GD-EEOS: Energy Efficient Heterogeneity Overlap Sensing Ratio using Gaussian Distribution (GD-EEHOS) in WSN

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Abstract: ***In this paper we explores the competing issues of coverage effectiveness and power accessible in wireless sensor networks Nonstop capacity increase of distributed grid-connected system produces more obvious disturbance on the grid. The Monitoring network technology can run protection for the safety and stability of power grid operation, but sensor nodes of the monitoring network will fall to failure due to conservation interference. According to the performance degradation problem produced by nodes failure monitoring network, of natural selection based on random weight is proposed in this paper to optimize monitoring performance can restore the monitoring network by moving redundant nodes. Simulation results show the effectiveness of the proposed algorithm. Our lower energy shifting propagation-loss model comprises with path loss function with random distributed shadowing, independent across with base stations. Our results are valid in the whole estate of GD-EEHOS (Energy Efficient Heterogeneity Overlap sensing Ratio- Gaussian Distribution), in particular for ECOSR < 1, where one discovers multiple coverage.***

Keywords: GD-EEHOS, H-WSN, sensing ratio, directional sensor nodes, AWGN, Node Energy, Heterogeneityetc

1. Introduction

In wireless sensor network assigning few heterogeneous nodes is an effective way to increase network lifetime and reliability. The WSNs is the networks composed of low-cost, low-power, and small-size sensors that have circle sense area and communicate information by multiple node & only provide simple sensing data, such as temperature, humidity, and so not as to meet the necessity of more difficult and accurate data applications. But WSNs is the circulated sensing networks composed of video cameras that have sector sense area and can process, send, and receive more concentrated and complicated video information data by packaging with wireless transceiver and differ from the WSNs due to their characteristic of directivity and turn ability

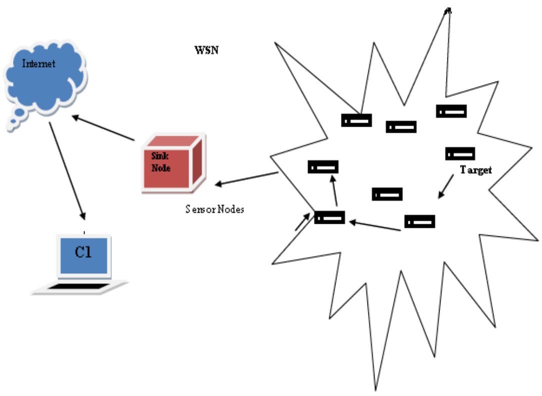

Figure 1: Wireless Sensor Network with sensor node

1.1 ECRM (enhance coverage ratio)

The process of ECRM can be separated into rounds and there are three phases in each round: backbone setup phase, cluster formation phase and steady communication phase. On the first stage, considered only fixed nodes, the communication backbone of network is formed, which should be continued until the first fixed node die, according to ECR protocol. After the backbone setup, Cluster will be formed and the cluster heads on each layer will be selected. On the last stage, data will currents to the base station via the communication link setup by the first two phases. Obviously, the critical phase of ECRM will be implemented in the second phase. In ECRM, cluster heads are in charge of long distance communication and data fusing which are serious energy consumption tasks.

1.2 Additive white Gaussian noise (AWGN)

The AWGN is a noise channel. It is a simple model of the imperfections that a communication channel consists of. The disturbance caused by the Thermal noise is modeled as Additive White Gaussian Noise. This noise channel classically is decent for cable and profound space communication but not in experienced communication since of multipath, land obstructive and interfering.

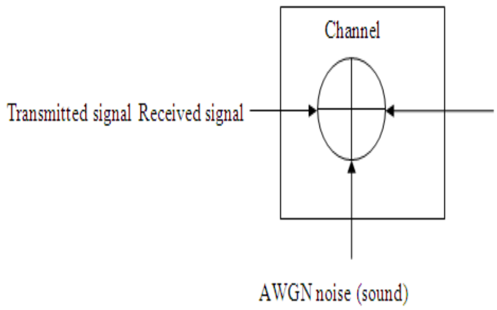

Figure 2: AWGN channel (frequency)

AWGN is used to pretend contextual noise (sound) of channel. In time domain the noise gets added in the transmitted signal so the received signal can be represented as – r (t) = s(t) + n(t) , where s(t) is conveyed signal and n(t) is contextual noise (sound). C AWGN = W log2 (1+P/N0W) bits/Hz.

1.3 Network lifetime

In wireless network we identified that mostly Sensor nodes are suffer due to its partial battery power volume. If sensor nodes are small size of present batteries, so that sensor nodes do not last as extensive as preferred. Then directional sensor nodes have several working directions, rotatable mechanical design is required to utilize all working directions. Physical movement consumes definitely much more power than other activities [3]. Therefore, physical activities like rotating a sensor node around its axes or moving it to another position should be well planned to minimize the energy consumption.

2. Problem Definition

Numerous workings have been approved in the field of WSN to remove the redundant data. In our paper [1] it is deliberated that whenever, an event takes place in a detected region it is first of all detected by the hexagonal sensors. Once detecting the event the scalars communicate the information to their respective sensor node. The condition is that the sensor node should lie within the field of view of camera. Then the sensors exchange their reading with each other collaboratively and decide in a distributed manner that who among them are to be actuated. However, the problem is that when the event takes place sensing of event not only occurs within the event region but also up to some extent outside the event region.

3. Literature Review

Raymond Mulligan et.al [1] this paper can be utilized for the beginning or a summary of the work that has been done to that time, several terms and concepts are defined by the author and then it is shown that how they are being used in numerous research works. Coverage is one of the most influential and popular areas of research in the field of wireless sensor networks. Making certain that there is sufficient coverage in a sensor network is essential to obtain valid and substantial data. In this paper a broad review of the work that has been done in the coverage problems in wireless sensor networks is addressed thoroughly.

Chetan Chugh et.al [2] in this paper a brief photographic representation of wireless sensor nodes deployment in MATLAB software is given. WSNs have been broadly considered as one of the most crucial technologies in this era. This paper the path between the source and the destination nodes for reliable data delivery is accommodated. The hostile nodes are choosen on manual base. Using Dijstra algorithm, the substitute shortest route has been found. In addition, an RSA algorithm algorithm for public key cryptography has been implemented to safeguard the nodes from obstacle attacks.

Wendi B.Heinzelman et.al [3] In this paper, authors develop and examine a low-energy adaptive clustering hierarchy (LEACH). This is a protocol architecture for micro-sensor networks that merge the scheme of energy-efficient cluster based data routing and media access with each other and with the application-specific data aggregation to attain efficient performance in terms of latency, network lifetime, and application-perceived quality.

Wendi Rabiner Heinzelman et.al [4] in this paper, the work glance at communication protocols, which have outstanding impact on the whole energy decadence of the network. On the basis of the findings that the traditional protocols of minimum-transmission-energy, direct transmission, static clustering and multi-hop routing may not be advantageous for sensor networks. LEACH (Low-Energy Adaptive Clustering Hierarchy) is a clustering-based protocol that uses random rotation of local cluster base stations i.e. cluster-heads to equally distribute the energy load among the sensor nodes in the network was proposed.

M. J. Handy et.al [5] this paper highlights on decreasing the power utilization of wireless micro-sensor networks. Hence, a communication protocol called LEACH is transformed. LEACH's stochastic cluster head selection algorithm is extended by a deterministic component.

I. Saha Misra et.al [6] Clustering technique in sensor nodes is an productive technique to attain the objectives instead of the traditional routing protocols such as minimum transmission energy routing, direct transmission or other relevant protocols which are applicable for static networks. Reorganizing this approach, the work proposed an enhanced energy efficient adaptive clustering i.e.EEEAC protocol stand on the leftover energy of each node inside the network.

V.Loscri et.al [7] the authors proposed a improvement to a popular protocol for wireless sensor networks named as LEACH. This is created for the wireless sensor networks where the end user ought to remotely observe the scenario.

Yongcai Wang et.al [8] authors proposed EDAC (Energy-Driven Adaptive Clustering) protocol, which is a modification over LEACH in heterogeneous wireless sensor networks. Unlike the homogeneous networks, if LEACH is applied in heterogeneous networks, the average energy dissipation mechanism will out-turn in prior death of "powerless" nodes and cannot utilize the primacy of the "powerful" nodes.

Weilian Su et.al [9] Advancement in electronics and wireless communications has empower the development of small size and low cost wireless sensor networks. The sensor network has wide range in numerous application domain (e.g., health, medical, military, home). There are many and unalike technical issues that researchers are resolving for different applications at present time. The present state of sensor networks is presented in the paper, where results and answers are debated under respective protocol stack layers. In this article 9 open research topics are represented and aspire to spot recent notices and developments in the field of wireless sensor networks.

Paolo Baronti et.al [10] Wireless sensor networks are developing technology and hot area of research for low cost, remote monitoring of broad scenarios and targets, and their significance has been imposed by recent dispatch of the IEEE 802.15.4 standard for both physical and MAC layers and the imminent Zigbee standard for the network and the application layers. Because of the rapid advancement of research on networking data management, energy efficiency and security issues in wireless sensor networks, and the requirement to differentiate with the resolutions acquired in the standards promotes the requirement for a survey in this field.

4. System Model

Sense the Random Direction of Region-

- In this system model, the sensing field with nodes presence positioned randomly square area is used to define the square region Fig.4 (a).
- The bi- dimensional area is developed to model the sensing region of directional sensor, which is shown in Fig.4 (b).

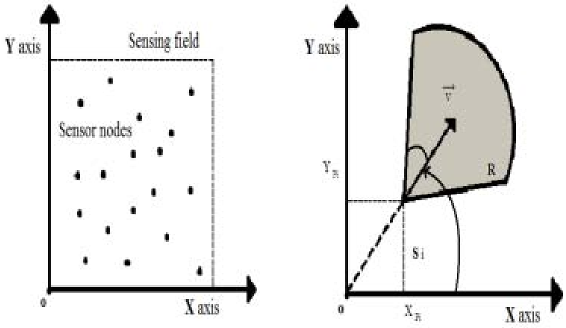

Figure 4: Sensing field and directional sensing field

The directional sensing model can be signified by (P_i, R, v, α) where P_i(x, y) signifies the position of nodes S_i, R is the radius of a sensing region that directs the maximum sensing range of nodes. → Is a unit vector called sensing direction that splits a sensing area into two parts.

The Sensing position is represented by α, where 2 α defines the sensor's field of view (FOV). Intersection angle among the sensing direction of nodes S_i and X axis is called the direction angle indicated by φi with the range of [0,2Π).

In the sensing field, nearby sensors nodes whose Euclidean distance to the present node is less than 2R?

It is sufficient to deliberate the consequence of neighboring sensors and adjust node's sensing direction.

It can be seen that S1 and S2 are the neighboring sensors of S_i, S3 is not the neighboring sensor because the distance between S_i and S3 is larger than 2R.

The grid part signifies the overlapping section of Si. The centroid of the overlapping region is represented by Cen.

5. Proposed Implementation

1. The segments for lower energy node consumption formulation & 2 categories of important things to estimate the k-coverage probability in a network with log-normal investigation (though the shadowing distribution can be slightly random and without coverage sensing area of higher energy shifting nodes.

2. Sensors node is used quadrature technique or a modest analytic formula for coverage sense with advance node energy.

3. The new composite high-dimensional important uses quadrature approaches for low dimensions and quasi-random integration for higher (n>2) computes 1-coverage probability for a network with Rayleigh fading (exponentially circulated with unit mean) and log-normal shadowing.

4. We present a modification of variables motivated by the dimensional spherical coordinates.
s1= u [sin θ1 sin θ2 . . . sin θn−1] 2/β
s2= u [cos θ1 sin θ2 . . . sin θn−1] 2/β
s3= u cos θ2 sin θ3 . . .sin θn−1] 2/β · · ·
sn = u[cos θn−1] 2/β .
Where qi = qi (θ i , . . . , θn−1) := (si/u) β/2 .
When β = 2 our system of synchronizes boils down to the regular n-dimensional spherical coordinates, whose Jacobin is J¯ (u, θ 1 . . . θn−1) = u n−1 Qn−1 i=1 sini−1 θi ; cf [21, eq. (1.5)]). By overview (or element belongings and the chain rule) our coordinate system has the corresponding Jacobian Mathematical addition of hyper geometric function 2F1 is used when the model has noise. A close-form answer with 2F1 is used in the no noise case.

5. Simulation characters are also included for valuation determinations. All network base stations are tried on a disk region. The disk region wants to be large sufficient to decrease "edge effects", which become more protruding when fading is included.

6. The Gaussian distribution assumes that there are a sufficiently large number of equal power multipath components with different and independent phase.

7. Gaussian and uniform model in wireless network can be used to track discourse, and to predict smooth discourse trajectories with applications to problem solving, which would be transmission of a data packet and its acknowledgment is preceded by sending and receiving packets between a pair by using Mac layer process for target tracking, after that sending and receiving nodes conversational analytics, to realize the framework which improve throughput and failure probability as compare to Gaussian distribution scheme by using MATLAB simulation.

We accept noise power −96dBm standardized by the base station power 62.2dBm which types W = 10−15.82. We reflect two values for the density of base stations: λ = 4.619km−2, which corresponds to a "OLSR" network deployment and λ = 0.144km−2 for a "suburban" one. We validate our approach by showing that the obtained results coincide with those of simulation with the latter approach being less numerically stable and much more time-consuming.

Algorithm for GD-EEHOS

1. Find neighboring sensors nodes in grid ;
2. If dead node occurrences;
3. Shift advance node due to dead node in another grid or area;

4. Set parameter for state=1
5. While (overlap==1)
6. Calculate OSR;
7. The Nodes are overlap optimal angle according to the Gaussian function

$$f_g(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-(x-a)^2}{2\sigma^2}}$$

8. The number of events is very large, then the Gaussian distribution function may be used to describe physical events. T
9. The Gaussian distribution is a continuous function which approximates the exact binomial distribution of events.
10. Ratio-of-uniforms is preferred only a few addition/multiplications and a log 1/1000 th of the time.
11. end
12. Calculate OSR;
13. while(OSR>=predefined threshold)
14. calculate **Gaussian** pseudo-random numbers given a source of **uniform** pseudo-random number.
15. y1 = sqrt(- 2 ln(x1)) cos(2 pi x2)
 y2 = sqrt(- 2 ln(x1)) sin(2 pi x2)
16. state=0;
17. *two* independent random numbers, x1 and x2, which come from a uniform distribution.
18. calculate OSR;
19. end

6. Result Analysis

In this existing system, in order to enhance the coverage area a Coverage-Enhancing Algorithm is used based on overlap sense ratio. By adjusting the sensing direction of the nodes, the coverage area is increased with the reduction of computational complexity. The performance of the GD-EEOS protocol is compared with those of the ECRM with-Coverage- ratio via an extensive series of simulations. The simulations using different protocols are ceased once all nodes run out of energy, and the comparison results generated. In the case the same network model in both approaches mentioned above is used to examine the protocols. The ECRM and the GD-EEOS both set their ***BS*** in a remote place, and each node can directly transmit data to the ***BS***. Such a condition, however, is not suitable for a real-world environment, because each tiny low-cost sensor node does not have such strong communication capability.

Table 1: Simulation Parameter

Simulation Parameters	*Values*
Network of field size (area)	200*200
Number of sensor nodes (N)	100
Number of advanced nodes (an)	0.2
Number of normal nodes(nn)	0.8
Energy of a normal node (E_0)	0.5
Location of the base station	X,y
Sensor network deployment type	Random
Simulator software Version	2012a
Mobility model	Random wave-point
Sensing range	100
Grid radius	3.5
Fading	AWGN

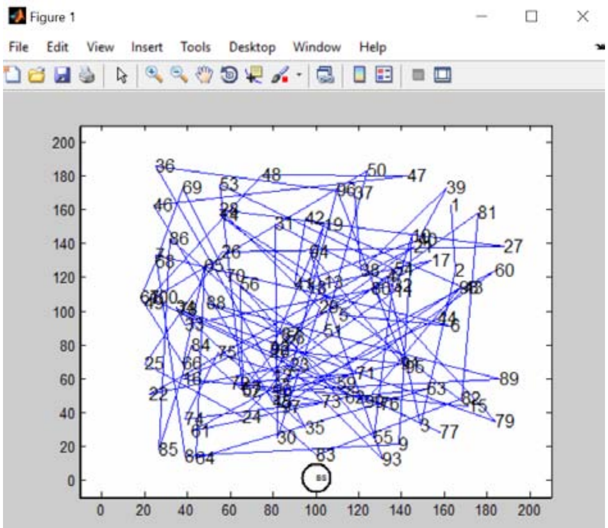

Figure 1: 100 Nodes with node shifting to void grid in 100 coverage range

In this figure shows the number of active sensor nodes (100) ***versus*** the simulation rounds. In this case, the ECRM and the GD-EEOS-Coverage-protocols lose their first node around the 200^{th} round. The proposed GD-EEOS-MCS protocol is able to maintain all sensor nodes alive till the 400 round, which is approximately 1.2 times longer than those generated by the ECRM and the GD-EEOS-MCS Coverage-protocols.

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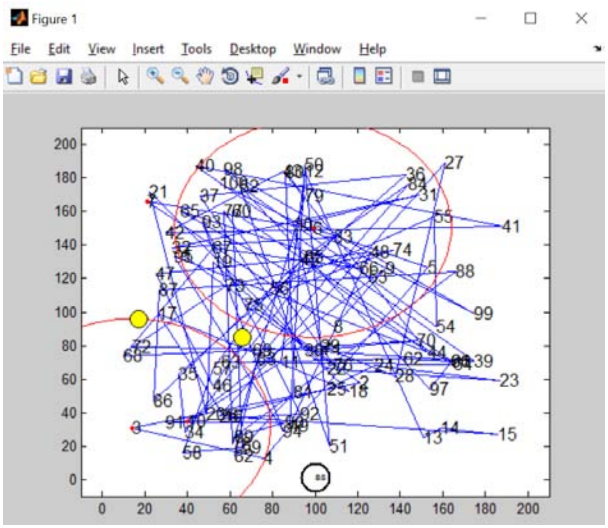

Figure 2: Node Sense the Weak Node Position in Grid

In figure 2 the advance nodes are shifting to other grid when occurrences of dead nodes. We see that a node is dead when its energy is less than the threshold level i.e., 0.5J in this case. The energy losses would be happened by transmitter, receiver and Data aggregation. The total number of rounds the network operates is until the last node in the network dies.

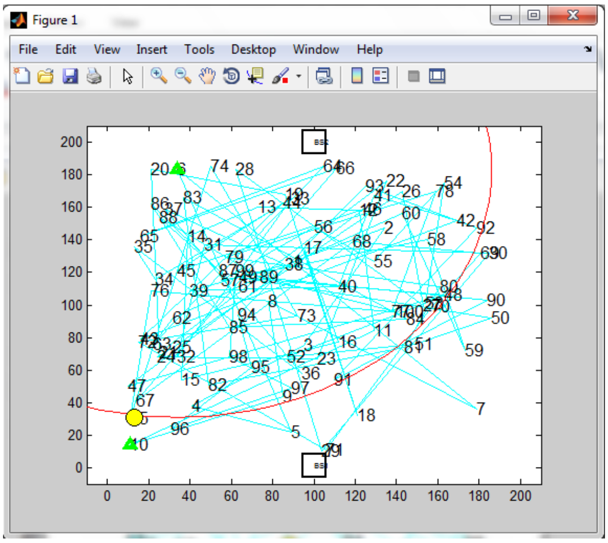

Figure 3: Higher energy node shifting towards the weak node

After shifting the advance node, showing 3 lower energy node areas in grid with respect to no of rounds which is 200. Showing above figure advantage that when a dead node is occur over the network or loss the node, the advance nodes shifted to other grid for enhancing the network lifetime to overall network.

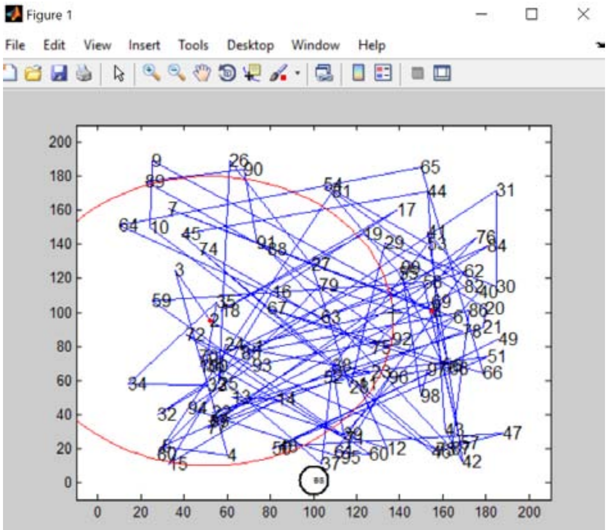

Figure 4: After shifting the nodes network update the node position

In figure 4 show the average minimum cover distance. The average energy coverage ratio consumption of each node ***versus*** the simulation Time stamp when using two different protocols. The average energy consumption of the GD-EEOS-MCS protocol steadily increases during the simulation due to its energy-balancing capability. Moreover, the comparison between the results yielded by the GD-EEOS protocols with compare to ECRM.

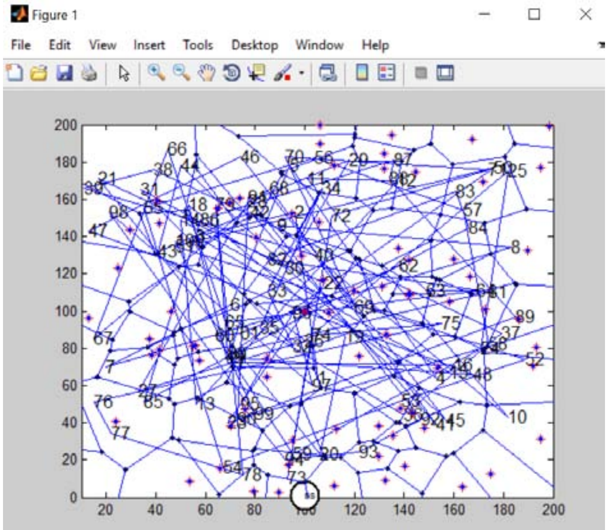

Figure 5: Hexagonal grid for 100 nodes

After updating entire network, it viewed like hexagonal grid.

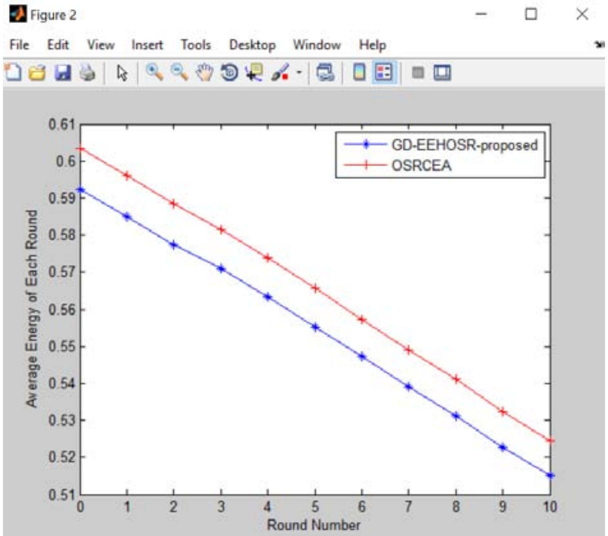

Figure 6: Average energy of each node w.r.t round number

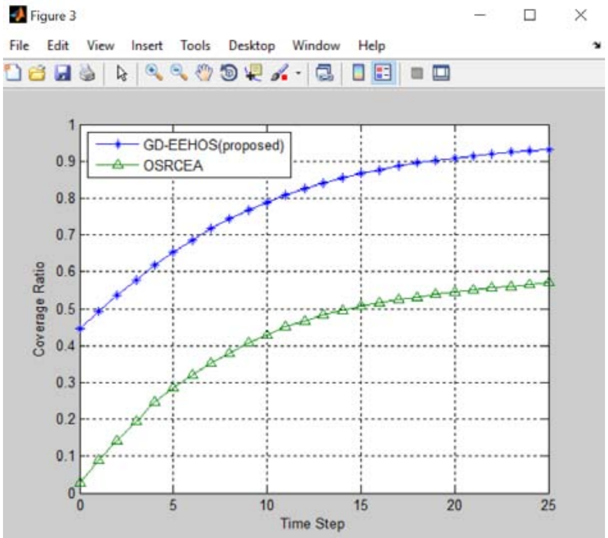

Figure 7: Showing Improvement Coverage ratio for GD-EEHO comparatively to Energy Coverage ratio

In figure 7, the coverage ratio getting improved with respect to time-step at initial stage to gaining better improvement when coverage increasing in response time as compare to grid based data aggregation (GBDAS).

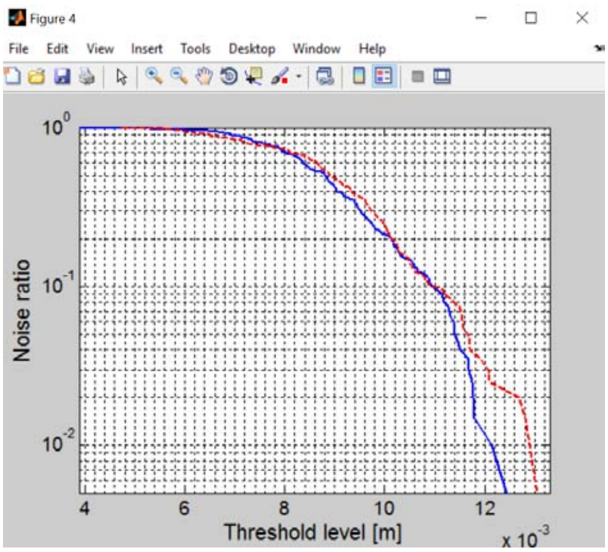

Figure 8: Failure probability of OSRCEA, VCFECA and GD-EEHOS

As per above graph, the GD-EEOS-MCS showing the less failure probabilty as compae to existing technique

7. Conclusion

In wireless communication systems have enabled the development of low-cost, low-power, multifunctional, tiny sensor nodes that can sense, process, and communicate with one another over random deployment distances. A sensor node by itself has severe resource constraints, including low battery power, limited signal processing, limited computation and communication capabilities, and a small amount of memory. Optimal resource management and assuring reliable QoS (qulity of service) are two of the most fundamental requirements in wireless sensor networks. Sensor deployment strategies play a very important role in providing better QoS, which relates to the issue of how well each point in the sensing field is covered. As we know based on the experimental records, coverage hole problems may exist in the sensor networks if the random deployment strategy is used to deploy the static sensor nodes. In this paper, we have proposed a grid-based with overlap sensing ratio recovery mechanism for wireless sensor networks. The whole network will be divided into grids to ensure the coverage ratio and connectivity.

In future work will focus on merging the algorithm with an energy consumption model to give deliberation to both coverage and lifetime performance in mobile and direction-rotatable directional sensor networks.

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