

Robust multi-gateway authentication scheme for agriculture wireless sensor network in society 5.0 smart communities

ABSTRACT

Recent Society 5.0 efforts by the Government of Japan are aimed at establishing a sustainable human-centered society by combining new technologies such as sensor networks, edge computing, Internet of Things (IoT) ecosystems, artificial intelligence (AI), big data, and robotics. Many research works have been carried out with an increasing emphasis on the fundamentals of wireless sensor networks (WSN) for different applications, namely precision agriculture, environment, medical care, security, and surveillance. In the same vein, almost all of the known authentication techniques rely on the single gateway node, which is unsuitable for the current sensor nodes that are broadly distributed in the real world. Despite technological advances, resource constraints and vulnerability to an attacker physically capturing some sensor nodes have remained an important and challenging research field for developing wireless sensor network user authentication. This work proposes a new authentication scheme for agriculture professionals based on a multi-gateway communication model using a fuzzy extractor algorithm to support the Society 5.0 environment. The scheme provides a secure mutual authentication using the well-established formal method called BAN logic. The formal security verification of the proposed scheme is validated with the AVISPA tool, a powerful validation method for network security applications. In addition, the security of the scheme was informally analysed to demonstrate that the scheme is secure from different attacks, e.g., sensor capture, replay, and other network and physical attacks. Furthermore, the communication and computation costs of the proposed scheme are evaluated and show better performance than the existing authentication schemes.

Keyword: Agriculture; Society 5.0; Wireless sensor network; Agriculture sensors; IoT; Multi-gateway