

Abstract

A boundary of wireless sensor networks (WSNs) can be used in many fields, for example, to monitor a frontier or a secure place of strategic sensitive sites like oil fields or frontiers of a country. This situation is modeled as the problem of finding a polygon hull in a connected Euclidean graph, which represents a minimal set of connected boundary nodes. In this paper we propose a new algorithm called D-LPCN (Distributed Least Polar-angle Connected Node) which represents the distributed version of the LPCN algorithm introduced in [1]. In each iteration, any boundary node, except the first one, chooses its nearest polar angle node among its neighbors with respect to the node found in the previous iteration. The first starting node can be automatically determined using the Minimum Finding algorithm, which has two main advantages. The first one is that the algorithm works with any type of a connected network, given as planar or not. Furthermore, it takes into account any blocking situation and contains the necessary elements to avoid them. The second advantage is that the algorithm can determine all the boundaries of the different connected parts of the network. The proposed algorithm is validated using the CupCarbon, Tossim and Contiki simulators. It has also been implemented using real sensor nodes based on the TelosB and Arduino/XBee platforms. We have estimated the energy consumption of each node and we have found that the consumption of the network depends on the number of the boundary nodes and their neighbors. The simulation results show that the proposed algorithm is less energy consuming than the existing algorithms and its distributed version is less energy consuming than the centralized version.