ABSTRACT

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The increasing demand imposed by Industry 4.0 has increased the interest for applications of Wireless Sensor Networks (WSN) in the area of industrial automation. The advantages of its use include: ease of installation and maintenance, reduction of installation time of devices, lack of cabling structure, savings in the cost of projects, savings in infrastructure, flexibility of configuration of devices, savings in cost flexibility in altering existing architectures. However, in the industrial automation, it is necessary to emphasize the reliability of the network, since loss of control due to lack of feedback can have catastrophic results. This work proposes a tool, called POSIMNET-R (Positioning Immune Network Resilient), which is able to develop a reliable network, from the positioning of routing nodes, meeting the criteria of low degree of failure and path redundancy. Just like its predecessor developed by Barreira (2013), the POSIMNET-R is based on the artificial immunological networks, which proposes to create K any or disjoint paths (edges and nodes) for the information sent by the sensor nodes to reach the central node. This work proposes other mutation operators based on the Theory of Graphs: Steiner and Elliptical Distillation, in addition to two methods of initialization of the network, namely: QuasiAleatory (Sobol) and QuadTree, in order to aid in the process of acceleration of convergence. Case studies were carried out in different scenarios: one artificial and two based on existing refineries. The results show that POSIMNET-R can generate simple and multiple fault-tolerant networks of its nodes.

Keywords: Positioning of nodes-routers; Industrial automation; Resilience; Industry 4.0; Steiner Mutation; Distillation Mutation; QuadTree; Acceleration of convergence; Artificial Immune Systems; Graphs; Submodular Functions.