	1024	1089	768	889	389	602
DEEC	1088	1102	948	1041	894	948
EAUCF	1342	1496	1196	1274	941	988
FUCHAR	1647	1834	1379	1584	1246	1376

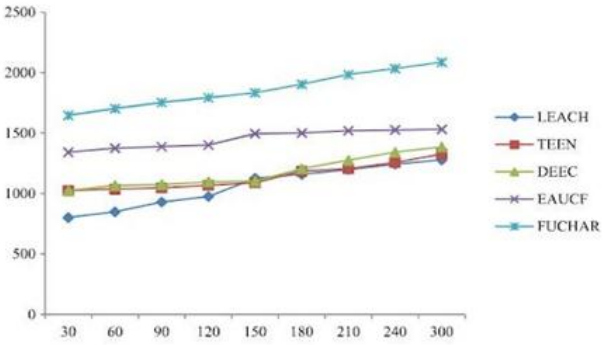

Fig. 4 S1: Number of alive nodes

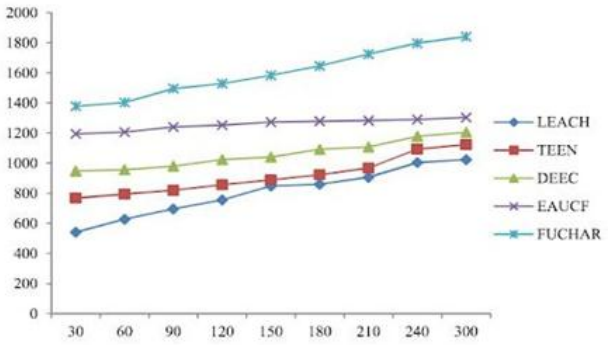

Fig. 5 S2: Number of alive nodes

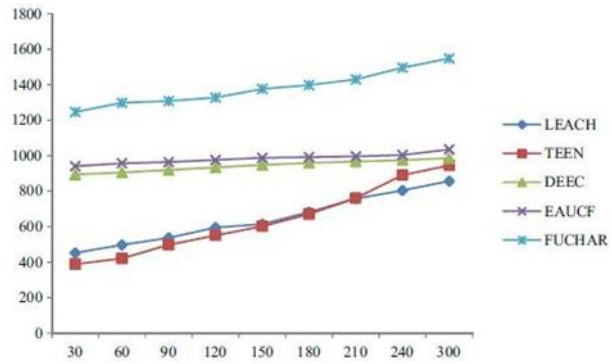

Fig. 6 S3: Number of alive nodes

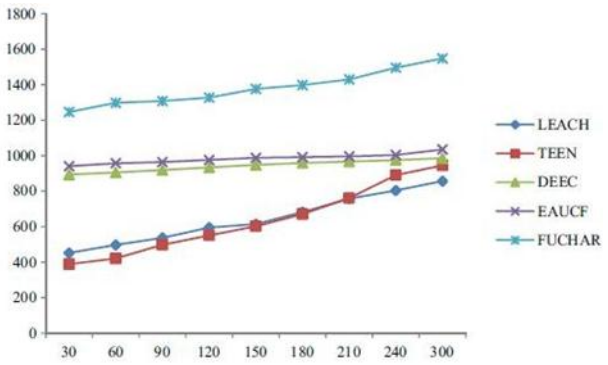

Fig. 6 S3: Number of alive nodes

ACO-based routing approach achieves efficient delivery charging; (iv) cluster Maintenance increases the lifespan of the network and lets all CHs spend the same amount energy. The proposed model is usually energy efficient and increases lifetime of the network.

6. CONCLUSIONS

This paper proposes a routing based on Fuzzy logic Unequal Clustering, and Ant Colony Optimization (ACO), WSN hybrid (FUCARH) protocol to eliminate hot spot issue, and optimize the existence of the network. Contradicting the present clustering protocols the system proposed uses five input parameters for calculating CHs and cluster size. In addition to periodic data transmission, the proposed approach makes use of the threshold principle of data transmission. We've got new inter-cluster routing strategy for loads was also implemented distribution by forwarding the threshold data in the shortest possible time unused paths and periodic data. What's more, the maintenance process of the clusters makes all CHs consume an equal capacity, and prolongs the lifetime of the network definitely. Extensive testing reveals the proposed approach yields better efficiency than current methods algorithms, in various situations. This strategy is well balanced data collection technique for both time sensitive and real-time approaches. The proposed approach can be expanded to include in future remote node network, and multiple sinks. In addition, we also concentrated on developing Fuzzy logic with additional parameters such as consistency of the connections, coverage redundancy and conditions related to it.

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