On the Potential of Fuzzy Logic for Solving the Challenges of Cooperative Multi-Robotic Wireless Sensor Networks

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Wireless sensor networks have recently been widely used in several applications and scenarios, especially because they have the ability and flexibility for establishing a scalable and reliable wireless network. Cooperative multi-robotic systems (CMRS) are one example of these applications where establishing a wireless network between robots is essential and paramount to their operation. Further, these robots can utilize their mobility to provide sensing functionality for areas that are not covered by the static sensor. This can be achieved by equipping the robots with specific sensors to sense the area of interest (AoI) and report the sensed data to a remote monitoring center for further processing and decision-making. However, the nodes that form the sensor network have limited energy, and, as such, efficient algorithms in clusters' formation, packets' routing, and energy and mobility management are paramount. In this paper, a literature survey is presented containing the most related works that have been proposed to solve these challenges utilizing fuzzy logic. Most of the literature work attempted to utilize a de-centralized approach, where certain input parameters such as the residual energy, communication link quality, network congestion status, the nodes' distance to the sink node and its location with respect to the other nodes, and the data and their sampling rate are all used as inputs to the fuzzy logic controller. These input parameters are used to determine several performance vital factors such as the cluster formation and its cluster head, best route to the sink node, optimal power management policies in terms of sleep/awake times needed to maximize the network lifetime, nodes' mobility management policies to maintain network connectivity, and best route in terms of packet loss and delay.

Khalifeh, Ala, Rajendiran, Kishore, Darabkh, Khalid A, Khasawneh, Ahmad M, AlMomani, Omar, Zinonos, Zinon, (2019), On the Potential of Fuzzy Logic for Solving the Challenges of Cooperative Multi-Robotic Wireless Sensor Networks, MDPI Electronics.