Dynamic Point Coverage in Wireless Sensor Networks: A Learning Automata Approach

M. Esnaashari[1] and M. R. Meybodi[1,2]

[1] Soft Computing Laboratory, Computer Engineering and Information Technology Department, Amirkabir University of Technology, Tehran, Iran
{esnaashari,mmeybodi}@aut.ac.ir
[2] Institute for Studies in Theoretical Physics and Mathematics (IPM)
School of Computer Science, Tehran, Iran

Abstract. Dynamic Point coverage in wireless sensor networks is the problem of detecting some moving target points in the area of the network using as little sensor nodes as possible. This can be accomplished by designing a dynamic schedule for making nodes on and off in such a way that in each slice of time, only nodes which can sense the target points in that period are on. In this paper, we propose a novel method for this problem using learning automata. Each node is equipped with a learning automaton which will learn (schedule) the proper on and off times of that node based on the movement nature of a single moving target.

Keywords: Dynamic Point Coverage, Wireless Sensor Network, Learning Automata, Scheduling.

1 Introduction

Point coverage in wireless sensor networks is the problem of detecting some stationary or moving target points in the area of sensor network using as little sensor nodes as possible. This problem can be addressed in many different ways such as designing a deployment strategy which can best address the criterion of minimum number of required nodes [1, 2, 3], rearrangement of nodes assuming movement ability for them [4, 5, 6] and designing a suitable scheduling strategy for making nodes on and off in such a way that in each slice of time (period), only nodes which can sense the target points in that period are on [7, 8, 9]. The last solution is superior to other ones since it can deal with changes occurred in the topology of the network and also prolong the lifetime of the network by allowing only a portion of nodes to be in on state at each slice of time. To our best knowledge, in all decentralized approaches for scheduling, some sort of notification messages are exchanged between nodes in on and off states. Such solutions have two drawbacks; one is the overhead of these notification messages and the other is that nodes in off state should have the ability to receive these messages, and hence they cannot power off their receiving antenna. This leads to high energy consumption even in off periods according to [12].

In this paper, we propose a novel method for addressing the problem of dynamic point coverage in wireless sensor networks using learning automata. This solution can