International Journal of Information & Computation Technology.
ISSN 0974-2239 Volume 4, Number 16 (2014), pp. 1661-1666

http://www. irphouse.com

Enhancing Coverage Area in Self- Orienting Directional Sensor Networks

Premlata Sati[1], Parul Goel[2], Shubhashish Goswami[3]

[1]Department of CSE, Dev Bhoomi Institute of Technology, Dehradun, Uttrakhand
[2] Department of CSE, Dev Bhoomi Institute of Technology, Dehradun, Uttrakhand
[3] Department of CSE, Dev Bhoomi Institute of Technology, Dehradun, Uttrakhand
[1]08premasati@gmail. com, [2]Parulgoel_1990@yahoo. com,
[3]subh. goswami@gmail. com

Abstract

In this paper, we are going to discuss the fundamental problem of coverage in directional sensors network for rotatable angles. A directional sensors network constitutes of various directional sensors nodes. The main objective of the coverage problem is to amplify the area covered with as minimum as possible number of activated nodes. In this paper the sensors nodes considered here are armored with such devices that are able to rotate in any direction. The sensing and processing of sensors are done on the basis of overlapping FOV clustering. This paper presents an auto-rotation mechanism of FOV for each sensor node having an overlapped FOV, in order to maximize the coverage area in an interested region. This goal is achieved by revolving the FOV of two or more sensor nodes sensing the same region and hence avoids redundant sensing. Simulation results shows that proposed algorithm performs better as compared to the previous ones in terms of coverage area.

Keywords: Directional Sensor Nodes, Field of View, Overlapped Region

Introduction

Emergence of efficient and short range radio communication results in miniaturization of computing devices due to which an intense interest has been generated in wireless sensors network. Wireless Sensor Network s are formed as autonomous and self-organized systems of large number of compact, inexpensive, battery powered sensor nodes having ability to communicate with the base station. The communication can be either direct (single hop) or via other nodes (multi hop) around it in a cooperative manner. In other words a sensors network consists of large number of sensing nodes

randomly and densely deployed inside the phenomenon. In recent times sensor network have mesmerizes/gained tremendous research interest because of its vast potential application and hence increased interest in applications like environment sensing, video surveillance etc. Earlier CMOS cameras and microphones are used to capture multimedia content from the sensing environment and now it leads to promotes the evolution of multimedia wireless sensor networks. WMSNs are the network of devices that are wirelessly interconnected to retrieve video-audio streams, scalar sensor data and still images. Multimedia sensors in wireless multimedia sensor network (WMSN) are used in order to process and retrieve information in real time. Traget coverage in WMSN is a fundamental problem that has been addressed by many researchers. Most of the work in WMSN had already been done by taking the assumption of Omni-angle of sensing range of omnidirectional sensors. These sensor networks are principally meant to be used for assemble information concerning to the intended environment e. g., temperature, light humidity etc, and for sending this sensed data to the base station or sink. Wireless Multimedia Sensor Networks (WMSN) [1][2], should be able to process in real-time, retrieve or fuse multimedia data. In designing and implementation of any WSN energy conservation and network lifetime is one of the primary concern. Node clustering can be done to put forward the enhancement in efficiency and hence network lifetime. These clusters can be made on the basis of different criterions as per the demand of the problem. Nodes in WSN are generally deployed in a random fashion in the intended environment. We are here discussing the multimedia nodes, specifically the nodes or sensors equipped with camera called directional sensor nodes. Earlier the directional sensor nodes are supposed to be Omni-directed nodes, but when talking about monitoring an environment by these nodes we need to give them a proper direction (called FOV). The sensors are deployed in such a manner so that they dedicatedly capture information within a particular sensing range and hence we need to define certain direction or Field of View (FOV) to these sensors, so that we can achieve *Maximum Coverage with Minimum Sensors* (MCMS), as nodes are sensing the environment in particular dedicated region FOV specified to it

A multimedia sensor node has different sensing region as compared to the ordinary sensor nodes. Every node in Multimedia Sensor Network must have a Field of View associated with it and capture images lies only within the specified region. The target to be covered by the multimedia node can be far from the node itself. due to the non-coincidence among the nodes and sensing region, coverage mechanisms are not able to satisfy the requirements of WMSN.

In our paper, we present a mechanism through which the FOV of some nodes having an overlapped region auto-rotate so that the maximum coverage can be achieved.

2. Related Work:

Immense research have been done on various coverage problems in Multimedia Sensor Networks, coverage problems can be categorized into three subcategories: area coverage, barrier coverage and point coverage[2]. Most of the research work has been

done in area coverage problem where every point within the region is sensed by at least one node. Recently, the coverage problem in directional sensor networks has been gained a remarkable attention from worldwide researchers. There is a difference between target coverage and area coverage. Area coverage problem is related to the coverage performance of the covered region whereas target coverage is related to the coverage performance of the number of targets to be covered. Mao-Cheng and Wei-Fu-Lu[3] proposes an algorithm that constructs sectors of sensors based on targets within the sensing distance of sensors to gain higher coverage rate. In [4] the author presented a greedy solution called the *Face-Away (FA)* algorithm to achieve the maximal area coverage rate in the interested area. According to this algorithm a new working direction is calculated by every sensor node that requires only the neighboring sensor's position. *Face-away* algorithm does not perform better for area coverage problem.

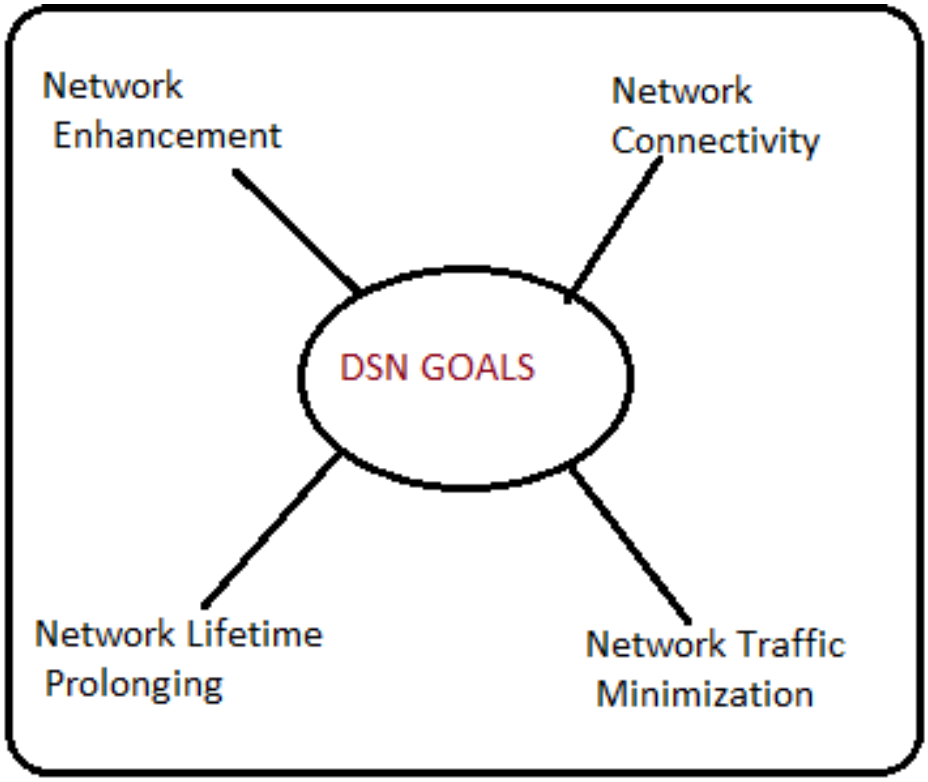

Fig. 1. Main goals in directional sensor networks.

3. Proposed Solution:

We first deployed certain number of directional sensors into the environment on random basis. Due to this random deployment there may be a case when more than one sensor sensing the same region as their FOV's got overlapped. If this situation exists we have a significant amount of loss in both network lifetime and coverage. To avoid this we introduce a scheme in which we cluster the nodes those are sensing the

same region or having their FOV overlapped. Two node have overlapped FOV's belongs to the same cluster. Now we have cluster of such nodes those are sensing almost same region. What we have to do is to re-direct or rotate the FOV of those nodes, in order to remove the overlapping in their FOV's. so that the high coverage and network Pro-longevity can be achieved. This can be done by calculating the intersecting points of the FOV with the boundary of the circle.

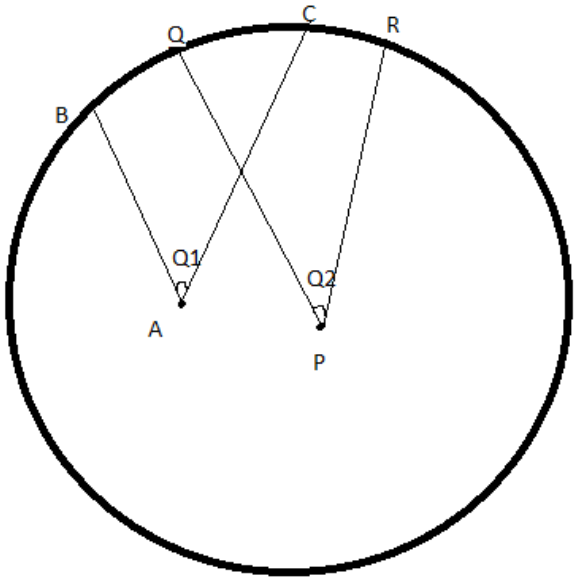

Figure 2. Initial FOV position

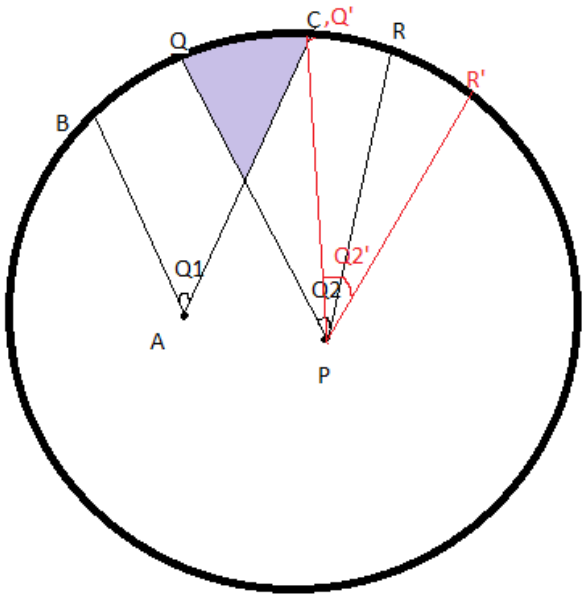

Figure 3. Rotated FOV

Once the intersection point Q is found, we can calculate equation of new line PQ', as the co-ordinates of P and Q' are known. After this we have all the values required for the generation of another line PR' to form re-oriented FOV, such as P(x, y), sensing radius Rs and angle Q (Where Q1=Q2). Now we have generated the second line of FOV by the same angle denoted by Q2'(Q1=Q2=Q2'). By self-orienting the nodes having overlapped regions we can achieve the goal of MCMS in turn.

4. Implementation and Results:

In this section of the paper, the experimental results shown are based on three parameters: number of nodes to be deployed, rounds and dead nodes. Here we have taken results of both the approaches i. e. direct approach and self oriented approach. As you can observe that plots are basically, "Dead Nodes in the Network vs. Nodes Deployed vs. Rounds"; it simply means that how many Nodes are dead in the network over round when the network has already been deployed with a definite number of nodes.

More illustratively, as in instance#1, at the round# 20, the network is left with 148 alive nodes as 102 nodes are dead when the network was deployed initially with 250 nodes. Similarly, in instance#2, against the initial deployment of 250 nodes, only 38 nodes are dead (or equivalently 212 nodes are alive) at the end of 20th round.

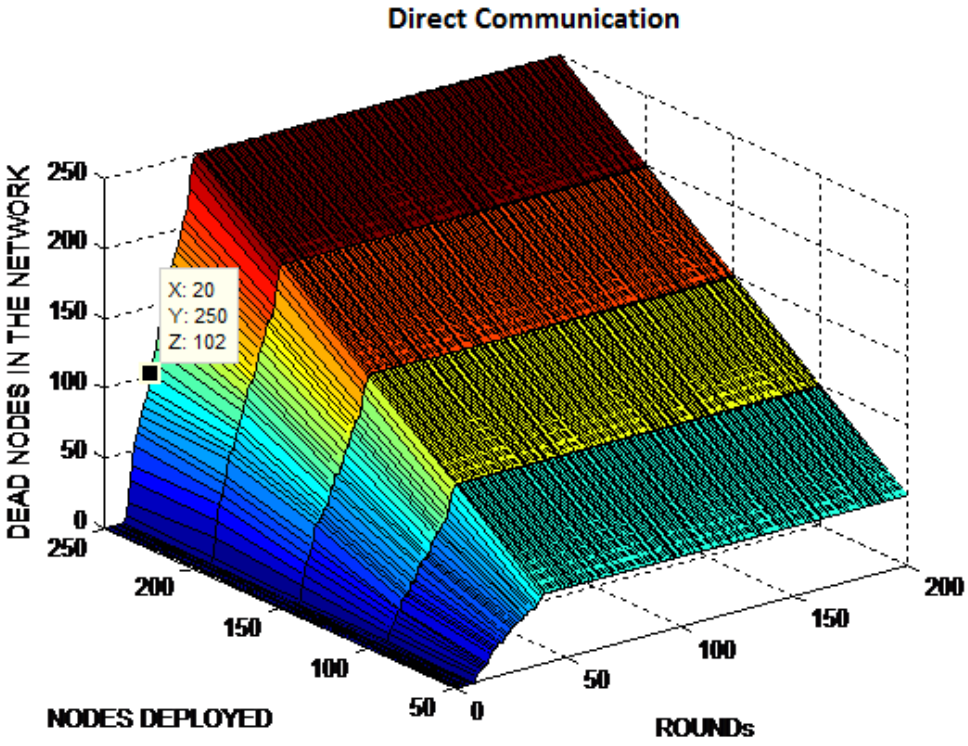

Figure 4. Direct Communication Approach

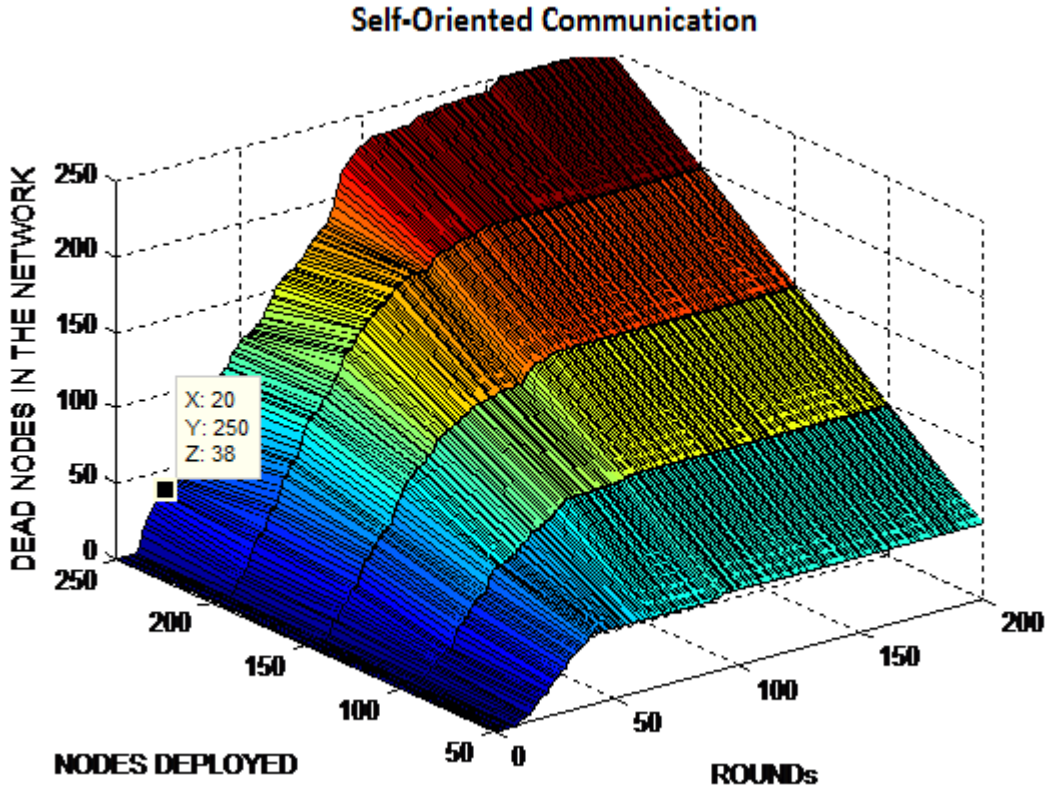

Figure 5. Self-Oriented Approach

Reference:

[1] F. Akyildiz, T. Melodia, and K. R. Chowdhury, *A survey on wireless multimedia sensor networks*, Computer Networks (Elsevier) Journal, Vol. 51, pp. 921-960, March 2007.

[2] I. F. Akyildiz, T. Melodia, K. R. Chowdhury, *Wireless multimedia sensor networks: applications and testbeds*, Proceedings of the IEEE, Vol. 96, no. 10, pp. 1588 – 1605, October 2008.

[3] Mao-Cheng Wu, Wei-Fu Lu, *On Target Coverage Problem of Angle Rotatable Directional Sensor Networks*, 2013 Seventh International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing.

[4] Kandoth, C., Chellappan, S., *Angular Mobility Assisted Coverage in Directional Sensor Networks*, International Conference on Network-Based Information System, NBIS 2009.

[5] I. Akyildiz, T. Melodia, K. Chowdhury, *Wireless Multimedia sensor Networks: application*, International Conference on Network-Based Information System, NBIS 2009.