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Performance Analysis Protocal of Goometrical Cluster based for WSN

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ABSTRACT: The clustering is an efficient technique used to achieve the specific performance requirements of large scale wireless sensor networks. We have carried out the performance analysis of cluster-based wireless sensor networks for different communication patterns. In this paper are using fuzzy clustering, k-mean and c-mean clustering method. It is observed that overhead in cluster based protocol is not much dependent upon update time. Simulation a result indicates that a cluster based protocol has low communication overheads compared with the velocity based protocol.

Keywords: WSN, Clustering, k-means, fuzzy c-means, etc.

I. INTRODUCTION

Wireless sensor network systems are now being applied by an international community for critical applications in healthcare, industry and security. These systems have exclusive features and face many implementation challenges. Amongst all, the requirement of extended lifetime for a Wireless sensor node under limited energy enacts the severe design constraints.

Wireless sensor network is a collection of sensor nodes interconnected by wireless Communication channels. In each Sensor node is a small device that can collect data from its surrounding area, communicate with other Sensors or with the base station (BS) and carry out simple computations. Recent years have observed an increasing interest in using wireless sensor networks (WSNs) in many applications, and including environmental monitoring and military field surveillance. They applications, small sensors are deployed and left unattended to continuously report parameters such as temperature, humidity, pressure, light, and chemical activity. A reports transmitted by these sensors are collected by observers (e.g., base stations).The dense deployment and unattended nature of WSNs makes it quite difficult to recharge node batteries.

Wireless Sensor Network (WSN) plays an extremely significant role in usual lives. It differs from Wireless Networks in provisions of constraints of their resources (energy).Energy consumption is the principal concern in WSNs. Therefore, a numerous researchers focused on energy efficient algorithms in WSNs for extending the life time of sensors. These differ depending on the deployment of node, the network design, the characteristics of the cluster head nodes and the network operation model. Energy is proficient o save by grouping nodes as clusters. Clustering is used in order to advance the scalability of network performance. Clustering is useful in several sensor network applications such as inter cluster communication, node localization and so on. Clustering algorithms have extensive applications in the precedent years and common clustering algorithms have been proposed for energy consumption in recent years in all of these algorithms, nodes are structured as clusters, superior energy nodes are called as Cluster Head (CH) and other nodes are called as normal sensor nodes.

II. WSN (WIRELESS SENSOR NETWORK)

Wireless sensor network is a popular area for research now days, in due to vast potential usage of sensor networks in different areas. The sensor network is a comprised of sensing, communication ability which helps to observe, processing, instrument, react to events and phenomena in a specified environment. This kind of network enables to connect the physical world to environment. By networking tiny sensor nodes, becomes easy to obtain the data about physical phenomena which was very much difficult with conventional ways. A Wireless sensor network typically consists of tens of thousands of nodes. These nodes collect, process and cooperatively pass this collected information to a central location. WSNs have unique characteristics such as a low duty cycle, power constraints and limited battery life, redundant data acquisition, heterogeneity of sensor nodes, mobility of nodes, and dynamic network topology, etc. Sensor network is relatively new having short history. Addition to that, these networks are autonomous and frequently require topology changes upon external intervention.

The prime objective of wireless sensor network is to collect data from node and deliver it to sink for further processing. To utilize wireless sensor network effectively one must develop a plan that combines the proposed applications with the underlying individual device hardware capabilities. Recently, WSNs have raised considerable interest in the research community thanks to their decisive advantages in real-time data processing at a minimal cost. Advancement in technologies further made technical and economical manufacturing of miniature low cost sensors a reality. Their capability to organize spontaneously in area of interest, particularly for autonomous operation and expand and maintain a resilient network of individual measurement points to give them an edge. Data is generally routed to the adjacent node or to the sink on stimuli. Several data routing protocols have been proposed in wireless sensor networks. A brief description of data routing in WSNs is discussed herein.

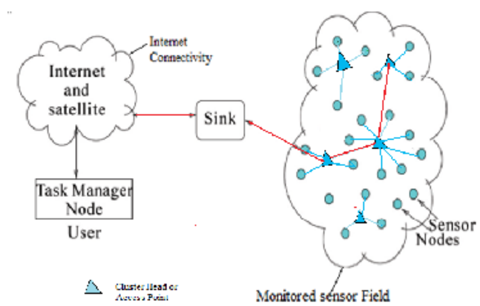

Fig. 1. Wireless sensor Network.

III. FUZZY LOGIC APPROACH FOR CLUSTERING

The cluster-heads are elected by the base station in each round by calculating the chance each node has to become the cluster-head by considering three fuzzy descriptors node concentration, an energy level in each node and its centrality with respect to the entire cluster. Its central control algorithm in the base station will produce better cluster-heads since the base station has the global knowledge about the network. Moreover, base stations are many times more powerful the sensor nodes, in sufficient memory, power and storage. In this approach energy is spent to transmit the location information of all the nodes to the base station (possibly using a GPS receiver). The cluster-head collects n number of k bit messages from n nodes that joins it and compresses it to c*n k bit messages with $c \leq 1$ as the compression coefficient. The operation of this fuzzy cluster-head election scheme is divided into two rounds each consisting of a setup and steady state phase similar to LEACH. The model of fuzzy logic control consists of a fusilier, fuzzy rules, fuzzy inference engine, and a de fusilier. We have used the most commonly used fuzzy inference technique called Mamdani Method due to its simplicity. In the process is performed in four Steps:

(i) Fuzzification of the input variables energy, concentration and centrality - taking the crisp inputs from each of these and determining the degree to which these inputs belong to each of the appropriate fuzzy sets.

(ii) Rule evaluation - taking the fuzzifier inputs, applying them to the antecedents of the fuzzy rules. Then applied to the consequent membership function.

(iii) Aggregation of the rule outputs - the process of unification of the outputs of all rules.

(iv) Defuzzification - the input for the defuzzification process is the aggregate output fuzzy set chance and the output is a single crisp number. During defuzzification, it finds the point where a vertical line would slice the aggregate set chance into two equal masses. In practice, the COG (Center of Gravity) is calculated and estimated over a sample of points on the aggregate output membership function, are using the following formula:

$$COG = \left(\sum \mu_A(x) \cdot x\right) / \sum \mu_A(x) \qquad (1)$$

Where, is the membership function of set a expert knowledge is represented based on the following three descriptors:

- Node Energy - energy level available in each node, a designated by the fuzzy variable energy,
- Node Concentration - number of nodes present in the vicinity, designated by the fuzzy variable concentration,

A. K-Means Clustering

k-means is one of the simplest unsupervised learning algorithms that solve the well known clustering problem. In procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed apriori. The main idea is to define k centers, one for each cluster. These centers should be placed in a cunning way because of different location causes different result. So, the better choice is to place them as much as possible far away from each other. In next step is to take each point belonging to a given data set and associate it to the nearest centre. When no point is pending, the first step is completed and an early group age is done. This point we need to re-calculate k new centroids as the varied center of the clusters resulting from the previous step. Then after we have these k new centroids, its newness binding has to be done between the same data set points and the nearest new center. As a result of this loop we may notice that the k canters change their location step by step until no more changes are done or in other words canters do not move any more. A loop has been generated. Finally, this algorithm aims at minimizing an objective function knows as squared error function.

$$J(V) = \sum_{i-1}^{c}\sum_{j-1}^{c_i}(\|x_i - v_j\|)^2 \qquad \ldots(2)$$

Where:

'||xi - vj||' is the Euclidean distance between xi and vj.
'ci' is the number of data points in ith cluster.
'c' is the number of cluster centers.
Algorithmic steps for K-Means clustering
Let X = {x1,x2,x3,……..,xn} be the set of data points and V = {v1,v2,…….,vc} be the set of centers.

Step 1: Randomly select 'c' cluster centers.
Step 2: Calculate the distance between each data point and cluster centers.
Step 3: Assign the data point to the cluster center whose distance from the cluster center is minimum of all the cluster centers.
Step 4: Recalculate the new cluster center using:

$$v_i = \left({}^{1}/_{c}\right)\sum_{j-1}^{c_i} x_i$$

Where, 'ci' represents the number of data points in ith cluster.
Step 5: Recalculate the distance between each data point and new obtained cluster centers.
Step 6: If no data point was reassigned then stop, otherwise repeat from step 3.

B. Fuzzy C-Means Clustering

This algorithm works by assigning membership to each data point corresponding to each cluster center on the basis of distance between the cluster center and the data point. The data are near to the cluster center more is its membership towards the particular cluster center. A clearly; summation of the membership of each data point should be equal to one. An after each iteration membership and cluster centers are updated according to the formula:

$$\mu ij = \frac{1}{\sum_{k=1}^{c}\left(\frac{dij}{dik}\right)^{(2/m-1)}} \qquad (3)$$

$$v_j = \left(\sum_{i-1}^{n}(u_{ij})^m x_i\right)/\left(\sum_{i-1}^{n}(u_{ij})^m\right), \quad \forall j = ,2,..c \quad (4)$$

Where:
'n' is the number of data point.
'vj' represent the j^th cluster centre.
'm' is the fuzziness index m € [1,∞]
'c' represent the number of cluster centre.
'μij' represent the membership of i^th data to j^th cluster centre.
'dij' represent the Euclidean distance between i^th data and j^th cluster centre.

Main objective of fuzzy c-means algorithm is to minimize:

$$J(U,V) = \sum_{i-1}^{n}\sum_{j-1}^{c}(u_{ij})^m \|x_i - v_j\|^2 \quad (5)$$

Where:
'||xi – vj||' is the Euclidean distance between ith data and j^thcluster centre.
Algorithmic steps for Fuzzy c-means clustering:
Let X = {x1, x2, x3 ..., xn} be the set of data points and V = {v1, v2, v3 ..., vc} be the set of centers.
Step 1: Randomly select 'c' cluster centers.
Step 2: Calculate the fuzzy membership 'µij' using:

$$\mu_{ij} = 1/\sum_{k-1}^{c}\left(d_{ij}/d_{ik}\right)^{(2lm-1)}$$

Step 3:Compute the fuzzy centers 'vj' using:
Step 4: Repeat step 2) and 3) until the minimum 'J' value is achieved or ||U(k+1) - U(k)|| < β.
Where:
'k' is the iteration step.
'β' is the termination creation between [0,1]
'U = (µij)n*c' is the fuzzy membership matrix.
'J' is the objective function.

V. RESULT

In this paper, we discuss about the results obtained from the simulation and their analysis is presented. The simulation results were plotted in terms of performance of the cluster based for WSN, in performing fuzzy cluster and k-means clustering,

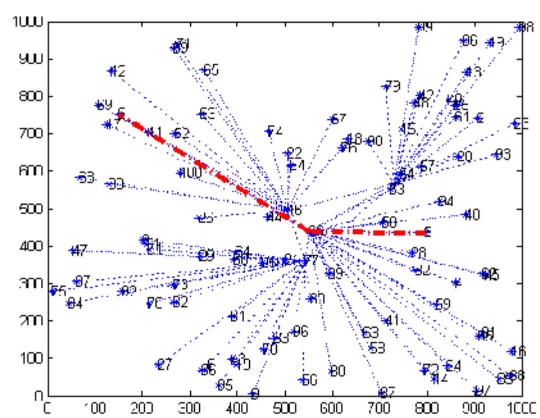

Fig. 2. The performance fuzzy clustering.

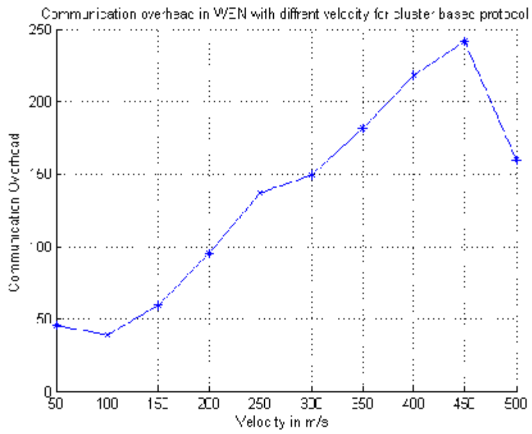

Fig. 3. The cluster based protocol in communication overhead WSN with velocity.

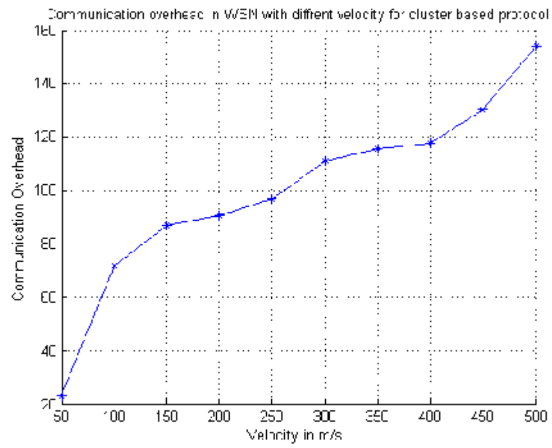

Fig. 6. Communication overhead in WSN with velocity cluster based protocol.

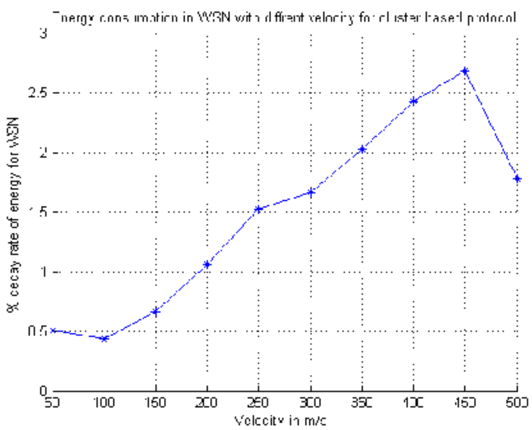

Fig. 4. Energy consumption in WSN with different velocity for cluster based protocol.

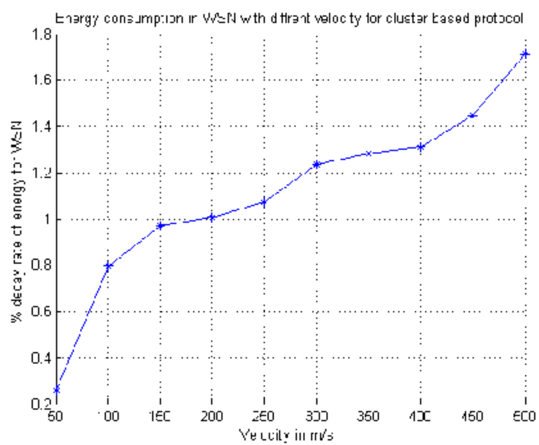

Fig. 7. Energy consumption in WSN with different velocity for cluster based protocol.

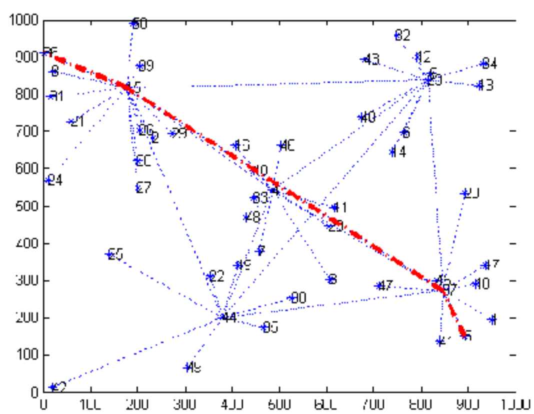

Fig. 5. The performance of Kmean clustering.

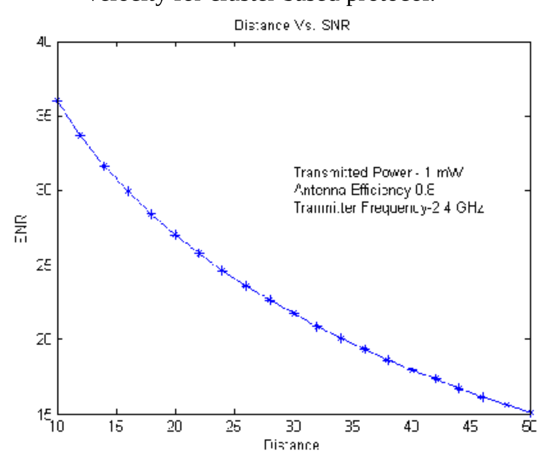

Fig. 8. The performance of distance Vs SNR.

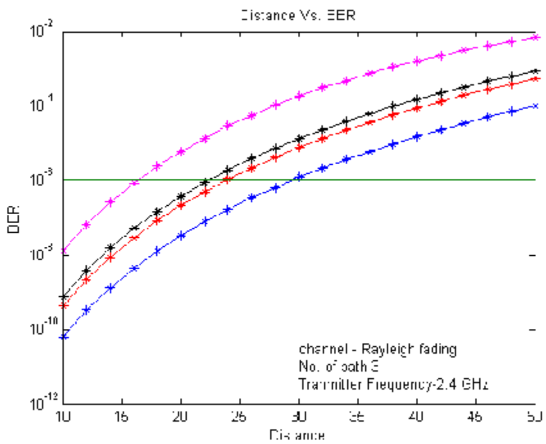

Fig. 9. The performance of distance Vs BER.

VI. CONCLUSION

In this paper, we have carried out the performance analysis of cluster-based WSNs for different communication patterns formed from the application constraints. Examples include disaster management, border protection, combat field surveillance. This is applications a large number of sensors are expected, in requiring careful architecture and management of the network. They are grouping nodes into clusters has been the most popular approach for support scalability in WSNs.

REFERENCE

[1]. Amitabh Basu , Jie Gao, Joseph S. B. Mitchell, Girishkumar Sabhnani , "Distributed localization using noisy distance and angle information" *7th AC Minternational symposium on Mobile ad hoc networking and computing*, 2006, pp. 262 – 273.

[2].Labisha R.V, Baburaj E, Energy Efficient Clustering Algorithms in Wireless Sensor Networks-An Analytical View Volume **9**, Number 3, May 2014

[3]. Anshul Shrotriya, Dhiraj Nitnawwre, "Energy Efficient Modeling of Wireless Sensor Networks Based on Different Modulation Schemes Using QualNet" *International Journal of Scientific Engineering and Technology*, Vol. **1**, Issue 3, pg : 171-174(ISSN : 2277-1581).

[4]. Wireless Sensor Networks – Technology and Protocols" , M.A. Matin et al. , Janeza Trdine 9, 51000 Rijeka, Croatia.

[5]. Soumighose and Sanjay K. dubey" Comparative analysis of K-mean & Fuzzy C-mean Algorithm. *IJACSA* vol.**4** No. 4 2013.

[6]. Mrs. Bharati R. Jipkate, Dr. Mrs.V.V.Gohokar "A Comparative Analysis of Fuzzy C-Means Clustering and K Means Clustering Algorithms.*International Journal Of Computational Engineering research* [7]. Vinaykumar, Sanjeev Jain, sudarshantiwari " Energy efficiency clustering algorithm in WSN a survey".