A CLUSTER BASED LOAD BALANCING TECHNIQUE FOR INCREASING THE WIRELESS SENSOR NETWORK LIFE TIME

S.Meenatchi*, S.Prabu

*School of Computer Sciences and Engineering, VIT University.
# School of Information Technology and Engineering, VIT University.

Email: meenatchi.s@vit.ac.in

Abstract

Energy capability is a crucial view in wireless sensor networks, to overcome this problem the efficient technique of clustering is used to achieve more data transmission, long network lifetime, less time consuming process, minimize energy utilization. In this paper we propose a multi cluster head groups, multi cluster heads via Load Balanced Clustering and Dual Data Uploading and sencar. It is responsible to maintain the energy and data transmission from each sub node. In each cluster head collect data and energy level form sub nodes then transmit to the cluster group head. Here Multi User-Multi input multi output(MIMO) is used for multi data transmission to the sink, each nodes connected their cluster heads and sending packet to the sink via cluster heads and group heads. Sink assign Id to each node for identification purpose which node transmit data. Although the transmission of inter cluster, each cluster head group data is gathered by SenCar then transport the data to the static data sink. Sencar is the mobility of mobile nodes used to update the energy in which the node has low energy. If sencar has low energy then it is energized by sink is the base station controls the entire network .As the Simulation results exhibit that the proposed load balanced clustering maintains the energy level as well as more data-gathering to increase the network life time.

Keywords: Clustering, Wireless sensor networks, SenCar.

I. Introduction

Sensor networks have a wide variety of applications and systems with vastly varying requirements and characteristics. The sensor networks can be used in Military environment, Disaster management, Habitat monitoring, Medical and health care, Industrial fields, Home networks, detecting chemical, Biological, radiological, nuclear, and explosive material etc. Deployment of a sensor network in these applications can be in random fashion (e.g., dropped from an
airplane) or can be Planted manually (e.g., fire alarm sensors in a facility). For example, in a disaster management application, a large number of sensors can be dropped from a helicopter. Networking these sensors can assist rescue operations by locating survivors, identifying risky areas, and making the rescue team more aware of the overall situation in the disaster area. The position of sensor nodes need not be engineered or pre-determined. This allows random deployment in inaccessible terrains or disaster relief operations. On the other hand, this also means that sensor network protocols and algorithms must possess self-organizing capabilities. Another unique feature of sensor networks is the cooperative effort of sensor nodes. Sensor nodes are fitted with an on-board processor. Instead of sending the raw data to the nodes responsible for the fusion, sensor nodes use their processing abilities to locally carry out simple computations and transmit only the required and partially processed data. The above described features ensure a wide range of applications for sensor networks. Some of the application areas are health, military, and security. For example the physiological data about a patient can be monitored remotely by a doctor. While this is more convenient for the patient, it also allows the doctor to better understand the patient’s current condition. Sensor networks can also be used to detect foreign chemical agents in the air and the water. They can help to identify the type, concentration, and location of pollutants. In essence, sensor networks will provide the end user with intelligence and a better understanding of the environment.

II. Related Work

Zeba Ishaq et al. [1] proposed the algorithm Cluster Based Wireless Sensor Networks (CBWSNs), and the concept of this paper Security also become a big problem for cluster-based wireless sensor networks, when node is cluster becomes selfish from the intension to save their limited resources, destroy cluster, new ideas of incorporating two special nodes, cluster heads(CHs), inspection node(IN), over heads CH is transmissions in order to prevent the selfishness attacks. Control selfishness attack also controls the black hole attack. To appoint two special nodes per cluster, inspector node and cluster head node. There is no analyze the behavior of nodes to successfully identify the intruders in the form of selfishness attack.

Chuan Zhu et al. [2] proposed a Tree-cluster-based data-gathering algorithm (TCBDGA), Most of the data-gathering strategies for WSNs cannot avoid the hotspot problem in local (or) whole deployment area, so we introduce tech like true –cluster based data-gathering algorithm, this algorithm balance the load of the whole networks, reduces the energy
consumption, avoid the hotspot problem prolong the network life time. Short and a mobile sink start the data collection tour periodically. Possible for heterogeneous sensory data.

Chaojie Xu, Zhongling et al. [3] proposed a novel adaptive distributed re-clustering Technique is used. In this paper proposed Nodes estimate their current locations; predict the most possible location of next time. Boundary node of a cluster periodically obtains location information of the nodes in the optimal cluster according to the components & separation of clusters. The outperformance of the proposed schema on packet delivery ratios comparing with existing schemes. The predicted locations are used to avoid the Ping-Pong effect. Re Clustering is not accurate.

Zilong Jin et al. [4] optimal cluster ratio from the perspective of network life time is mathematically analytics. Network life time is extended by jointly optimizing the network transmission count & link reliability. CR deliver based on the proposed analytical model enhances the energy efficiency & effectively increases the network life times. To increase the Energy Efficiently and Node Life Time. Not Applicable for data aggregation scheme and specific application environments.

Hamidreza Tavakoli et al. [5] proposed a Cluster-head rotation protocol with virtually zero overhead, Clustering protocol called fan-shaped clusters. (FSC) to partition a large-scale networking into fan-shaped clusters. This paper proposed, different energy saving methods, such as efficient cluster head relay selection, locality of re-clustering. Dead time is eliminated and clustering overhead is minimized. Changes needed to accommodate sensors with heterogeneous traffic and different power sources.

Vipin Pal et al. [6] proposed a Clustering protocol called fan-shaped clusters. (FSC) to partition a large-scale networking into fan-shaped clusters. This paper proposed, different energy saving methods, such as efficient cluster head relay selection, locality of re-clustering. It has balanced clusters and better cluster quality. Possible only on heterogeneous sensor node.

J.S. Lee et al. [7] used the techniques called A fuzzy-logic-based clustering, Based on analysis of energy consumption for data transceiver, single-hop forwarding scheme is proved to consume less energy than multihop forwarding scheme within the communication range of the source sensor or a current forwarder, using free space energy consumption model. This approach is proposed to address the problem and it provides balanced clusters by considering thresholds for cluster formation.
Y. Liu N et al.[8] used the algorithm called Effective clustering algorithm. Proposed the concept of extension to the energy predication has been proposed to prolong. The lifetime of WSN by evenly distributed the work load.

DucChinh Hoang et al. [9] proposed the fuzzy C-means (FCM) clustering algorithm. In this paper the protocol considers the dual factor of nodes remaining energy and distance between vehicular node and the centre station comprehensively. Routing protocol better balance energy consumption in the network, effectively solve sensor networks for many-to-one data transmission mode; effectively extended the network life time.

Jenq-ShiouLeu et al. [10] proposed the Regional Energy Aware Clustering with Isolated Nodes (REAC-IN), The network life time has been proven to be extended when compared with a protocol, MIEACH that is a modified version of the well-known cluster-based protocol LEACH, text-bed for different optimization algorithm to achieve the best efficiency in WSNs.

MiaoZhaoetal. [11], used a Load balanced Clustering Algorithm. It consists of Sensor layer, Cluster head layer, and SenCar layer. This algorithm load balanced clustering for sensor self-organization, adopts collaborative inter-cluster communication for energy efficient transmissions among cluster Head Groups, Uses Dual data uploading for fast data collection and optimizes Sencar’s mobility the benefits of MU-MIMO.

III. Proposed Solution

A. Background

To improve network lifetime proposed load balanced clustering of dual data uploading is used to balance the process of over loading and to maintain the energy efficiency. Clustering is the key technique for routing, improve network life time and reduce the collisions during the data transmission. Each of the distributed sensor nodes typically has the efficiency to collect data, analyze them, and route them to a desired destination of sink point.

B. Problem Statement

The limited energy resources of sensor nodes and the though environmental conditions can limit the success of forest fire detection systems that are based on wireless sensor networks. Constant surveillance of the whole forest is required and this may cause excessive energy usage if not carefully planned. By analyzing the formation of cluster in previous clustering algorithm, we find that it just considers the cost of communication between the cluster head and ordinary node; it did not consider the remaining energy of cluster head and current location information.
Regardless of the current energy of the node, the probability of the node to become a cluster head is roughly the same in the round. This may lead to the energy of small residual energy node rapid depletion, which may result in the monitoring region appearing “blind area”, it not conducive to the life cycle of the network, also affects the robustness of the network.

C. Importance

This work is based on concept called clustering. It is used to improve the system’s availability to users, its aggregate performance and overall tolerance to fault and component failures. Include algorithm of Load Balancing, this algorithm should be avoid the overloading of any single resource and to optimize the use of minimize the response time. Sensor node performance also be increased, because sensor nodes have very limited battery powers, they cannot able to replace the batter. This work reduce the data packet loss, more data gathering as well as maximum energy consumption and increasing network.

IV. Proposed System Overview

The proliferation of the implementation for low-cost, low-power, multifunctional sensors has made wireless sensor networks (WSNs) a prominent data collection paradigm for extracting local measures of interests. In such applications, sensors are generally densely deployed and randomly scattered over a sensing field and left unattended after being deployed, which make it difficult to recharge or replace their batteries. After sensors form into autonomous organizations, those sensors near the data sink typically deplete their batteries much faster than others due to more relaying traffic. When sensors around the data sink deplete their energy, network connectivity and coverage may not be guaranteed. Due to these constraints, it is crucial to design an energy-efficient data collection scheme that consumes energy uniformly across the sensing field to achieve long network lifetime. Furthermore, as sensing data in some applications are time-sensitive, data collection may be required to be performed within a specified time frame. Therefore, an efficient, large-scale data collection scheme should aim at good scalability, long network lifetime and low data latency. Several approaches have been proposed for efficient data collection in the literature. Based on the focus of these works, we can roughly divide them into three categories.

The first category is the enhanced relay routing in which data are relayed among sensors. Besides relaying, some other factors, such as load balance, schedule pattern and data redundancy, are also considered. The second category organizes
sensors into clusters and allows cluster heads to take the responsibility for forwarding data to the data sink (as shown in.

Clustering is particularly useful for applications with scalability requirement and is very effective in local data aggregation since it can reduce the collisions and balance load among sensors. The third category is to make use of mobile collectors to take the burden of data routing from sensors (as shown in Although these works provide effective solutions to data collection in WSNs, their inefficiencies have been noticed. Specifically, in relay routing schemes, minimizing energy consumption on the forwarding path does not necessarily prolong network lifetime, since some critical sensors on the path may run out of energy faster than others. In cluster-based schemes, cluster heads will inevitably consume much more energy than other sensors due to handling intra-cluster aggregation and inter-cluster data forwarding. Though using mobile collectors may alleviate non-uniform energy consumption, it may result in unsatisfactory data collection latency.

Based on these observations, in this project a three-layer mobile data collection framework, named Load Balanced Clustering and Dual Data Uploading (LBC-DDU). The main motivation is to utilize distributed clustering for scalability, to employ mobility for energy saving and uniform energy consumption, and to exploit Multi-User Multiple-Input and Multiple-Output (MU-MIMO) technique for concurrent data uploading to shorten latency.

**D. Load Balanced Clustering**

The distributed load balanced clustering algorithm at the sensor layer. The essential operation of clustering is the selection of cluster heads. To prolong network lifetime, we naturally expect the selected cluster heads are the ones with higher residual energy. Hence, we use the percentage of residual energy of each sensor as the initial clustering priority. Assume that a set of sensors are homogeneous and each of them independently makes the decision on its status based on local information. After running the LBC algorithm, each cluster will have at most M (> 1) cluster heads, which means that the size of CHG of each cluster is no more than M. Each sensor is covered by at least one cluster head inside a cluster. The LBC algorithm is comprised of several phases: Initialization, Status claim, Cluster forming and Cluster head synchronization.

**E. Cluster Forming**

Cluster forming that decides which cluster head a sensor should be associated with. The criteria can be described as follows: for a sensor with tentative status or being a cluster member, it would randomly affiliates itself with a cluster
head among its candidate peers for load balance purpose. In the rare case that there is no cluster head among the
candidate peers of a sensor with tentative status, the sensor would claim itself and its current candidate peers as the
cluster heads. In case a cluster head is running low on battery energy, re-clustering is needed. This process can be done
by the sending out a re-clustering message to all the cluster members. Cluster members that receive this message switch
to the initialization phase to perform a new round of clustering.

F. Clustering Algorithm

In this section, we present the centralized clustering algorithm. Given the network $G = (V, E)$ our algorithm has two
major steps: 1) select $C$ CHs from the set $V$ of $N$ sensor nodes and divide the sensor nodes into $C$ clusters and 2)
construct a backbone routing tree in the that connects all CHs to the sink. The $k$-median problem is NP-hard. A lot of
heuristic algorithms have been proposed to solve the $k$-median problem. We adopt an efficient method that iteratively
closes to the near-optimal solution.

Our algorithm starts from an initial set of CHs, which is randomly selected. At each iteration, the algorithm proceeds
following steps:

- Connect sensor nodes to their closest CHs. Ties break arbitrarily.
- For each cluster, choose a new CH, such that the sum of the distances from all nodes in this cluster to the new CH
  is minimized.
- Repeat the above two steps until there is no more change of the CHs.

This algorithm converges quickly. The simulations show that it takes four or five iterations on average for the algorithm
to compute the CHs of clusters.

G. Calculating Central Points of Cluster-Areas

Given a sensor field and the number of cluster $C$ to be divided to, the sink needs to find out the central points of $C$
cluster-areas. We first divide the whole sensor field into small grids, as shown in Fig. Then, we place a virtual node at
the center of each grid to represent the grid. $C$ nodes in the grids will be chosen as the approximate central points of the
cluster-areas.

We use an auxiliary graph $G = (VA, EA)$ to help finding the central points, where $VA$ is the set of nodes in the grids,
and each node $vi$ in $VA$ has an edge to each of the nodes in its neighboring grids. Each grid, except those on the border
of the sensor field, has eight neighboring grids. The distance of all edges in EA is set to 1. We compute a subset of nodes such that the total distance from all nodes in VA to their nearest nodes in VC is minimized. The nodes in VC are the approximate central points of the C cluster-areas in the sensor field.

H. Cluster Head Election

Given the geographic location of the central point of a cluster-area, the sensor node that is the closest to the central point will become the CH. Since the sensor nodes do not know who is the closest to the central point of a cluster area, and we do not know if there is a sensor node falling into the close range of the central point, we let all nodes within the range of Hr from the center be the CH candidates of the cluster, where r is the transmission range of sensors. The value of H is determined such that there is at least one node within H hops from the central point of a cluster To elect the CH, each candidate broadcasts a CH election message that contains its identifier, its location and the identifier of its cluster. The CH election message is propagated not more than 2H hops. After a timeout, the candidate that has the smallest distance to the center of the cluster among the other candidates becomes the CH of the cluster.

I. Cluster Head Selection Criteria

Following are some of the parameter used for selecting the cluster head.

1) Initial Energy:

This is an important parameter to select the cluster head. When any algorithm starts it generally considers the initial energy.

2) Residual Energy:

After some of the rounds are completed, the cluster head selection should be based on the energy remaining in the sensors.

3) Average Energy:

The Network The average energy is used as the reference energy for each node. It is the ideal energy that each node should own in current round to keep the network alive.

J. MIMO

A multihop clustering scheme with load balancing capabilities. Each mobile node periodically broadcasts information about its ID, Cluster head ID, and its status to others within the same cluster. With the help of this broadcast, each
mobile node obtains the topology information of its cluster. Each gateway also periodically exchanges information with neighboring gateways in different clusters and reports to its cluster head. Thus, a cluster head can know the number of mobile nodes of each neighboring cluster. Adaptive multihop clustering sets upper and lower bounds on the number of cluster members within a cluster that a cluster head can handle. When the number of cluster members in a cluster is less than the lower bound, the cluster needs to merge with one of the neighboring clusters. In order to merge two clusters into one cluster, a cluster head always has to get the cluster size of all neighboring clusters. It prevents that the number of cluster members in the merged cluster is over the upper bound. On the contrary, if the number of cluster members in a cluster is greater than the upper bound, the cluster is divided into two clusters.

K. Challenges

Wireless sensor networks have many applications. Industrial application areas where wireless sensor nodes are used include Industrial process monitoring and control machines. Civilian applications of WSN include Health care applications, home automation, traffic control, health monitoring, environment and habitat monitoring. Many applications of wireless sensor networks demand reduced the energy consumption by the sensor nodes in receiving, transmitting of information and to decrease the delay in transmission of data from source to destination in a wireless sensor network. While used to load balancing algorithm faced that challenges are scalability, Resource utilization, Response time. Also a main challenge without affecting the energy we have to transfer data base station to destination node. So the main two challenge of WSN is energy consumption and reduce the packet loss, by making low and high temperature concept we reduced energy consumption and making LBC algorithm without losing data. The major limitation in the existing methods, packet losses is higher during the data transmission and it causes the mobility of the networks. The proposed methods can be used for contributed the responsibility of cluster head to develop the energy conversation in WSN and reduce the packet losses.

L. Architecture Specification

1. Node Construction
2. Cluster Head Formation
3. Energy Transmission
4. Re-Transmit Energy via cluster head
5. Data Transmission Through SenCar
1) **Node Construction:**

First we have to construct a base station which consists of ‘n’ number of Nodes. So that nodes can request data from other nodes in the network. We can assume that the nodes are moving across the base station. All nodes in the cluster head connect through the base station. Base station is used to store all the Nodes information like Node Id and other information. Also base station will monitor all the Nodes Communication for security purpose.

2) **Cluster Head Formation:**

Base station assigns energy for each node and it selects the cluster head and group cluster head based on node distance. Then the cluster head selects sub nodes based on coverage area. Although cluster head1 selects the cluster head2 similarly cluster head are selected and it forms the group. Once we created node group in the cluster head, any of the node in cluster head can send the data to reach the base station via group cluster head.

3) **Energy Transmission**

Cluster group is formed one black node that node not having enough energy for transfer energy. Sink assigned the initial energy directly to their group header and each group header sent that information to their specific cluster region. Then specific have enough energy to transfer the data.

4) **Re-Transmit Energy via Cluster Head**

Energy assigned successfully for that node.so, if have any less energy available then it will be recycle from the monitoring sink.

5) **Data Transmission Through SenCar:**

Source node in cluster head sends data to base station via group cluster head and SenCar node. In that process, sensor nodes send data to its cluster head. Then the cluster head sends the collection of data to its group cluster head. We coordinate the mobility of SenCar to fully enjoy the benefits of dual data uploading, which ultimately leads to a data collection tour with both short moving trajectory and short data uploading time. Finally SenCar node collects the data from group cluster head and gives that collection of data to base station.

**V. Conclusion**

In this project, we have proposed the Load Balanced Clustering-Dual Data Uploading framework for mobile data collection in a WSN. It consists of sensor layer, cluster head layer and SenCar layer. It employs distributed load
balanced clustering for sensor self-organization, adopts collaborative inter-cluster communication for energy-efficient
transmissions among Cluster Head Groups, uses dual data uploading for fast data collection, and optimizes SenCar’s
mobility to fully enjoy the benefits of MU-MIMO. Our performance study demonstrates the effectiveness of the
proposed framework. The results show that LBC-DDU can greatly reduce energy consumptions by alleviating routing
burdens on nodes and balancing workload among cluster heads.

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**Corresponding Author:**

S. Meenatchi*

**Email:** meenatchi.s@vit.ac.in