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Grid-Based Routing Using Fuzzy Inference System and Dijkstra Tree in Wireless Sensor Network

[1]Anupama Kaushik, [2]Subhash Chandra

[1]*M.Tech Scholar, Rajasthan College of Engineering for Women, Jaipur*
[2]*Assistant Professor, Department of Computer Science, Rajasthan College of Engineering for Women Bhankrota, Ajmer Road, Jaipur -302026*

Abstract—As we can see the prospective utilization of the wireless sensor networks (WSNs) different fields such as battlefield surveillance, management of disaster, surveillance of border security as the last few years. In given uses, sensor nodes in huge no. being deployed, those are generally unattended as well as work in parallel. Clustering is a vital form of method required to enhance sensor network lifetime through h decreasing the consumption of energy. It may also enhance the scalability of the network (NW). Sensor nodes being taken to be as the homogeneous form as the research in the field of WSNs been taken place, but few nodes are of various form of energy to prolong WSN lifetime along with its reliability. In this paper, we are using Grid-based technique of WSN which is compared with the previous work where we have found the enhancement in network lifetime and less consumption of energy as compared to that of previous research work.

Keywords—WSN; Clustering algorithms; Energy consumption,

I. INTRODUCTION

Energy use is a crucial issue in designing WSNs that usually depends on transportable energy sources such as electric batteries. WSNs are huge NWs of undersized integrated gadgets, all by means of sensing, computing, communication skills. Overall, they have been referenced in the last year1-3. Smart sensors were produced by the Micro-Electro-Mechanical System (MEMS) sensor era, such as clever sensor nodes being small devices thru unfinished energy, processing then resource computation. Smart sensors are energy-restrained strategies with more than just sensors, recollection component, computer, power source also actuator. In WSNs, sensor nodes (SN) consume limited their processing power, verbal exchange bandwidth and storage area over a period of time, requiring very green use of resources. [1].

In WSN sensor nodes that are often classified as disconnecting individual form units known as a cluster, clustering is utilized in WSNs it delivers community scalability, resource sharing, also effectual usage of resource constraints that give community topology constancy as well as strength-saving characteristics. Clustering method provides decreased communiqué overheads, and green aid allocations, for this reason, reducing the full energy intake and lowering interferences amongst sensor nodes. A massive range of clusters will also obstruct region by the minor scope of clusters & a completely less no. of clusters will weaken CH through the huge quantity of messages transferred through the members of the cluster. LEACH protocol is a hierarchical routing based primarily on clustering then discovering the most advantageous range of clusters within WSNs to store strength & improve community life [2].

Clustering is a key technique used to extend the lifetime of a sensor network by reducing energy consumption [10]. A sensor network can be made scalable by forming clusters. Leader of the cluster is often referred to as the cluster-head (CH). A CH may be elected by the sensors in a cluster or pre-assigned by the network designer. Various clustering algorithms have been specifically designed for WSNs for scalability and efficient communication. The concept of cluster-based routing is also utilized to perform energy-efficient routing in WSNs. In a hierarchical architecture, higher energy nodes (cluster heads) can be used to process and send the information while low energy nodes can be used to perform the sensing. LEACH [11], PEGASIS [12], TEEN [13] and APTEEN [14] are some of the clustering algorithms
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Clustering is basic for the sensor organize applications where enormous no. of specially appointed sensors are transferred for detecting purposes. Assuming every single sensor begins to suggest & receive a part in the transmission of information in the system, extraordinary information blockage &its effects will be experienced. This will empty energy rapidly out of sensor organize. Clustering is a strategy required to beat given issues. In the cluster network, a few sensors are chosen as cluster heads (CHs) for each cluster made. Sensor hubs in every group transfer their information to the

individual CH & CH totals information & advance them to the focal base station (BS). Clustering encourages proficient constrained energy need as of the sensor hubs & henceforth broadens arrange lifetime. In spite of the fact that sensor hubs in the clusters forwarded messages over a short separation (inside groups), huge energy is depleted from CHs because of the message is being transmitted over long separations (CHs to BS) contrasted with other sensor hubs in the cluster. Intermittent re-appointment of the CHs inside clusters dependent on their lingering energy is a conceivable answer for equalization power utilization of every cluster. Clustering builds the effectiveness of information transmission through the help of lessening the number of sensors endeavoring to forward information to the BS. Totaling information at CHs through intra-cluster correspondence additionally guides in annihilating information duplication. Clustering is proposed in view of its system adaptability, energy sparing and arrange topology steadiness [3]. Clustering plans lessen the correspondence overheads among the sensor hubs. Grouping calculations anyway have a few drawbacks, for example, extra overheads during CH choice, task and cluster development process. Several clustering algos have shown up in writing, as well as point of this overview is to feature their shared characteristics, qualities, weakness.

Given the significance of clustering for the WSNs, relaxation of the paper is prepared in subsequent shape; Section II offers a survey on state-of-artwork of clustering algorithms reported in the literature, section III discusses about proposed methodology of this research work, section IV is all about the result and discussion about the result using graphical and tabular methods and section V offers end of paper.

II. LITERATURE REVIEW

In [4], a genetic form of the algorithm being proposed to frame clusters as far as a couple of fitness of the parameters, for example, the entirety of the considerable number of separations from every sensor to BS. HEED intermittently chose CHs as indicated by a node lingering energy & secondary parameter, for example, the proximity of node to it is neighbors or degree of the node.

In [5], via observing the power of signal which is received from its nodes of neighboring side, every node assesses the number of dynamic nodes progressively and registers its ideal likelihood of turning into a CH

In [6], nodes with a high proportion of lingering energy to normal leftover energy of every node of neighbor into its group range that contains a huge likelihood to turn into the CH. This can more readily deal with energy conditions of heterogeneous form than existing clustering algo which choose the CH just dependent on the node's very leftover energy

Cheng et al. [7] consolidates a few distinctive weight measurements, for example, remaining energy, separation and node degree, and to think about those in CH choice procedure. The algo is adaptable and coefficients can be balanced by various systems.

Another method for turning CH is BS controlled unique clustering. In [8], nodes being occasionally re-clustered to an extent that: (l) just those nodes with higher levels of energy generate progress toward becoming CHs, (2) CHs are consistently dispersed, (3) clusters consist of roughly a similar no. of hubs. 1661 The CH in every group is haphazardly picked surrounded by those higher form of energy

In EECS [9], a space of created cluster development strategy is being projected toward delivering clusters having imbalanced extent in single-hop systems. weighted capacity is acquainted with let clusters more distant far BS consist littler sizes, in this way insufficient energy saved for the far-distance information transmission to BS.

EEUC [10] is being distributed form of a competitive algorithm, where a range of competitive is from the firm on the basis of the relative form of the value of utmost distance among sensors & sink. Consequently, having a short form of distance, the sensor consists of a smaller form of competition range so as to become CH.

[11] Present a near investigation of homogeneous and heterogeneous systems as far as generally speaking expense of the system, characterized as the whole of energy cost & equipment cost. They break down together single-hop as well as multi-hop systems. They can make usage LEACH as a delegate of a homogeneous type, single-hop NW& contrast LEACH besides a single-hop arrange in heterogeneous form. The creators infer that utilizing single-hop correspondence among SNs & CH may not be the best decision engendering misfortune list k for the correspondence of intra-cluster is enormous (k>2). They suggest a multi-hop rendition of LEACH convention (M-LEACH), demonstrate bags where M-LEACH outflanks protocol version for single-hop.

[12] Present methodical cost-based inquiry when combining single-hop, multi-hop correspondence technique, as well as giving o / c which could serve guidelines to select which mode should be used for defined environments. They also work on hybrid communiqué mode, which is a combined form of multi-hop modes, single-hop and is better financially from both modes.

Grid-Based Wireless Sensor Network

In the NW model, the state of a grid is being squared, &every square form shape is consisting of the zone. Lattice n×n form of the grid from every arrangement of the nodes. The quantity of rows &columns is signified through n×n. The matrix shows to one side to the right and through and through; as it were, it is a mix of rows & columns. The lines start from left side to right side (n), while sections begin from top & end base (n). The 2 x 2 matrix based NW model given in Figure 1, with R denoting to lines, while C denotes to the segments [4]. Figure 2 demonstrates the sensor NW field which has been isolated into networks. The system region has been partitioned into a non-covering square grid of equivalent sizes. Every grid ought to have a hub working whenever. The hubs of the matrix should work in a steady progression, so the life expectancy of the NW can be drawn out. Every grid is relied upon to have one hub, filling in as the head, and being in charge of the sending directing data & transmission of information packets. Routing is completed in grid based-system way. The motivation behind system dependent on multi-way routing packet is to empower the quick routing of packets, use and expand the energy of sensor hubs, while averting congestion of NW, or taking care of congestion of NW, in the event that it happens.

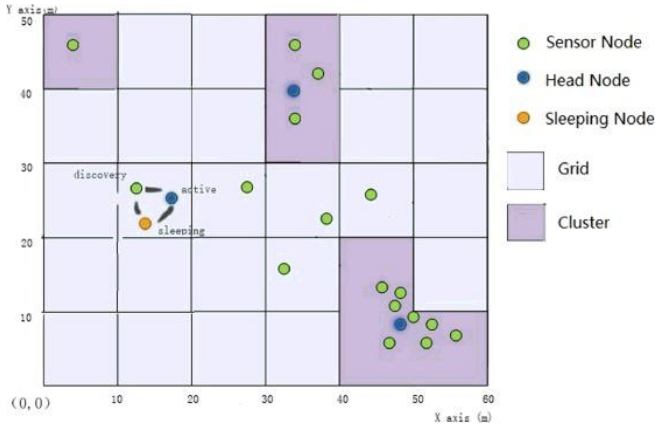

Fig 1 Grid based in WSN

III.PROPOSED METHODOLOGY

In the proposed methodology, we are applying a Sugeno Fuzzy Inference System (FIS) and Dijkstra algorithm. FIS is used for the election of Cluster head and the Dijkstra algorithm is used for making minimum spanning tree for providing the efficient tree structure for the shortest path to deliver our data.

The setup as well as phase of steady form. In the phase of setup, WSN is divided into clusters (nodes having groups). In every cluster, the given node those acts as CH. In steady-state, every member in the cluster (Non-CH nodes) sense &transfer data to the CH in systematic order. Every sensor node into the cluster consists of its self-time to transfer the sensed from the data to the CH.

Given section being working on so-called Sugeno, or Takagi-Sugeno-Kang, techniques of fuzzy implication. Being Presented 1985 [16], it's related to Mamdaniways in several forms. The 1st2 shares of the process of fuzzy inference, fuzzing the i/p&using fuzzy operator, are same. The key difference among the Mamdani&Sugeno is that Sugenoo/p functions of association can be linear or it can be endless.

The usual rule in a model named as Sugeno fuzzy consumes procedure

- If Input 1 = x also Input 2 = y, then Output is z = ax + by + c

Aimed at Sugeno model having zero-order, level of output z is being constant (a=b =0).

zi yield concentration of every rule is weighted via shooting rule's power wi. For example, aimed at AND rule thru Input 1= x too Input 2= y, shooting force is

wi= AndMethod (F1(x), F2(y))

Wherever $F_{1,2}(.)$ is membership functions having i/p 1 & 2. The ending o/p of the scheme being weighted by an average of each rule o/p, calculated as

$$\text{Final Output} = \frac{\sum_{i=1}^{N} w_i z_i}{\sum_{i=1}^{N} w_i}$$

Benefits of Sugeno Method

• It's effective in computational form.
• It performs well having linear techniques (for eg PID control).
• It performs better in having optimization & adaptive methods.
• It assured output external continuity.
• It's well suitable to be precise form of study.

Dijkstra Algorithm

Dijkstra's Algorithm allows us to calculate the direct method amid a node & every another node in the graph.

- At 1st iteration, the algorithm searches the nearest node from source node those need to be a source node neighbor.

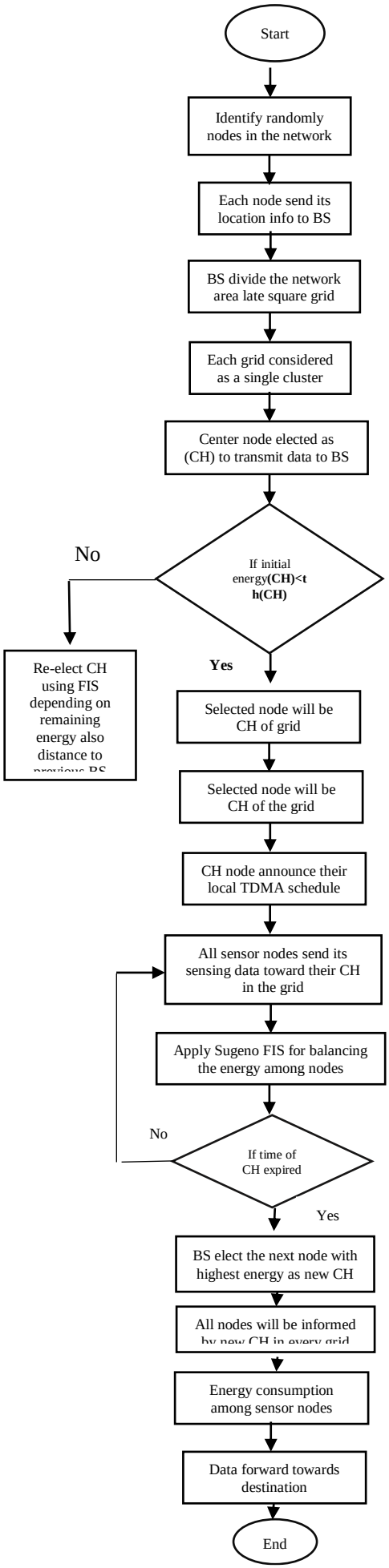

Fig 2 Flow diagram of FIS

- At 3rditeration, the third-closest side of a node from a source node. Given node need to be either the neighbor of source node or else one of the first 2 nodes which are closest.
- This keeps on going until the iteration of the Kth side, the algorithm searches the 1stk closest nodes starting source node.
- At 2nditeration, the algorithm searches the second-closest node starting from the source node. Given a particular node need to be either the neighbor of the source node or closest node create in 1st iteration.

Figure 2 shows the working of this research work, where we can see the working of the model. Here the election of CH is done by Sugeno FIS. The first center node of every cluster being elected as CH of clusters. If the initial energy of CH is less than the threshold (70%) value then selection will be done by FIS.
The screens below show the result comparison of the base and proposed work. Scenario 1 and 2 are the GUI of base and propose work respectively.

IV.RESULTS AND DISCUSSIONS

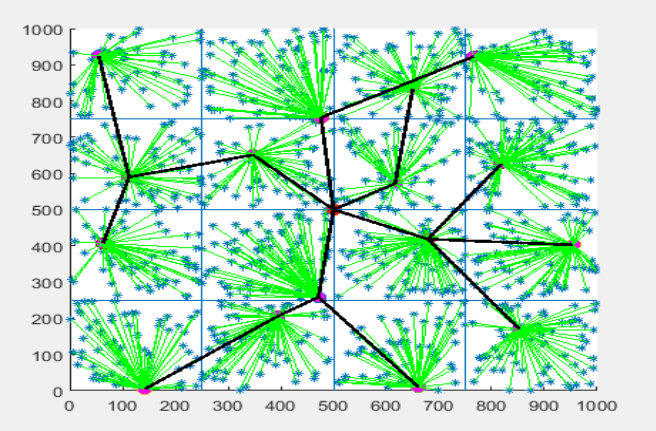

Fig 3 GUI of Scenario 1

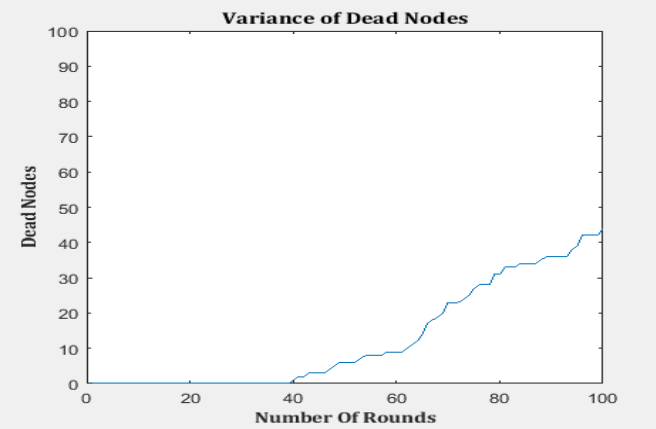

Fig.4The no. of dead nodes in each round previous work

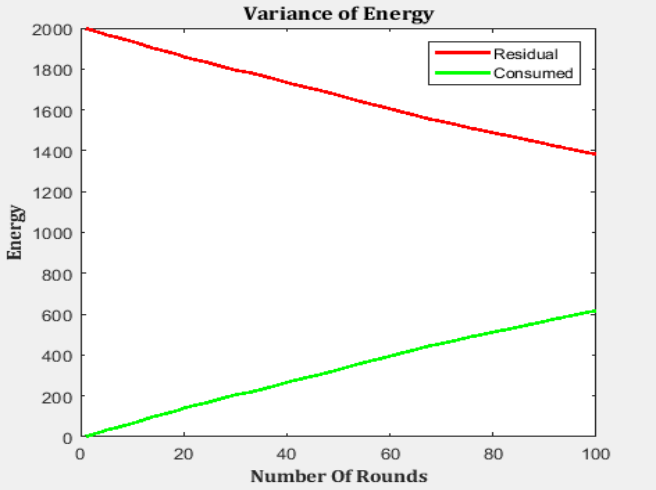

Fig 5 Energy consumption and residual energy of previous work

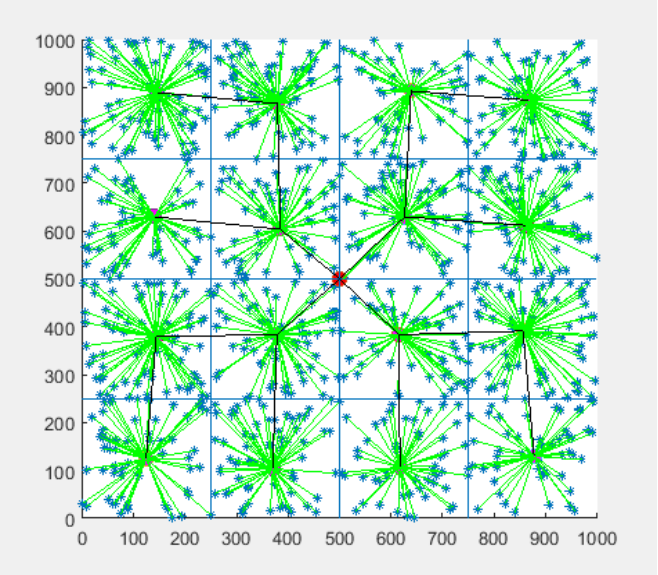

Fig 6 GUI of Scenario 2

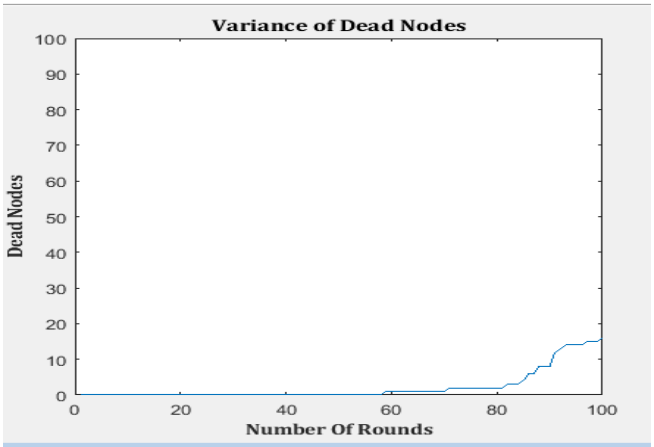

Fig 7 No. of dead nodes in each round in the current round

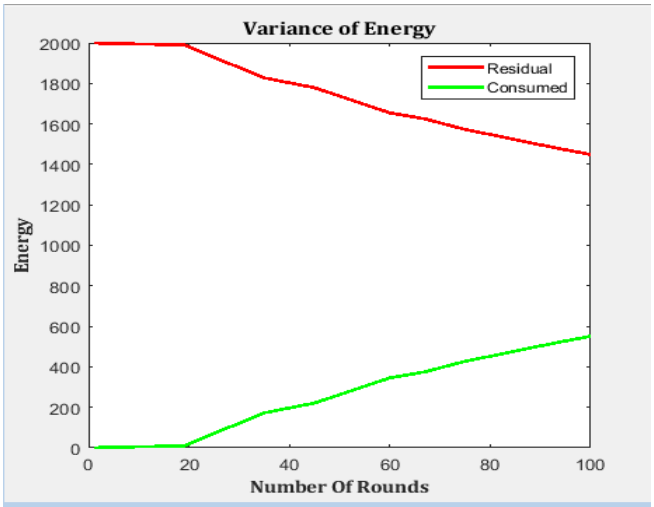

Fig 8 Energy consumption and residual energy of current work

V. CONCLUSION

A grid-based clustering algorithm in the WSN reduces the consumption of energy as well as resolves the problem of balancing the energy as it distributes load & energy consumption between each node in NW. Grid topology offers a high form of reliability with the decreased cost for a long time of transmission. As soon as NW implementation with these two algorithms, it is denoted with the aim of using a single cluster in each grid form having efficiency with the increased energy. It takes care of load balancing, clustering overhead as well as the energy efficiency of the routing problems

mutually. It makes sure that an increasing figure of energy nodes is being taken in use for sensing region as well as forwarding the data it can decrease their overhead to increase the extent also the prolongs NW lifetime. Further, grid-based CH algorithm creates well in case of enhancing the lifetime of the NWbygenerating better throughput as well as residual energy, reduce the consumption of energy in comparisons to the grid-based random form of clustering in WSN.

In the results we can see the First Node Dead Round is at 40, by using FIS, First Node Dead (FND) Round is 59. Energy consumption in previous work is 0.006179 Joule and that of present work is 0.005513.

REFERENCES

[1] Y. Ming, K. K. Leung, and A. Malvankar, "A dynamic clustering and energy-efficient routing technique for sensor networks," IEEE Trans. Wireless Commun., vol. 6, no. 8, Aug. 2007, pp. 3069-3079.
[2] Q. Zhao, 1. Tong, and D. Council, "Energy-Aware Adaptive Routing for Large-Scale Ad Hoc Networks: Protocol and Performance Analysis," IEEE Trans. Mobile Computing, vol 6, no. 9, Sep. 2007, pp. 1048-1059.
[3] 1. Cheng, D.Qian, and W. Wu, "An Energy-Efficient WeightClustering Algorithm in Wireless Sensor Networks," FCST 2008, pp. 30-35.
[4] S.D. Muruganathan, D.C.F. Ma, R.1. Bhasin, and A.O. Fapojuwo, "A centralized energy-efficient routing protocol for wireless sensor networks," IEEE Radio Commu., Mar. 2005, pp. s8-sl3.
[5] W. B. Heinzelman, and S. Soro, "Prolonging the lifetime of wireless sensor networks via unequal clustering," Proc. the 19th IEEE International Parallel and Distributed Processing (IPDPS), 2005.
[6] M. Ye, C. F. Li, G. H. Chen, and 1. Wu, "EECS: An Energy Efficient Clustering Scheme in Wireless Sensor Networks", Proc. IEEE Int'! Performance Computing and Communications Conference (lPCCC), 2005, pp. 535-540.
[7] 1. Chengfa, Y. Mao, C. Guihai, and W. lie, "An energy-efficient unequal clustering mechanism for wireless sensor networks," IEEE 1663 International Conference on Mobile Adhoc and Sensor Systems Conference, 2005.
[8] S. Lee, H. Choe, B. Park, Y. Song, and C. Kim, "LUCA: An Energy-efficient Unequal Clustering Algorithm Using Location Information for Wireless Sensor Networks," Wireless Personal Communications, 2011, vol. 56, no. 4, pp. 715-731.
[9] V. Mhatre, and C. Rosenberg, "Homogeneous vs heterogeneous clustered sensor networks: a comparative study," IEEE Communications Society, 2004.
[10] V. Mhatre, and C. Rosenberg, "Design guidelines for wireless sensor networks: communication, clustering, and aggregation," Ad Hoc Networks, 2004, vol. 2 no. I, pp. 45-63.
[11] AI-Karaki, 1. N. and A. E. Kamal, "Routing techniques in wireless sensor networks: a survey," IEEE Wireless Communications, Dec., 2004, vol. II, no. 6, pp. 6-28.
[12] N. A.Pantazis, and D. D. Vergados, "A survey on power control issues in wireless sensor networks," IEEE Communications Surveys & Tutorials, 2007, vol. 9, no. 4, pp. 86-107. A. Kartit, A. Saidi, F. Bezzazi, M. El Marraki & A. Radi, "A new approach to intrusion detection system", Journal of Theoretical and Applied Information Technology, Vol. 36, No. 2, 2012, pp. 284-289