Indian Journal of Engineering
ANALYSIS
International Journal for Engineering
ISSN 2319 – 7757 EISSN 2319 –7765

Energy Balanced WSN with Enhanced – DDCD Method

Publication History
Received: 09 July 2015
Accepted: 14 August 2015
Published: 1 September 2015

Citation
Tamilarasi P, Sathish S. Energy Balanced WSN with Enhanced – DDCD Method. *Indian Journal of Engineering*, 2015, 12(30), 163-168

Energy Balanced WSN with Enhanced – DDCD Method

P. Tamilarasi,
Research Scholar
Department of Computer Science
Periyar University, Salem
Tamilnadu, India
tamiljayanthi1991@gmail.com

S.Sathish,
Assistant Professor
Department of Computer Science
Periyar University, Salem
Tamilnadu, India
sathishkgm@yahoo.com

***Abstract*—proposed work is an attempt to reduce the no.of transmission in order to construct the efficient energy balanced network. In data transmitting process, the energy of sensor nodes should be considered to construct an energy balanced networks. In the data broadcast, the energy of sensor nodes are handled to build the energy balanced network and then for wireless sensor network we use compressive sensing to reduce the number of transmissions in balanced network and also handled the network traffic. This application shows major effect on clustering performance. Compressive sensing (CS) can reduce the number of data transmissions and also reduce the energy consumption of network. The Cluster head (CH) transmit the data to another CH if the CH is same it to reduce the data transmission. If size of cluster is low then the number of transmissions is low. So our proposed method can build the energy balanced network and reduce the number of transmission in the wireless sensor network.**

Keywords—DDCD Clustering, Compressive Sensing, Energy balanced network, Transmission.

I. INTRODUCTION

A **W**ireless **S**ensor **N**etwork **(WSN)** consists of spatially distributed autonomous sensors to *monitor* physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *control* of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on [1].

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes [1].

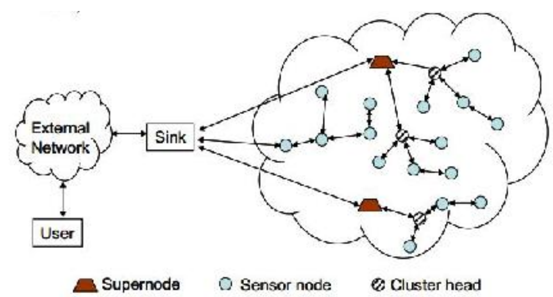


Figure 1. Wireless Sensor Networks

This paper is organized as follows: Section I explains the Introduction, Section II describes the related work, Section III deals with Energy Balanced WSN with Compressive Sensing, Section IV discusses and analyses experimental results of the proposed work, and Section V presents the conclusions of this research work.

II. RELATED WORK

Many researches were given to study the correlation in WSN in recent years. It gives the information about the theoretical aspects of the correlation. To increase lifetime of WSN is an important aspect of intensive research. Many methods are suggested in order to minimize the nodes energy consumption.

A. DDCD

Singh et al., [2] focus on design of an energy balanced and energy optimal algorithm for sorting in a single-hop sensor network. The energy optimality is achieved by maintaining the balanced energy dissipation among all the nodes. Energy optimality and energy balancing is demonstrated for single-hop, single-channel network of randomly distributed sensors.

The process of sorting is performed for specific amount of time and energy with no sensor being aware more than stipulated time steps. This algorithm can be applied successfully to low cost paging channels, but it increases the overall execution time for other types of channels. It also requires more accurate time synchronization between sensors.

Ashok et al., [3] proposed a location-based protocol for WSN which supports an energy-efficient clustering, cluster head selection/rotation and data routing methods to extend network lifetime. Clustering ensures the balanced size cluster formation within the boundary of sensing field with minimum number of transmit and receive operations. Then Cluster head rotation ensures balanced energy dissipation of the node in spite of the non-uniform energy requirement of cluster head sensor nodes. In this scheme, the cluster head rotation will be more effective by considering the constraints like distance and energy density rather than residual energy.

K.-Y.Cai et al., [4] author created aggregation tree which is then used to reduce energy consumption. It minimizes the distance traversed. In this technique the node having maximum available energy is considered as parent node or aggregator node. It creates best possible aggregation tree minimizing energy utilization, minimizing cost and hence as a result maximizing network lifetime. Therefore by achieving these parameters the obtained aggregation tree proves to be the best for enhancing the network lifetime.

B. Compressive Sensing

Sheenam et al., [5] Improvement of Energy Efficiency of Compressive Sensing in Wireless Sensor Networks is proposes Wireless sensor network used in many applications like electronic commerce, mobile communications and smart cards. This survey paper aims at reporting an overview of WSNs technologies, component, and network throughput.

HaifengZheng et al.,[6] addresses the efficient protocols in wireless sensor network for network functions. He introduced the centralized and distributed algorithm in tree based computation. In the centralized, tree based computation is introduced to transfer of data to the parents from children. In distributed, gossip based protocol was proposed for data transmission. However these both approaches provide robust result to the failure of nodes and links in the tree based computation. Therefore energy consumption also increased in the network which makes the transmission infeasible.

III. ENERGY BALANCED WITH COMPRESSIVE SENSIG

We consider sensor networks where the base station and sensor nodes are all static and all sensor nodes in the network are homogeneous and energy constrained. We aim to make energy consumption balanced for data transmission and receiving in sensor networks.

A. DDCD Clustering Method

The energy efficiency of the Data Density Correlation Degree clustering method is not always the uppermost in data transmitting process. While in the clustering process, the DDCD clustering method is an energy efficient one [7]. The main goal of data aggregation algorithms is to gather and aggregate data in an energy efficient manner so that network lifetime is enhanced. Wireless sensor networks (WSN) offer an increasingly attractive method of data gathering in distributed system architectures and dynamic access via WSN [8].

Data density correlation degree and the data density correlation degree (DDCD) clustering method With the DDCD clustering method, the sensor nodes having high correlation are distributed in the same cluster, allowing more accurate aggregated data to be obtained in cluster-based data aggregation networks produced by the DDCD clustering method. Also, the amount of data conveyed to the sink node can be minimized [9].

The WSN is modeled by undirected graph G = (V, E). Where V is the sensor node set consisting of all sensor nodes in the WSN, E is the edge set consisting of all links in the WSN. The antenna of sensor node I ($I \in V$) aim an Omni directional antenna, with a communication radius of α. In cluster-based data aggregation networks, the data transmission process is that every cluster head sends aggregated data obtained from its member nodes to the sink node by one hop or multi-hops [9].

B. Energy Balanced Network

In Wireless Sensor Networks (WSN), energy is a very precious resource for sensor nodes and communication overhead is to be minimized. So energy is an extremely critical resource for this type of battery-powered based Wireless Sensor Networks (WSN), and thus making energy-efficient design is a key challenging problem [10].

In order to achieve and use the limited energy at sensor nodes effectively, the recently proposed routing schemes are attempting to find the minimum energy path to the sink, which is used to optimize the energy usage at nodes. And also identified that the uneven energy depletion which is dramatically reduces the lifetime of networks and decreases the sensors coverage ratio [10]. And this imbalance of energy consumption imbalance is certainly undesirable for the long-term strength and health of the sensor network.

These sensor nodes itself consume their energy heavier evenly, then the connectivity between these sensors and the sink could be maintained for a longer time and thus the network partition might be postponed. This beautiful degradation of the network connectivity could be obviously provided substantial gains. And hence, it should be rational to make a suitable trade-off between both the energy efficiency and the balanced energy consumption [10].

C. Compressive Sensing Method

Compressive Sensing (CS) shows high promise for fully distributed compression in wireless sensor networks (WSNs). In theory, CS allows the approximation of the readings from a sensor field with excellent accuracy, while collecting only a small fraction of them at a data gathering point.

Compression techniques reduce the amount of data which also lead to reduce the energy consumption of the network. It is well known that proper data aggregation technique may significantly reduce the amount of data transmission load carried by a WSN and may hence improve its performance in every aspect [11].

Compressive sensing (CS) can decrease the figure of data transmissions and balance the traffic load throughout networks. However, the overall transmissions for data gathering by using pure CS are still huge. This CS method was projected to decrease the figure of transmissions in sensor networks [12]. The sensor nodes are ordered into clusters. We first suggest an analytical model that studies the correlation between the number of transmissions and size of clusters [12].

CS provides a promising solution in a more efficient manner for the data gathering problem in WSNs, which attempts to reduce sensor data traffic over the network through collecting far fewer measurements than the number of original sensor data. The capacity and delay of data gathering with CS in WSNs. When a sink collects *M* random measurements for a snapshot, it forms a reconstruction of the snapshot. Time is divided into time slots with a fixed length t = b/w seconds [13].

D. Method Description

- Cluster head election
- Sensor node clustering
- Data aggregation with compressive sensing
- Performance evaluation

i. 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. 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. Thus, no node will be left out of the network.

ii. Sensor Node Clustering

After a CH is elected, the CH broadcasts an advertisement message to other sensor nodes in the sensor field, to invite the sensor nodes to join its cluster. The hop count is initialized to be 0. When a sensor node receives an advertisement message, if the hop count of message is smaller than that recorded from the same CH, it updates the information in its record including the node of previous hop and the number of hop to the CH, and further broadcasts the message to its neighbor nodes; otherwise, the message is discarded. After the advertisement of CH is complete, each non-CH node decides which cluster it joins. The decision is based on the number of hops to each CH. The routing from a sensor node to its CH follows the reverse path in forwarding the advertisement message.

iii. Data aggregation with compressive sensing

Within a cluster, each sensor node transmits its data to its designated CH via the shortest path. The routes that sensor nodes use to send their data to the CH form a shortest path tree in each cluster. The total number of cluster transmissions is the sum of the distance of all sensor nodes to their CHs. The distance between two nodes is defined as the number of hops of the shortest path between them. Data collected from sensor nodes is compressed by the CS method at the CHs. The data projections generated at each CH are forwarded to the sink in M rounds along the backbone tree. At each CH in the backbone tree, it aggregates its own data projection with the projections received from other CHs by using the CS method and forwards the aggregated projection upward toward the sink along the tree. There are usually multi hops between two CHs.

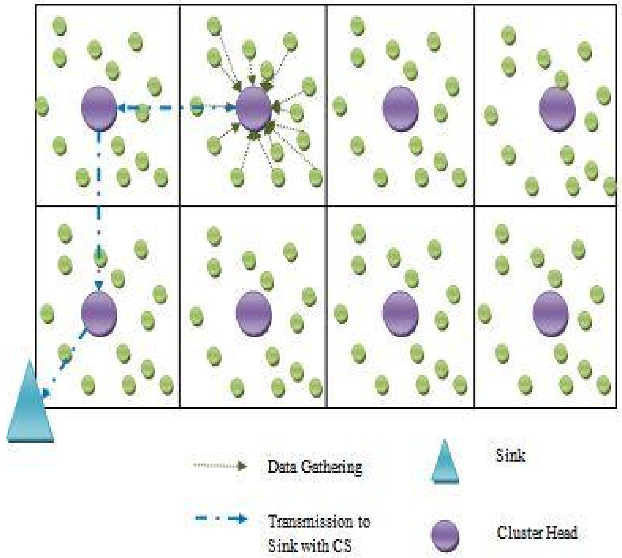
iv. Performance evaluation

All sensor nodes are randomly scattered with a uniform distribution. Randomly select one of the deployed nodes as the source node. The location of the sink is randomly determined. We evaluate our proposed method with respect to the following metrics: No. of Transmission.

No. of transmission: is the number of report messages the sink receives from all the cluster head nodes.

These parameter values are recorded in the trace file during the simulation by using record procedure. The recorded details are stored in the trace file. The trace file is executed by using the Xgraph to get graph as the output.

E. System Architecure



About this architecture the Cluster Head can collect the data from near all sensor nodes. The one CH can forward the data to another CH. If the data repeated means the CH remove the redundancy to forward the data to sink node. Using this method the no. of transmission will be reduced compare with previous work.

IV. Experimental Results

TABLE I. SIMULATION PARAMETERS

Parameters	**Specifications**
Energy model	Energy model
Channel	Wireless Channel
Simulation Duration	20s
Simulation area	1000m*1000m
Number of nodes	55
Number of Cluster Head	6
Queue	Drop Tail
Protocols used	DSR
Maximum speed	20m/s
Traffic type	CBR

Simulation Results

Fig. 4.1. Simulation for Initial stage of CH

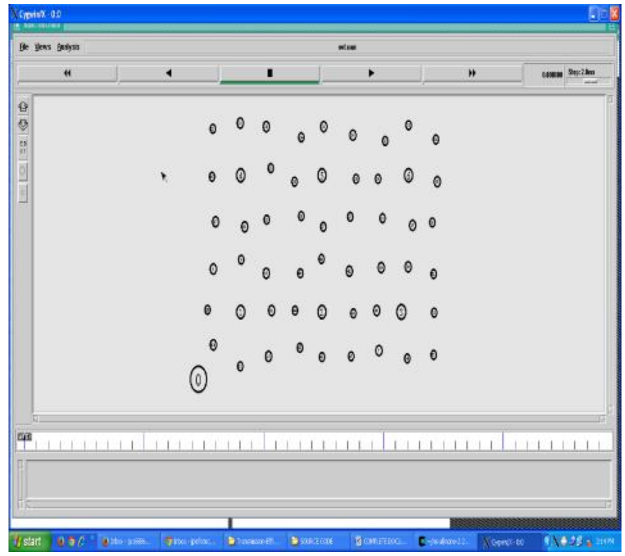


Fig 4.2 Simulation for CH transmits data to Sink node.

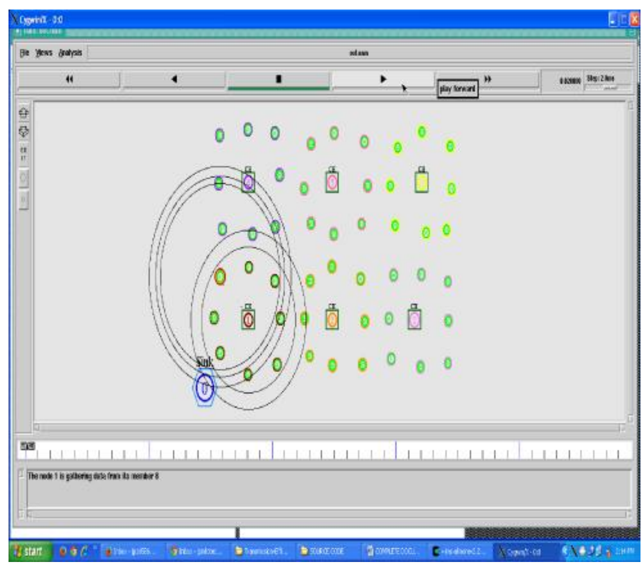


Fig. 4.3. Comparison of No.of Transmission for Proposed work

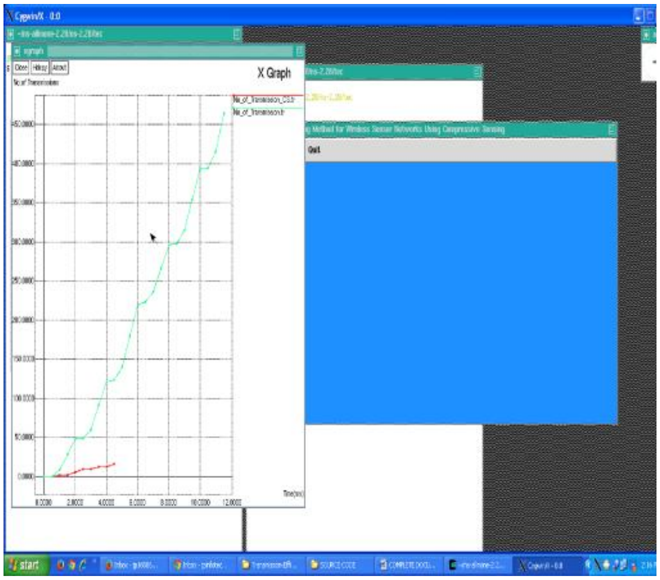
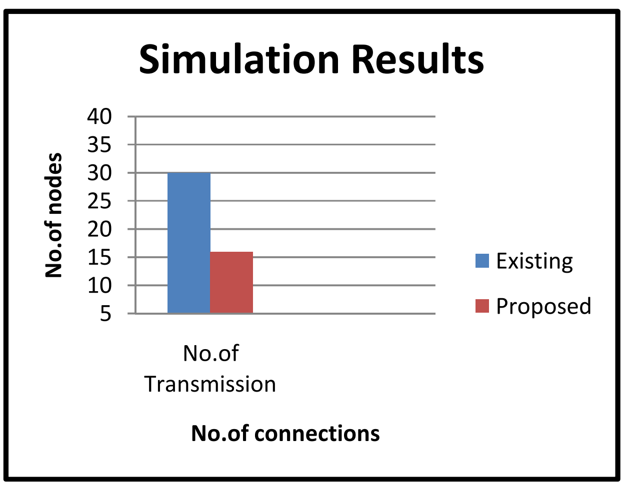


Fig. 4.4. Comparison for No.of Transmission for Proposed work



V. CONCLUSION

In this work, we used Compressive Sensing (CS) to design a clustering based data collection method, to reduce the data transmissions in wireless sensor networks. Sensor nodes are organized into clusters. Within a cluster, data are collected to the Cluster Heads by shortest path routing; at the cluster head, data are compressed to the projections using the CS technique. The undeviating auxiliary work on the DDCD clustering method is developing a method which could confirm the parameters adapted to the real sampled data, especially the data doorstep has major result on cluster routine. we use compressive sensing to reduce the number of transmissions in balanced network and also handled the network traffic To reduce the number of transmission we use systematic model, that model revise the connection between the size of cluster and number of transmissions. If size of cluster is low then the number of transmissions is low. So our proposed method can build the energy balanced network and reduce the number of transmission in the wireless sensor network.

References

[1] Lavanya, Dhanalakshmi, Dhivyanjali, Priyanga and Esther, "Optimization of Data Density and Energy in Wireless Sensor Network," IJIRSET , Vol. 4, Issue 2, February 2015.

[2] M. Singh and V. Prasanna,"Energy-Optimal andEnergy-Balanced Sorting in a Single-Hop Wireless Sensor Network," Proceedings First IEEE International Conference Pervasive Computing and Communication, 2003.

[3] Ashok Kumar and Vinod Kumar, (2011)"Energy Efficient Clustering and Cluster Head Rotation Scheme for Wireless Sensor Networks," (IJACSA) International Journal of Advanced Computer Science and Applications, vol. 3, no. 5.

[4] K.-Y. Cai and L. Zhang, "Fuzzy reasoning as a control problem," IEEE Trans. Fuzzy Syst., vol. 16, no. 3, pp. 600 –614, Jun. 2008.

[5] Sheenam, Navdeep Kaur,"Improvement of Energy Efficiency of Compressive Sensing in Wireless Sensor Networks,"International Journal of Advances in Science and Technology (IJAST) Vol 2 Issue 2 ,June 2014.

[6] S. Soro and W.B. Heinzelman , "Cluster Head Election Techniques for Coverage Preservation in Wireless Sensor Networks," Ad Hoc Networks, Vol 7 , No . 5 , PP . 955-972, 2009.

[7] Fei Yuan, Yiju Zhan, and Yonghua Wang , "Data Density Correlation Degree Clustering Method for Data Aggregation in WSN," IEEE Sensors Journal, Vol 14 , No .4 , April 2014.

[8] Savita Patil and Sunita Rawat, "Analysis of Energy Efficiency and Data Density inWSN, "IJIRCCE , Vol .3,Issue 4 , April 2015.

[9] Snehal Lonare and Dr.A.S.Hiwale, "A Data Aggregation Protocol to Improve Energy Efficiency in Wireless Sensor Networks," IPGCON , 2015.

[10] N.Kaleeswari and Dr.K.Baskaran, "Implementation of Energy Balancing in Wireless Sensor Networks," IJCSI , Issues 3 , No. 2 ,ISSN (online):1694-0814 , May 2012 .

[11] Jun Luo Liu Xiang and Catherine Rosenberg,"Does Compressed Sensing Improve the Throughput of Wireless Sensor Networks ? ," Proc. IEEE Sensor,2002.

[12] Vitthal Yenkar, Prof. Dinesh Datar , "Transmission Efficient Data Gathering Using Compressive Sensing in Wireless Sensor Network," IJIRCCE ,Vol. 3 , Issue 4 , April 2015.

[13] B.Malathi , Ms.Saranya Dr.K.Ramasamy, "Data Collection Based Hybrid Compressive Sensing in Wireless Sensor Networks", IJAIST , ISSN : 2319 : 2682 , Vol . 34 , February 2015.