

# ENERGY EFFICIENT ADAPTIVE WEIGHTED FUZZY CLUSTERING BASED ROUTING PROTOCOL IN SENSOR NETWORKS

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**Abstract**— Clustering approach provides a vital role for ease of data transmission through cluster head node. Clustering algorithm depends upon the characteristics such as distance, battery power, transmission data rate etc. In order to achieve good clustering performance, the cluster node should move from one cluster to another without affecting the topology. This project proposes an Adaptive Weighted Fuzzy Clustering based Cluster head selection Algorithm (AWFCA) to solve problems found in existing methods, such as the node distribution, flat structures and disturbance of the cluster formation. The proposed mechanism uses fuzzy concept to select the cluster head for clustering in wireless sensor networks. The new protocol is aimed at prolonging the lifetime and improves the stability of WSNs by finding the energy efficient cluster heads (CHs) and energy consumption of the sensor nodes using Adaptive Weighted Fuzzy Clustering method. The operation of the proposed work have set-up phase where the base station finds the CHs, and steady-state phase, where the sensed data are transferred to CHs and then to the base station. The network simulation results shows that the proposed Adaptive Weighted Fuzzy Clustering based Routing Protocol(AWFCRP) achieves better performance compared with existing Cluster Based Routing Protocol(CBRP).

**Keywords**— AWFCA, CBRP, Cluster Head, WSN, LEACH, First Node Die

## I. INTRODUCTION

In traditional Wireless Networks uses data transmission between the sender and the receiver which uses the protocols such as AODV, DSDV, and DSR etc. Such protocols may not work in all situations. In such cases we can able to from a group of mobile nodes such as cluster to take a charge of data transmission. Once you form a cluster we need to elect the cluster head. The cluster head may act as gateway for data transmission as well as reception. Our proposed approach uses new energy efficient adaptive weighted fuzzy clustering based routing protocol for efficient content delivery.

## II.LITERATURE SURVEY

Safa et al.(2014) implement dynamic energy efficient clustering algorithm(DEECA).The formation of the cluster is based on the characteristics such as mobility and network connectivity. While electing cluster head we need to focus on mobility, connectivity, energy of the wireless nodes. CH should be carefully elected for better throughput.

Yu et al. (2014) focus how wormhole attack is eliminated with the new clustering mechanism.

Ben ahmed et al.(2014) proposed an algorithm to find the misbehaved nodes with certain parameters such as NACK. Cluster formation is necessary when the there is no change in network topology or when there is a less change in that.

## III.PROBLEM DEFINITION

The connectivity between the sensor nodes in the network are based on the energy. In existing system it was implemented with clustering algorithm in which it is difficult to determine the routing path and consumes more energy because of difficulty in selecting the cluster head. In order to minimize the energy consumption, we implement an improvement on cluster based routing protocol with a

combination of clustering algorithm and Adaptive weighted fuzzy logic, which is used for the determination of robust routing path across intermediate cluster heads under two cluster head node parameters such as cluster head node degree and hop count.

### **3.1 OVERVIEW OF THE PROJECT**

In this project, we focus on clustering that clustering should satisfy some requirements as cluster should cover entire sensor field, average cluster size should be as possible to maximize data aggregation efficiency, cluster should be reorganized to balance energy consumption among nodes, cluster overhead should be controlled, some of the nodes are arranged in clusters, where each cluster consists of member of sensors, gateways, and a cluster head. Nodes of a cluster send data to their cluster head, which performs data aggregation, such as data compression, suppression, minimum, maximum, or average data. Cluster heads transmit aggregated data through the network of gateways and to a central destination. In this way consumption of energy is reduced, since, if every sensor node were to transmit data directly to a central destination, more intermediate relay nodes would be required to relay data and consume more energy. The data averaging function of the cluster heads also provides fault tolerance, minimizing the effect of failed sensor nodes.

## **IV. SYSTEM ANALYSIS**

### **4.1 EXISTING SYSTEM**

The cluster-based routing is an efficient way to reduce energy consumption by decreasing the number of transmitted messages to the sink node. LEACH is the most popular cluster-based routing protocol, which provides an adaptive cluster generation and cluster header rotation. However, its communication range is limited since it assumes a direct communication between sensor nodes and a sink node. However, this assumption is not applicable to sensor networks deployed in large regions. In real world applications, the obstacles (i.e., wall) should be considered to provide reliable network communication. Secondly, the random selection of a cluster header causes the skewed distribution of clusters. Next the remaining nodes join the cluster head that requires minimum communication energy. In this system, cluster head is elected only based on the energy without considering the distance of the source and the base station. The cluster headers are not uniformly distributed over the network, some nodes will fail to find a cluster header within their communication range for WSNs. Energy consumption is also high because packet transmission takes long time. So, energy of the node drains rapidly.

#### **DRAWBACKS:**

- The scheduling algorithm is formulated as the LEACH problem elect the cluster head only based on the energy.
- Energy consumption of the network is high.
- Re-clustering is occurring frequently. So that the entire transmission stops and transmission of packets gets delay.

### **4.2 PROPOSED SYSTEM**

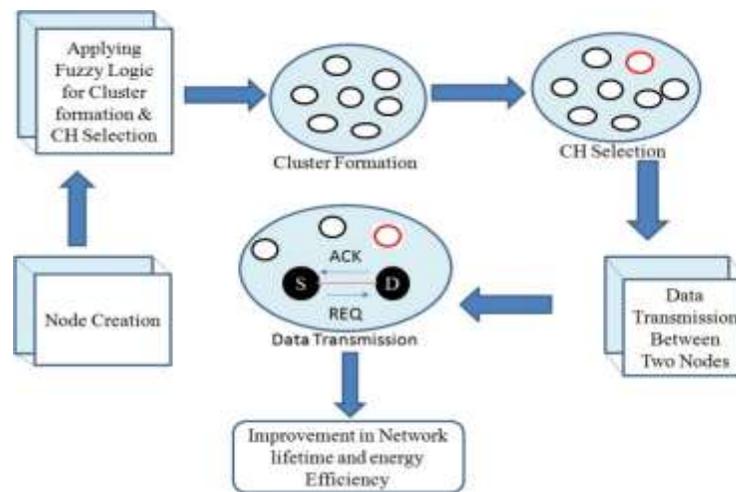
In this system, we propose a new energy-efficient Adaptive Weighted Fuzzy Cluster-based routing protocol (AWFCRP), which adopts a centralized clustering approach to select Cluster Head (CH) by generating a representative path. To support reliable data communication, we propose a multihop routing protocol that allows both intra- and inter cluster communications. Based on a message success rate and a representative path, the sensor nodes are uniformly distributed in clusters so that the lifetime of network can be prolonged. Through performance analysis, we show that our energy-efficient routing protocol outperforms the existing protocols up to 2 times, in terms of the distribution of cluster members, the energy consumption, and the reliability of a sensor network.

#### **ADVANTAGES:**

- The adoptive fuzzy logic control enhances routing path selection in the clustering protocol.
- This protocol provides better results than existing distributed clustering algorithm in terms of energy efficiency and network reliability.

## **V. SYSTEM DESIGN**

### **5.1 SYSTEM ARCHITECTURE**



**Figure 5.1: Architecture of the Proposed System**

This architecture shows that, cluster head is elected based on the optimized energy and distance. So, the energy consumption is low when compared to the existing system. Re-clustering is also reduced.

Clustering also facilitates load balancing and extends network lifetime. For example, if a cluster head's energy becomes depleted due to its tasks of intra-cluster communications, performing the aggregation function, and inter-cluster communications, the cluster head may choose to resign its position new clusters may be formed and other nodes may become cluster head to relieve the current cluster head of its duties. In this way, nodes in the network share the duties of being cluster head based on some parameter such as Node connectivity, energy, mobility. Accordingly, clustering try to maximize the lifetime of the network by balancing the duties of being cluster head. Finally, clustering is proposed because of its network scalability many nodes can be added or removed from the network without significantly affecting the performance, because of the clustering architecture.

However, clustering algorithms have some disadvantages and create certain research challenges, such as protocol overheads for cluster maintenance. Other problems are to control cluster size, granularity, and density frequency of cluster changes by the nodes and cluster reselection minimizing interference and collision for intra- and inter-cluster communications and the domino effect of cluster reformation.

## **VI. SYSTEM IMPLEMENTATION**

### **6.1 APPLY FUZZY CLUSTERING ALGORITHM**

The proposed strategy, AWFCA, is an Adaptive Weighted Fuzzy Clustering based routing protocol , the CHs algorithm using fuzzy logic control will be constructed in the BS that has the global view over the networks. The BS is more powerful than the sensor nodes in terms of computation power, sufficient memory, unlimited power supply and storage, the BS is loaded with the fuzzy logic control to compute desirable CHs candidates. By considering three fuzzy parameters which are energy, concentration and centrality, the network lifetime can be improved.

## 6.2 CLUSTER FORMATION AND CLUSTER HEAD SELECTION

### Cluster formation

Battery power is important concern mobile nodes. The node with less energy leads to packet loss. We cannot able to charge the nodes deployed in hazard areas. In cluster mobile nodes will be grouped into a cluster. Each cluster has a cluster head which is act as a gateway node. This will reduce the network congestion by only allowing cluster head (CH) to communicate with the base station.

### Cluster Head Selection

Cluster heads are selected based on the following weighted sum  $W=w_1D_1+w_2D_2+w_3D_3$  Where  $D_1$  is the power level of the node,  $D_2$  is the connectivity factor and  $D_3$  is the stability index and  $w_1, w_2$  and  $w_3$  are the weighting factors. Cluster head has the least  $W$  value. After the node is selected as a cluster head, the node or the members of the node will be discerned as "considered". Every "unconsidered" node undergoes the election process. After the selection of "considered nodes" the election algorithm will be terminated.

## 6.3 DATA TRANSMISSION BETWEEN CH AND BS

The cluster head collects data from member nodes in the same cluster and aggregates the collected data so that it can be transmitted to the base station. Implementing this protocol will significantly reduce the overall energy used and reduce the network congestion by only allowing the cluster head to communicate with the base station. The BS(base station) considers two selection criteria from sensor nodes which are energy level and distance to the base station to select the suitable (CH) cluster head that will prolong the First Node Die (FND) time, data stream guaranteed for every round and also increase the throughput received by the base station before FND. In cluster routing protocol, energy consumption is concentrated on cluster heads which collect and aggregate the sensed data from member nodes and forward the aggregated information to the base station.

## VII. PERFORMANCE ANALYSIS

The performance of the both CBRP and AWFCRP method is analyzed and X-graphs are plotted. Throughput, Energy Consumption, is the basic parameters considered here and graphs are plotted for these parameters. And the results obtained from this module is compared with the result of CBRP and comparison X-graphs are plotted.

The result of the network lifetime is achieved by the proposal algorithms. Here identical initial energy and imbalanced initial sensor nodes are employed in 1500\*1500 square meters areas. The transmission range is fixed to 250 so that all of the networks generated are fully connected.

SIMULATION PARAMETERS	
Simulator	Ns-2.34
Simulation duration	40 Seconds
Simulation Area	1500*1500 Sq.meters
Number of nodes	26
Transmission Range	250m
MAC Layer Protocol	IEEE 802.11
Maximum speed	50 m/s
Packet rate	4 packet per sec
Traffic Type	CBR
Data Payload	512 bytes/packet
Transmission rate	11Mb max and 2 Mb min

Table 7.1 : Simulation Parameter

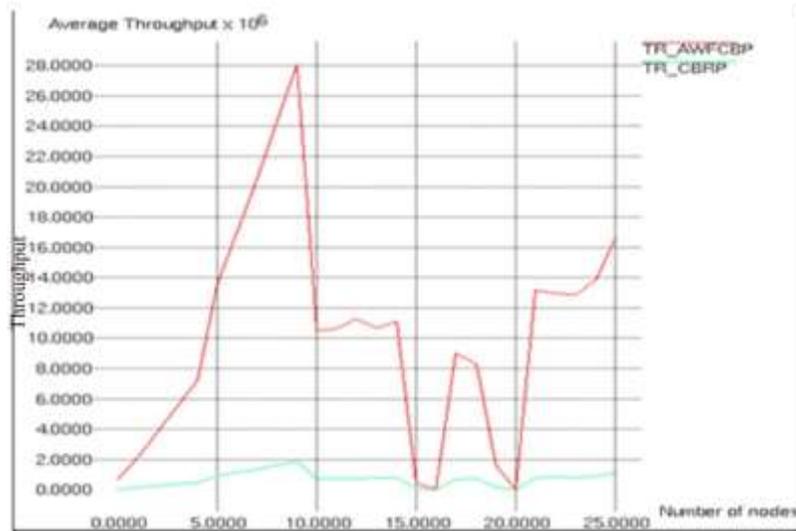


Figure 6.1: Throughput

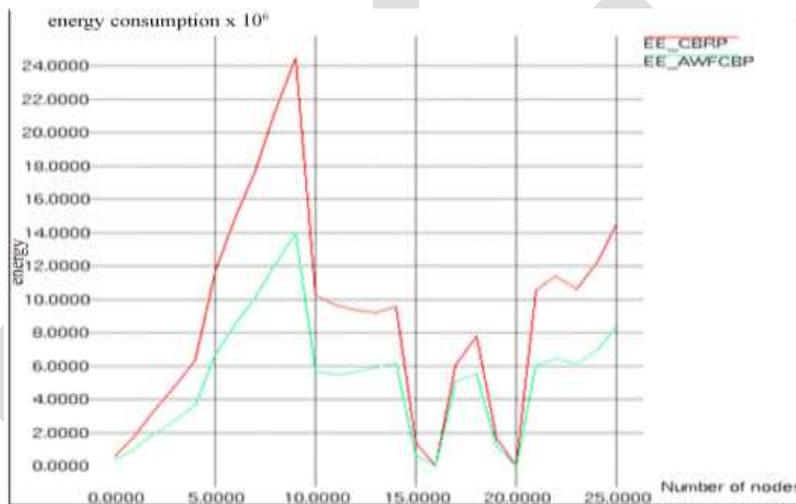


Figure 6.2: Energy Consumption

## VIII. CONCLUSION AND FUTURE ENHANCEMENTS

### 8.1 CONCLUSION

In this work, an Adaptive Weighted Fuzzy Clustering protocol for mobile wireless sensor networks is presented. This protocol is energy efficient, flexible against node mobility and due to its recovery mechanism it also reduces packet loss. It acquires less messages exchanges during cluster head selection. It gives high packet delivery ratio and network lifetime. This method is applicable to both static networks and node having mobility. It is clear that the cluster head node closer to the base station will consume less energy than other nodes because communication of data consumes the most energy in WSNs. Thus the process of electing the cluster head is reduced. The simulation results showed that the proposed AWFCA achieves better performance than other existing mechanisms.

### 8.2 FUTURE ENHANCEMENT

In future, this work includes implementation of cross layer design in order to achieve more energy efficiency, robustness and more extensive simulations by using other power and mobility models, comparison with other protocols that deal with mobility.

**REFERENCES:**

- [1] W.Choi,M.Woo(2006), "A Distributed Weighted Clustering Algorithm For Mobile Ad Hoc Networks", Proc.of the Advanced International Conference On Telecommunications And International Conference On Internet And Web Applications And Services(AICT/ICIW 2006),IEEE,2006.
- [2] Dahane Aminea, Berrached Nassreddinea, Kechar Bouabdellahb(2014)," Energy Efficient and Safe Weighted Clustering Algorithm for Mobile Wireless Sensor Networks" Procedia Computer Science 34 ( 2014 ) 63 – 70 ,Elsevier, The 9th International Conference on Future Networks and Communications (FNC 2014).
- [3] V.Geetha, P.V.Kallapur, S.Tellajeera(2008), " Clustering In Wireless Sensor Networks: Performance Comparison of LEACH & LEACH-C Protocols Using NS2",Procedia Technology(c3 IT-2012),Elsevier,Vol.4,PP.163-170,2012.
- [4] Junping H., Yuhui J., and Liang D(2008), "A Time Based Cluster-Head Selection Algorithm for LEACH," IEEE Symposium on Computers and Communications ISCC 2008, pp. 1172-1176, 2008.
- [5] Yu M., Li J., and Levy R(2006), "Mobility Resistant Clustering in Multi-Hop Wireless Networks," Journal of Networks, vol. 1, no. 1, pp. 12-19, 2006.
- [6]Zhan Wei Siew, Chen How Wong, Aroland Kiring, Renee Ka Yin Chin and Kenneth Tze Kin Teo(2012),"Fuzzy logic based energy efficient protocols in Wireless Sensor Networks", Unit School of Engineering and Information Technology, University Malaysia Sabah. December 2012,Volume:03