THE MODEL APPROACH FOR DYNAMIC CLUSTER FORMATION USING LEACH PROTOCOL IN WIRELESS SENSOR NETWORK

Khushpreet Kaur, Manuraj Moudgil
Department of Computer Science & Engineering, Department of Information Technology, *Bhai Gurdas Institute of Engineering and Technology Sangrur, India*

Abstract— The use of wireless sensor network (WSNs) has grown enormously in the last decade, pointing out the crucial need for scalable and energy-efficient routing and data gathering and aggregation protocols in corresponding large-scale environments. Hierarchical clustering protocols (as opposed to direct single-tier communication schemes) have extensively been used toward the above directions. Moreover, they can greatly contribute to overall system scalability, lifetime, and energy efficiency the cluster formation the cluster formation technique is proposed for better and long life of cluster

Keywords— *wireless sensor metwork (WSN), Underwater Wireless Sensor Networks (UWSNs), Mobile Wireless Sensor Networks (MWSNs)*

I. INTRODUCTION

WSN has become an emerging field in research and development due to the large number of applications that can become significantly beneficial from such systems and has led to the development of cost effective, not-reusable, tiny, cheap and self-contained battery powered computers, also called sensor nodes.

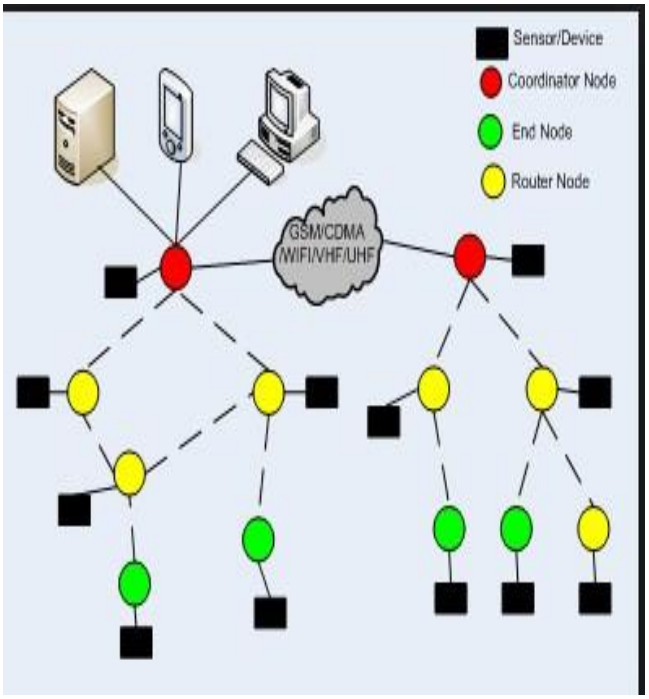


Fig1. Wireless Sensor Network

These sensor nodes can accept input from an attached sensor and process the input data gathered from the sensor nodes. After that the process data wirelessly transmits the results to transit network.[2] WSNs are highly dispersed networks of lightweight and small wireless nodes, deployed in huge numbers, to monitor the system or environment by the measurement of physical parameters like pressure, temperature, or relative humidity. WSNs can be applied in industry, agriculture, military defense, environment monitoring, remote control and city management etc. that is why WSNs are becoming more and more popular . WSNs consist of tiny and Low power sensor nodes that collect data through tiny sensors, process the data and send to particular location.[4] However, there are still many problems about MANETs, such as security problem, finite transmission bandwidth, and restricted hardware.

II. TYPES OF WSN

WSN has following types:
(1) Mobile Wireless Sensor Networks (MWSNs)
(2) Underwater Wireless Sensor Networks (UWSNs)
(3) Wireless Underground Sensor Networks (WUSNs)
(4) Wireless Multimedia Sensor Networks (WMSNs)

A.

B. *A. Mobile Wireless Sensor Networks (MWSNs)*

MWSNs can be defined as a WSN that have mobile sensor nodes as compared to the usually used WSN in which sensor nodes are static. MWSNs have more versatility than the static WSNs because MWSNs can be deployed for any scenario and they can manage with quick topology changes. [4]

C. *B. Underwater Wireless Sensor Networks (UWSNs)*

Underwater wireless communication is one of the major challenges in building UWSN. It has been observed that Radio Frequencies and acoustic waves (having narrow bandwidth) are heavily attenuated and altered in water. An alternative but a feasible solution that can be considered is using optical communication, in case of short range distance. This approach mainly emphasizes on an Optical Physical (PHY) Layer taking into account the features of WLAN (IEEE 802.11) Infrared Physical Layer and the compatibility with the most recent terrestrial Wireless Sensor Network's protocol i.e. IEEE 802.15.5[10]

C. *Wireless Underground Sensor Networks (WUSNs)*

WUSNs are one of the unique extensions of terrestrial WSNs. WUSNs' heterogeneous network architecture and channel characteristics; the connectivity study is much more complicated than in the ad hoc networks and terrestrial WSNs. [10]

D. *Wireless Multimedia Sensor Networks (WMSNs)*

The Wireless Multimedia Sensor Networks (WMSNs) comprise of tiny sensor-nodes that can sense compute actuate, communicate, and have control components. Various applications of the Wireless Sensor Multimedia Networks (WMNs) include target

III. CLUSTERING

Clustering can be considered the most important unsupervised learning problem; so, as every other problem of this kind, it deals with finding a structure in a collection of unlabeled data. A loose definition of clustering could be "the process of organizing objects into groups whose members are similar in some way". Cluster is therefore a collection of objects which are "similar" between them and are "dissimilar "to the object belonging to other clusters. [13]

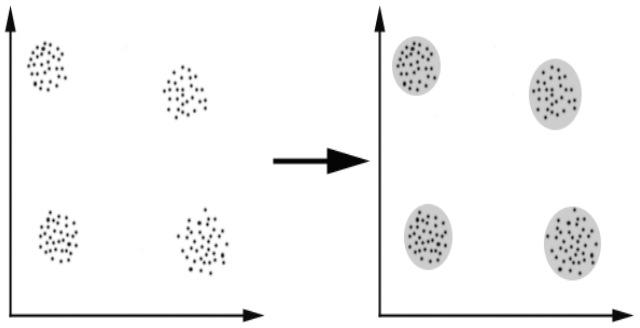


Fig2 Cluster Formation

In this case we easily identify the 4 clusters into which the data can be divided; the similarity criterion is distance: two or more objects belong to the same cluster if they are "close" according to a given distance (in this case geometrical distance). This is called distance-based clustering. Another kind of clustering is conceptual clustering: two or more objects belong to the same cluster if this one defines a concept common to all that objects[14]. In other words, objects are grouped according to their fit to descriptive concepts, not according to simple similarity measures useful and suitable groupings ("useful" data classes) or in finding unusual data objects (outlier detection).

Manal Abdullah et al [2015] [1] Wireless Sensor Networks WSNs are special networks consist of devices (sensor nodes) in large numbers and spatial distribution. They have various sensing capability and cooperate to accomplish common task. Clustering is one of the most effective techniques used to solve the problem of energy consumption in WSNs. Grid based clustering has proven its efficiency specially for high dynamic networks. The girds' strategy used in this research is implemented on dense network and divides the network area into multiple grid cells with different densities (High, Low, and empty). Then grids are combined to form clusters as normal and advanced clusters.

Haghighi et al[2013] [3] has proposed a novel algorithm that is capable of detecting significant change points, or " points of interest " in an unsupervised fashion across multiple data streams in parallel. This algorithm was based on an incremental dimensionality reduction approach known as subspace tracking. Sensomax exploits this algorithm to detect the change points and dynamically respond to the applications' demands whilst executing concurrent application switching operational paradigms and reorganizing at cluster and network levels.

A. Amini,et al [2013] [5]has proposed a Multi-Density clustering algorithm for data stream called MuDi-Stream. MuDi-Stream is an online-offline clustering algorithm, in which the online phase forms core-mini-clusters using a new proposed core distance and offline phase clusters the core-mini-clusters based on a density-based method. The new core distance called mini core distance is calculated based on the number of neighbouring data points around the core. Therefore, the algorithm has different core distances for different clusters that leads to cover multi density environments.

D. R. Edla et al [2013] [6] Grid-based clustering methods have been extensively applied on large data sets because of low computational cost, has proposed a new algorithm for grid-based clustering by finding the optimal grid-size using the boundaries of the clusters. The algorithm has linear time complexity. The problem of outliers is resolved with the help of local outlier factor (LOF). They applied the proposed method on various synthetic as well as biological data sets. The results are compared with K-means and few existing grid-based techniques. The comparison results show the effectiveness of the proposed method.

M. Bala Krishna et al [2012][7] Cluster management techniques aim to minimize the number of clusters, density of clusters and energy consumption per cluster. For that they proposed self-organized Energy Conscious Clustering protocol (SECC) for WSNs to group the sensor network into clusters based on node energy and node distance. If the node energy is below the threshold value, SECC forms self-organized clusters and re-organizes the sensor network. Nodes with energy attributes less than the threshold value are eliminated from the clusters to maintain energy efficient sensor network

Jerusha, et al [2012] [8] has explained wireless sensor nodes are usually embedded in the physical environment and report sensed data to a central base station. Clustering is one of the most challenging issues in wireless sensor networks. This paper proposed a new cluster scheme for wireless sensor network by modified the K means clustering algorithm.

Sensors nodes are deployed in a harsh environment and randomly scattered in the region of interest and are deployed in a flat architecture.

Z. W. Siew et al. [2011] [9] has explained cluster based hierarchical routing protocol is among the most common protocol being opted due to the load balancing among each other sensor. Sensors are randomly deployed in a specific area to collect useful information periodically for a few months or even a few years. Therefore, battery power limitation becomes a challenging issue. It is also impractical to maintain the network lifetime by changing the battery frequently. Low energy adaptive cluster hierarchical (LEACH) is one of the common clustering protocols that will elect the cluster head based on the probability model which will possibly lead to a reduce in network lifetime due to election of cluster head with a least desired location in the network

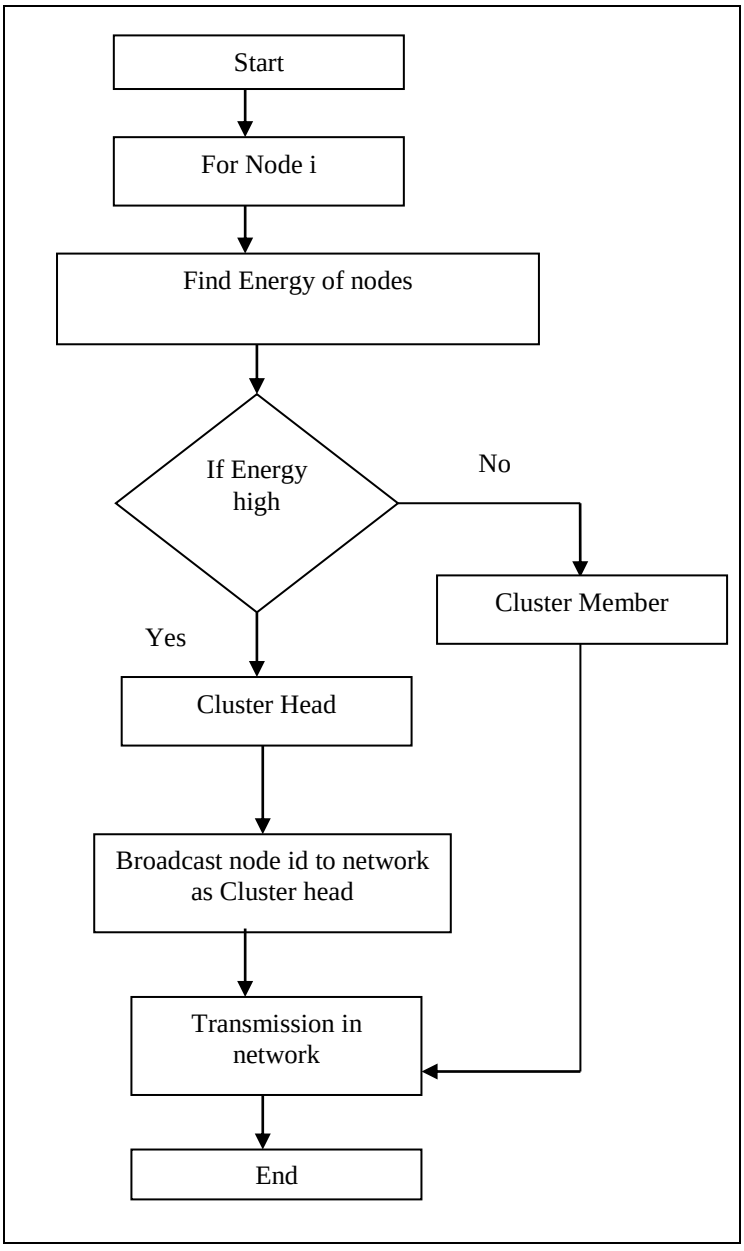
H. M. Abdulsalam et al [2010] [11] has explained the many applications deal with continues flows of data (data streams). One important area of applications that is based on data streams is the area of Wireless Sensor Networks (WSNs) application. Since sensors have limited lifetime, the need for developing algorithms for aggregating sensors data forms an important concern in the area of WSNs. They present W-LEACH, a data-stream aggregation algorithm for WSNs that extends LEACH algorithm by Heinzelman et al. W-LEACH is able to handle non-uniform networks as well as uniform networks, while not affecting the network lifetime. It, instead, increases the average lifetime for sensors. Its simulate the algorithm to evaluate its performance.

IV. PROPOSED METHODOLOGY

The idea is to form cluster of sensor nodes based on signal strength and use the cluster head as a router to forward data of other nodes in cluster to the base station. The data processing is performed at cluster heads. LEACH is a dynamic clustering mechanism. Time is divided in rounds/intervals with equal length. At the beginning of the round, cluster heads is generated randomly among the nodes which have remaining energy higher than the average remaining energy of all the nodes. Each sensor node n generates a random number such that 0< random <1 and compares it to a predefined threshold T (n). If random < T (n), the sensor node becomes cluster head in that round, otherwise it is cluster member. After becoming cluster heads, the nodes broadcast messages to all nodes to inform the status of them. Non Cluster head nodes decide which cluster head to join based on the receiving signal strength of these messages

Step 1. To discover the optimal route in WSNs from the sources node to the Base Station.
Step 2. To implement LEACH algorithm
Step 3. To find the cluster head with higher energy and form cluster
Step 4. If cluster head fails automatically new cluster head will form with the proposed technique
Step 5. The Proposed Algorithm will reduce the network bandwidth usage and decrease the amount of Energy consumption
Step 6. The Proposed algorithm will reduce delay time by automatically creating cluster head and avoid process of cluster redistribution process source node (SN) finds secure route up to destination by broadcasting RREQ message information regarding cluster head and its prime product of all nodes from source to destination is maintained by intermediate node (IN)

ALOGRITM1: *Cluster Formation*
1: for time=1 to simulation time



2: for i=1:N, where N the number of sensor nodes that located in the segment

3: for CID=1:NCL, NCL Number of clusters within the segment
4: if location (i) within the loc(CID);
5: Add i to (MCID); add sensor nodes i to the Members of CID combined with time
6: endif
7: end
8: end
9: end

The algorithms performance has been observed and analyzed on the basis of result of simulation which is performed on the NS2.

S. No.	Parameter	Value(s)
1	Simulator used	NS 2.35
2	Simulation Time	10 sec
3	Simulation Area	1000 X 1000
4	MAC	802.11
5	Number of nodes	45
6	Speed of Nodes	2 to 16 (m/sec)
7	Mobility Model	Random Waypoint

V. RESULT AND ANALYSIS

The analysis of Throughput with proposed cluster formation technique are shown in figure3 the shows that Throughput using proposed is high as compared to previous technique .our proposed technique the results are better.

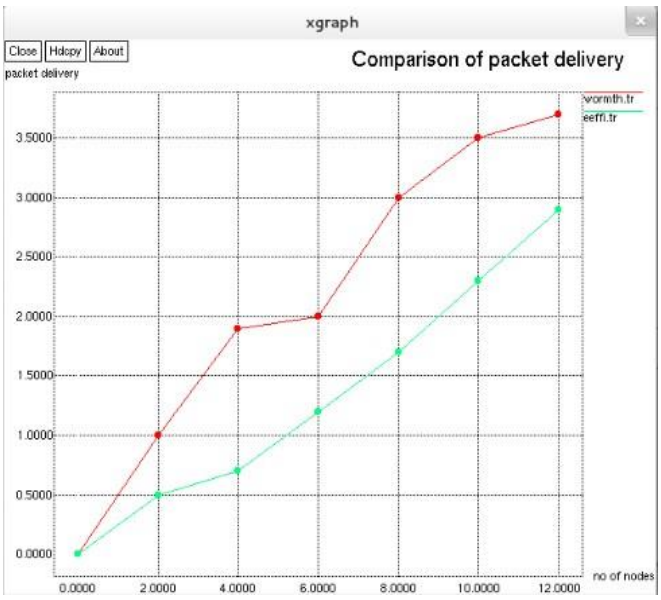


Fig3 Comparison of Throughput

The analysis of Packet Delivery ratio between proposed cluster and previous technique are shown in figure4 the shows that Delivery ratio using proposed cluster technique is high as compared to previous technique but in our proposed technique the results are better as compared to previous technique.

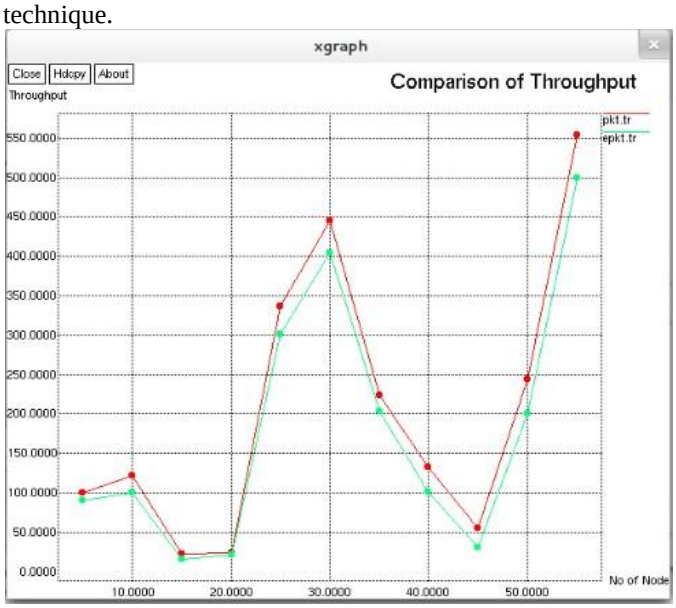


Fig 4 Comparison of Packet Delivery Ratio

VI. CONCLUSION

In this paper dynamic clustering algorithm for cluster formation are proposed. The cluster structure is formed by Leach protocol the proposed algorithm shows cluster stability with longer cluster life time and cluster reformation is lower as compare to previous algorithm The Simulation results shows that the proposed scheme performs better in terms of cluster formation time and cluster life time

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References

[1] M. Abdullah, H. N. Eldin, T. Al-Moshadak, R. Alshaik and I. Al-Anesi5. (2015) "Density Grid-Based Clustering for Wireless Sensors Networks International Conference on Communication, Management and Information Technology (ICCMIT)"
[2] Z.W. Siew, A. Kring, H.T. Yew, P. Neelakantan and K.T.K. Teo (2011). "Energy Efficient Clustering Algorithm in Wireless SensorNetworks using Fuzzy Logic Control" IEEE colloquium on humanities, Sconce and engineering research
[3] W. Heinzelman, "Application-specific protocol architectures for wireless networks," Ph.D. dissertation, MIT, 2000
[4] T Luo, H.P. Tan, and T. Q. S. Quek. "Sensor Open Flow Enabling Software-Defined Wireless Sensor Networks Dynamic" IEEE communications letters, Vol. 16, 2012.

[5] M. Haghighi, C. J. Musselle “Dynamic Collaborative Change Point Detection in Wireless Sensor Networks” International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery.
[6] A. Ciampi, A. Appice, D. Malerba. P. Guccion “Trend Cluster Based Compression of Geographically Distributed Data Streams” IEEE Symposium on Computational Intelligence and Data Mining (CIDM).
[7] J. Wu, N. Sun “Optimum Sensor Density in Distortion-TolerantWireless Sensor Networks” IEEE Transactions on Wirless Communications, Vol.11, No.6, June 2012.
[8] G. Sikander, M. H. Zafar, A. Raza, M. I. Babar, S. A. Mahmud, and G. M. Khan, "A Survey of Cluster-based Routing Schemes for Wireless Sensor Networks", in Smart Computing Review , vol. 3, no. 4, 2013.
[9] H. M. Abdulsalam and L. K. Kamel, "W-LEACH: Weighted Low Energy Adaptive Clustering Hierarchy aggregation algorithm fordata streams in wireless sensor networks," in Data Mining Workshops (ICDMW), 2010 IEEE International Conference on, 2010, pp.1-8
[10] C. K. D. Wagner “Secure routing in wireless sensor networks attacks and countermeasures” University of California at Berkeley, Berkeley

Khushpreet Kaur, born in India, on 10 july 1990. He received her B.Tech in Computer Science and Engineering from SUSWEC Tangori. She is pursuing M.Tech in Computer Science and Engineering from BGIET Sangrur, India. Her area of interest is in networking.
Email: lovekhushi.kaur78@gmail.com

Manuraj Moudgil, born on 11 september 1984. He is working as assistant professor in the department of information technology at BGIET Sangrur, India since last twelve years. He receieved his M.Tech in Computer Science and Engineering and B.Tech in Information Technology from BBSBEC Fatehgarh Sahib, India. He is persuing Ph.D from JJT University Rajasthan, India. His area of interest is in natural language processing.
Email: manu.moudgil@gmail.com