A Fuzzy-Based Simulation System for Actor Selection in Wireless Sensor and Actor Networks Considering as a New Parameter Density of Actor Nodes

Donald Elmazi, Tetsuya Oda, Evjola Spaho, Elis Kulla, Makoto Ikeda, Leonard Barolli

Abstract Wireless Sensor and Actor Networks (WSANs), refers to a group of sensors and actors that get the information about the physical environment and perform appropriate actions. In order to provide effective sensing and acting, a distributed local coordination mechanism is necessary among sensors and actors. In this work, we propose a fuzzy-based system for selection in WSANs. Our system uses four input parameters. Different from our previous work, we consider also the Density of Actor (DOA) parameter. The system output is Actor Selection Decision (ASD). The simulation results show that the proposed system has a good behaviour and makes a proper selection of actor nodes.

Donald Elmazi
Graduate School of Engineering,
Fukuoka Institute of Technology (FIT),
3-30-1 Wajiro-Higashi, Higashi-Ku, Fukuoka 811-0295, Japan,
e-mail: shinji.t.sakamoto@gmail.com

Tetsuya Oda, Makoto Ikeda, Leonard Barolli
Department of Information and Communication Engineering,
Fukuoka Institute of Technology (FIT)
3-30-1 Wajiro-Higashi, Higashi-Ku, Fukuoka 811-0295, Japan,
e-mail: oda.tetsuya.fit@gmail.com, makoto.ikd@acm.org, barolli@fit.ac.jp

Evjola Spaho
Department of Electronics and Telecommunication,
Polytechnic University of Tirana
Bul. Deshmoret e Kombit, Mother Theresa Square, Nr. 4, Tirana, Albania
e-mail: evjolaspaho@hotmail.com

Elis Kulla
Department of Information and Computer Engineering,
Okayama University of Science
1-1 Ridai-cho, Kita-Ku, Okayama 700-0005, Japan
e-mail: kulla@ice.ous.ac.jp

© Springer International Publishing AG 2017
L. Barolli et al. (eds.), Advances on Broad-Band Wireless Computing, Communication and Applications, Lecture Notes on Data Engineering and Communications Technologies 2, DOI 10.1007/978-3-319-49106-6_15
1 Introduction

Wireless Sensor and Actor Networks (WSANs), have emerged as a variation of WSNs. WSNs can be defined as a collection of wireless self-configuring programmable multi-hop tiny devices, which can bind to each other in an arbitrary manner, without the aid of any centralized administration, thereby dynamically sending the sensed data to the intended recipient about the monitored phenomenon [1].

WSANs are capable of monitoring physical phenomena, processing sensed data, making decisions based on the sensed data and completing appropriate tasks when needed [2]. For example, in the case of a fire, sensors relay the exact origin and intensity of the fire to actors so that they can extinguish it before spreading in the whole building or in a more complex scenario, to save people who may be trapped by fire.

Unlike WSNs, where the sensor nodes tend to communicate all the sensed data to the sink by sensor-sensor communication, in WSANs, two new communication types may take place. They are called sensor-actor and actor-actor communications. Sensed data is sent to the actors in the network through sensor-actor communication. After the actors analyse the data, they communicate with each other in order to assign and complete tasks. To provide effective operation of WSAN, it is very important that sensors and actors coordinate in what are called sensor-actor and actor-actor coordination. Coordination is not only important during task conduction, but also during network’s self-improvement operations, i.e. connectivity restoration [3, 4], reliable service [5], Quality of Service (QoS) [6, 7] and so on.

Sensor-Actor (SA) coordination defines the way sensors communicate with actors, which actor is accessed by each sensor and which route should be selected to transmit data packets. Among other challenges, when designing SA coordination, the energy minimization should be considered. On the other hand, by Actor-Actor (AA) coordination can be selected which actor will lead performing the task (actor selection), how many actors should perform and how they will perform. Actor selection is not a trivial task, because it needs to be solved in real time, considering different factors. It becomes more complicated when the actors are moving, due to dynamic topology of the network.

In this paper, different from our previous work [8], we propose and implement a simulation system which considers also the Density of Actor nodes (DOA) parameter.

The system is based on fuzzy logic and considers four input parameters for actor selection. We show the simulation results for different values of parameters.

The remainder of the paper is organized as follows. In Section 2, we describe the basics of WSANs including research challenges and architecture. In Section 3, we describe the system model and its implementation. Simulation results are shown in Section 4. Finally, conclusions and future work are given in Section 5.