



Optimal Sensor Deployment in Homogeneous & Heterogeneous Wireless Sensor Network

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ABSTRACT: Optimal sensor deployment is necessary for homogeneous and heterogeneous wireless sensor deployment. It recommends to spatial communication among wireless sensor nodes and its intermediate node. Currently sensor deployment strategy leads towards more delay in packet transmission in wireless network. In order to resolve minimum cost for packet transmission proposed system design an approach of optimal sensor deployment. Which present an idea for implementing optimal sensor deployment in homogeneous and heterogeneous wireless networks. Proposed approach implements a Restrained Lloyd (RL) algorithm and a Deterministic Annealing (DA) algorithm to optimize sensor deployment in both homogeneous and heterogeneous WSNs. This paper also investigates a dynamic deployment using non-uniform sensor densities to gain energy consumption balance and maximize network lifetime. This can be achieved by First Order Radio Model where Movement algorithm is used for optimal sensor deployment to balance energy resource. Sensor nodes can move several times where network life time in divided into some rounds. Proposed simulation result shows that network lifetime can be improved in both homogeneous and heterogeneous wireless network. The deployment and topology control of such heterogeneous WSNs that involve the sensor nodes with different communication or sensing area have been manipulated. Furthermore, proposed system makes enhance work by multiple sink nodes in wireless sensor network. Location wise predetermined sensor deployment. The simulation results show that proposed sensor deployment technique does not com-promise with other performance metrics like end-to-end delay and throughput, while obtaining the proposed solution. Finally, all the comparative results show that this scheme is supremacy over the competing systems.

KEYWORDS: Sensor deployment, DA, RL.

I. INTRODUCTION

Wireless sensor networks (WSNs) gather information from the wireless network deployed in the environment and sends to virtual information world, such as computers. Appropriate wireless sensor deployment improves monitoring and controlling the networks environment. To achieve their tasks, WSNs need to solve two requirements like

(i) Sensing in the target area and

(ii) Communication between the sensor nodes.

WSNs are deployed to gather information about environment such as temperature, humidity, voice and mane more. But, the collected data is useless if it cannot be transmitted to the access point (AP) and to the outside information. When sensors are connected by wire lines, the connectivity is provided automatically. Proposed system implements the sensing and connectivity together and redefines the goal of WSN for optimal sensor deployment to collect information. In specific, we develop a general model for both homogeneous and heterogeneous WSNs. Proposed technique focus on area detection and mobile sensors. To evaluate sensing quality, the binary coverage model and the probabilistic model



International Journal of Innovative Research in Computer and Communication Engineering

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are used in WSNs. This work implements a dynamic deployment using non-uniform sensor network to achieve energy balance and longer network lifetime. Different from the previous study, the sensor placement is dynamic which can change the sensor densities according to application. A mathematical model is proposed to synthesis the expected sensor density in the monitored area. Here, first introduce the system model for both homogeneous and heterogeneous WSNs and formulate the problems of sensing and connectivity. The density requirement may also change after a network has been created due to changes in application modes or environmental conditions. Some regions may create or transmits more packets than others for some needful events still their locations are not near the sink node. For example, after an intruder is detected, the region in the location of the intruder may generate more messages. Proposed system develops a model which provides minimum distortion with Maximum Coverage. We develop node deployment strategy in Dimensional environment. By considering node deployment we can deploy maximum number of sensor nodes in a limited range that results in optimization of network lifetime. This work can derive number of homogeneous and heterogeneous sensors to be deployed along with their deployment region. Deployment system in WSN explore each sensor node sends its data to the relay node having maximum energy and then it is send to the nearest sink node of the WSN.

II. REVIEW OF LITERATURE

A proposed system emphasizes the literature study of different sensor node deployment methods are defined In [2] this researcher have introduced the maximum coverage for network deployment problem in wireless sensor networks and reasons of properties of the problem and its solution space. This work proposes an efficient genetic algorithm with a novel normalization method. To cover a wide range of a target area with a minimum number of sensors and can be accomplished by efficient deployment of the sensors. Sensor coverage models measure the sensing capability and quality by capturing the geometric relation between a point and sensors. An approach to find out least covered regions in a sensor network where further sensor deployment is expected.

In [3] this work researcher tackles the problem of optimal surface deployment problem on 3D surfaces, aiming to achieve the highest overall sensing quality. It introduces a new model to formulate the problem of sensor deployment on 3D surface. It considers stationary and homogeneous sensors deployed on surfaces. The accuracy of their gathered information based on the distance between the sensor and the destination point to be sensed. It presents the optimal solution for 3D surface sensor deployment with minimized overall unreliability.

In [4] Researcher determines the optimal deployment of nodes by taking into consideration the density in monitored area. By using this dynamic deployment scheme, energy balance can be achieved. A mathematical model is proposed to compute the desired sensor density in the monitored area. Sensor nodes send their messages to a sink located centrally. The density distribution optimization problem is solved by determining number of nodes in each sub-region as a result, longer lifetime is achieved.

In [5] researcher proposed techniques for balanced energy depletion for a primitive geometric node distribution (GND) and a primitive energy proportional node distribution (EPND). Three novel non uniform node distribution strategies are proposed. Strategy I is able to fully achieve energy balance. Strategy II achieves the longest network lifetime through the EPND and a simple sensing/ non sensing switch scheduling. Strategy III requires the fewest sensor nodes among the three proposed strategies.

The distributed wireless video scheduling with delayed control information (DCI) is proposed in [6]. It considers two classes of DCI distributions first the class with finite mean and variance and second is a general class that does not employ any parametric representation. A distributed scheduling scheme is proposed to achieve performance bound by making use of the correlation among the time-scale control information.

S. Halder and A. Ghosal [7] designed an approach for deployment strategy for energy balancing using customized Gaussian distribution in a layered network architecture by discrediting the standard deviation. Standard deviation has been identified as the parameter responsible for energy balancing. The target of the strategy is achieving energy

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balancing and enhancing network lifetime. Node deployment using Gaussian distribution is widely acceptable when random deployment is used.

Optimal Sensor deployment together with a realistic terrain model is proposed in [8]. It assumes only those terrain features which can be modeled by convex polygons. Optimal sensor deployment together with a realistic terrain model makes sensor deployment more practical and robust. Results show that the number of sensors, their locations and the node density change in presence of obstacles.

In [9] researcher proposed a curve based sensor deployment for coverage barriers in WSN. For improving barrier coverage performance, we introduced a concept of distance-continuous curve, and provided an algorithm to obtain the optimal sensor deployment when the deployment curve is distance continuous, and an algorithm which can attain close-to-optimal sensor deployment when the deployment curve is not distance continuous.

Two deployments strategies-Hexagonal Deployment Strategy (HDS) and Diamond Deployment Strategy (DDS) are proposed in this system [10]. A Radar Sensor Network (RSN) is efficiently deployed to find multi-target within a given network deployed area with required detection performance and energy consumption. It propose two decision fusion rules over pass-loss fading channel in multi-hop RSN to improve the performance of multi-target detection.

In [12] described the sensor deployment problem as a source coding problem with distortion reflecting sensing accuracy. When the communication range is limited, a WSN is divided into several disconnected sub-graphs under the condition that every sensor node location should coincide with centroid of its own optimal sensing region. In this a backbone network is designed for communication between sensor nodes and cluster node in the wireless sensor or mobile adhoc network [12].

III. SYSTEM ARCHITECTURE

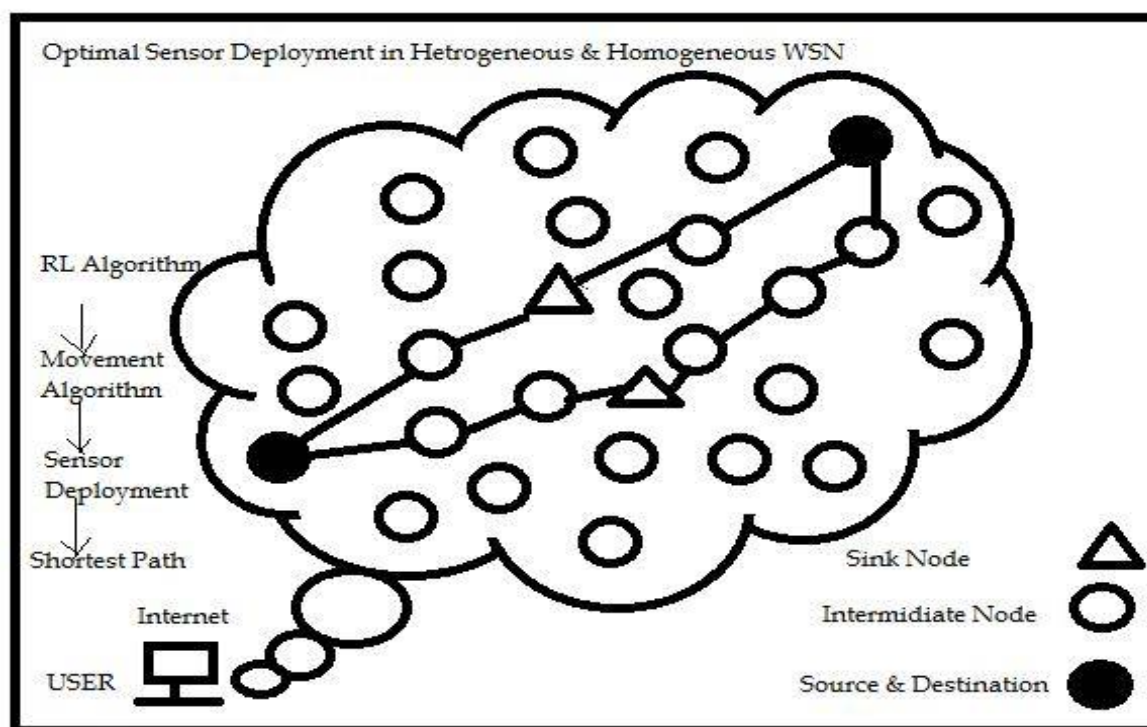


Fig. 1. Optimal Node Deployment Architecture



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Proposed optimal sensor deployment provides the use of our RL Algorithm. The algorithm implemented in between two steps: (i) Sensors in the backbone network move one by one. Each sensor in the base network calculates its own approximate desired region $L_i(P)$ and moves to a critical location with maximum local performance. Sensors outside the backbone network move randomly and check if there is a path to the AP. Unlike the conventional Lloyd algorithm, these new locations may not be the centroid of the partition regions; (ii) The target area, Q , is partitioned to WVDs for sensors in the backbone network, $S(P)$. The final distortion only considers sensors in the backbone network. Initially, two strong sensors and four weak sensors are consisted in the backbone network. A Sensor Nodes in network chooses a Relay Nodes as a receiver which is nearest to SN and has the highest residual energy for sending its data. If there is more than one receiver node with the same highest residual energy, one of them is chosen randomly. Next, the receiver RN employs the same procedure to choose the next receiver RN in the network for sending its data. This process repeats till the data arrives at the sink node.

IV. MATHEMATICAL MODEL

Sensor nodes are distributed within two dimensional region covered by a set of regular hexagonal cells. The network coverage area (ab) is divided into N number of layers and each layer is divided into M number of RHCs with radius r . In every a layer where $i=1, N$. A layer is called either odd or even based on the value of i . For example, are the even layers whereas are the odd layers. Further, the sink is assumed to be located at one corner of the network area and responsible for collecting imagery data from the SNs. A RHC in the network is identified by (where $i=1, N$ and for each $i, j=1, M$) which indicates the j th cell in layer- i . For example, the RHC identifies the 224th cell in layer-4. Here, $i=1$ indicates the layer nearest to and $i=N$ indicates the layer farthest from the sink, whereas $j=1$ indicates the cell nearest to and $j=M$ indicates the cell farthest from the sink within a layer. B_i is defined as the boundary between two consecutive layers- layer- i and layer- $(i+1)$.

For target tracking sensor deployment in wsn Euclidean distance between points p and q is the length of the line segment between two sensor points. A vector can be described as a directed line segment from the origin of the Euclidean space (vector tail), to a point in that space (vector tip). If we consider that its length is actually the distance from its tail to its tip, it becomes clear that the Euclidean norm of a vector is just a special case of Euclidean distance: the Euclidean distance between its tail and its tip. The distance between points p and q may have a direction (e.g. from p to q), so it may be represented by another vector, given by Shortest Distance Calculation In proposed Radio Resource Controlling model designed to implement energy efficient wireless communication by shortest path routing.

Proposed shortest path routing uses Euclidean distance between two sensor is calculated using Distance

$$((x, y), (a, b)) = \sqrt{(x - a)^2 + (y - b)^2}$$

Where, Distance between two sensor node using their longitude and latitude that is x as longitude and y as latitude for first node and a is longitude and b is latitude for second node in mobile sensor nodes. Euclidean formula gives the distance for one to every another sensor in the same cluster for energy efficient packet transmission.

Throughput, or flow rate, is a calculation is used in operations management that allows a simulation to find what their output is in a given amount of time. This output can be in either a packet transmission time in network. The formula is based on Little's Law, which in essence is used to calculate the average number packet transmission in a stipulated amount of time. When the nodes are rearranged,

$$TH = I / T$$

TH is the throughput that proposed system calculated, or the average output of packet transmission within stipulated amount of time.

The time is most commonly illustrated per minute, hour, or day. I is the packets that are send within period of time.



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T is the total time that is required to complete packet trans-mission time.

A. Algorithms :

1. Steps Target Localization in to deploy sensor

```
Set loops=0;
Set MaxLoops=MAX_L_OOPS;
While(loops < maxLoops)

ForP (x; y)inHexGrid; x[a; width]; y[1; height] Forsis1; s2; s3:sk

CalculateCxy(Si; P )fromthesensormodel Using(d(si; P ); cth; dth; );

End IfcoveragerequirementaremetBreakwhileloop

End

End

Forsis1; s2; ;sk

CalculateFijusingd(si; sj); dth; wA; wR; CalculateFiAusind(si; PA1; ; PAnP ); dth;
CalculateFiRusingd(si; OA1; ; OAnO); dth; Fi = Fij + FiR + FiA; j[1; k]; j = i;

End

Forsis1; s2; ;sk Fi(si)virtuallymovessitoitsnextposition; End

Setloops = loops + 1; End
```

2. Sensor deployment in 3D by multi objective 3D environment

```
1: Initial Sensor deployment;
2: Determine the best individuals best1 best2 according to
objective1 objective2;
3: Divide the population into two sub-populations;
4: For each sub population do
Determine the fitness of each
Individual according to
Corresponding objective;
End for
```



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- 5: Roulette wheel selection for each sub population;
- 6: Combine and alter sub populations into temporary population
- 7: Perform recombination on temporary population
- 8: Perform mutation on temp-population;
- 9: Next generation= temp-population;
- 10: Inject best1 and best2 individuals into the next generation;
- 11: If stop criteria is not satisfied, Go to step 2;
- 12: Show results for objective1 objective2

3. Routing Algorithm:-

```
// on receiving ENERGYQUERYM SGfromnodei1 : ifIsRN(i)then
2 :AckEnergyInfo(ID);
3 : else
4 :DiscardMsg;
5 :endif
==onreceivingaDATAF ORWARDMSGfromnodej6 : k = SelectNextRN(q)
7 :ifIsRN(j) == TRUEthen
8 : Send(k; DATAF ORWARDM SG(data)) 9 : else
10 :DiscardMsg;
11 :endif ==onreceivingnomessage
12 : k = SelectNextRN(q);
13 : Send(k; DATAF ORWARDMSGk(selfdata))
```

V. SYSTEM OVERVIEW

In this system Sensor nodes are distributed in a In pro-posed system optimal sensor deployment with hexagonal cell based sensor nodes are deployed in both homogeneous and heterogeneous wireless sensor network. The proposed sensor deployment is to improve sensing performance, reflected by distortion and coverage. System model the sensor deployment problem as a source coding problem with distortion reflecting sensing accuracy. However, when the communication range is limited, a WSN is divided into several disconnected sub-graphs.To optimize sensor deployment in both homogeneous and heterogeneous WSNs proposed system uses hexagonal cell for sensor deployment, which tends to improve sense performance of WSN. Due to location wise sensor deployment node to node communication route can be decided efficiently. Proposed sensor deployment leads to accuracy model due to coverage area.



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A. Software Requirement Specification

1. Design Wireless sensor Network as Simulation
2. Determine network communication type i.e. Heterogeneous and Homogeneous.
3. Prepare routing table for prescribed source and destination.
4. Selection of optimal sensor nodes for energy efficient communication.
5. Optimal sensor deployment in WSN.
6. Heterogeneous and homogeneous sensors communication.
9. Secure routing by appropriate key management i.e. public key cryptography.
10. Energy efficient packet transmission.

In proposed work is designed to implement above software requirement. To implement this design following software requirements are used.

B. Platform

Operating System: Windows7

Front End : Java Swing (Simulation)

Tool : Eclipse Luna

C. Outcomes and success

Proposed system is designed using java swing component as simulator. Optimal sensor deployment is designed for maximize end to end throughput by reducing communication overhead in wireless sensor network. Proposed system achieves great performance for packet transmission in network.

D. Simulation Parameter

Parameter	Value
Simulation Time	500ms
Terrain Area	600*500
Time Arrival	32ms
Protocol	RRC based
No of Node	25,45,100

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E. Comparison with similar System

Goals	Existing System	Proposed System
Throughput	80%	90%
Network	Hop By Hop response	Queue based Response
Controller	Network Owner	Base Station Controller
Security	-	Sensor node authentication
Protocol	MAC	Radio Resource Control

VI. RESULT ANALYSIS

Optimal sensor deployment in dynamic wireless sensor network expected to explore simulation in the form of minimal sensor deployment evolve to maximize throughput in wireless packet transmission. Proposed system is expected node deployment with LLOYD Algorithm in shown in following figure2. Optimal sensor deployment improves the throughput for packet transmission, Optimal sensor deployment. Proposed predetermined sensor deployment leads to reduce delay for packet transmission.

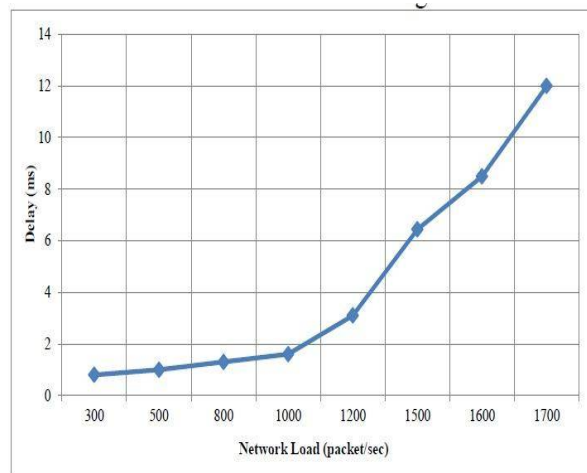
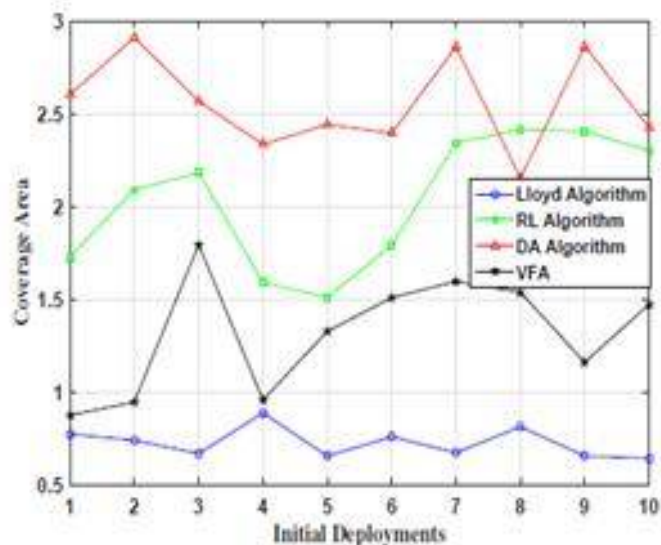


Fig. 2. Throughput for Sensor deployment



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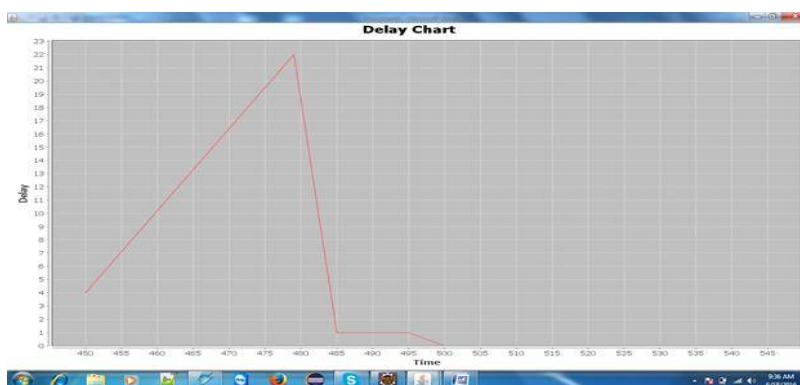
Fig. 3. Sensor Deployment

In this section performance metrics are used to evaluate performance of routing protocols and data dissemination protocols scheme when no in networking processing is performed and no caching is used.

VII. PERFORMANCE MEASURES

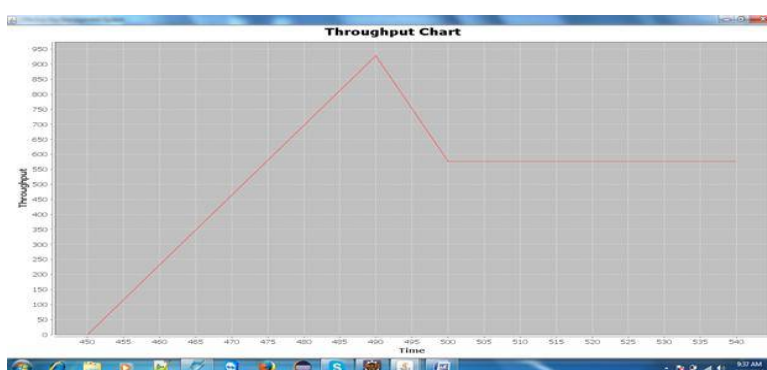
A. Delay Chart

This measure is used to reduce packet transmission in wireless sensor network or mobile adhoc network along



B. Throughput Maximization:-

Proposed system aims to improve throughput maximization by reducing packet loss during wireless communication. Optimal sensor deployment helps to maximize network.





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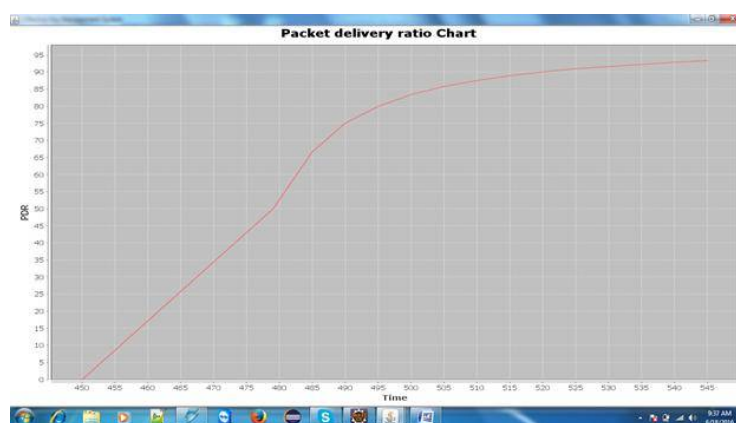
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C. Packet Delivery Ratio:-

Proposed wireless sensor network designed to improve packet delivery ratio at end to end sensor nodes. This measure verifies against packet loss during wireless communication between source nodes.



VIII. CONCLUSION

In dynamic wireless sensor network the deployment of sensors for three types of network in heterogeneous wireless sensor networks. The optimal sensor deployment and gradient are provided to find optimal sensor locations. Proposed model permits network deployment to find the most efficient density for sub-region to achieve energy balance and maximize the lifetime of network. Proposed system achieves target of network lifetime improvement by optimal sensor node deployment. Proposed movement algorithm tends to deploy sensors in limited area range so that they improve efficiency in both heterogeneous and homogeneous wireless communication. Proposed optimal sensor deployment does not limit transmission coverage area for sensor nodes. Clustering techniques are used for energy efficient packet transmission in a limited transmission range.

ACKNOWLEDGMENT

The authors would like to thank. The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.

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ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

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