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Secure and Reliable Object Tracking in Wireless Sensor Networks

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Abstract

Mobile object tracking is one of the most important applications of Wireless Sensor Networks (WSNs) deployed in battlefields, wildlife or habitat monitoring applications. Existing object tracking algorithms are mostly centralized and based on heavy and complex signal processing algorithms hence they cannot be applied to resource constrained WSNs directly. Object tracking algorithms of WSNs should be designed by considering energy conservation, bandwidth and communication overheads. Moreover, as practical object tracking applications are typically used in mission-critical applications, security is another important design matter to be considered. In mission-critical applications, sensor nodes are deployed in hostile fields and they can be easily captured by intruders. Such compromised nodes can be used to falsify the collected data and threaten the object tracking reliability. In this paper, we propose a novel secure and reliable object tracking protocol that considers security and object tracking tasks simultaneously. The basic idea behind the proposed protocol is to ensure tracking security using reputation based trust concept for individual sensor nodes. The performance evaluation results show that the proposed protocol allows the network to retain the reliability of tracking data even in the presence of compromised nodes, thereby achieving secure and reliable object tracking process.

Keywords — object detection, secure object tracking, secure target tracking, reputation, trust, wireless sensor networks

1. Introduction

Wireless Sensor Networks (WSNs) are a kind of ad-hoc mesh networks with strict resource constraints. They often comprise a large number of randomly deployed resource constrained sensor nodes and inherit all characteristics of ad-hoc mesh networks such as being self-organizing, self-healing, wireless and adaptive [10-11]. WSNs are usually deployed in remote and unfriendly territories, often called the monitored areas, for monitoring purposes. Sensor nodes work as instruments capable of covering large areas and collecting detailed information