Chapter 17
A Uniformly Distributed Mobile Sensor Nodes Deployment Strategy Using Swarm Intelligence

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ABSTRACT

WSN consists of spatially dispersed and dedicated sensors for monitoring the physical conditions of the universe and organizing the collected data at a central location. WSN incorporates a gateway that provides wireless connectivity back to the wired world and distributed sensor nodes. Various applications have been proposed for WSN like Ecosystem and Seismic monitoring, where deployment of nodes in a suitable manner is of an immense concern. Currently, sensor nodes are mobile in nature and they are deployed at an accelerated pace. This chapter focuses on developing the mobile nodes in an apt technique to meet the needs of WSNs properly. It considers the swarm intelligence-based movement strategies with the assistance of local communications through which the randomly deployed sensors can arrange themselves to reach the optimal placement to meet the issues like lower cost, lower power consumption, simpler computation, and better sensing of the total area.

1. INTRODUCTION

Wireless sensor networks (WSNs) comprise sensor nodes in which each node is able to supervise the physical area and send collected information to the base station for further analysis as depicted in figure 1. The important key of WSNs is detection and coverage of target. Developments of wireless sensor network enable them to operate with lower cost, lower power consumption, simpler computation, and

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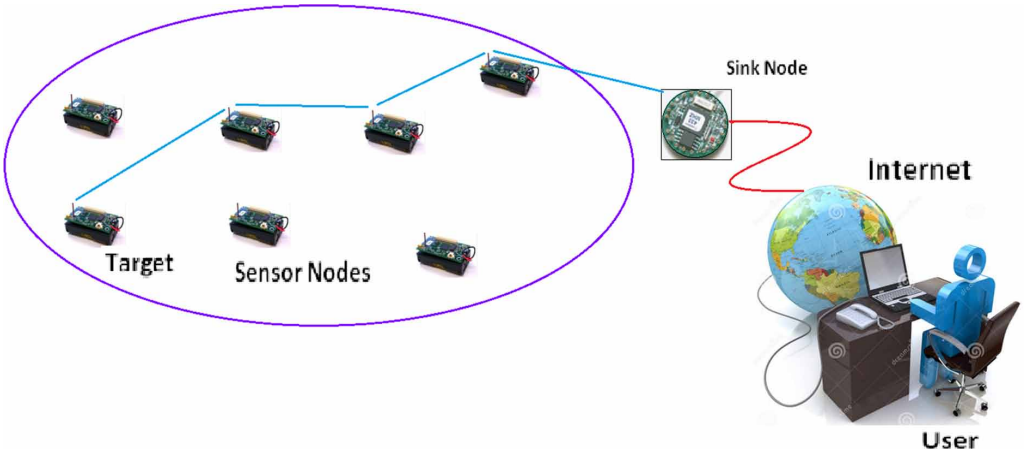
Figure 1. A typical wireless sensor network



better sensing of the area when sensors move around. Furthermore, sensors also can sense the environment behind the movement, compute the data, and send the collected data to the sink node that can route the data to the other analyzing center through the internet.

Wireless sensor network has prospective in many applications, such as healthcare, environment, industry, and environment monitoring surveillance in military, wildlife monitoring, and battle field. For instance, sensor network can be deployed in the environment for monitoring and controlling of plants and animal behavior or in the ocean for controlling of temperature and seismic activities. However, in many places that are unfriendly, physical deployment is impossible and nodes have to be deployed haphazardly. The main problem in the wireless sensor network is deployment, coverage, and mobility strategy of sensor node; however, the coverage problem depends on a deployment sensor node in the wireless sensor network. Deployment of the sensor nodes can be placed haphazardly in a target area. When network size is large and sensor field is unfriendly, the only choice for deployment of nodes is to scatter with aircraft. However, when sensor nodes are scattered haphazardly, it is difficult to find best strategy for haphazard deployment that could minimize the coverage hole and communication overhead. Minimizing of the coverage hole can improve the quality of service for sensor network. Recently, mobile sensor node has great impact on network coverage. They are equipped with vehicle and move around the area after haphazard deployment to enhance network coverage. However, mobile sensor node is very expensive in comparison to the stationary node. It has maximum utility to increase the network coverage and lifetime and provide fault tolerance and quality service for network. The key objective for mobile node is to cover all area in the network and ensure each position has at least one sensor node for coverage. According to the monitoring area, three types of coverage have been identified: area coverage, target coverage, and barrier coverage. The mobile sensor node moves to exact location and connects to the other sensor node to form path coverage. This paper presents how the deployment of nodes increases the coverage and collects the intended information robustly as mentioned by Mini and Udgata, 2011.

A large number of research activities have been carried out to explore and overcome the constraints of WSNs and solve design and application issues. In this paper swarm based sensor node deployment strategy are discussed and compared with the conventional method. Section 2 of the paper discusses the applications of sensor networks. In Sections 3, the characteristics of sensor networks are described.