ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 3, Issue 2, pp: (1140-1146), Month: April - June 2015, Available at: www.researchpublish.com

Cluster Based Energy Conserving Wireless Sensor Network with In-Network Data Aggregation

[1]Priya Kinikar, [2]Bharati S. Pochal

[1]PG Student, [2]Asst.Professor, MCA Dept, VTU PG-Centre, Regional Office, Kalaburagi, India

Abstract: **Due to the limited resources of the network transmission of large sized data can be a bottleneck in sensor network. The objective of sensor network differs from computer network in a sense that in sensor network the goal is to get an estimate of the environment and not to receive all packets. As such the network provides the ability for In-Network data processing. The data delivery is done by selecting appropriate cluster heads. This kind of region diversity may be utilized to achieve higher energy efficiency. We divide the network into four regions. Node with highest energy in each region is selected as cluster head. Remaining nodes forwards their data to cluster head which aggregates the data and forwards only one packet instead of all the packets received from other nodes. Therefore the overall energy consumption is reduced in such a network. In our proposed method we recalculate cluster head after every round of transmission and bypass nodes with lower energy to preserve more energy. We compare the performance with non-energy centric pure region based cluster head and prove that the proposed technique fares better in terms of low energy consumption, fewer node deaths, more packet delivery ratio and improved packets par node. Here by compressing redundant data we ensure better degree of compression without compromising on mean square error and in the process extending the lifetime of the network. The design is simulated using NS2 network simulator and results are analyzed using trace analysis feature. A result shows that proposed system performs better in terms of all the performance metrics in comparison to conventional uncompressed sensing.**

Keywords: **Wireless Sensor Network, Clustering, Energy model, Energy conserving, Normalized Routing Load, Throughput.**

1. INTRODUCTION

A wireless sensor network (WSN) (sometimes called a wireless sensor and actor network (WSAN) A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, pressure etc., the output is generally a signal that is converted to human readable display at sensor location. Ex: home security light, automatic doors etc., they send out some type of energy such as ultrasonic waves or light beams.

In practical application, energy resource of node is extremely limited in Wireless Sensor Network. Global network energy unbalance, we divide the large-scale network into equivalent layers and propose a Energy Conserving Wireless Sensor Network With Packet Aggregation. Balancing Energy Consumption to Maximize Network Lifetime in Data-Gathering Sensor Networks Involving Compressive Sensing Theory, the novel algorithm obviously has great advantages in reducing energy consumption during transmission, prolonging network life-time and eliminating information redundancy which could realize load balance for multi-layer wireless sensor network. The project is simulated in NS2 and it is proved that by using the proposed technique, network lifetime can be improved and packet delivery ratio is increased.

There are several techniques for data transmission. But generally data transmissions are constrained by the size of the data and energy of the nodes. Hence suitable compression of the data is essential for data transmission. Also parallel transmission of the data helps in reducing load in a single path and also protects the data from intrusion. Therefore in this work we propose a parallel data transmission by suitably aggregating data for data compression at the cluster heads.

ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 3, Issue 2, pp: (1140-1146), Month: April - June 2015, Available at: www.researchpublish.com

Compressed data reduces the energy requirement for transmission. We also propose an energy based clusterhead calculation where a clusterhead is periodically elected by a cooperation between the nodes in a area as a node with the maximum residual energy.

The objective of the work is to propose a suitable solution to energy loss for sensor network where all the nodes senses some environmental parameters like energy, humidity. Nodes transmit this information to a base station. Group of nodes in a region create a cluster with cluster head where each cluster member nodes send their data to the cluster head which aggregates the data and forwards the data to the base station. Hence number of packets are reduced resulting more energy saving.

2. METHODOLOGY

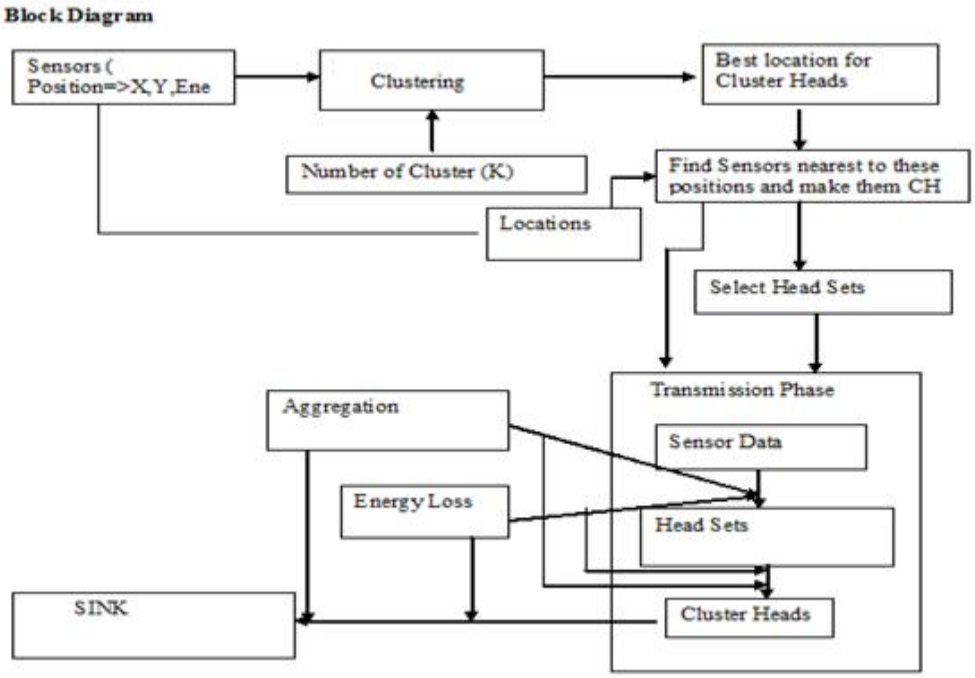


Fig (a): Basic Architecture of the proposed work

Figure shows the basic architecture of the network. Firstly group of nodes, distributed over a geographic area select a cluster head depending upon the energy of the nodes. Once selected, this node acts as local data gathering and aggregation node. It schedules all the cluster member's reception and is responsible for channel allocation. Once he data is gathered from the cluster members, it aggregates the packets and forwards a single packet containing the aggregated data to the sink thereby reducing the overall number of packets being transmitted in the network.

Each step is briefly explained here.

- N wireless sensor nodes are uniformly and independently, and randomly distributed in a unit monitoring area.
- The monitoring area is a large-scale wireless sensor network, which is round with radius R.
- The whole network is divided into L layers, the width of each layer is R=L.
- Each node has the same transmission power and transmission rate.
- Adopting free space propagation model in data transmission, data will be abundant once the distance between nodes is further than certain value d.
- Nodes could randomly generate a vector of Bernoulli distribution, and meanwhile the recovery terminal could generate the corresponding matrix combined with vectors of all nodes.
- The noise in measuring processing z and recovering processing w belongs to AWGN.

ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 3, Issue 2, pp: (1140-1146), Month: April - June 2015, Available at: www.researchpublish.com

- The global original signal is sparse with degree K. In our method, we can get series of coefficients as:
- Each node has initial energy value Eini, and the global initial energy value is equal to NEini.
- Each node sends and receives q bits data with average energy consumption ES and ER, here satisfied,

Network Initialization:

Step1. Each node gets its own ID, and broadcasts its node ID and competition value p, looking for its neighbour node.

Step2. Nodes out of the competition, pronounce to be CHs. The surrounding nodes send their requirements to join the group. CH should record its cluster members, and members should record their CH ID.

Step3. The CHs in layer i should joint the (i-1) th layer as the member of up-layer CHs.

Step4. Nodes adapt their own data and send them to sink in traditional multi-hop method. Meanwhile, the sink could determine the sparse domain .

Step5. Sink distributes the measurement seeds to all nodes, and forms the global measurement matrix. Each node generates its corresponding M measurement coefficient according to the certain seeds.

Data Transmission:

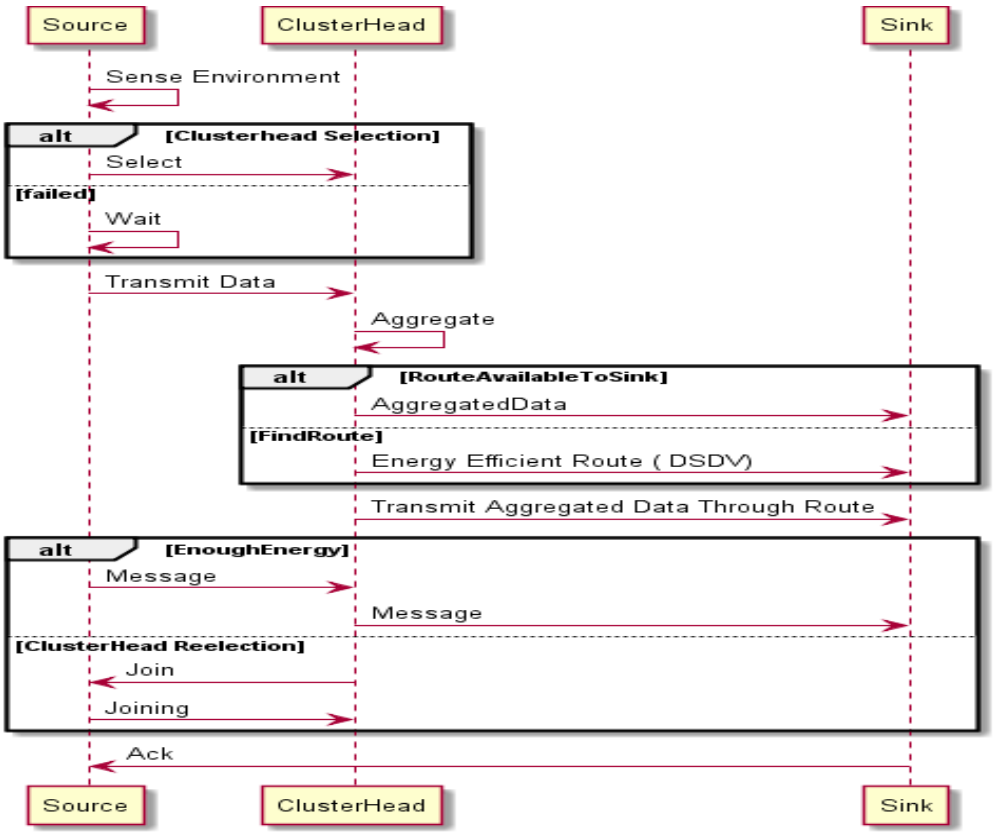
Step1. In each round, node senses its data xi and multiplies with inset observed vector 'i, then we can get measurement information value

Step2.In its time slot, each node sends its M measured values to its CH. CH collects all measured values of its children, and plus them with its own M values.

Step3. Each CH sends its cluster measured data to the up-layer CH, then the up-layer CH collects its cluster data and processes them as Step 2 in its own time slot.

Step4. Finally Sink receives the sum of the global measured data.

Set of events can be presented with event sequence diagram



3. PROBLEM STATEMENT

Data are transmitted from sensors to sink using suitable encoding technique to reduce the number of bits. Examples are network coding, Hauffman coding etc. Even though actual number of bits gets reduced in this transmission scenario, overall packet is not reduced. Also variable length encoding demands variable bandwidth allocation which is constrained in sensor environment. Dedicated routing from every node to sink adds tremendous routing overload. Therefore variants of cluster based routing are preferred. Cluster heads are needed to collect data from cluster members, calculate summery of data and forward it to sink.

This data forwarding from cluster heads to sink can also be using direct diffusion or through intermediate nodes using suitable routing technique. Therefore these cluster heads looses their energy very fast. It is important therefore to refresh the cluster heads periodically and select nodes with better residual energy as cluster heads for longevity of the sensor network. But current cluster based techniques like LEACH suggests that there should not be any cluster reformation during the transmission phase. Through our simulation we show that in transmissions with high rounds of data, such nodes tend to loose energy fast. Hence we need an alternative system which is discussed in the next section.

Some of the limitations associated with current state of art in sensor networks are:

- Packets are more that take more time to reach destination.
- Too many packet energy is lost.
- Hence node is dies early.

4. PROPOSED SYSTEM

In the proposed system, data's are acquired by source sensors and are forwarded to cluster heads. Cluster heads aggregates data and forwards to sink. Data transmission is synchronous with CH monitor in the schedule of transmission. After sink receive data from all the sinks, cluster heads are recalculated for every area. If on the middle of data forwarding any cluster head runs out of energy, it immediately triggers re cluster calculation. During the transmission process if a node looses energy, packets are dropped. MSE error is calculated as error sum of uncompressed data and compressed data. Proposed system's MSE is more than present system. But it is compensated through longer network lifetime and better energy saving. Proposed system also delivers more packets. For high volume of data, because of high packet delivery ratio, we get better MSE performance.

The proposed system improves the current state of art in several ways. Some of the advantages of the proposed designs are as below.

- Energy Consumption is reduced
- Number of packet is reduced saving communication cost
- Base station gets aggregated data. Hence decision making is faster.
- Due to less number of packets, congestion is lower
- Reduced the work load.

5. RELATED WORK

In [1] have planned and displayed a remote sensor system observing and control framework for aquaculture. The framework can identify and control water quality factors of temperature, broke down oxygen content, pH esteem, and water level progressively. The sensor hubs gather the water quality factors and transfer them to the base station host PC through ZigBee remote correspondence standard. The host PC is utilized for information investigation, handling and presentation utilizing Lab VIEW programming stage. The water quality factors will be sent to proprietors through short messages from the base station by means of the Global System for Mobile (GSM) segment for notice. The test assessment of the system execution measurements of nature of correspondence connection, battery execution and information conglomeration was displayed. The exploratory results demonstrate that the framework has extraordinary prospect and can be utilized to work in genuine environment for ideal control of aquaculture environment.[2]proposes techniques for compressive sensing. Energy resource of node is extremely limited in Wireless Sensor Network (WSN). In order to

extend the life-time of Large-scale Wireless Sensor Network (LsWSN), it is higher requested for system to load adjusts and diminishing vitality cost in information transmission. Presenting Compressive Sensing (CS) to remote sensor layer bunching structure system, we display a novel Multi-bounce Clustering Transmission Model (MCTM), which could diminish vitality utilization (EC) in information transmission and take out data repetition, to acknowledge burden offset of the system. Re-enactment results demonstrate that, contrasting and the customary grouping topology, utilizing CS as a part of WSN could show signs of improvement impact in EC and transmission effectiveness. It draws out the life-time of WSN, and gets essential part in managing the application for Ls WSN.

Large scale wireless sensor network have been utilized for an extensive variety of applications, one of the most critical issues in these applications is the way to enhance system lifetime of the sensor hub fuelled by battery. In this paper, we propose a new data gathering algorithm using compressive sensing. The system vitality utilization is examined hypothetically. [3] Methodology offers precise information recuperation from a little number packed information. Its execution is assessed in Tiny OS. Recreation results demonstrate that our methodology can adequately delay the system lifetime for huge scale remote sensor system. Its vitality proficiency likewise beats the tree accumulation convention stack.Conventional approaches to sampling signals or pictures follow Shannon's theorem the rate should be a minimum of double the utmost frequency present in the signal (Nyquist rate). Within the field of information conversion, commonplace analog-digital converter (ADC) technology implements the standard measure Claude Elwood Shannon illustration - the signal is uniformly sampled at or higher than the Nyquist rate. [4] surveys the idea of compressive sampling, additionally called compressed sensing or CS, a unique identifying/sampling model that goes against the common knowledge in information acquisition. CS theory asserts that one will recover sure signals and pictures from so much fewer samples or measurements than ancient strategies use.

[5] Describes a very different approach to the decentralized compression of networked information. Considering a very salient aspect of this struggle that revolves around large-scale distributed sources of knowledge and their storage, transmission, and retrieval. The task of transmission info from one purpose to a different may be a common and well-understood exercise. [6] Presents the primary complete style to use compressive sampling theory to sensor knowledge gathering for large-scale wireless sensor networks. The undefeated theme developed during this analysis is anticipated to supply recent frame of mind for analysis in each compressive sampling applications and large-scale wireless sensor networks.The proposed compressive knowledge gathering is ready to cut back world scale communication value while not introducing intensive computation or difficult transmission management. The load levelling characteristic is capable of extending the lifespan of the complete sensor network additionally as individual sensors. What is more, the proposed theme will address abnormal sensor readings graciously. We have a tendency to additionally perform the analysis of the network capability of the proposed compressive knowledge gathering and validate the analysis through ns-2 simulations. a lot of significantly, this novel compressive knowledge gathering has been tested on real sensor knowledge and also the results show the efficiency and robustness of the proposed scheme.

6. RESULTS

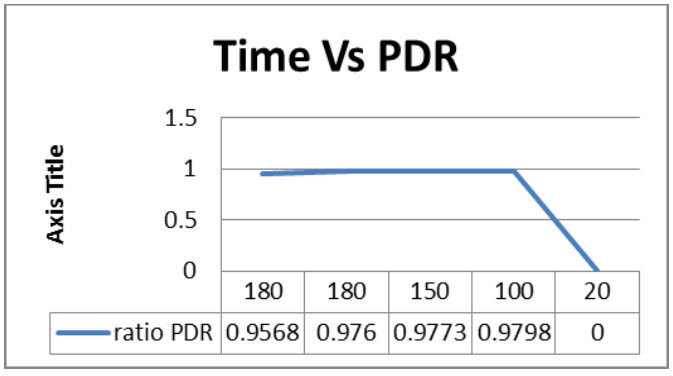


Fig.1.Simulation time Vs Packet Delivery Ratio

Packet delivery ratio increases with time. Once the network builds the cluster heads and routes, data transmission becomes 100%. Thus the proposed design is verified.

ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 3, Issue 2, pp: (1140-1146), Month: April - June 2015, Available at: www.researchpublish.com

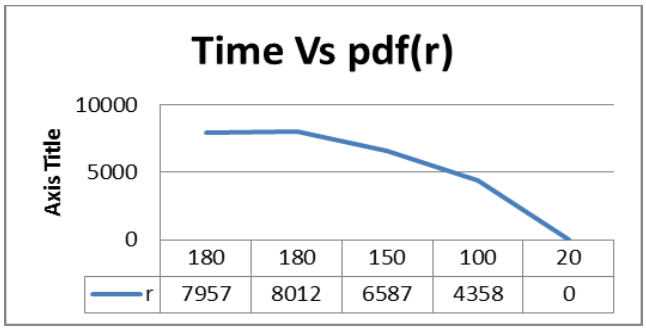


Fig.2. Simulation time Vs PDF(received)

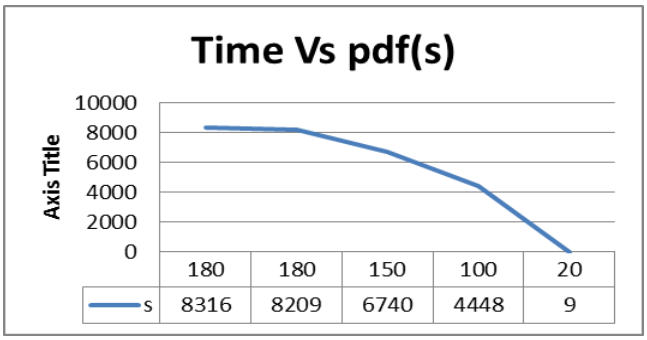


Fig.3. Simulation time Vs PDF (send)

Packet Delivery Function (pdf) is a measure of generated traffic rate. The above two graphs shows that the transmitted and received traffic builds up with cluster head formation and route discovery and increases with time. Then after saturation limit, they get steady.

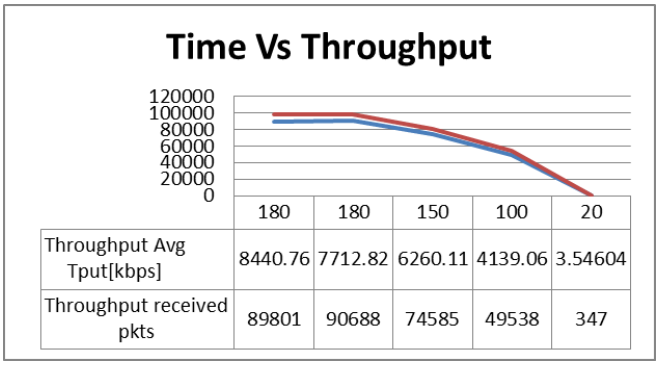


Fig.4. simulation time Vs Throughput

As throughput is a direct function of Pdf, both overall throughput and received packet increases with time. But as simulation time is higher, received throughput comes down. This is because many nodes looses energy with time which results in many packet drop.

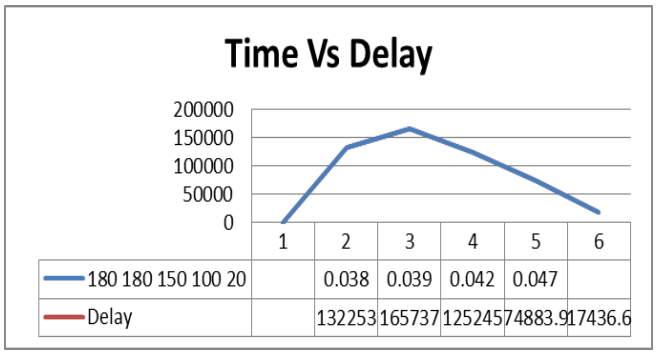


Fig.5. Simulation time Vs Delay

ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 3, Issue 2, pp: (1140-1146), Month: April - June 2015, Available at: www.researchpublish.com

During intermediate phase of simulation, rate of transmission is very high, which results in high delay. As packet rate comes done, delay is also saturated.

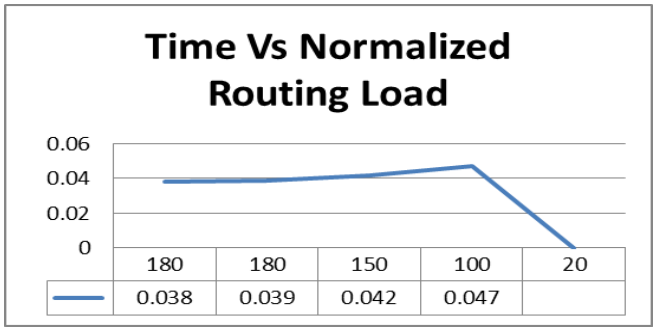


Fig.6. Simulation time Vs Normalized Routing Load

Normalized routing load gives the ratio of packet being forwarded by intermediate nodes divided by total packets. The graph shows that for most part of the simulation, all nodes load are balanced and this proves the proposed system.

7. CONCLUSION

Wireless sensor network is exciting new area of study. With the ever demanding need for more food and ever reducing agro production, more technological paradigm shifts are desired. Sensor Networks are breath of fresh air in many fields, but specially in agriculture. When sensors are placed at different parts of fields, they can remotely transmit the condition of the crop from remote areas. Thus monitoring cost is greatly decreased. But as the agricultural fields are large which needs long range data transmission and range of the sensors are small, sensors are to be laid in high number. Sensors are battery driven. When more transmission takes place, they lose their energy. It is not possible to manually replace each node's battery. Hence new techniques are needed that can help preserving energy in sensor network. In this work we have presented energy preserving sensor network design with cluster heads. Cluster heads by aggregating in network data can significantly reduce the overall traffic. We have proved through simulation results that proposed system is variable and offers good energy utilization.

REFERENCES

[1] D. Ma, D. Qisheng, L. Daoliang, Z. Linlin, Wireless Sensor Network for Continuous Monitoring Water Quality in Aquaculture Farm, sensor letters, 8(1), 2010, 109-113.

[2] Zhang Ying, Sun Guiling, Li Weixiang, Load Balance using Compressive Sensing Theoryin Large- Scale Wireless Sensor Network, Sensor Letters, 9(5), 2011, 1855-1859

[3] Guangming Cao, Fengqi Yu, Baoli Zhang, Improving Network Lifetime for Wireless Sensor Network Using Compressive Sensing, 2011 IEEE International Conference on High Performance Computing and Communications, 2011, 448-454.

[4] E. J. Candes and M. B. Wakin, An Introduction to Compressive Sampling, Signal Processing Magazine, IEEE, 25 (2008), 21-30.

[5] J. Haupt, W. U. Bajwa, M. Rabbat etc, Compressed Sensing for Networked Data, Signal Processing Magazine, IEEE, 25 (2008), 92-101.

[6] C. Luo, F. Wu, J. Sun, etc, Compressive Data Gathering for Large-scale Wireless Sensor Networks, Proceeding of the annual international conference on Mobile computing and networking, Beijing, China, 2009, 145-156.