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# Cluster Method For Sensor Networks Using Hybrid Cluster Algorithm

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**Abstract**

Wireless sensor network denotes to a cluster of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location.Some of the common applications of wireless sensor networks are monitoring of temperature, sound, humidity, earth monitoring, and forest fire detection. In this paper, it is proposed a clustering method that uses hybrid Compressive Sensing for sensor netwroks. Compressive sensing (CS) method can decrease the number of data transmissions and balance the traffic load throughout networks. However, the total number of transmissions for data collection by using pure CS is still large. The hybrid method of using CS was proposed to reduce the number of transmissions in sensor networks. The sensor nodes are organized into clusters. Within a cluster, nodes transmit data to cluster head (CH) without using CS. CHs use CS to transmit data to sink. It is first proposed an analytical model that studies the relationship between the size of clusters and number of transmissions in the hybrid CS method, aiming at finding the optimal size of clusters that can lead to minimum number of transmissions. Then, it is proposed to implement a centralized clustering algorithm based on the results obtained from the analytical model.

**Keywords:** Wireless Sensor Networks (WSN), Compressive sensing, Clustering, Data transmission

## 1. INTRODUCTION

In the commissioning of wireless sensor networks, one of the key issues is data gathering seamlessly. Sensor nodes receive and transmit the information via routing or casting in WSN through multi hop. The majority of the research on practice for WSNs has been focused on routing solutions.According to field experiments, data communication contributes majority of energy consumption of sensor nodes. It has become an important issue to reduce the amount of data transmissions in sensor networks.Generally, WSN has collection of wireless sensor nodes which collects, process, transmit data from physical environment to another distributed area. Often, there will be overlapping of sensor node information to be correlated. In order to overcome the issue, many studies on data correlation happen. Here I have proposed a hybrid compressive sensing method to solve the issue on data correlation and energy for data transmissions in a novel method.

## 2. Literature review

Salim, Osamy & Khedr, 2014; Al-Zubaidi, Ariffin & Al-Qadhi, 2018; Mittal, Singh & Singh Sohi, 2017) cannot ably deal with the huge data traffic of WSNs. Aziz, Osamy & Khedr, 2019; Xiang, Luo & Vasilakos,

2011; Osamy, Salim & Khedr, 2020; Haupt, Bajwa & Rabbat, 2008; Chong et al., 2009; Aziz et al., 2019) considered some CS techniques are used for data gathering and improve the transmission. Chong et al., 2009) suggested CS and routing scheme for WSN. But authors did not provide any algorithm for that. Xiang, Luo & Vasilakos, 2011) aimed to minimize the energy expenditure by uniting compression techniques and routing schemes.

## 3. Proposed Method

In proposed methodology, hybrid CS clustering method is adopted. Sensor nodes are arranged in clusters. Each cluster has a cluster head (CH). CH collects data using sensing method. If the cluster size is large, data transmission will be high and if it is small, the data transmission will be less accordingly. It is very much needed to look into the size of clusters before transmission of data. Based on the selection of cluster transmission path with the size of clusters, a centralized clustering algorithm is proposed for transmission.

## 4. IMPLEMENTATION PROCEDURE

- The sensor nodes are organized into clusters.Before optimization, every cluster head collect the information from the cluster members.

- Analytical model that studies the relationship between the size of the clusters and number of transmissions in the hybrid CS method, aiming at finding the optimal size of clusters that can lead to minimum number of transmissions.

- Therefore, centralized clustering algorithm for select the cluster head in each luster. This algorithm based on the results obtained from the analytical model.

- If the cluster member needs to transmit the data to the destination, they will send through the cluster head for avoiding the time delay and reduce the number of transmission.

- A data gathering tree spanning all CHs is constructed to transmit data to the sink by using the compressive sensing method.

- Hybrid compressive sensing method to finding the optimal size of clusters that can be lead to minimum number of transmissions.

  The block diagram of the data stream to compress as shown as the step by step process in the figure:

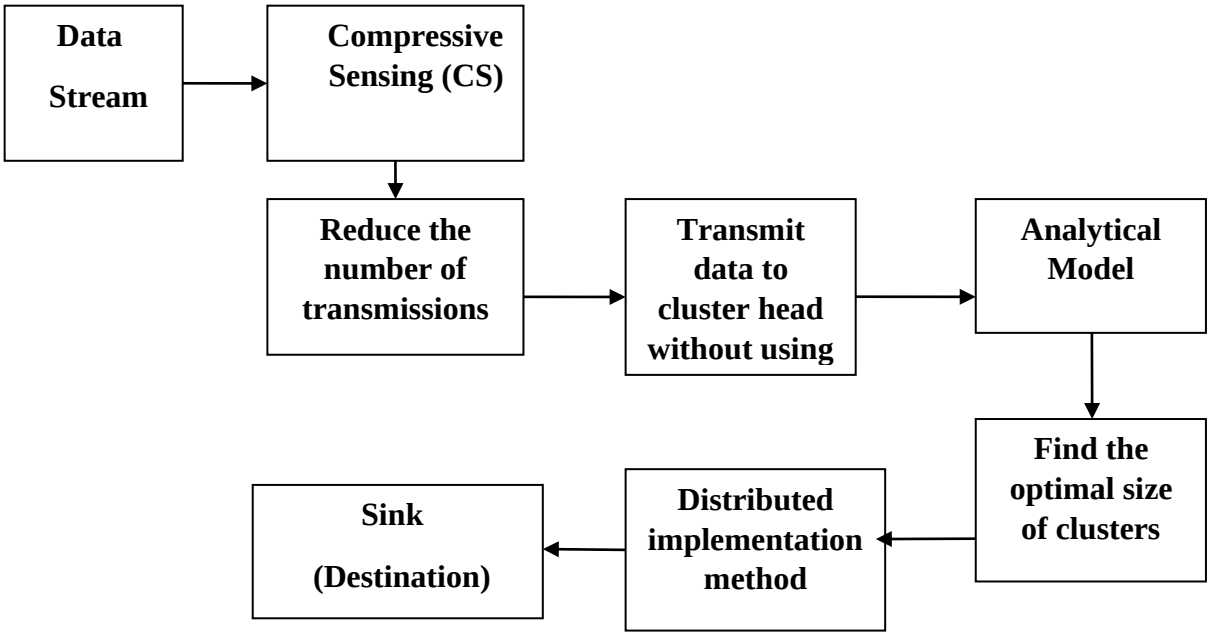



**Fig : 4.1. General block diagram**

### 4.1. CENTRALIZED CLUSTER ALGORITHM

As the centralized algorithm, sink node has the full knowledge of the network topology. The sink will divide the sensor nodes into clusters. Choose a CH for each cluster, and construct a backbone tree that connects all CHs to the sink. After computing the clustering, the sink can broadcast the clustering information to all sensor nodes and start data collection subsequently. In our method, 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.

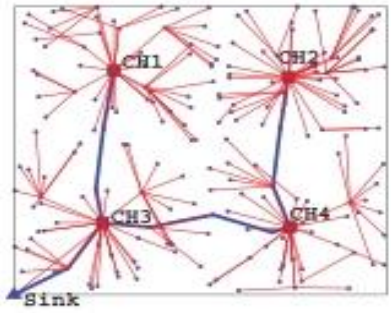



**Fig: 4.1.1. Centralized Cluster Algorithm**

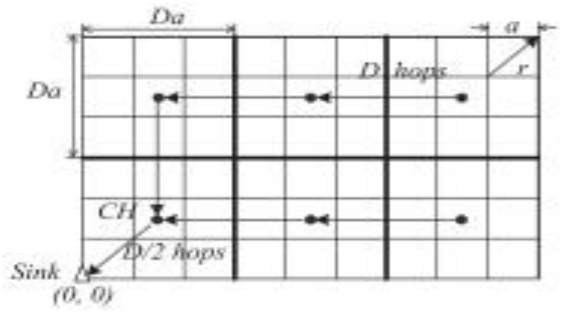
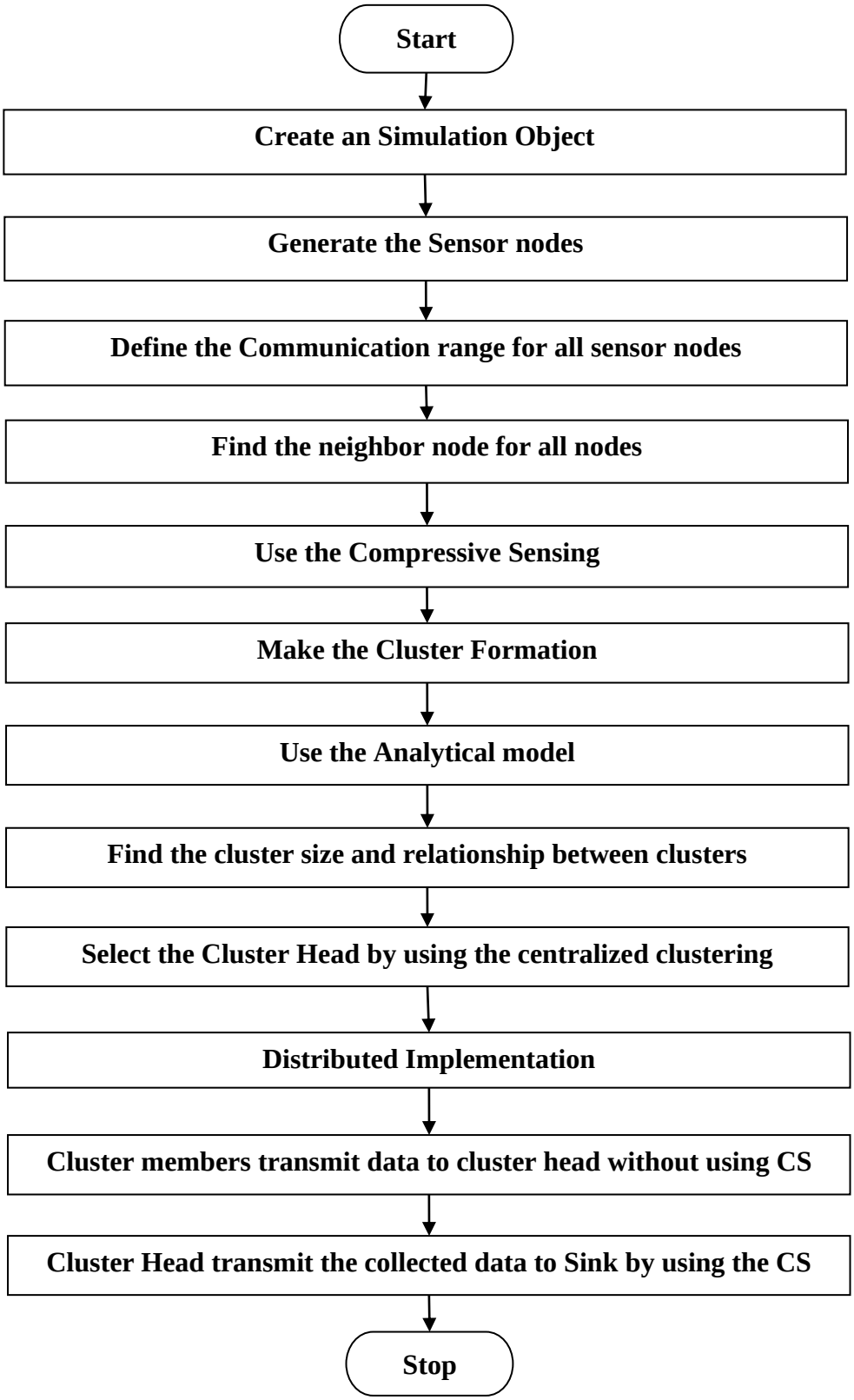



**Fig: 4.1.2. Finding the cluster header in a sensor**

The total number of intra-cluster transmissions is the sum of the distance of all sensor nodes to their CHs. 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.



## 5. RESULT AND DISCUSSIONS

Evaluation metrics: Number of Transmission – find the number transmission between the cluster head and sink, End-to-End delay – the time taken to be data transmitted from source to destination, Packet Loss – total number of packet losses during the data transmission, Energy level – residual energy are simulated for performance metrics. In WSN,source nodes want to send the data stream(number of packets) to the sink(destination) efficiently in the network.

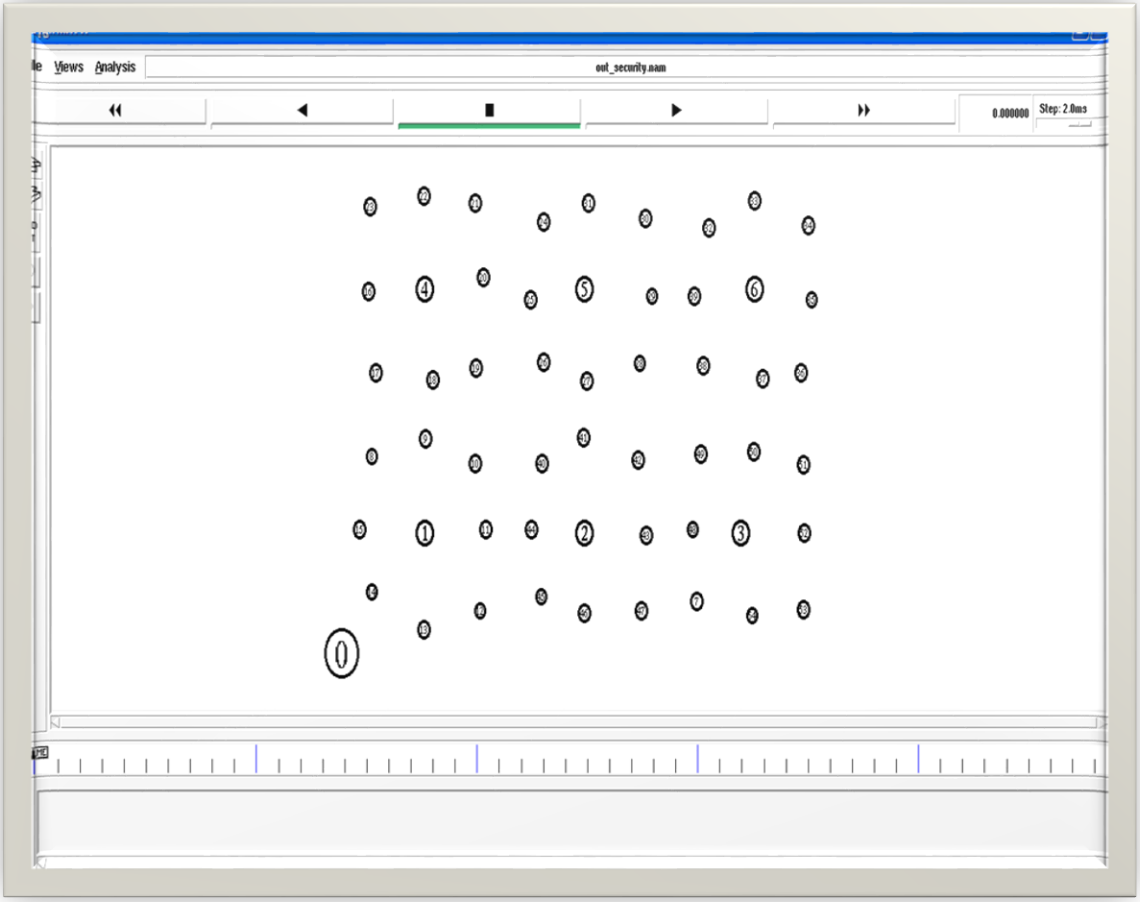



**Fig 5.1 NODE ARRANGEMENTS**

Fig 5.1 represents the whole network has 55 sensor nodes.The sensor nodes are organized into cluster.Each cluster has a cluster header at its center position. Other nodes are cluster member.

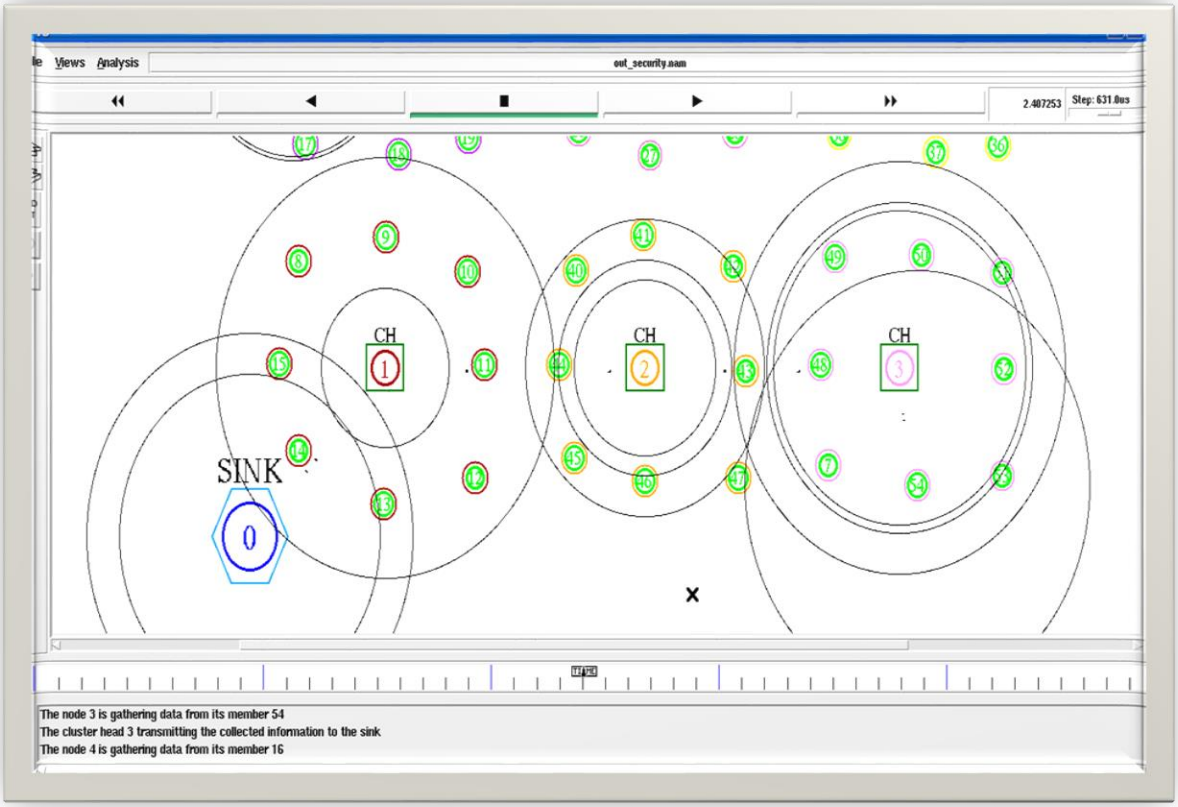



**Fig 5.2: NODE TO NODE INFORMATION TRANSFER**

Fig 5.2 represents within a cluster, nodes transmit data to cluster head without using CS. Each cluster head use CS to transmit the data to sink.

**COMPARISON OF OUTPUTS FOR ALGORITHMS**

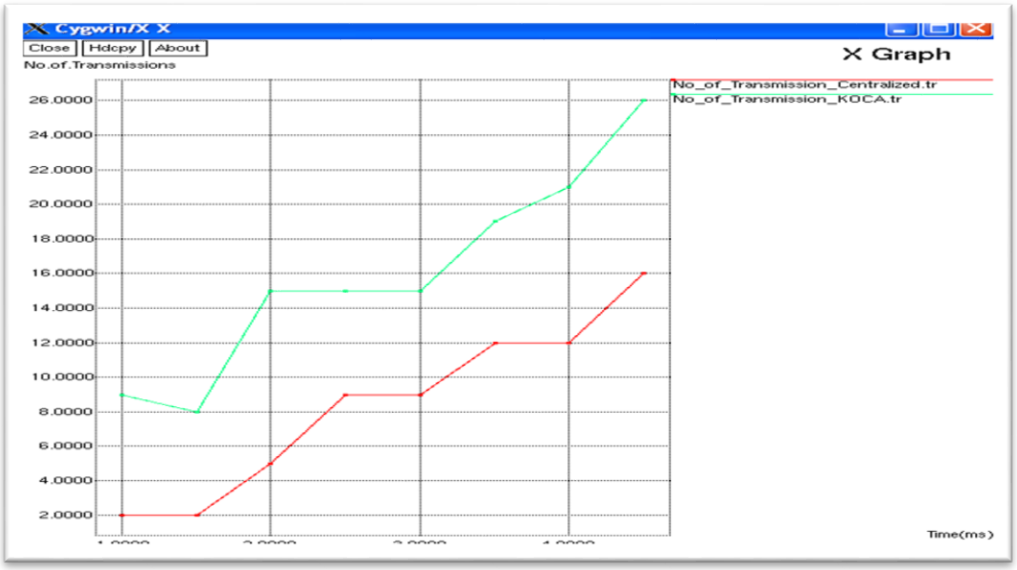



**Fig.5.3: NO.OF TRANSMISSION**

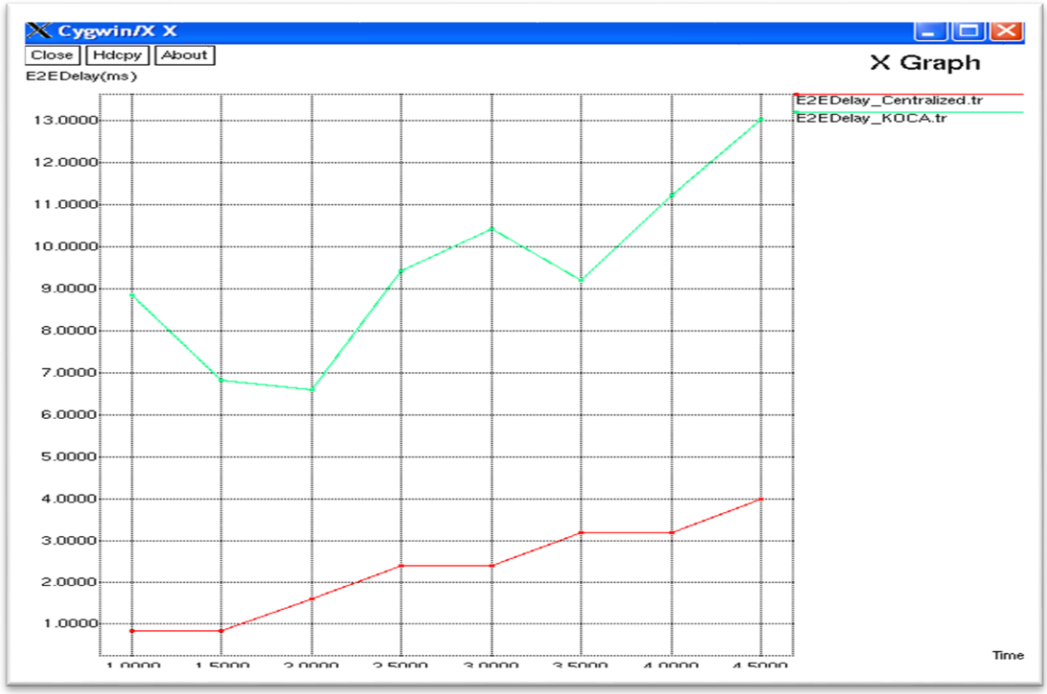



**Fig.5.4 END TO END DELAY**

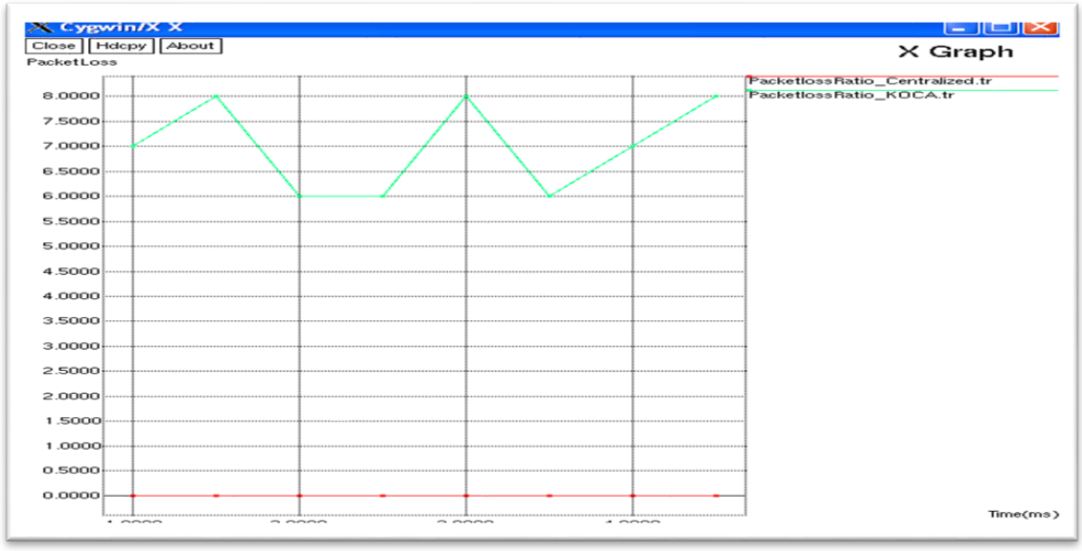



**Fig.5.5. PACKET LOSS**

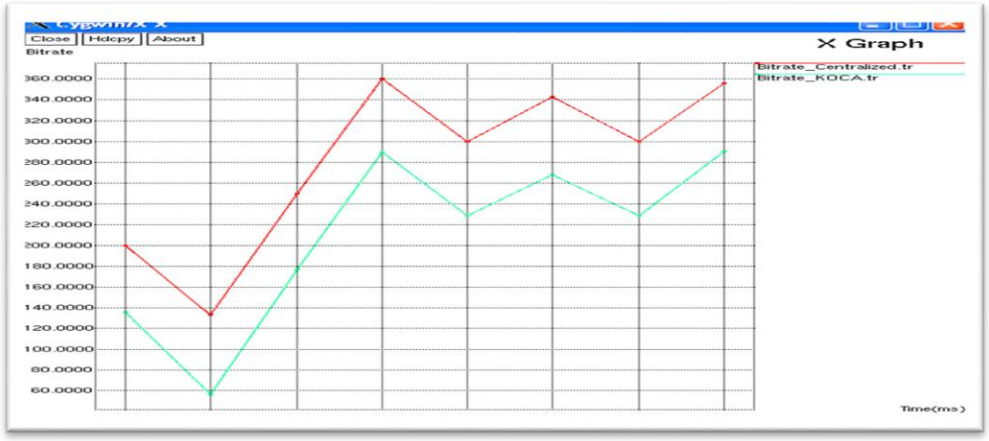



**Fig.5.6. BIT RATE**


**Fig.5.7 THROUGHPUT**

Comparison ofresults obtained using centralized clustering algorithm and overlapping clustering algorithm is shown in the below table 5.1.

| PARAMETER | KOCA ALGORITHM | CENTRALIZED CLUSTERING ALGORITHM |
|---|---|---|

| | | |
|---|---|---|
| No.of transmissions | 9000 | 2000 |
| End to end delay | 80700 | 9000 |
| Packet loss | 70000 | 0000 |
| Throughput | -5 | 2 |
| Bit rate | 140 | 200 |

**Tab.5.1: SIMULATION PARAMETER**

**6. CONCLUSION**

Finally hybrid CS to design a clustering-based data collection method, to reduce the data transmissions in wireless sensor networks is proposed. The information on locations and distribution of sensor nodes is used to design the data collection method in cluster structure. 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 projections are forwarded to the sink following a backbone tree. An analytical model that studies the relationship between the size of clusters and number of transmissions in the hybrid CS method, to find the optimal size of clusters that can lead to minimum number of transmissions is done. Then, a centralized clustering algorithm based on the results obtained from the analytical model is compared with an existing algorithm.

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