FuMAM: fuzzy-based mobile agent migration approach for data gathering in wireless sensor networks

ABSTRACT

A mobile agent (MA) was recently proposed to provide an alternative solution for traditional data gathering in wireless sensor networks. An MA is a software component that can migrate among network nodes by following an assigned itinerary (or path). Instead of transporting data from the nodes to the processing unit (e.g., sink) for data gathering, the MA visits each node, and thus, it performs data gathering locally. The MA has two types of itinerary planning: single-agent itinerary planning (SIP) and multi-agent itinerary planning (MIP). The MIP was introduced to address the drawbacks of the SIP in terms of task duration, energy consumption, and reliability. Despite the advantages of the MIP, determining the optimal itinerary for each MA in the MIP poses a considerable challenge. Most proposed itineraries adopt a static itinerary in which the nodes to be visited by the MA are predetermined at the sink node. The distance among nodes is the only parameter that has been used to determine the itinerary of the MA. Other parameters, such as the remaining energy and a number of neighbors, have not been considered. This omission can negatively impact MA migration and result in an unsuccessful MA round-trip, particularly when the remaining energy of the node is insufficient to transfer an MA to the next hop. In this paper, a fuzzy-based MA migration approach (FuMAM) is proposed to determine appropriate itinerary for an MA by considering three parameters: distance, remaining energy, and a number of neighbors. Simulation experiments show that the FuMAM approach improves the rate of the successful MA round-trip and network lifetime. Moreover, the proposed FuMAM approach outperforms the compared algorithms in terms of energy distribution usage among nodes.

Keyword: Data gathering; Mobile agent; Itinerary; Static itinerary; Dynamic itinerary; MIP