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A Study of Clustering Architecture and Characterization for Sensor Network

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ABSTRACT

A sensor network is the real time network that captures the environment or object or activity sensitive information. But the network is defined with various restrictions at node level, network level and communication level. In this paper, a study on different issues of sensor network is defined along with architecture specification. The clustered architecture is defined in this work to utilize the restriction and limitations of network and to define a real communication form. The process flow of cluster formation is also defined in this paper.

Keywords : Clustering, Sensor Network, Cluster Head, Architecture

I. INTRODUCTION

Sensor network is one of the challenging networks applied under the application and domain specification. The network is composed of smaller sensor devices which are having the capability to sense some object, material or the environment constraint. The network is generally defined in real time environment and with specification various associated constraints, features and limitations. The sensor network is the specialized network that can be defined in a particular region with constraint specification. It can be indoor network, outdoor network, underwater network or the underground network. The sensor network is restricted at each level of network formulation including the network region, node capabilities, communication capabilities etc. These restrictions or the constraints relative to the sensor network are shown here in figure 1.

The first and foremost issue is the infrastructure driven network. Even the network is wireless adhoc but because of the restricted node capabilities and communication range, the application specific controller is required that can control the work behavior of the network. The infrastructure is here defined in terms of base station. The placement of base station with intelligent control system which is having a larger memory, high processing power and the security system integration. Another criticality associated to this network is the region or the domain in which it is applied. For each application, the configuration of network, selection of sensor device and constraint setup is required. The sensor network or the constraints of one domain, application can be applied to other domain or application. Such as the sensor which are observing the chemical leakage in a plant cannot used in agriculture field to analyze the soil quality.

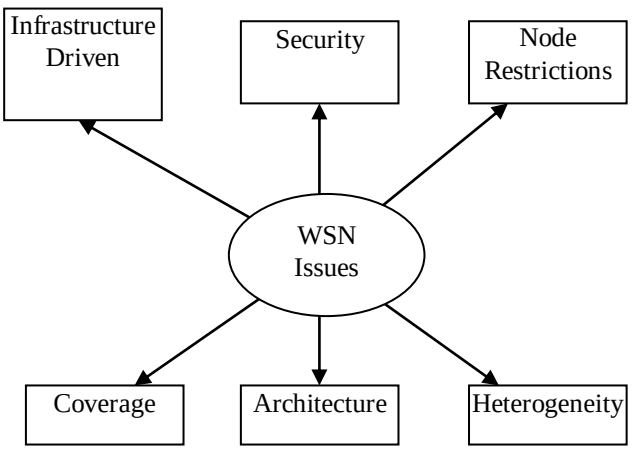

Figure 1: WSN Restrictions and Issues

The WSN issue includes the various restrictions defined for each sensor devices. The sensor devices are specialized and associated to the particular activity. The energy of node, memory, processing power is the some required constraints. These constraints defines the strength of the nodes based on which the energy adaptive algorithmic implementation can be applied for the network. Another challenge to WSN issues is coverage. The coverage of a node is defined as the maximum communication distance of a node. Based on this, the density and coverage estimation is required. To resolve this, the target coverage and area coverage aspects are defined sensor network. As defined earlier, the sensor nodes are defined specifically for the device or the object or the component. Because of this each sensor node having own battery backup and the processing capabilities. Because of this, the network is considered as heterogeneous network.

Another concern to sensor network is the architectural specification. One of the common sensor network architecture is clustered architecture. According to this architecture, the network is divided in smaller segments and each segment is controlled by the cluster head. This architecture is able to provide the effective communication while considering the associated network issues. The security is another critical issue of sensor network because of its real time support. The sensitive information is captured by the sensor devices and communicated to the base station or the controller device. This controller passes the information to the main server. But this two level communication suffers from various internal and external attacks. Because of this, there is the requirement of security measures to provide the reliable and safe communication.

A) Clustering

As the sensor network is defined with various restrictions and the constraints, the clustering architecture is able to observe these all constraints and restriction and able to provide the effective communication. The clustered sensor network architecture is shown here in figure 2.

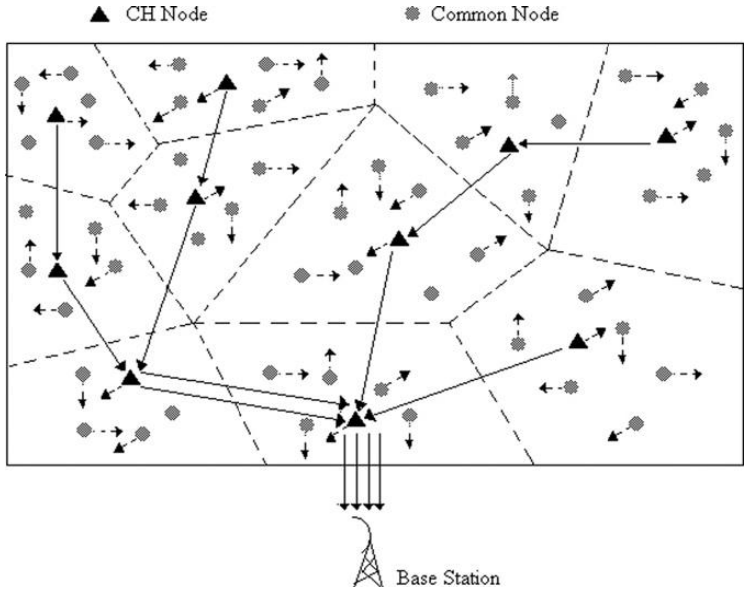

Figure 2 : Clustering Architecture

Here figure 2 is showing the clustering architecture with specification of multiple clusters. The tower shown outside the rectangular region is the main controller called base stations. All the interaction of this sensor network to the outer world is performed via these base stations. It passes the instruction to the network and collects the captured Network. The irregular partitions shown in the figure are the cluster regions. It shows that the clusters can be formed in any shape based on the requirement and observations. Here the round circles defined in gray color are the sensor devices. The triangle shaped devices shown in dark gray are the cluster heads. The nodes in a cluster communicate with its cluster head and deliver the Network to the cluster head. The cluster heads generates the hierarchical aggregative path to deliver the complete information to the base station. Here the larger arrows are showing the generated path from each CH to base station.

In this paper, an ABC improved clustering method is defined to generate the Network segments. The proposed dynamic method used the agent specific approach for generating the effective clusters. In section I, the basic requirement and characterization of clustering is presented. In section II, the work defined by earlier researchers for cluster optimization

is presented. In section III, the proposed research methodology is presented. In section IV, the results obtained from the work are presented. In section V, the conclusion of the work is presented.

II. RELATED WORK

Network Clustering is the essential Network processing activity used to filter the available Network pool and to generate the required Network patterns. Many researchers already submitted clustering work on organized, semi-organized, unorganized and incomplete Network sets. In this section, some of the work provided by earlier researchers is presented and discussed. Author[1] has defined self organized analysis method to provide clustering on incomplete Network. Author examined the Network under different parameters to handle the features of incomplete Network and provided the dimension specific clustering. The method is defined to generate the effective clustering solution under practical approach. This defined Network set is processed under iterative manner and to provide the cluster formation to improve the cluster quality. Author[2] defined a study specific work on clustering for different Network sets and for different applications. The streamed Network analysis and task specific mining method is provided for evolution of Network elements. The mining method is here applied under feature analysis to process the clustering Network and to provide the effective cluster formation. Author[3] has improved the purity of clustering method under entropy specific Network categorization.

Author provided the distance specific analysis on Network points and distance specific under different parameters. Author used the Shannnon concept with clustering method to provide integration to cluster formation. Author also identified the outlier to improve the efficiency of clustering algorithm. Author[4] has used the hybrid clustering method using KMeans clustering and Neural network approach. Author generated the Network clustering based on the automated mask generation method to discover the hidden patterns and to provide the boundaries specific membership analysis. This visualization specific method provided the integration in an emergent method. The Network mining method and relative feature analysis was provided to discover the hidden similarities so that the membership characterization will be achieved. Author[5] has used the shift specific clustering method for educational Network and provided the aspect driven mining method integration for improving the clustering results. Author processed the educational Network to generate the pattern prototype for resolving the associated difficulties and to provide the cluster quality enhancement using clustering approach. Author defined a feature trained method for improving the quality of clustering methods.

A work on microarray[6] Network processing and decomposition using clustering method was provided by Wang. The work combined the FCM method with empirical decomposition method to reduce the noise effect and to generate the effective clustering structure. Author processed the structural information of Network set under fuzzy operation to generate more reasonable results. Another work on temporal[7] clustering was provided by Yang by using the concept of weight assignment. A feature cut specific information organization and reduction was provided by the author along with time series specification. Author processed the benchmark Network sets to generate effective clusters underweight processing method. The proposed ensemble algorithm used the partitioned method to improve the quality of formed clusters. An optimization to clustering method was provided using PSO[8] approach for Web usage Network. Author processed the heterogeneous Network by combining the hierarchical clustering and PSO approach.

The similarity measure based clustering effect was verified by the author to improve the degree of applicability. A work on Affinity Propagation based clustering method was provided on large scale Network sets. The complexity driven analysis along with cluster formation in global environment was provided by the author. The Network point specific similarity analysis along with adaptive hybrid algorithm was provided by the author. A work on stock[10] Network analysis using clustering approach based on featured SVD method. The proposed hybrid method used the singular decomposition method to generate the features using Canopy and KMeans algorithm and implement them in Hadoop environment. The proposed massive method is defined for time series Network and able to provide the effective conclusion for Network clustering. Another work on fuzzy[11] adaptive clustering method was provided for relational Network. Author used the Euclidian distance based similarity analysis to identify the degree of membership and to generate the effective clustering results. The outlier identification and interpretation under noise class estimation was provided by the author.

A comparative study on distance and similarity measures for mix attributes based clustering method was provided by Prasetyo et. al.[12] Author provided the prototype and feature driven analysis on multiple Network sets. The ratio specific mismatch analysis was provided to generate the similarity specific clustering results. Reddy[13] used the labeling specific categorical data processing under entropy method for generating the clusters. A feature specific similarity analysis was provided to generate the clusters and to identify the outlier.

III. COMMUNICATION SETUP IN SENSOR NETWORK

The clustering architecture is able to utilize the limitations of sensor network and provides the effective and reliable communication. In sensor network, this communication is controlled by the specific protocol. One such protocol is

LEACH protocol. The working of the protocol for cluster formation is divided basically in two main process stages called Setup Stage and Steady Stage. The complete working or the functional behavior of clustering is shown here in figure 3.

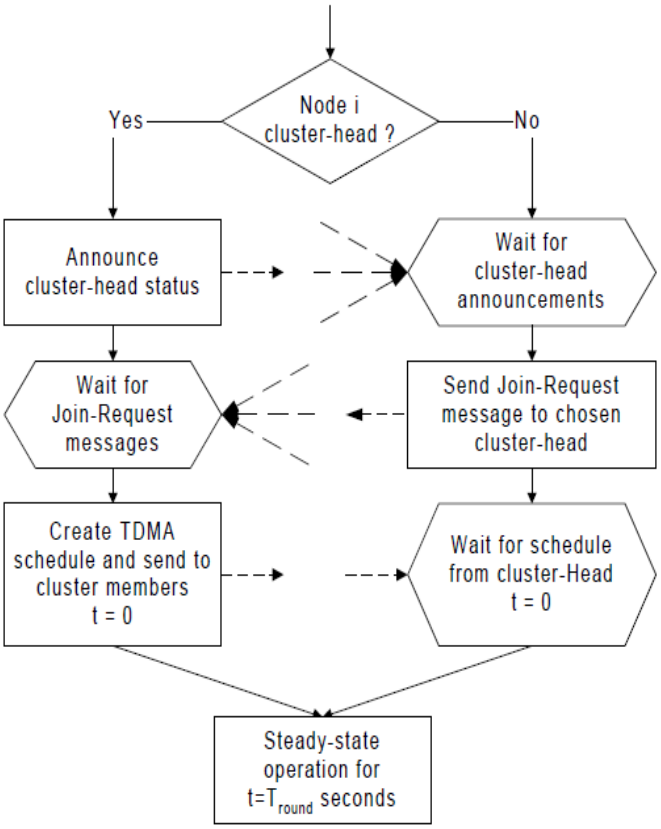

Figure 3 : Cluster Formation Process

The process includes the selection of the feasible effective nodes from the node pool and applies the condition for identifying the cluster head. Once the cluster head is identified, a request to communication map is defined to perform the communication between the node and the cluster head. To control the work behavior of this architecture, an access time limit is also applied. This limit also insures the security and integrity against different attacks. If the node is not responding normally, the time stamp can vary, in such case the attacker can be identified and the safe communication can be performed. The working of this architecture with defined stages is explained hereunder

A) Setup Stage

In this stage, the advertisement setup and the constraint setup for cluster formation is defined. In this stage, the cluster head node informs all the neighbor nodes by submitting an advertisement packet. In this phase, the cluster head and non-cluster head evaluation is done based on the parameter specification. The advertisement pick based packet communication is here observed under the signal strength analysis.

The membership to the particular cluster head is observed under the time stamp specific analysis. The encoded communication can be performed to provide the safe and reliable communication in the network. The TDMA based schedule is here defined to provide the control communication with specification of the cluster head and the cluster members. The broadcast communication to the environment is here defined while generating the cluster head.

B) Steady Phase

In this stage, the transmission over the network is regulated by nod level estimation. The TDMA slot setup is defined to provide the node to cluster head communication. As the communication is defined some amount of energy is lost. The strength specific communication is here defined to provide the reliable communication under time slot specification. The node pair communication is here defined to identify the energy consumption, energy limit and the probabilistic estimation. The cluster head collects the aggregative communication from all the nodes. Once the aggregative packets are obtained, the aggregative path is composed to generate the effective communication to the base station.

C) Protocol Working

The clustering can be defined in fixed network with specification of protocol specification. The protocol itself controls the communication with position, probability and energy limit analysis. The search is applied in the network to identify the number of cluster heads and to provide the effective cluster specific communication. The LEACH is one such protocol that provides the cluster formation with each communication. The maximum energy, round specific probabilistic estimation can be applied to generate the clusters. The centralized cluster based responsible cluster head selection can be defined. The restriction can be applied to generate the architecture of cluster head identification. The mapping of the cluster head to the environment is defined to provide the effective cluster formation.

CONCLUSION

To overcome the restrictions or the limits of sensor network, some architectural communication is required. One such architecture is clustered architecture. In this present work, the restrictions of sensor network are explored at multiple levels. To improve the communication effectiveness, the process model for cluster generation is defined. The paper has defined the complete process model of cluster formation.

REFERENCES

[1]. V. T. N. Chau, "A Robust Self-Organizing Approach to Effectively Clustering Incomplete Network," Knowledge and Systems Engineering (KSE), 2015 Seventh International Conference on, Ho Chi Minh City, 2015, pp. 150-155.
[2]. Yogita and D. Toshniwal, "Clustering techniques for streaming Network-a survey," Advance Computing Conference (IACC), 2013 IEEE 3rd International, Ghaziabad, 2013, pp. 951-956.
[3]. H. Venkateswara Reddy, P. Agrawal and S. Viswanadha Raju, "Network labeling method based on cluster purity using relative rough entropy for categorical Network clustering," Advances in Computing, Communications and Informatics (ICACCI), 2013 International Conference on, Mysore, 2013, pp. 500-506.
[4]. S. S. R. Abidi and J. Ong, "A Network mining strategy for inductive Network clustering: a synergy between self-organising neural networks and K-means clustering techniques," TENCON 2000. Proceedings, Kuala Lumpur, 2000, pp. 568-573 vol.2.
[5]. V. T. N. Chau, P. H. Loc and V. T. N. Tran, "A Robust Mean Shift-Based Approach to Effectively Clustering Incomplete Educational Network," 2015 International Conference on Advanced Computing and Applications (ACOMP), Ho Chi Minh City, 2015, pp. 12-19.
[6]. Y. F. Wang, Z. G. Yu and V. Anh, "Fuzzy C-means method with empirical mode decomposition for clustering microarray Network," Bioinformatics and Biomedicine (BIBM), 2010 IEEE International Conference on, Hong Kong, 2010, pp. 192-197.
[7]. Y. Yang and K. Chen, "Temporal Network Clustering via Weighted Clustering Ensemble with Different Representations," in IEEE Transactions on Knowledge and Network Engineering, vol. 23, no. 2, pp. 307-320, Feb. 2011.
[8]. S. Alam, G. Dobbie, Y. S. Koh and P. Riddle, "Clustering heterogeneous web usage Network using Hierarchical Particle Swarm Optimization," Swarm Intelligence (SIS), 2013 IEEE Symposium on, Singapore, 2013, pp. 147-154.
[9]. X. Liu, M. Yin, J. Luo and W. Chen, "An improved affinity propagation clustering algorithm for large-scale Network sets," 2013 Ninth International Conference on Natural Computation (ICNC), Shenyang, 2013, pp. 894-899.
[10]. Y. Xie, A. Wulamu, Y. Wang and Z. Liu, "Implementation of time series Network clustering based on SVD for stock Network analysis on hadoop platform," 2014 9th IEEE Conference on Industrial Electronics and Applications, Hangzhou, 2014, pp. 2007-2010.
[11]. R. N. Dave and S. Sen, "Robust fuzzy clustering of relational Network," in IEEE Transactions on Fuzzy Systems, vol. 10, no. 6, pp. 713-727, Dec 2002.
[12]. H. Prasetyo and A. Purwarianti, "Comparison of distance and dissimilarity measures for clustering Network with mix attribute types," Information Technology, Computer and Electrical Engineering (ICITACEE), 2014 1st International Conference on, Semarang, 2014, pp. 276-280.
[13]. H. V. Reddy, B. S. Kumar and S. Viswanadharaju, "A Network Labeling Method for Categorical Network Clustering Using Cluster Entropies in Rough Sets," Communication Systems and Network Technologies (CSNT), 2014 Fourth International Conference on, Bhopal, 2014, pp. 444-449.