

COVERAGE MAXIMIZATION IN WIRELESS SENSOR NETWORKS USING K- MEDOIDS ALGORITHM

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Abstract:

Our paper deals with the coverage issue of Wireless Sensor Network. This issue is addressed by employing K-Medoids algorithm. K-Medoids algorithm is better than K-Coverage algorithm because it provides better coverage area than K-Coverage algorithm. This algorithm also considers the coverage and Residual energy of sensor nodes like K-Coverage algorithm. K-Medoids algorithm is a clustering algorithm used for clustering data object in Data Mining the algorithm provide in two steps: Build Step and Swap Step. Comparison of K-Coverage and K-Medoids algorithm will be illustrated in the paper. The advantages of K-Medoids over K-Coverage will be explained in detail with simulation at the end of the project. Graphs depicting the coverage are provided by K-Medoids and K-Coverage algorithms with included as a part of the project.

Keywords- **coverage, K-medoids.**

I. INTRODUCTION:

A Network is a finite collection of tiny, cellular nodes which collaborate and work together for communication. A Network may be wired or wireless. A "Wireless Sensor Network" is a group of tiny, small and cheap Sensor nodes which communicate with each other to establish communication. The nodes are placed at finite distances from each other. These nodes are fitted with an inbuilt Battery. The power of the Battery is limited and it is difficult to recharge as well replenish the Battery. Once the Sensor nodes run out of energy, the nodes become inactive and cannot participate in communication. If all

the nodes lose energy, the entire network fails. Energy is a main issue in WSN. Another two important issues in WSN are Coverage and Connectivity. Coverage is the Sensing range of a Sensor node, that is, the maximum distance upto which the Sensor can detect changes in the environment and respond to it. The coverage should be good and maximum to provide continuous and uninterrupted connectivity to the users. If the Coverage of a node is very good, the number of nodes deployed can be reduced. Several algorithms have implemented to maximize Coverage. "Connectivity" of a Network is the ability of the Network to provide a good, continuous and uninterrupted

connectivity to all its users. It refers to the communication range of the Networks. Coverage and Connectivity are important QoS parameters in a Network. QoS is, 'Quality of Service' which means the degree of goodness of the services provided by a Communication Network. "K-Coverage algorithm" has been implemented to improve Coverage in the paper, "Coverage Contribution area base k-coverage for Wireless Sensor Network. This algorithm has been designed considering both the Residual energy and coverage of sensor nodes. K-Medoids algorithm in WSN. The advantage of K-Medoids over K-Coverage is that K-Medoids takes lesser time to extend Coverage of Nodes than K-Medoids. Also, K-Coverage takes the mean of the Coverage values but K-Medoids considers the median of the Coverage values. The initial part of the paper sheds light on the K-Medoids algorithm, its usage and implementation. The latter part throws light on the advantages of K-Medoids over K-Coverage algorithm. Comparison between K-Coverage and K-Medoids is made and a Comparison Graph is drawn.

II.RELATED WORK:

"Coverage contribution area based K-Coverage for wireless sensor networks" by Jiguoyu. Coverage contribution area mainly deals with the coverage Issue in wireless sensor networks. K-coverage algorithm used in this paper in order to address the coverage issue. K-Coverage algorithm is closely related to K-Means algorithm. This algorithm has been designed considering both the residual energy and sensing range of the sensor nodes in the network.

"Improving coverage and connectivity using Harmony Search Algorithm in wireless sensor network" by Deepika Sharma, Vrinda Gupta. Harmony search algorithm is used in this paper in order to deal with the coverage issue. Coverage is the sensing range of a sensor node in a network. Coverage decreases with increase distance from the sensor node. In order to address this issue harmony search algorithm has been used. Here and also to prolong lifetime and energy of the sensor node is saved in this network. Energy of the sensor nodes is saved by putting the sensor nodes in lowest sleep mode in the network. When the sensor nodes are put in the lowest sleep mode the energy is conserved and hence network life time is prolonged. There are three types of coverage explained in this paper, they are target coverage, area coverage and barrier coverage. This paper deals with the coverage issue in area coverage network. There are two types of node use in wireless sensor network. They are Homogeneous and Heterogeneous node. In a homogeneous network all the sensor nodes are identical and have the same battery constraints and energy limits. In a heterogeneous network all the sensor node are not identical every sensor node is different from each other and the battery level and energy constrains of every sensor node is different from each other.

"Application of K-Medoids and PAM to the Clustering rules" by VJ. Raywart-Smith and G. Righards. This paper mainly explained above K-means, K-Coverage and K-Medoids algorithm used for coverage maximization in wireless networks. K-Coverage and K-Means algorithm are clustering algorithms. Similarly K-medoids is also clustering algorithm. The difference between K-

Medoids and K-Coverage algorithm is that, K-Coverage algorithm considers mean values for maximizing the coverage but K-Medoid algorithm considers the median value for maximizing the coverage. Whereas K-Medoid uses the median value for maximizing the coverage. In this paper comparison is made between both the K-Coverage and K-Medoids algorithm and graph is plotted.

“Randomized K-Coverage algorithms for dense Sensor Networks” by Mohamed Hefeeda .This paper is mainly explains the waste to deals with the coverage issue in wireless sensor network. It also deals with providing a good Quality of Service(QoS). Quality of Service is a network is nothing but the degree of fairness or degree of goodness of the service provided by the network to it's a user. Various algorithm have been proposed and implemented in this paper in order to increase coverage and connectivity of wireless sensor networks.

III.K-MEDOIDS ALGORITHM:

K-Medoids algorithm is a Clustering algorithm similar to K-Means and K-Coverage algorithm. This is a Partition algorithm which splits dataset into fragments. Objects are grouped into clusters based on their similarity. All objects in a cluster are similar and closely related to a central value known as 'Medoid'. Medoid is an object in a cluster whose average dissimilarity to other objects in the cluster is lesser than the dissimilarity of other objects. Both K-Means and K-Medoids try to minimize between two points in a cluster. Unlike k-means, k-medoids chooses 'Data points' as centres. It groups n objects into k clusters known as 'p priori'. K-Covered means that every node in the network is covered by

at least k nodes. k value is determined using the tool 'Silhouette'. Silhouette value is a measure of how similar an object is to its own cluster than other clusters. The Silhouette value varies from -1 to =1. 1 indicates maximal matching and -1 indicates minimal matching with the cluster. Silhouette can be calculated using 'Euclidean distance' formula.

IV.MODULES:

There are five main Modules included for the implementation of this algorithm

1. Network Creation

This is the initial phase of Network functioning. This module is fully under the control of Network Administrator. The Admin creates the network settings. He specifies the number of Base stations, Local stations and Routers required for the network. Coverage range is also specified. All users within the coverage range are connected to the local stations and Base stations under his control. The Admin checks if all users receive continuous signal and Bandwidth when they are within the Coverage range. He maintains the database of connected users and the number of connected users to every local station and Base station.

2. Base station creation

Base station or Base Transceiver station(BTS) is a combination of a Tower and Antenna. BTS controls all local stations under it and is mainly responsible for delivering messages from source to correct destination. Any message exchanged between source node and destination node passes through the base station before reaching the destination node. Number of Base stations deployed in

a locality depends on the area and surface of the place. When a user moves out of the Coverage range of one BTS, the user is connected to the next nearby BTS(Mobile offloading or Hand over).

3. K-Medoids analysis

This is the main and central part of algorithm implementation. Data objects are grouped into clusters based on their similarity. A 'Median' or "Datapoint" is set and objects are clustered based on this value. This median value is the 'Medoid'. This is also a partitioning algorithm like k means and k-clustering algorithm. K-Means considers the mean value of Sensing range whereas K-Medoids takes median value into consideration. K-Medoids takes less time for coverage maximization than K-Coverage and K-Means algorithms. The implementation of this algorithm is executed and demonstrated through Simulation using Java Swing. Every module is implemented and a clear demonstration of the algorithm is made.

4. QoS Monitoring

QoS refers to 'Quality of Service'. QoS is 'Fairness or degree of goodness of a service delivered by a network to its users'. Coverage and Connectivity are important parameters of QoS. Both coverage and connectivity decrease with increase in distance from the sensor node. 'Full Coverage' or 'Blanket Coverage' is coverage of the entire region. K-Medoids provides Area coverage or Blanket Coverage. A QoS Framework or MANET Framework is implemented using k-medoids in Wireless Sensor Network. The Network admin continuously monitors the fairness of signal strength delivered to all

its users. This is the main phase of QoS Monitoring.

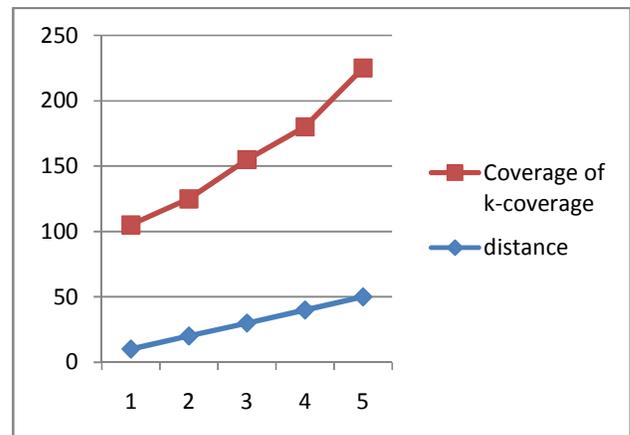
5. Report Generation

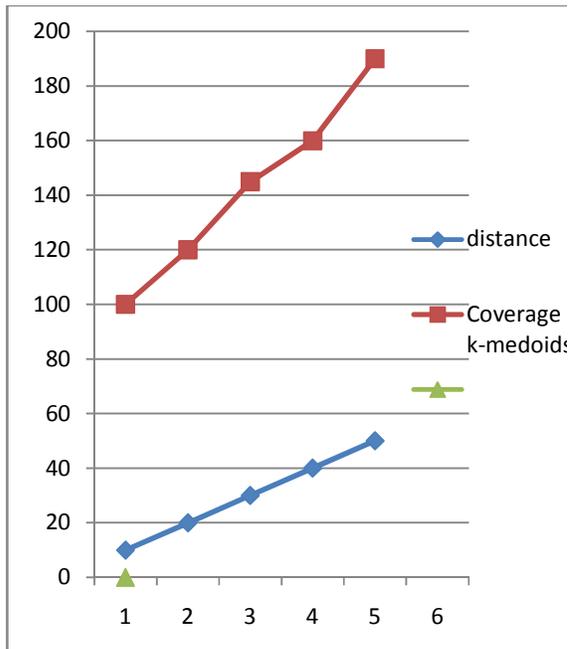
Finally, comparison between the Existing system and proposed system is made. Simulation technique is used for demonstration of K-Medoids algorithm is implemented. Outputs of both the algorithms are compared. A Graph is plotted for both the algorithms to show the difference. Finally it is established that K-Medoids algorithm is better than K-Coverage algorithm.

V. CONCLUSION:

Coverage is a primary issue in Wireless Sensor Networks. Several algorithms have been proposed to address this issue. Every Algorithm has few disadvantage which has been overcome K-Medoids on such algorithm which has been implemented to maximize coverage without affecting the connectivity. This improves lifetime and performance.

Comparison:





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