

# Enhanced Strategy of Selection of Cluster Head with Optimal Solution of Data Transmission in Wireless Sensor Networks

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**ABSTRACT:** Wireless Sensor network has been set various challenging issues for the interested researchers in this domain. It suffers from various problems such as reduced lifetime, inefficient clustering, delay in data delivery etc. It was observed that the higher energy consumption is one of the major reasons behind all of the issues of WSN. The nodes that are deployed in WSN are allotted with a fixed amount of energy which is impossible to replace and refill specifically in case dense areas. Various protocols have been developed from last many years to reduce the energy consumption and still this research is going on. The appropriate selection of CHs is one of the solutions that is capable to reduce the energy issues in WSN.

In this work a fuzzy based cluster head selection approach is developed which considers the 3 major factors i.e. energy, centrality and mobility as input membership functions and derived an output in the form of the chances of a node to become a cluster head. The node with the high amount of residual energy has the highest priority of becoming a CH. The result section explained in this work proves that the proposed work is quite better than the traditional LEACH protocols in the terms of number of dead nodes, number alive nodes and network lifetime.

**KEYWORDS:** Super Cluster Head, LEACH and Gateway nodes.

## I. INTRODUCTION

In the Wireless Sensor Networks (WSNs) the communication between the nodes is done in wireless form. In the large areas various numbers of users are present; for example mobile users [1]. So the towers in the particular area that are behaving as the sensors are referred as node in WSNs. Therefore the transmission of data from one node to another can be carried out through air medium [2]. In this transmission network various numbers of nodes are used in which one node is used as source while other node is used as destination. Major advantage of WSN is its ability to work in the harsh environment in which the monitoring of network by human is risky and not possible [3]. The WSNs or Wireless sensor networks are usually created with the help of small devices transmitting and receiving information over the wireless links and the network infrastructure is also dynamic in nature. Due to the limited range of transmission, the reception and transmission of data between any two devices need to be collaborated by using the intermediate forwarding [4] network nodes. Forming the communication link between any two nodes can be based on simple flooding phenomenon. It is required to use highly elaborated routing paradigms in the Wireless sensor networks (WSNs) and the reason behind this was to preserve the energy of the network and utilization of energy in wireless sensor network in the optimum and efficient way [5].

## II. LITERATURE SURVEY

**Padmalaya Nayak (2015), [1]** defined that WSN sets a paradigm of real time based embedded systems along with less complex calculations, communications, storage and power that has been utilized in various application where it is impossible to use or install the traditional network systems. Since the nodes operates on the basis of the initial defined

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energy. Thus the nodes did not have the capacity for performing any kind of operation if the energy of the nodes gets exhausted once. And these energy batteries are not replaceable and refilled to maintain the longevity of the network. It was considered in this work that the energy is the factor that influences the network's lifetime highly. Thus in order to reduce the energy consumption level, the cluster formation is introduced in the domain of WSNs. For this purpose, LEACH is considered as the most prominent cluster head selection protocol that elects the CH on the basis of the energy. In LEACH a probability threshold is evaluated to select the CH and only CH has the access to transmit the data to the BS. This work proposed a mechanism in which a super cluster head is elected out of the available CHs in the network. Then the super cluster head is the only one which is allowed to communicate with the base station. The proposed mechanism works along with the FIS thus the SCH elected the fuzzy descriptor i.e. remaining energy, mobility of the sink, and centrality factor of the clusters. Then Mamdani fuzzy system started its processing for electing the SCH. The implementation of the work was done by using the NS2 simulator. And after deriving the results it was proved that the proposed work has better results in comparison to the LEACH with respect to the first dead node, half alive nodes, network stability and enhanced lifetime.

**Jyoti Singh (2014), [2]** proposed a novel strategy for routing and named as LEACH. In LEACH the clusters are refreshed after a fixed time interval on the basis of the remaining energy and distance. The process of re-clustering and refreshing the network was done in order to perform the equal distribution of the workload to the nodes of the network so that the network lifetime can be enhanced. In proposed work the nodes that are operating currently were on active state and the nodes which are not working were on sleep mode. Hence the energy of the nodes was saved in a smart way by letting the non operational nodes on the sleep mode. The simulation of the proposed work was done using the MATLAB. The LEACH and MOD-LEACH was compared with the proposed work. After getting the results it was observed that the throughput of the proposed work has better values in comparison to the throughput of the traditional work.

**J. Gnanambigai, (2014), [3]** focused towards the creation of new variety of hybrid routing protocols for WSN. The proposed mechanism was based on LEACH and Q-DIR algorithm. The objective of this work was to overcome the shortcomings of the LEACH protocols and also assured the energy efficient network with the enhanced lifetime. This study also implemented the various energy parameters.

### III. PROBLEM FORMULATION

From the literature survey, it has been studied that several protocols have been defined followed the clustering criterion. However, these algorithms have been suffering from several issues such as cluster heads are selected on the random basis. The selection of cluster heads can reduce the efficiency of the network as chosen cluster head can be far from another sensor nodes and energy dissipation is high. Moreover, the concept of super CH was introduced to perform the data transmission from CH to sink node via SCH. But the data transmission becomes difficult for that CH which is located far away from the SCH. In such cases, the CH located at the farther distance has to consume the high amount of energy to transmit the data to the SCH. Therefore, the existing algorithms consume high energy and reduces lifetime of the network.

### IV. PROPOSED WORK

Considering the problem in the existing technique, a novel approach is proposed in this work. In proposed work, the idea of evaluating the fitness value of the nodes is introduced to avoid the random CH selection process. The node with the maximum fitness value has the highest chances of being a CH for the network. The following formulation is used for evaluating the fitness value:

$$CH\ selection = MAX(w_1 * E + w_2 * d_{node\ to\ CH} + w_3 * d_{node\ to\ BS}) \dots (1)$$

Where,  $w_1 + w_2 + w_3 = 1$

Addition to this, the concept of multi hop communication is also added to the proposed work, so that the CH which is at farther distance from the SCH can perform data transmission without spending extra energy. Firstly, the distance between far located CH and SCH is measured if it is higher, than the CH evaluates the distance from adjacent CH. Then

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the near CH acts as a Hop for sender CH. Thus the sender CH sends the data to near located CH and then it is the responsibility of that CH to transmit the data to the SCH. The far located CH measures the distance.

The methodology of proposed work is as follows:

1. Initiate the process of network set up.
2. Then select cluster head on the random basis. First selected cluster head receives the data packets from other sensor nodes and forwards received data to the base station or sink.
3. Perform Cluster creation on the basis of the distance. The most near located nodes are used to create a cluster.
4. Evaluate the weight value and update the status of the created clusters on the basis of evaluated weight values.
5. Next step is to update the location of the sink node on the basis of the mobility.
6. Initialize or design the fuzzy network to elect the cluster heads.
7. Perform communication i.e. data transmission from source CH to SCH and to further base station.

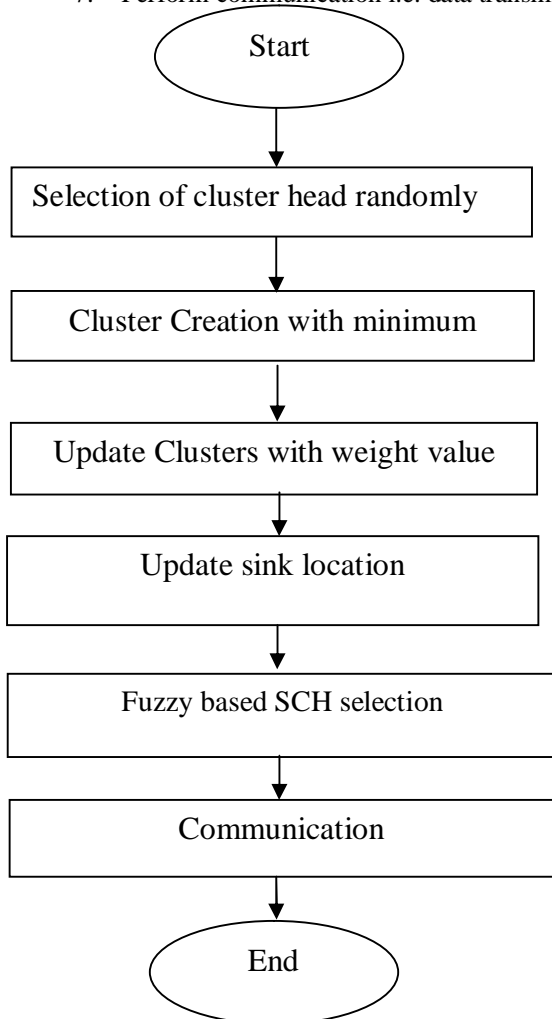


Figure 1 Proposed methodologies

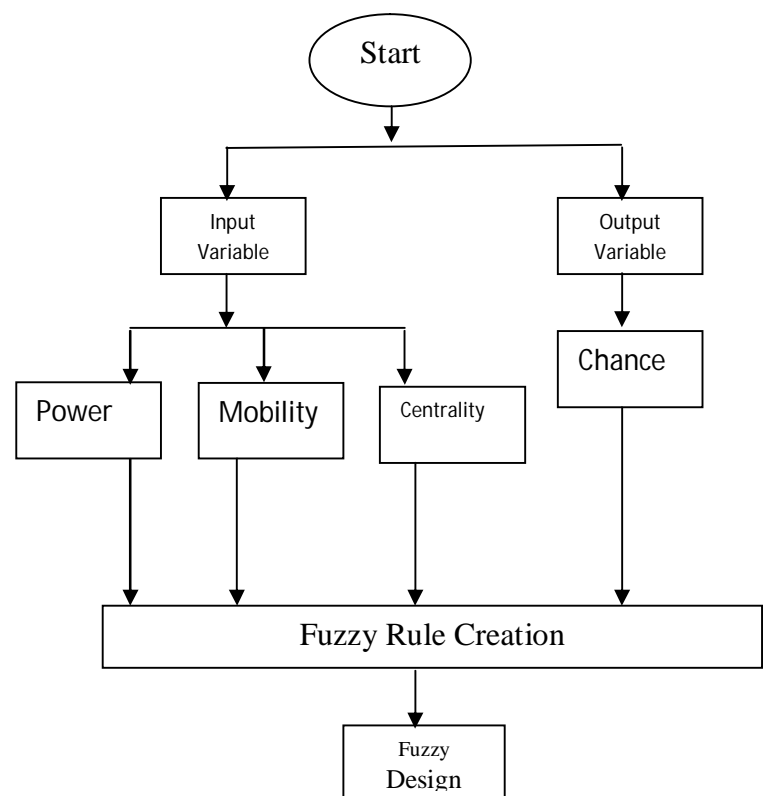


Figure 2 Proposed Fuzzy Design

The figure 1 depicts the methodology of proposed work in 7 steps and the figure 2 depicts the design of proposed fuzzy inference model.

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Design fuzzy inference system including its number of input and output variables. Further the membership functions are defined used to evaluate the rules and produces output accordingly.

## V. RESULTS

This section provides an overview to the results that are obtained after implementing the proposed work in MATLAB. The figure 3 portrays the comparison of proposed and leach-fuzzy technique on the basis of the network lifetime.

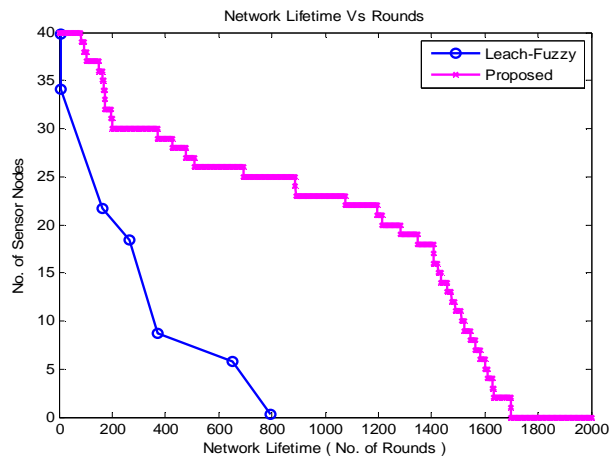


Figure 3 Comparison of network lifetime

The curve in blue depicts the network lifetime of the leach-fuzzy and curve of pink color shows the network lifetime of proposed work. The graph shows that the network lifetime of the proposed work is better than the lifetime of the leach fuzzy. The network lifetime is evaluated on the basis of the number of working nodes and communication rounds of the network.

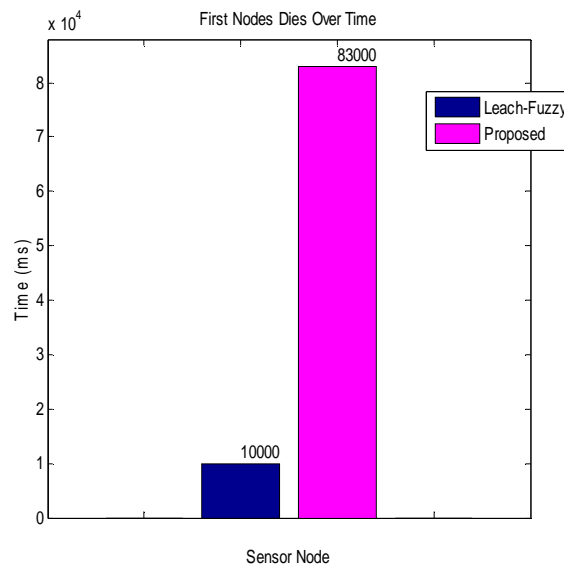


Figure 4 Comparison of first dead node

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The graph in figure 4 depicts the comparison of proposed and traditional work in the terms of the first dead node in the network. In proposed work, the first dead node found at 83000 ms and in traditional work, the first node dies at 1000 ms.. The graph proves that the in proposed work the first node dies later than the traditional work.

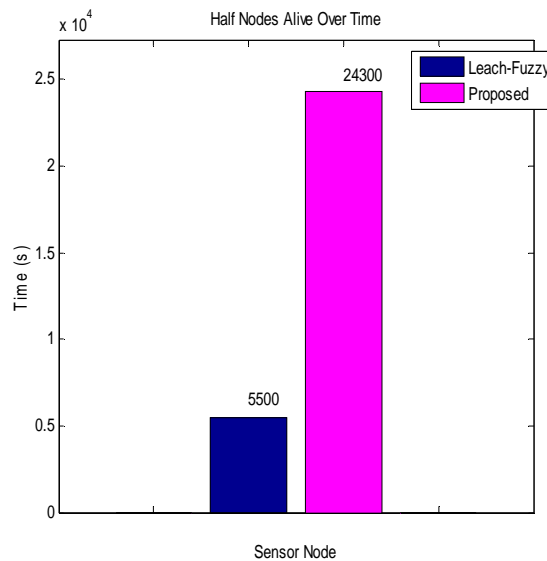


Figure5 Comparison of alive nodes

The graph 5 shows the half dead in case of proposed and traditional work. The half alive depicts the 50% nodes of the total available nodes. In traditional work, the half alive nodes are located earlier i.e. at 5500 seconds in comparison to the proposed work i.e. 24300 seconds.

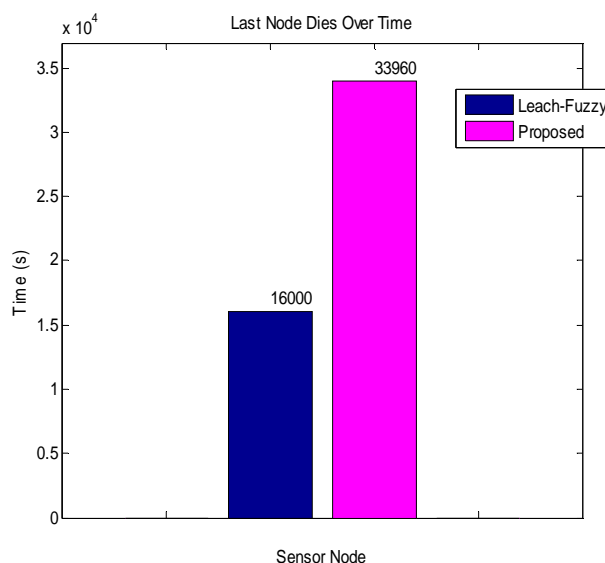


Figure 6 Comparison of last dead node

The graph in figure 6 shows the comparison of proposed and traditional work in terms of last dead node located in the network. The graph represents that in traditional work last dead node is found at 16000 seconds that is earlier in

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contrast to proposed work and it results to the shortest network lifetime whereas for proposed work, the last dead node is found quite later i.e. at 33960 seconds in the network which ensures the enhanced lifetime of the network.

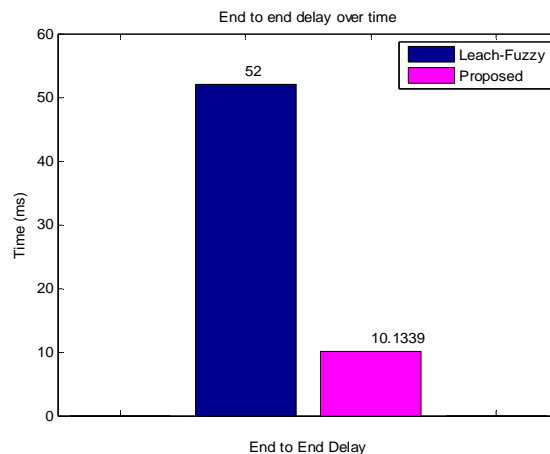


Figure 7 Comparison of end to end delay

The graph in figure 7 draws a contrast among proposed and traditional work on the basis of the end to end delay. The term end to end delay is used for measuring the time taken by the data packets to reach from sender end to receiver end. The end to end delay should be low. It is observed from the graph 5.7 that the proposed work has quite lower end to end delay i.e. 10.1339 m.sec approx in comparison to the LEACH-FUZZY (52 ms).

### VI. CONCLUSION

It is concluded in this study that the appropriate cluster head selection can reduce the energy consumption in wireless sensor network. Various authors had been developed different energy efficient cluster head selection techniques for sensor based communication network. This study is comprised of a related work that is driven on the basis of the past work that is done by the different authors. The LEACH protocol is used as a base for this study to develop a novel energy efficient cluster head selection technique by using fuzzy inference system. The proposed work considers the remaining energy of the nodes, mobility and centrality of the nodes as input parameters for input membership function of Fuzzy. Then the Mamdani is applied to perform the set of rules to elect the super cluster head. The output is generated in the form of chance that depicts the probability or chances of a particular node to become a cluster head. Then the comparison study has been drawn to perform the performance evaluation of the proposed work with respect to the LEACH-Fuzzy technique. The results conclude that the network lifetime and number of dead nodes of proposed work is relatively efficient than the LEACH-Fuzzy mechanism.

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