Chapter 1

Localization System Optimization in Wireless Sensor Networks (LSO–WSN)

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ABSTRACT

Localization of nodes in wireless sensor networks is needed to track/know the event origin and node location both, routing, network coverage and querying of sensor clusters. Wireless Sensor Networks (WSN) have different applications along with different challenges. Here, position information system is one of the challenging aspects that play an important role in increasing the lifetime and survivability of WSN. And, the computational techniques have been successfully used in recent years to address the localization system of nodes in WSN. However, it is very difficult to know about the best computational technique for optimizing localization system of nodes. This work intends to close the gap for selecting suitable computational technique for node localization system optimization. Our aim is to provide a better understanding of the current research trends in this field.

INTRODUCTION

Wireless sensor network (WSN) consists of a network of wireless nodes that have the capability of computation, communication and to sense a parameter of interest.

WSNs potential applications include mine site operations, habitat monitoring, prediction, medical monitoring, emergency disaster relief, structural health monitoring and battlefield control. It is also applicable in wireless places for bidirectional communication among peoples. Wireless sensors can be deployed either randomly or deterministically in the field of interest. Sensor nodes are severely constrained in terms of storage capacity, computational capabilities, sensing range, communication bandwidth and
power supply. Further, densely deployed sensor nodes may be very close to each other. As a result, multi-hop communication in sensor networks is expected to consume less power than the traditional single hop communication. Sensor nodes forward their data to cluster heads, which in turn forward it to base station (BS) or sink node. Sensor nodes form cluster that is group of sensor nodes located geographically close to each other. Cluster head collect data sensed by sensor nodes within a WSN cluster.

Here position information to the nodes is provided by the localization system. And the localization information is advantageous for many aspects such as node addressing, coverage, and geographic routing. There is several localization algorithms proposed. And these algorithms focused on different aspects such as Global Positioning System (GPS) usage, beacons, and settled nodes. Generally the localized algorithms tried to remove the GPS receivers on beacon nodes. Three major phases of localization systems are shown in Figure 1.

Researchers have successfully used computational techniques to address different challenges of WSNs. However, various research communities are working towards localization to formulate it as optimization problem. Different computing techniques are neural networks, fuzzy logic, genetic algorithm, ant colony optimization, particle swarm optimization, bacterial foraging algorithm, etc., and multi-objective, and hybrids of two or more of the above, have found applications in the area of wireless sensor networks (WSNs). Solutions of localization systems often involve soft computing techniques in order to optimize multiple design parameters. In literature, a wide range of optimization algorithms exist. Our work focuses in recent trends towards localization system optimization.

This chapter is organized as follows: Section 2 discusses the overview of different soft computing techniques which plays an important role for localization system optimization. A detailed investigation of current proposals in localization system is described in section 3 whereas in section 4 a comparative assessment of different techniques is provided. Finally, section 5 concludes the work presented in different sections.

Figure 1. Phases of localization system
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