Lifetime Maximization of Wireless Sensor Network using Unequal Clustering

N. Sivaraman, S. Mohan, M. Selvakumar

Abstract*: *Wireless Sensor Network (WSN) is a set of self-regulating sensors which are minute devices and it has limited battery power and a reduced amount of computing ability. The nodes of the sensors dispensed arbitrarily or physically in the sensing region to log the environmental constraints of a region meant to notify a specific destination called BS (BS). The organization of WSN into a set of clustering enabling effective exploitation of restricted energy resources of the placed nodes. But, the issue of uneven energy utilization exists and is related to the localization of a specific node in WSN. When the network undergo organization into different clusters where few significant nodes plays a vital role of cluster head (CH) for network management. In some cases, the clusters are organized in an unequal form called Unequal Clustering Size (UCS) to organize the nodes, results in consistent energy utilization and maximized lifetime of WSN. Besides, it is evident that it offers consistent energy utilization in a homogeneous way.

Keywords*: *WSN, Clustering, Network lifetime, Unequal clustering.

I. INTRODUCTION

WSN a group of little sized, low energy sensor nodes with the ability to detect and transmit the physical phenomenon to BS. It finds useful in various areas like border surveillance, power plants, industries, environmental monitoring, industrial automation and so on. In contrast to conventional wired systems, the deployment cost of WSN is very low. Further, the WSN has the capability for adapting with the varying environmental conditions. The sensing field can be the physical environment, buildings otherwise an information technology structure the sensor node includes four main components namely sensor unit, processor unit, battery and communication unit. The sensor unit converts the sensed data to electrical form where each node forwards the sensed data to BS through intermediate sensor nodes. As a sensor node operates only on the inbuilt battery power, it might be employed in hazardous or difficult environments it is very hard or not possible for recharging or replacing the power supply. As a result, the clustering methodologies have a necessity to enhance its effectiveness to improve the lifespan of the coverage in sensor network [1]. Otherwise, WSNs proceed to keep the similar coverage in sensing in spite of fatality of some sensing nodes within the network, through getting the benefit of spatially repetitive node deliverance.

Some of the coverage aware cluster methods are being projected to improve the lifespan of the coverage [2]. But, they over seemed the scene of the partly overlapping sensing region In WSNs, routing is a difficult task since it is connected to different features of WSN which makes it different from conventional communication networks, For example, ad hoc network. Firstly, it is impossible to use a global addressing method while deploying nodes in Fig.1.

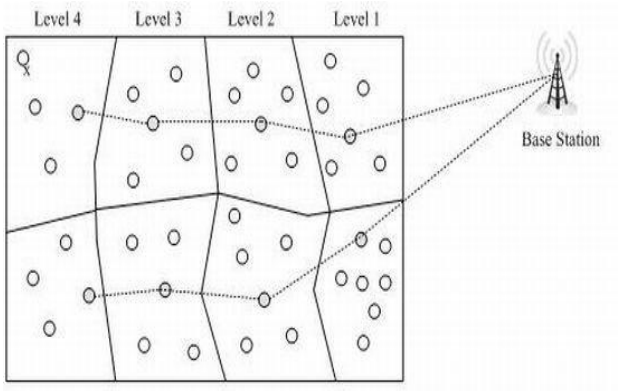

Fig. 1 Network Model Adopted

Next, contrastingly to conventional communication models, every WSN application needs the course of Sensed information out of many nodes to a specific BS. The clustering techniques groups the nearby nodes into clusters based on some criteria and leader known as CH would be selected in a cluster [3]. The CH is solely responsible for the particular cluster and the leftover nodes are known as cluster members. Though several measures in the literature involved the energy consumption criteria, the major drawback lies in the fact of high data redundancy along with the problem of hot spot issue. Hot spot issue refers the faster energy depletion of CHs located closer to the BS compared to other CHs. To resolve this problem, unequal clustering schemes were introduced, which constructs small clusters near to BS and large clusters far from BS. The overall unequal clustering model is depicted in Fig. 2.

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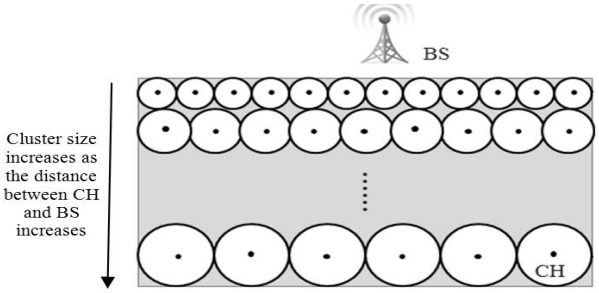

Fig. 2 Unequal Clustering in WSN

To overcome the above-mentioned problems, this paper presents unequal clustering mechanism and threshold based data transmission. This paper incorporates two main phases: (i) unequal clustering using vote based metric and communication capability of the sensor nodes, and (ii) reactive data transmission. In reactive data transmission, the sensor node transmits the data only when the sensed value crosses the threshold value. This reactive manner eliminates the data redundancy as well as the amount of data transmission. The simulations were performed to highlight the advantages of the presented algorithm to improvise the lifetime and energy exploitation of WSN.

II. RELATED WORKS

LEACH is a popular and foremost clustering algorithm widely used in periodical gathering of data applications in WSNs. The nodes selection itself as CH by means of few possibilities. This selection of possibility to become of CH depends on the consideration which every sensor nodes initiates with similar quantity of energy; in addition to that, every node will send data in its time frame. When the nodes with variant quantity of energy, the node need, high energy needs to become CH compared to the nodes with minimal energy, to verify which all the nodes deplete its energy at the similar instance. The presented a general weight-based clustering technique which integrates every sensor in the midst of some weights. In WCA, the weight is computed using some local information about the sensors like transmission power, degree of the node, mobility as well as level of battery of sensor node [4]. The CHs are chosen from the nodes with less weight compared to their nearby nodes. This algorithm employs single hop communication in which every node straightly transmits the data to the CH. In UCS [5], the foremost unequal clustering strategy is presented for uniform load distribution among the CHs. The BS is placed at the middle of the target region and it gathers data from WSN. The location of CHs are fixed earlier, with all CHs are sorted in the form of concentric circles in the region of the BS [6]. Through the use of unequal clustering along with multichip communication, the nodes are properly organized to clusters. EEUC be a competitive algorithm, wherever CHs be chosen by partly opposition and the intermediate node with high remaining energy to forward the data. WCA algorithm employs voting scheme to elect CH in UCRA [7]. In the cluster setup phase, the nodes exchanges information to compute vote and it select the node with maximum vote will be considered as CH. The CH broadcasts the control messages to intimate remaining nodes. The CHs broadcasts the manages messages to notify additional nodes. The left nodes select the most excellent CH to connect based on the fitness. This process undergoes iterations until every node goes under a CH.

This work commences an algorithm called Fuzzy logic depended unequal clustering, ACO depended Routing, Hybrid protocol (FUCHAR) to avoid hot spot issue in addition to broaden the lifespan of a network. This protocol contains three processes: CH selection, inter-cluster routing as well as cluster maintenance. Fuzzy logic chooses CHs efficient as well as also partitions the network into unbalanced clusters using residual energy, distant to BS, distance to its likelihood, node degree as well as node midpoint. It employs ACO routing method for effective as well as standard inter-cluster routing out of CHs towards BS. This protocol broadcasts information in a hybrid way, that is together proactive as well as reactive way.

III. PROPOSED METHOD

Previously, several probabilistic based approaches were developed to solve hot spot problem by effectively selects the appropriate cluster size and CHs. When the number of nodes in WSN tremendously increases, probability based methods fails to manage efficiently and the clustering problem is considered as a NP hard problem. After bio-inspired algorithms have evolved for solving NP hard problems, the area of clustering in WSN grasps a number of researchers to solve it. This part of interest leads the researchers to design various algorithms for select CHs and cluster size to maximize the lifetime of WSN. In our research work, a Hybridization of Krill Herd (KH) and Grey Wolf Optimization (GWO) algorithm is introduced to design and develop energy efficient unequal clustering protocol to enhance the network lifetime in Wireless Sensor Nodes for the flow chart of given bellow in Fig.3.

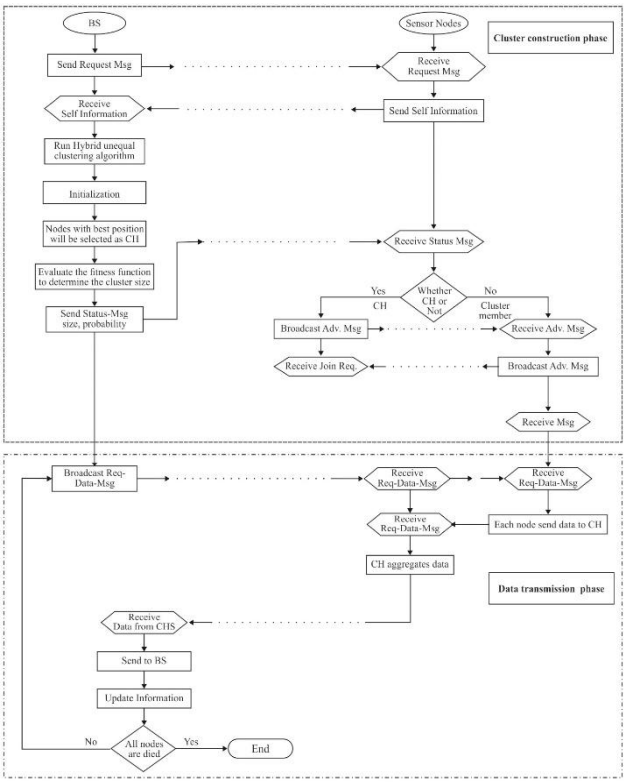

Fig. 3 Flow chart of the proposed Method

IV. SIMULATION RESULT AND DISCUSSION

Table: 1 Node, Parameter and Area Value

Parameters	Value
Area	100x100
E_0	0.5J
E_{elec}	50nJ/bit
ε_{mp}	100pJ/bit/m^2
ε_{fs}	100pJ/bit/m^2
Packet size	4000bits
Node count	50 (small scale WSN)
	200 (medium scale WSN)
	500 (large scale WSN)
Position of BS	S1: (50, 50)
	S2: (100, 100)
	S3: (150, 50)

BS in this area at the located of the sending field, edge field and far away from sending field they are using in Nodes, Parameter and Area Value in Table.1.

The BS divided into Three Types of Scenario and Scenario 1 (S1) – BS is kept in the middle of the target area in Fig.4, Scenario 2 (S2) – BS is kept at the corner part of the target area in Fig.5 and Scenario 3 (S3) – BS is kept away from the target area in Fig.5. Here the Nodes are increased in Counting of area. Small scale of 50 nodes, Medium scale of 200 nodes and large scale of 500 nodes are used.

A. BS at the Centre of Sending field

BS at the located at the centre of the sending field. The Node deployed at the BS to the centre of Sending field. The CH receiving the data and transmit to BS. They are X-axis and Y-axis to the in this particular specific Area in Fig.4.

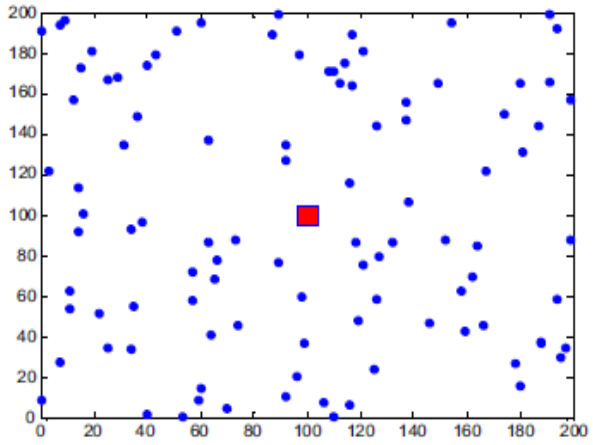

Fig: 4. S1: BS at the center of sensing field

B. BS at the edge of sensing field

BS at the located at the edge of the sending field. The Node deployed at the BS to the edge of Sending field. The CH receiving the data and transmit to BS. They are X-axis and Y-axis to the in this particular specific Area in Fig.5.

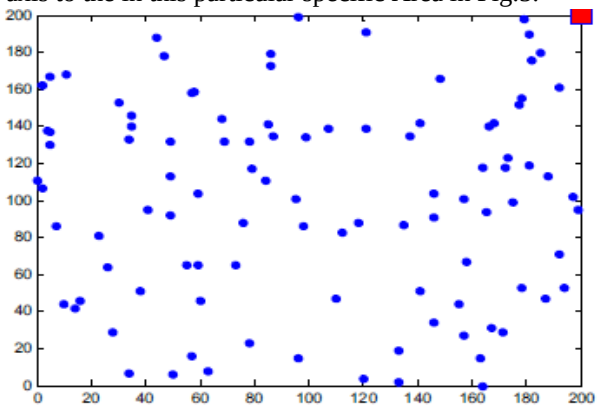

Fig: 5. S2: BS at the edge of sensing field

C. BS at the far away from the sensing field

BS is kept away of the target region. The Node deployed at the BS to the fare away of Sending field. The CH receiving the data and transmit to BS. They are X-axis and Y-axis to the in this particular specific Area in Fig.5.

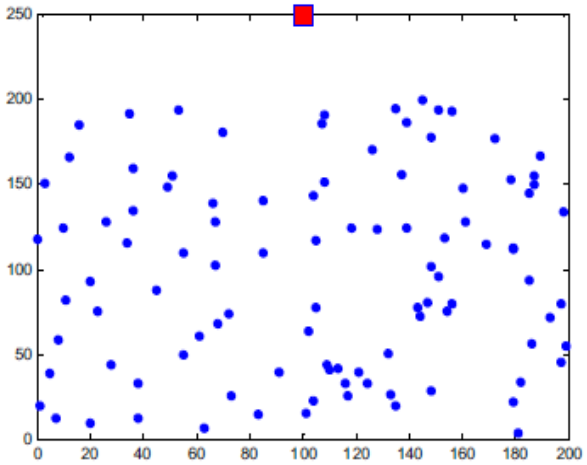

Fig: 6. S3: BS at the far away from the sensing field

In this Nodes deployed at the BS at the center, edge and far away from the sending field.

V. CONCLUSION

The clustering process is applied to diminish the quantity of the data communication and also saves energy. It builds a network which improves the effectiveness by restricting the energy utilization. This paper presented an unequal clustering mechanism and threshold based data transmission. This paper incorporates two main phases are an unequal clustering using vote based measure as well as transmission power of sensor nodes and reactive data transmission. This reactive manner eliminates the data redundancy as well as the amount of data transmission. The simulations were performed to highlight the advantages of the CBR algorithm for enhancing the lifetime with minima energy utilization.

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