iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2 **Issue:** IV **Month of publication:** April 2014

DOI:

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

Grid Based Coverage Algorithm Using GPSR In Wireless Sensor Network

[1]ANCY EMMANUEL, [2]PRIYADHARSINI.C

[1]Post-Graduate Student,Department of Computer Science and Engineering,Karunya University, India

[2]Assistant Professor,Department of Computer Science and Engineering,Karunya University, India

Abstract- ***Maintain long network lifetime of the wireless sensor network without affecting either coverage or connectivity is one of the issues in WSN. Redundant nodes in dense sensor network of the WSN wastes large amount of energy during deployment. An approach mentioned In this paper solve these issues with the help of virtual square grids and greedy perimeter stateless routing (GPSR) .The dividing method helps to divide the sensing area of each sensor node into square grids. The target node is a redundant node if all the grids' centers are covered by its neighbors. In greedy forwarding location information of the sink node is firstly tracked out and we send the data from the source node to the sink node without waiting for the reply. In some situations where the greedy fails then the perimeter forwarding is used to forward the data packets .The GPSR helps to improve the life time of the network by avoiding unwanted energy wastage of redundant nodes during data transmission. The proposed dividing method and GPSR not only guarantee that the monitoring area is covered by sensors completely but also decrease the computational complexity and achieve best performance with fewer active nodes. In the aspect of average coverage degree and the number of active nodes, grid based coverage algorithm using GPSR is close to VSGCA, CCP, ERPC and better than Ottawa, in the aspect of time and space complexity. Compared with other algorithms it can achieve better quality of service.***

Keywords— WSN; Coverage; Connectivity; Redundant node; Active node; GPSR; VSGCA

I. INTRODUCTION

A Wireless sensor networking is a collection of numerous sensors and they are connected with each other for performing the same function collectively. WSNs are used to monitor the environmental changes. They are also useful for military, medical, and scientific applications etc. Coverage is one of the most important areas in WSNs. It is defined as a measure of how well and for how long the sensors are able to observe the physical space. The ability of the sensor nodes to reach the data sink is known as the connectivity of the WSNs. If a group in which all of the nodes have the same capabilities then it is called homogeneous group otherwise it is heterogeneous group.

One of the major aims of the design of WSNs is how to save energy and prolong the network lifetime at the same time of meeting user sense demand. In most deployments of sensor nodes battery replacement is not feasible. So conserve energy and prolong battery life is important. Failures are occurs in WSNs due to the harsh environment conditions. Redundant sensor nodes are one of the most important sources of faults in WSNs. So By eliminating the redundant nodes and use minimum number of active nodes to achieve the coverage, connectivity and higher performance of the WSNs is the major aim of this work.

The rest of the paper is organized as follows. Section 2 gives the previous related works. Section 3 describes the proposed system in detail. In Section 4 describes the simulation results and discussions Finally, Section 5 concludes the paper.

II. RELATED WORKS

The coverage is the one of the most important feature in WSNs. Here we include several algorithms and techniques that address's coverage, connectivity and performance issue in WSNs. In [1] introduces Artificial Bee Colony algorithm for dynamic deployment of Wireless Sensor Networks. The artificial bee colony algorithm achieves high performance by increasing the coverage area of the network and is developed by

ISSN: 2321-9653

taking forging behavior of honeybee swarms as model. In [2] introduces Energy Efficient Ant Colony Algorithms for Data Aggregation in Wireless Sensor Networks. One of the most effective swarm intelligence that is applied in wireless sensor network is ant colony optimization. In [3] introduces connectivity coverage algorithm for area monitoring using wireless sensor networks. This connectivity covering algorithm will keep a subset of nodes as active to maintain the coverage and it will keep minimum number of nodes as active to achieve the coverage and also it minimizes the energy consumption of the network. In [4] proposed the maximum coverage set calculated algorithm for WSN area of coverage. K-Cover algorithm can prolong network lifetime. All the nodes are divided into K coverage node set and each coverage node set can cover the entire area. In [5] proposed Grid Based Wireless Mobile Sensor network Deployment with Obstacle Adaptability. Suppose an obstacle came over the target field it should be managed carefully during deployment. To achieve full connectivity a self deployment scheme implemented. In [6] proposed a multi objective hybrid optimization algorithm. The major aim of this approach was to solve the Dynamic coverage and connectivity problem in flat WSNs. It combines multi objective and global on-demand algorithm that helps to improve the coverage and connectivity problem in flat WSNs. In [7], introduces Voronoi diagrams and graph theory in order to achieve full coverage for WSNs. In [8] builds upon and extends the work of [7]. This paper provides an optimum best coverage path that consuming the least amount of energy and it use Delaunay triangulation to solve the coverage problem. In [9], introduces Coverage Connectivity Protocol (CCP) using geometric analysis for providing better the relationship between coverage and connectivity.

III. PROPOSED SYSTEM

A grid based coverage algorithm using GPSR is proposed here. Each sensor node divides its sensing range into virtual square grids. If the neighbor nodes cover all the grids of the sensor node then that node is a redundant node. The GPSR is used for improving the node scheduling process

.

A. OVERVIEW OFGRID BASED COVERAGE ALGORITHM USING GPSR

In wireless sensor networks, the node is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. Number of Nodes are created depends on the application. Communication between two unconnected nodes is achieved through intermediate nodes. Every node that falls inside the communication range *r* of a node *u*, is considered reachable. Since wireless sensor networks change their topology frequently and without prior notice, routing in such networks is a challenging task. Position-based routing algorithms eliminate some of the limitations of topology-based routing by using additional information. They require information about the physical position of the participating nodes in the network their availability. Position based routing is mainly focused on two issues. A location service is used by the sender of a packet to determine the position of the destination and to include it in the packet's destination address and a forwarding strategy used to forward the packets.

In the position based routing algorithm the forwarding will start as greedy forwarding and when it fails the graph is to be planarized first using the above method. In this method the neighbors of both u and v are considered. In this algorithm a set of all the neighbors of v is taken and now when u sees any witness w in between u and v it will first check that whether w is a neighbor of v or not. If w is not a neighbor of v then no need to delete the edge between u and v and it can continue as normally but if w is a neighbor of v then the condition is to be checked as specified in the given algorithm. If the condition is true, w is in shaded line between u and v then the edge is deleted. Then after planarizing the graph it gets switch over to perimeter routing and the packets are forwarded in the perimeter mode till a point is reached where it can switch back to greedy forwarding, at this point packets will be forwarded in the greedy way. The greedy forwarding helps to easily get the neighbor information and it does not wait for a replay from the sink node to send the packets from the source node. In the case of weak signal strength less TTL time we cannot reach all the uncovered neighbors by using the coverage approach of transferring data suppose if any redundant node present in the node then we need to avoid that node also it consumes more energy to do so but in the case of greedy forwarding approach it first identify the sink node location so that it can efficiently transfer the data without consuming large amount of energy it helps to achieve better quality of service.

Vol. 2 Issue IV, April 2014

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

1. CONSTRUCT THE SET OF GRID'S CENTER

In wireless sensor networks, the node is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. No of Nodes are created depends on the application. Communication between two unconnected nodes is achieved through intermediate nodes. Every node that falls inside the communication range *r* of a node *u*, is considered reachable.

The sensing area of each node is divided into square grids. If all the grids' centers are covered by its neighbors, the target node is a redundant node. Through the center of circle (x_i, y_i), make a diameter which parallels to x axis. Divide the diameter into N parts. Then we are find out how much of sensing area of sensor node is covered by its neighbors. However, although the neighbors cover the grid's center, they cannot guarantee that the area of this grid is covered fully. So we are calculating the determining distance in order to avoid the blind spot occur in the sensing area. The determined distance d(p, uj) is the distance between point v and point w, l is the length of grid's side.Node u_i is the target node, $u_j \in N(u_i)$. $C(u_j)$ is the set of covered grids.

$$d_p(u_j) = \sqrt{Rs^2 - (|Yp - Yi| + l/2)^2} - l/ \quad (1)$$

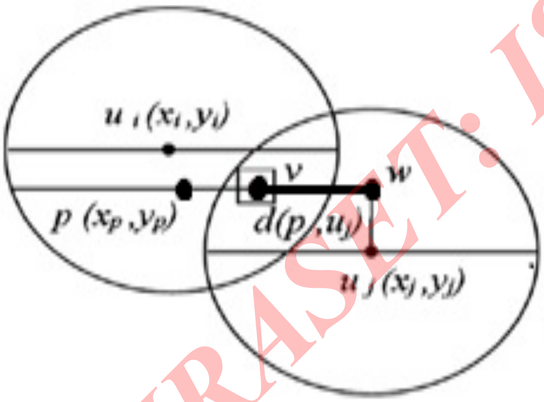


Fig. C.1.1. Calculating determining distance

2. REDUNDANCY COMPUTING

Algorithm: - f-redundancy computation (node i)
1: loop
2: Update the neighbor set N (i)
3: for all n belongs to N (i) do
4: for all m belongs to N (i) and n = m do
5: the no.of f_{mn} ways m and n can communicate
6: if f-redundancy < f_{mn} then
7: assign f-redundancy=fmn
8: end if
9: end for
10: end for
11: Wait for a period
12: end loop

3. MAINTAINING COVERAGE

1. Construct communication neighbor lists.
2. Update the value of each node.
3. Select an initial node *u*.
4. Calculate the determined distance of communication neighbor lists.
5. Update the determined distance of sensor node.
6. Find out maximum determined distance of sensor node in order to avoid redundant node
7. Repeat steps 4, 5, and 6 until in the set of grid's centers some elements have not been scanned.

4. MAINTAINING CONNECTIVITY

Algorithm: - Disconnection discovery (node i)
1: if Connection to a neighbor *j* is lost and F-redundancy < minimum required redundancy then
2: for all n belongs to N (i) do
3: Send a discovery message to n with depth d=0
4: end for
5: if j is not found then
6: Request a node for repair
7: end if
8: Remove j from N (i)
9: end if

5. GPSR

Maintenance:- all nodes maintain a single-hop neighbor table, Use Relative Neighborhood Graph or Gabriel Graph to make the graph planar
At source:- mode = greedy
Intermediate node:-
if (mode == greedy)
{
greedy forwarding;

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

```
    if (fail)
      mode = perimeter;
  }
 if (mode == perimeter)
 {
   if (have left local maxima)
      mode = greedy;
   else
            (right-hand rule);
 }
```

IV. SIMULATION RESULTS AND DISCUSSIONS

In this section, we will verify the superiority of our proposed algorithm through simulations. Simulations are carried out in NS2, and the effect of grid's length, the number of inactive nodes, the blind spot and the average coverage degree of the grid based coverage algorithm using GPSR are explored in the simulations.

1. The Number of Active Nodes

The number of active nodes by grid based coverage algorithm using GPSR is about 23.With the increasing of deployed nodes' number, it maintains the same number of active nodes. Number of nodes versus active nodes is shown in fig V.1.1

2. Average coverage degree

Average coverage degree versus Number of nodes is shown in Fig. V.2.1 for grid based coverage algorithm using GPSR, Ottawa, CCP and ERPC, the number of deployed sensor nodes is from 100 to 600.The average degree of our algorithm is about 2, the same as VSGCA, CCP and ERPC. In contrast, the average degree of Ottawa is between 4 and 6, and increases with the number of deployed sensor nodes.

3. Square Grid Length

In the monitoring area, the number of deployed sensor nodes is set to 200. With the increasing of grid's side, it is evident that the number of active nodes increases in Fig. V.3.1. But for each sensor node, the number of iterations in grid based coverage algorithm using GPSR would also decrease (in Fig. V.3.2).The complexity of algorithm would be reduced and the performance of WSNs would be improved. Hence, the value of grid's side is an important trade- off parameter between algorithm's performance and algorithm's complexity. It is suitable for varied case of WSNs should depend on application's requirement.

4. Blind Spot

The coverage algorithm should guarantee that the monitoring area is covered by sensors fully In Fig. V.4.1, no matter how many sensor nodes are deployed in the area grid based coverage algorithm using GPSR, VSGCA, Ottawa and ERPC do not cause any bind spot. However, for CCP, the fewer the deployed sensor nodes are, the more blind spots are. This is because the eligibility rule of CCP is an insufficient condition and would turnoff some non-redundant nodes.

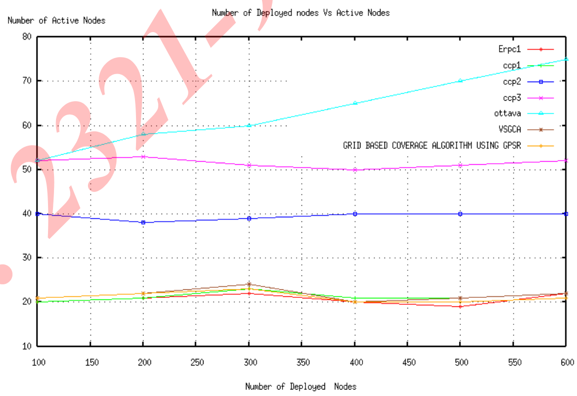


Fig. V.1.1 Number of deployed nodes Vs Active Nodes

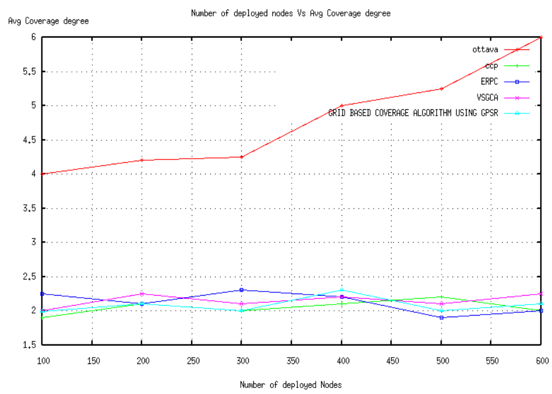


Fig. V.2. 1 Number of deployed nodes Vs Avg Coverage Degree

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

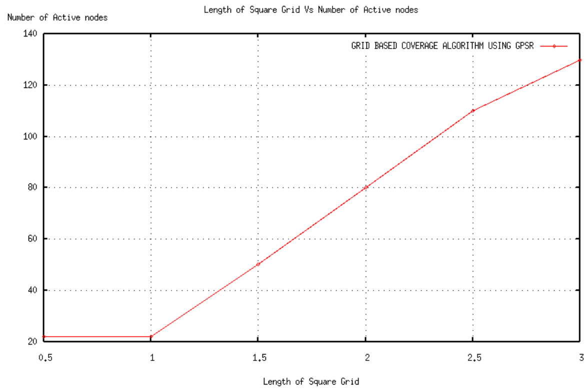


Fig. V.3.1.Length of Square grid vs Number of Active Nodes

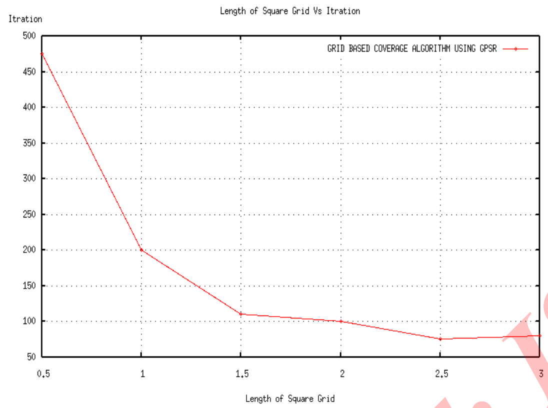


Fig. V.3.2. Length of Square grid vs Iteration

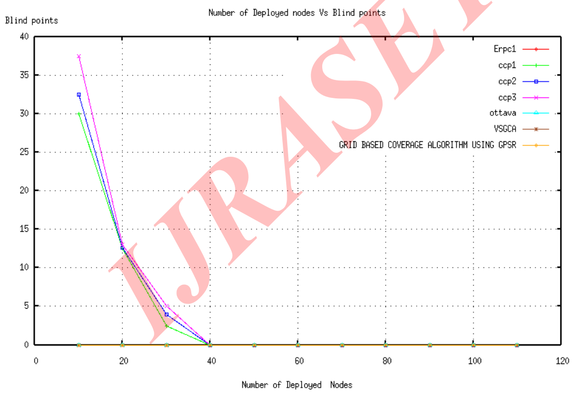


Fig.V.4.1 Number of deployed nodes vs blind points

V. CONCLUSION

The grid based coverage algorithm using GPSR the basic idea of this algorithm is that the sensing area of each sensor node is divided into square grids. Whether the target node is a redundant node is equivalent to checking whether all the grids' centers are covered by its neighbors. The grid based coverage algorithm using GPSR has two characteristics, one is dividing method which constructs the set of grids in a node, and the other is determined distance. The proposed dividing method and determined distance not only guarantee that the monitoring area is covered by sensors fully but also decrease the computational complexity and achieve best performance with fewer active nodes. From theoretical proofs and simulations, in the aspect of average coverage degree and the number of active nodes, grid based coverage algorithm using GPSR is close to Ottawa and better than CCP, ERPC. A location based routing algorithm is used to improve the forwarding of the packet. A location service is used by the sender of a packet to determine the position of the destination and to include it in the packet's destination address. A forwarding strategy used to forward the packets.

REFERENCES

[1] Celaozturk, Karaboga, Beyza Gorkeml, "Artificial bee colony algorithm for dynamic deployment of wireless sensor networks", Turk J Elec Eng & Comp Sci, Vol.20, No.2, pp.101-1030 ,2012

[2] Chi Lin, Guowei Wu, Feng Xia, Mingchu Li, Lin Yao, Zhongyi Pei, "Energy efficient ant colony algorithms for data aggregation in wireless sensor networks", Journal of Computer and System Sciences 78 (2012) 1686–1702, 2011 ELSEVIER.

[3] Sudip Misra, Manikonda Pavan Kumar, Mohammad S. Obaidat, "Connectivity preserving localized coverage algorithm for area monitoring using wireless sensor networks", Computer Communications 34 (2011) 1484–1496, 2011 ELSEVIER.

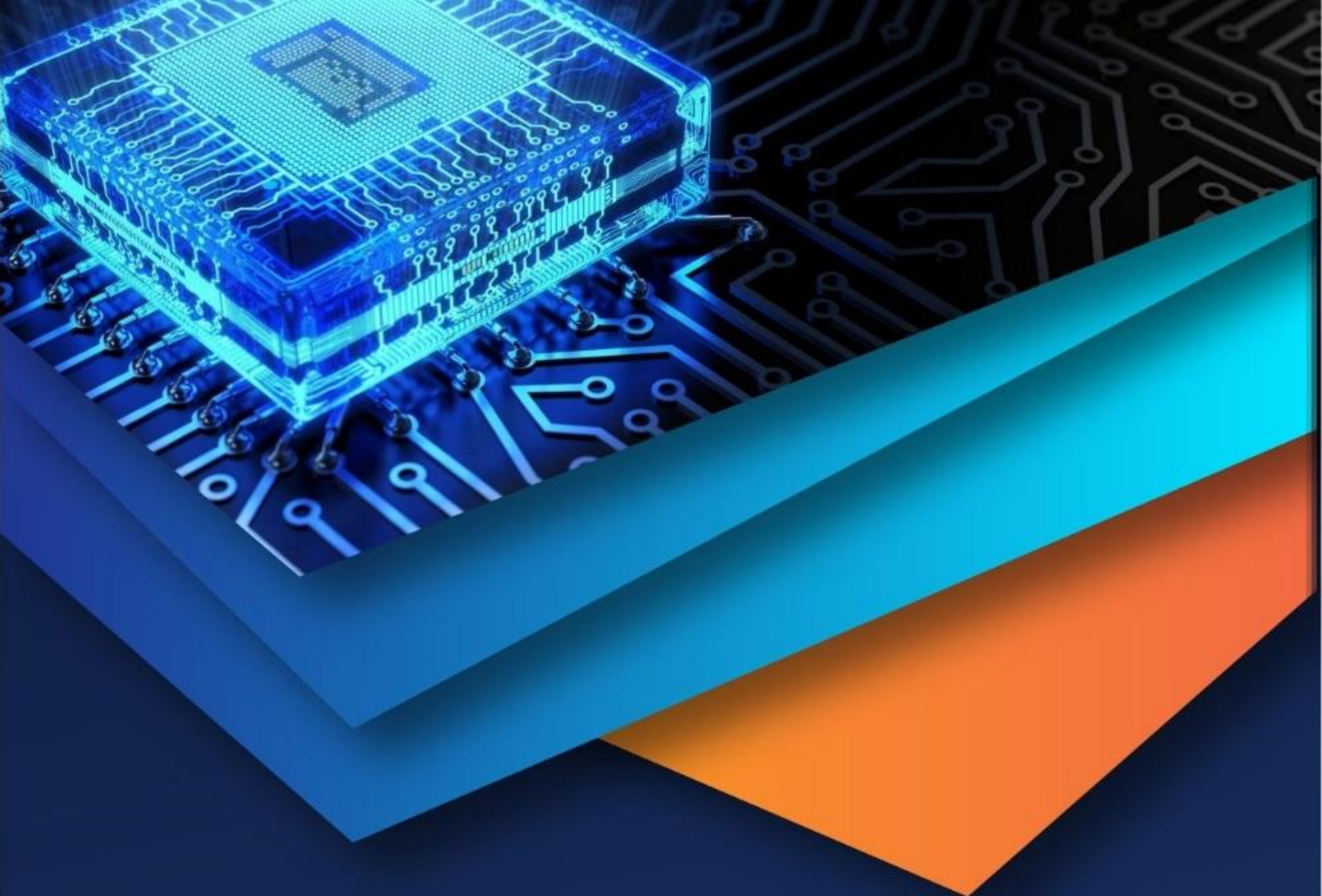
[4] Xin He,Hua Yang,Xiaolin Gui, "The Maximum Coverage Set Calculated Algorithm for WSN Area Coverage", JOURNAL OF NETWORKS, VOL. 5, NO. 6, JUNE 2010.

[5] Mr. Mayur C. Akewar and Dr. Nileshsingh V. Thakur,"Grid Based Wireless Mobile Sensor Network Deployment With Obstacle Adaptability", International Journal of Wireless & Mobile Networks (IJWMN) Vol. 4, No. 5, October 2012.

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

[6] Flávio V. C. Martins, Eduardo G. Carrano, Elizabeth F. Wanner, Ricardo H. C. Takahashi, Member, IEEE, and Geraldo R. Mateus,"A Hybrid Multiobjective Evolutionary Approach for Improving the Performance of Wireless Sensor Networks", IEEE SENSORS JOURNAL, VOL. 11, NO. 3, MARCH 2011.
[7] Yanheng Liu , LongxiangSuo, DayangSun , AiminWang, "A virtual square grid-based coverage algorithm of redundant node for wireless sensor network", Journal of Network and Computer Applications 36 (2013) 811–817,2012 ELSEVIER.
[8].Chun-Hsien Wu, Kuo-Chuan Lee, and Yeh-Ching Chung(2006),"A Delaunay Triangulation Based Method for Wireless Sensor Network Deployment", Proceedings of the 7th International Conference on Mobile Data Management (MDM'06) 0-7695-2526-1/06,2006 .
[9].Deng J, Han YS, Heinzelman WB, Varshney PK. (2005) "Scheduling sleeping nodes in high density cluster-based sensor networks.", ACM/Kluwer Mobile Networks and Applications ;10(6):825



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY