Proposed Algorithm for Clustering Based Routing protocol in WSN

Jyoti Attri, Tanuj Wala, Pushpender Kumar

***Abstract*— A wireless sensor network extends our capability to explore, monitor and control the physical world. The sensor networks have evolved over a period of time. Routing is a vital technology in WSN. There are many routing protocols like: location based, multipath, data centric, mobility based, hierarchical routing, hybrid routing etc. The energy is a critical factor in order to extend the lifetime of the network as nodes once deployed cannot be recharged. The clustering besides reducing energy consumption also helps in achieving efficient and scalable control. In this paper we proposed a Degree based clustering (DBC) routing protocol in WSN. Through this protocol we detect the forest fire detection easily.**

***Index Terms*— Clustering, Degree based clustering, Routing protocols , Sensor nodes, Wireless Sensor Networks.**

I. INTRODUCTION

Wireless Sensor Networks (WSNs) comprise of numerous tiny sensor nodes that are deployed in an application area to measure the given physical phenomenon. Sensor nodes communicate wirelessly and often self organize after being deployed in an ad-hoc fashion. Sensor nodes (SNs) have limited processing capabilities. SNs cooperatively transmit there data through the network to a central gateway also called base station. This data is collected at base station, get analyzed and processed according to needs [1]. Basically WSN consist a number of sensor node, called tiny device and these are working together to detect a region to take data about the environment. WSN has two types: Structured and Unstructured [2].

Unstructured WSN- The nodes are densely deployed and also the nodes can be deployed in ad-hoc manner in the sensing area or region. Structured WSN – Sensor node developments of some or all nodes are pre planned. The nodes placement is also planned. So, the maintenance of structured WSN is much easy as compare to Unstructured WSN [3]. Sensor nodes, referred as source nodes, can gather information from the monitoring region and send the sensing information to their corresponding cluster head [4]. The cluster head is elected from all the sensor nodes in a cluster according to some criteria, and is responsible for collecting sensing data from source nods. After receiving data from source nodes, the cluster head also performs data aggregation to reduce the data size before sending data to the sink, which further reduces the power expended for data transfer [5].

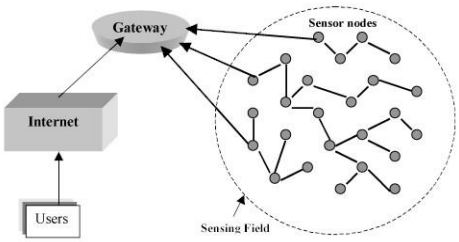

Fig. 1 Basic Structure of Wireless Sensor Network

WSNs are different from traditional networks because of some characteristics like, denser level of node deployment, higher unreliability of sensor nodes, and severe energy, computation, and storage constraints. A large amount of research activities have been carried out to explore and solve various design and application issues, and significant advances have been made in the development and deployment of WSNs [1].

II. RELATED WORKS

A. LEACH

Low Energy Adaptive Clustering Hierarchy referred to as LEACH is a clustering-based protocol that uses randomized rotation of the cluster-heads to distribute the energy load evenly among the sensor nodes in a network. Once the clusters are built, the cluster heads broadcast TDMA schedules which provide the order of transmission for members on the cluster. It transmits data to the cluster head within its exclusive time slot.

When the last node in the schedule has transmitted its data, the cluster head will be selected randomly in the next round. To improve the scalability and balance the energy usage of the network among all the nodes, it makes use of localized coordination [6].

B. LEACH-C

LEACH-C is a centralized cluster formation version of LEACH, where the BS organizes and controls the network. More precisely, LEACH-C protocol provides a centralized cluster formation, local processing for aggregation of sensed data and the rotation of CHs for every round. These activities are aimed at achieving uniform energy consumption among sensor nodes and maximizing network lifetime. Since, the BS does not have energy constraint, centralized cluster formation methods can be attractive alternatives [7]. In LEACH-C, the cluster formation is formulated as a p-median

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problem, which is one of the well known facility location problems. This algorithm produces better clusters by dispersing the cluster head nodes throughout the network [8].

C. PEGASIS

Power Efficient Gathering in Sensor Information Systems is a chain-based power efficient protocol constructed on the basis of LEACH. It assumes that each node must know the location information about all other nodes at first. PEGASIS begins with the farthest node from the sink. The chain can be easily built by using a greedy algorithm. The chain leader aggregates the data and forwards them to the sink. To create a balance in the overhead engaged in the communication between the chain leader and the sink, each node in the chain takes turn to be the leader [10].

D. Hausdorff Clustering Protocol

It shows that it is a static clustering method based on wsn localization, in which the Hausdorff distance between two node sets is used as clustering metric. In this algorithm, the sink appoints an initiator. The initiator forms clusters by sending joining/rejection message to the sensor nodes within its radio range, based on two Hausdorff distance criteria (i) Hausdorff distance between the nodes of same cluster, and (ii) Hausdorff distance between the nodes of neighboring clusters. In this process, a node may receive multiple rejections from the initiator nodes before it overcomes member of a particular cluster. This reads to high energy consumption for clustering process. The Hausdorff distance has been used in the literature for image matching and partitional clustering algorithms. The Hausdorff clustering algorithm is that based on location, communication efficiency and network connectivity [11].

E. ERP_SCDS

Energy Efficient Routing Protocol for wireless networks with Static clustering and Dynamic Structure is a static clusters are connected in the beginning using well distributed virtual points in side the network. Sensor nodes choose the nearest virtual point and keep the virtual point ID. Now with the same virtual point ID belongs to the same cluster, resulting in a static cluster with dynamic structure. With the two special treatments balanced cluster sizes can be reached. Furthermore, cluster head chosen according to the remaining energy as well as the distance to the nearest virtual point so that a longer network lifetime can be expected in a network. For routing from the cluster heads to the sink, every cluster head selects a relay node by considering its remaining energy and distance to the sink to ensure both longer network lifetime and right direction of data transmission [12].

F. TEEN

Threshold Sensitive Energy Efficient Sensor Network protocol is founded on LEACH. It is divided into two parts. First, as soon as the absolute value of the sensed attribute exceeds a Hard Threshold (HT), the node that senses this value must switch on its transmitter and report it. Secondly, when the change in the value of the sensed attribute is greater than a Soft Threshold (ST), it stimulates the node to switch on its transmitter and report the sensed data. A node will report data only when the sensed value is beyond the HT or the change in the value is greater than the ST [13].

G. HEED

Hybrid Energy-Efficient Distributed Clustering has been referred as a HEED. HEED is a standalone distributed clustering approach in which each node takes two factors into account: remaining energy and communication cost before deciding to join one cluster or the other. In HEED, a cluster head, once elected, is kept for a fixed number of iterations. This is in contrast to some other approaches in which the cluster heads are elected anew in every step. This is to reduce the unnecessary high setup cost associated with the cluster head selection process [9].

III. PROPOSED ALGORITHM

The routing protocol DBC (Degree Based Clustering) is divided into two parts, one is cluster formation and second is cluster head rotation. This protocol is supporting an energy efficient clustering, cluster head selection rotation and data routing method to the sensor network. The method ensures the formation of clusters in degree based, almost in uniform fashion- around the sink. Energy consumption based analytical approach for cluster head rotation has been proposed to achieve the balanced energy consumption among the nodes within the cluster.

A. FORMATION OF CLUSTER

In the sensor networks different number of clusters are present in the sink. In the sensor networks cluster formation will be formed on the basis of degree. Clusters will collects all the information from their nodes and then send information to the CHs. Degree will be calculated in the adjacent matrix with the rows and columns. Highest degree of the cluster can be act as the CH. If the degree is not high then the new cluster formation is not done.

Algorithm for cluster formation:

Step 1: Node transmits its (x_i, y_i) co-ordinate to sink.

Step 2: Prepare Adjacent matrix.

Sep 3: Diagonals represents degree and columns represents link.

Step 4: Average value of the degree (m).

Step 5: Connectivity by using following formula:

$$CV = \frac{2m}{n}$$

Where, n is number of nodes.

Step 6: If $deg > 5$ then, neighbouring one hop act as clusters.

Otherwise, new cluster is not formed.

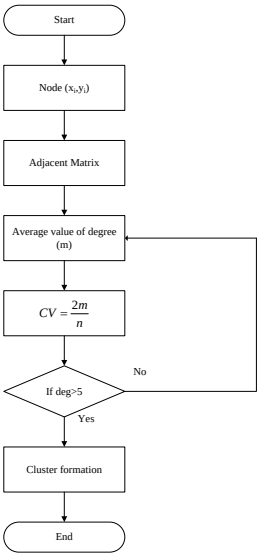

Fig. 2 Flow chart of Cluster Formation

B. Cluster Head Rotation

The role of cluster head in cluster must be rotated regularly amongst the sensor node of the sensor network by balancing the energy consumption of various sensor nodes. Since, cluster head is required to perform the extra task of data gathering and data relaying compared to the sensor node, its drains out faster. Therefore, some mechanism must be adopted to rotate the role of cluster head. The rotation mechanism must ensure the balanced energy consumption of all the sensor nodes in the clusters. After the cluster formation while the value of CH is less than, cluster head rotation will be started. In this it will choose those cluster which are closely to the CH. Threshold value also be calculated in the cluster head rotation.

$$T(n) = \frac{P}{1 - P \times (r \bmod P^{-1})} \times \frac{E_{n\_current}}{E_{n\_max}}$$

Where, P is the cluster head probability.

$E_{n\_current}$ is the current amount of Energy.

E_{n_max} is the initial amount of energy.

For our proposed model the cluster head rotation process has been performed based on the threshold energy of the cluster head. The frequency and timing of cluster head rotation process aimed at wireless sensor network, is decided by calculating the energy consumption for regular sensor nodes and cluster head nodes for various task performed by these nodes including the data relaying and cluster head selection/rotation. After assessing the actual energy consumption of sensor nodes, the balanced energy consumption is ensured by optimal rotation of cluster head node at regular intervals.

IV. CONCLUSION

In this paper we can propose a clustering based routing protocol for energy efficient and forest fire detection. Energy efficiency and fire detection are the major issues in wireless sensor networks. Through this protocol we can decrease the energy efficiency in the wireless sensor networks. In future we can implement this algorithm for the best result. A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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