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Abstract

Wireless Sensor Networks (WSN) are groups of sensors, connected by communication links, spread over the area of interest, to perform a specific task. The network may get partitioned into clusters due to unanticipated simultaneous multiple node failures, and in such an event, will need to get reconnected to continue operation. These clusters are unaware of their own size, surviving nodes and links as well as the size and location of other survivor clusters. In our work, we propose a distributed and autonomous approach, namely Round Table Negotiation (RTN) approach, for reconnecting disjoint clusters in a short time. In this approach, each survivor cluster undergoes a self-discovery process, compiles its information and then sends a negotiator to participate in the round table negotiation and decision-making process to the round table around a pre-specified meeting point. All such negotiators exchange information and decide upon reconnection paths between the clusters and the nodes to involve in the reconnection process. The negotiators then return to their respective clusters and the reconnection process is carried out. Simulation results on wireless networks of varying sizes are presented. We show through a detailed comparison with existing methods that the proposed approach achieves reconnection in significantly lower time and is favorably comparable with respect to other performance metrics as well.

In the second part of the work, we introduce the notion of importance of coverage area, that is, WSNs deployed in areas of varying coverage importance, classified by Importance Ranks (IR). In addition to connectivity restoration, the lost coverage of higher importance needs to be recovered, using the survivor nodes from the less important coverage area. This is done in two ways: recovery followed by reconnection and vice-versa, using the RTN approach. At the round table, the negotiation includes the assignment of importance based replacements for lost coverage along with reconnection paths and nodes to involve in the process. Once the negotiators return to their clusters, recovery and the reconnection processes are carried out. Simulation of the application of proposed modules on a randomly generated network is presented, along with comparison of these methods with that of original RTN approach over various random networks, to prove the applicability and to further study the efficacy.