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AN EVOLUTIONARY INTUITIONISTIC FUZZY K-MEANS CLUSTERING APPROACH BASED CLUSTER HEAD SELECTION IN MANET

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ABSTRACT
Recent technological advances in Sensors, low-power microelectronics and miniaturization, and wireless networking have all helped to enable the design and dissemination of Mobile Adhoc Networks capable of monitoring and regulating environments autonomously. Between the cluster head and the base station, one of the most promising problems is efficient data transfer with low resource use. The primary influential factors in achieving such efficiency are energy consumption, density, and distance, which are discussed in this study. The sensor nodes are clustered using intuitionist fuzzy K-means clustering with the membership and non-membership values of each component taken into account in the Clustering phase of the proposed work. After the clustering phase, the cluster leader is chosen based on the greatest fitness function acquired by the genetic algorithm.

Keywords: MANET, K Means, CLuster Head, WSN

INTRODUCTION
The scalability of MANET can be highlighted by using node clustering. The process of picking a leader among the sensor nodes in a network for balanced load distribution is known as cluster head selection, and the elected node is known as Cluster Head. These head nodes will save information about the properties of the clusters to which they belong. The details of the nodes that belong to this cluster, as well as the way for navigating between them, were kept as cluster information characteristics. It is the responsibility of each CH node in each cluster to maintain constant communication with its own cluster's nodes. At the same time, it should be reachable by other cluster nodes using the same protocol. via the gateway / cluster head. Communications have done in three steps. The cluster head collects data from its members, compresses it, and then sends it to the base station or another CH. Suitable cluster head will reduce energy utilization and also enhances the network lifetime.

Choosing a single node to serve as the cluster head is a crucial but difficult task. For selecting the best node as the cluster head, a variety of parameters might be examined. Some of these factors consisting of position of the node with respect to the other nodes, mobility, energy, trust, and throughput of the node.

In general nodes of WSN and MANET have limited battery and resources. Process of election will increases the overall processing overhead of the network. As a result, the election process must take into account the nodes' processing and energy restrictions.

Multiple cluster heads inside a single cluster will exacerbate cluster reformation, Quality of Service (QoS), and routing executive difficulties, hence only one cluster head per cluster should be chosen during the election process. Various surveys of CH election schemes have been presented in recent years. This survey's goal is to talk about their parameters, the necessity for reclustering, and their performance. To the best of my knowledge, no overview of CH election has been provided so far that emphasizes node position in cluster, node trust factor, and single cluster head selection per election process. The purpose of this research is to use cluster head selection techniques in MANET to create an intuitionistic fuzzy-based cluster structure. A comparison of various CH selection methods is presented in terms of parameters employed and the potential of selecting many CHs to have a better understanding.

Problem definition

One of the most promising problems existing is efficient data transmission with less resource utilization between cluster head and base station

Limitations of existing system

1. It should have Cluster Head Selection concept.
2. The total nodes should be specify.
3. Every node should have correct power supply otherwise node gets dead.
4. If the node doesn't have proper signal connection,the node will dies.
5. If the energy is low then node will die.

Proposed system

This paper proposes an enhanced evolutionary model of energy-saving routing architec- ture was designed that clusters the sensor nodes based on the Intuitionistic Fuzzy C means based clustering algorithm. The main motive of this work is to reduce the energy consumption and to prolong the network lifetime in MANET in case of uncertainty in cluster head selection.

Set-up Phase:

First phase is the set-up phase and it is performed only one time.

In the set-up phase, pre-defined numbers of sensor nodes are chosen as cluster heads.

The number of CHs also indicates the number of clusters in the network. Intuitionist fuzzy K-means based Cluster formation. Once the Initial Clusters heads are selected and framed clusters then each Non-CH nodes are assigned to the clusters based on Intuitionistic fuzzy K-Means clustering. The non-CH nodes with similar range of membership and non membership values are as- signed to different clusters based on the features of residual energy, density, centricity and distance. Once Cluster formation is completed then the optimal cluster head is selected. Steady State Phase based on Genetic Algorithm based Cluster head Selection

In this phase the potential cluster head is selected using genetic algorithm. In the method, GA is used to maximize the lifetime of the network by means of rounds. Binary representation of the network is used and each sensor node corresponds a bit. CHs are represented as "1" and non-CH nodes are represented as "0". A Chromosome or Genome, a collection of bits, is the representation of a network. Initially the GA starts with a population, a predefined number of chromosomes, consists of randomly generated individuals. After that, GA calculates the fitness of each chromosome. Fitness of a chromosome depends on some fitness parameters described as follows

After evaluating the fitness of each chromosome in the population, GA uses a special selection strategy based on fitness values to choose the best-fitting chromosomes, and then applies two operators, Crossover and Recombination and then applies two operators, Crossover and Mutation, respectively. These operations are carried out in order to create a new population for the following generation that is better than the previous one. The Cluster Head for each round is selected the node with highest fitness value i.e the resid- ual energy and distance from it neighbor nodes are considered. The elected CH node once it receives messages from all member nodes, it fuses the data packets into one packet and sends it to the base station (BS). A round is completed when all CHs have sent their data to BS.

At the end of each round the BS checks the fitness function (energies) of CHs and the member nodes. If the energy of a CH is under the average energy of the member nodes of its cluster then the reclustering is performed using intuitionist fuzzy K means. This round is completed, and the next round begins with a set-up phase and a steady-state phase; this process is repeated.

Materials and Methods:

K- Means

K-Means [10] is one of the classical methods for unsupervised evolutionary DM algorithm that solves the well-known medical imaging, bio-metrics and other emerging fields. For de- tecting the grouping objects, it automatically adapts the best known clustering approaches. The K-Means algorithm divides a set of vectors into K groups and finds a cluster centre in each of them. Finally got constant cluster center in each group in an iterative way that a cost function shown in figure is minimized.

$$J = \sum_{r=1}^{k} J_r = \sum_{r=1}^{k}\left(\sum_{x\in G_r} d(x, C_r)^2\right) \quad (1)$$

Where, k is the number of clusters, and are the set of rth cluster and its associated center re- spectively. X presents a data point and d(a,b) is the distance functional (usually Euclidean distance) between a and b. The value of k should be determined first in this procedure. This value is fixed during the execution of the algorithm. The algorithm is summarized in the following steps:

Step1: Initializes the k cluster centers randomly Step2: while the stop condition is not satisfied do the following:

a) Assign each vector to a cluster with nearest center. b) Update cluster centers to the average of vectors belong to that cluster in order to decrease the cost function (2).

$$Min_{C_k} \sum_{i=1}^{N} \left\| x_i^k - C_k \right\|^2 \quad (2)$$

Fuzzy K-Means :

Fuzzy K-Means (also called Fuzzy C-Means, Hard or Crisp Cluster) is a simplified ex- tension of K-Mean Clustering algorithm [11, 12]. This technique works by identifying the pattern structure and attempting to capture and quantify non-random imprecision.

$$J(K,m) = \sum_{k=1}^{K}\sum_{i=1}^{N} (U_{k_i})^m d^2(x_i, c_k) \quad (3)$$

Where K is the number of Cluster, m is the parameter, Is the membership degree of in Cluster K, is the distance from controls .The parameter in this equation are the centroid vector and the components of the membership vector . The belonging ratio to a cluster K and the centroid

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belonging expression cluster k are displayed in Evaluate. In this strategy, a data point can belong to multiple groups, each with a membership degree ranging from 0 to 1 . This is represented by a matrix in which k is the number of clusters and m is the number of data points that satisfy the criteria in (4).

$$\sum_{r-1}^{c} U_{ri} = 1, \forall i = 1, \ldots, n \qquad (4)$$

Where, is the membership degree of ith pattern in rth cluster. The cost function used in this method is shown in the equation (5)

$$J(U, c_1, \ldots, c_k) = \sum_{r-1}^{k} J_r = \sum_{r-1}^{k} \sum_{i}^{n} U_{ri}^{m} d(x_i, c_r) \qquad (5)$$

In order to minimize the cost function, membership degrees and cluster centers, in each iteration, are computed and the equations are (6) and (7)

Where, represents the ith pattern in dataset. Fuzzy K-Means [34] [39], like K-Means, works on objects that may be represented in n-dimensional vector space and have a distance measure. This method performs the following steps.

Step1: Initializes the k fuzzy cluster centers randomly

Step2: while the stop condition is not satisfied do the following:

- Compute the membership matrix U according to the equation (6)
- Update fuzzy cluster centers according to the equation (7)

Algorithm

Step1: Initializes the k fuzzy cluster centers randomly

Step2: while the stop condition is not satisfied do the following:

- Compute the membership matrix U according to the equation
- Update fuzzy cluster centers according to the equation

Sample Data

The data describes about the modules used in the project.Each UML diagrams explains different process of the project.It contains step by step methods that involves the clear infor- mation of the , modules we have used. In this we find many UML diagrams and also sample graphs.by the reference of UML diagrams we design our project.

Calculate design on the basis of algorithm .By algorithm, we design code and create nodes and execute them. The data we collected by the references we prepare the graph and that make differences between existing and propose algorithm.

$$U_{ri} = \frac{1}{\sum_{i-1}^{k} \left(\frac{d(x_i, c_r)}{d(x_i, c_i} \right)^{2/(m-1)}} \qquad (6)$$

$$C_r = \frac{\sum_{i-1}^{k} u_{ri}^{m} x_i}{\sum_{j-1}^{k} u_{rj}^{m}} \qquad (7)$$

Figures

The below figure the frame work of Evolutionary Instuitionistic Fuzzy K

Means based Cluster Head Selection

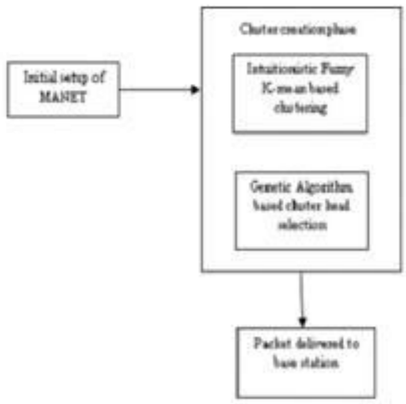

Fig. 1: Proposed Framework of An Evolutionary Intuitionistic Fuzzy K-Means based Cluster head Selection

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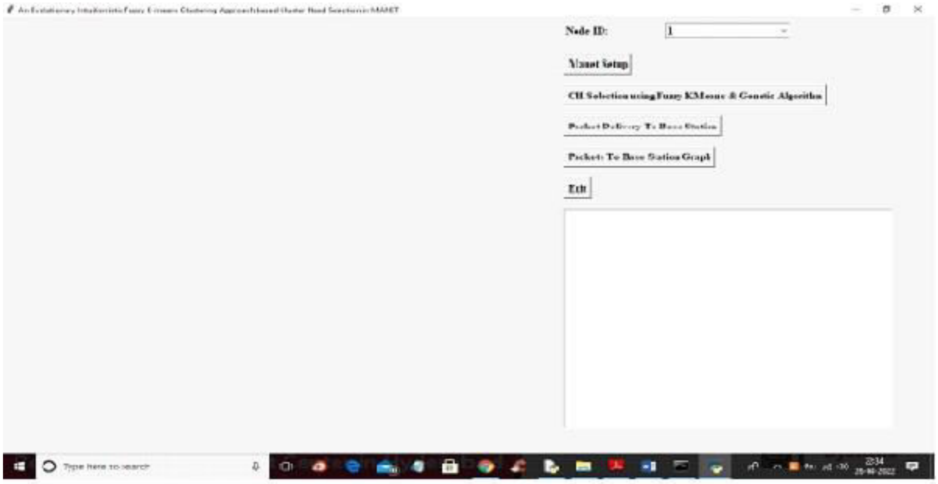
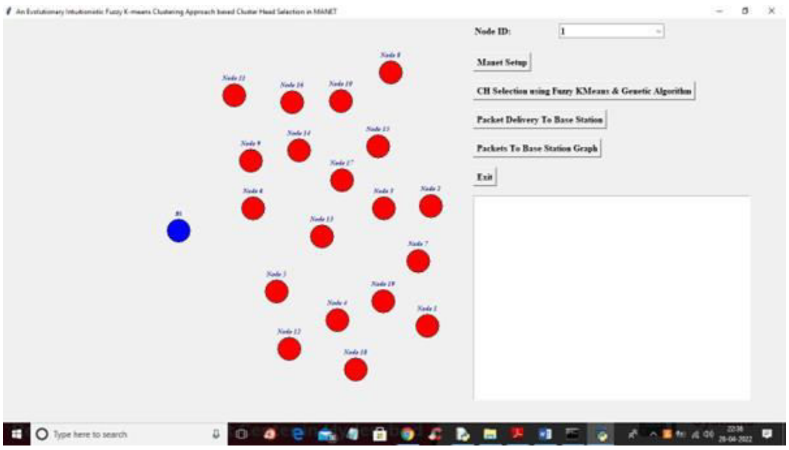
Output Screens

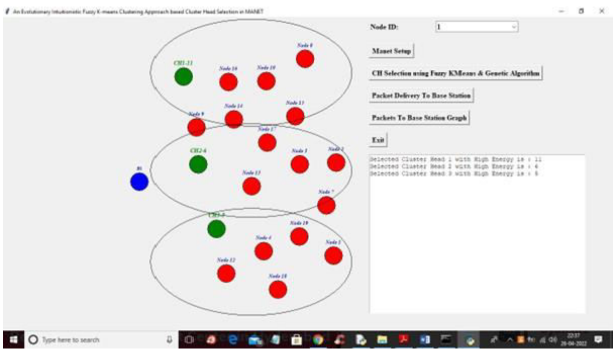
To run project double click on ‘run.bat’ file to get below screen



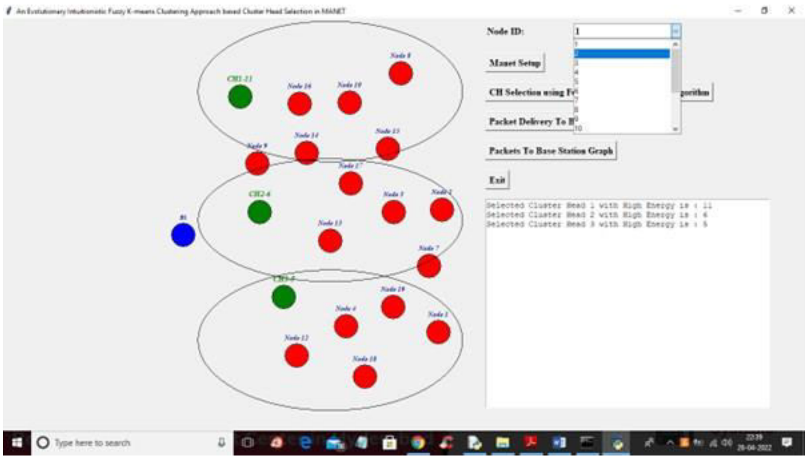
In above screen click on ‘Manet Setup’ button to create dummy manet simulation nodes as we don’t have real sensors so we are creating dummy nodes like below screen.



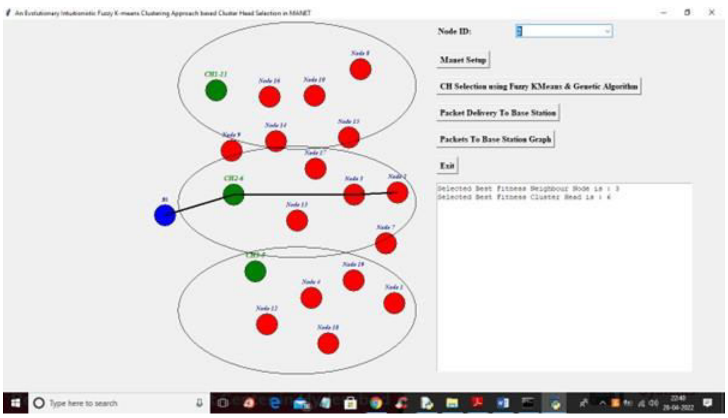
In above screen blue colour node is the base station node and all red colour nodes are the normal sensors and now click on ‘CH Selection using Fuzzy KMeans Genetic Algorithm’ button to select node with less distance to base station and high available energy as cluster head



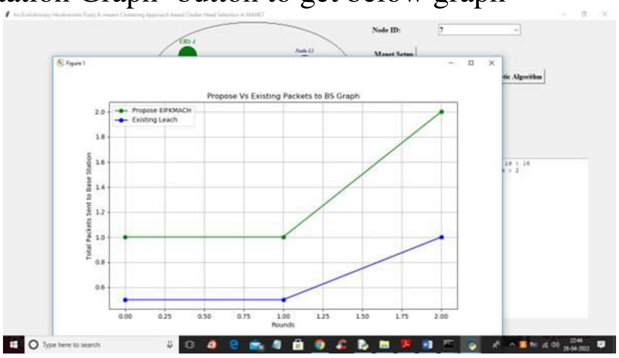
In above screen green colour nodes are the selected cluster head and they are closer to base station and big oval is the cluster region and all red circle inside big oval consider as that cluster members and in above text area we can see then node name which is elected as cluster head. Now select any source node from drop down box to send packet to base station



In above screen I am selecting source node as 2 and then click on 'Packets Delivery to Base Station' button to send packet to base station node



In above screen we can see Node 2 is sending data to its nearest node called 3 and 3 sending to cluster head 6 and cluster head 6 sending to base station. Similarly you can select any source node and send data to base station-In above screen source node is 8 and now click on 'Packets to Base Station Graph' button to get below graph



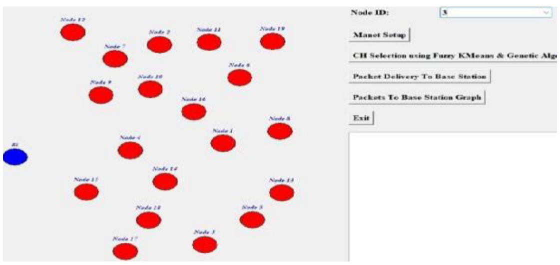
In above graph x-axis represents rounds of packets and y-axis represents number of packets send to base station. In above graph green line represents propose algorithm and blue line represents existing algorithm. In above graph we can see existing always choose same node so it will lose battery soon and send less packets and propose algorithms always choose cluster head with high energy so it will not lose battery soon and can send more packets.

Result Analysis

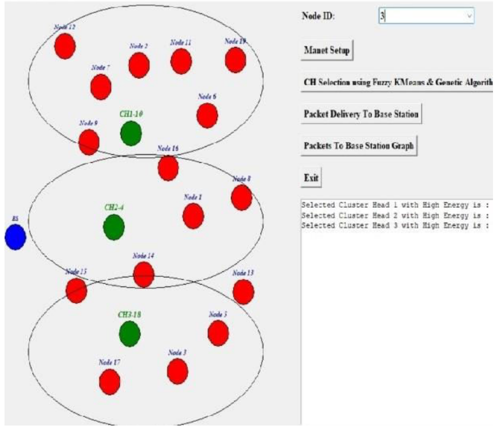
Authors are advised to choose a refereed journal in their field in which the title of the paper also appears in the list of references and consistently follow the citation style used by this journal. Names of all the authors with their initials, title of the article, names of editors for edited books or proceedings, and the range of pages that contain the referenced material must appear in the bibliography. One should not mix citation styles of several journals and not create your own style.

Design of Test Cases and Scenarios

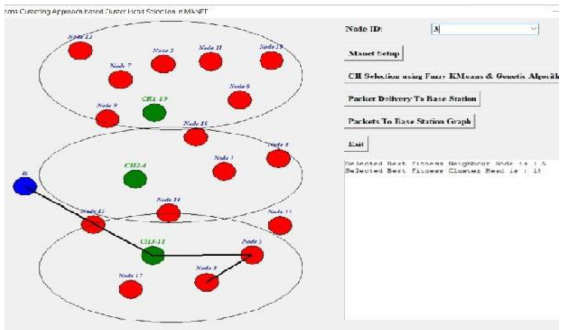
In the test cases we executes all the setup MANET nodes with its process. First we initialize a node from any 20 need. Here the design is structured in such a way where total nodes are 20. scenario:1 Here we select an example as node ID = 3



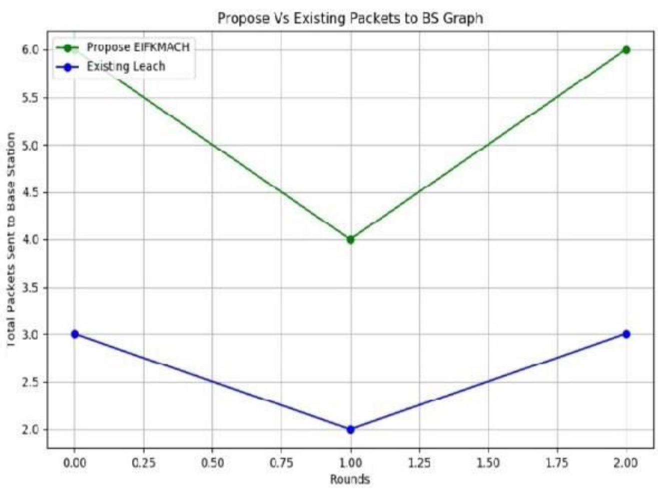
Second step includes the Selection of CH by using Fuzzy K means.



Third step explains the packet delivery to the Base Station using Cluster Head.



Finally we examines the Packet to Base Station Graph



This graph explains the difference between existing and genetic algorithm. The result of the test cases will be of send more data packets in less time and distance with high energy, compare to LEACH techniques.

CONCLUSION

Energy consumption in a mobile Adhoc networks can be due to either useful or wasteful work. Useful energy consumption results from transmitting and receiving data packets, querying requests, and forwarding data. Wasteful energy consumption is due to collisions and resulting retransmissions, idle listening to the channel, and overhead of each packet header. Simulation results indicate that the proposed algorithm EIFKMACH achieves lower energy consumption and prolonged network lifetime in MANET. In the proposed scheme, an intuitionistic fuzzy k –means based clustering architecture for sensor nodes is created. The election of cluster head is done through the genetic algorithm with the factors of residual energy, distance and density of each node. The node with highest factor is selected based on the membership and non-membership value of the factors. The data passed by the nodes in the cluster doesn't communicate with the base station they pass it to the cluster head where the data are collected, compressed and passed to the base station via gateway or the other cluster heads. Thus the proposed work best suits in adversial environment

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