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Surveillance of Sensitive Fenced Areas Using Duty-Cycled Wireless Sensor Networks With Asymmetrical Links

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Abstract

This paper presents a cross-layer communication protocol for Wireless Sensor Network (WSN) enabled surveillance system for sensitive fenced areas, e.g., nuclear/oil site. Initially, the proposed protocol identifies the boundary nodes of the deployed WSN to be used as sentinel nodes, i.e., nodes that are always in active state. The remaining nodes are used as duty-cycled relay nodes during the data communication phase. The boundary nodes identification process and data routing are both performed using an enhanced version of the Greedy Perimeter Stateless Routing (GPSR) protocol, which relies on a Non Unit Disk Graph (N-UDG) and referred to as GPSR over Symmetrical Links (GPSR-SL). Both greedy and perimeter modes of GPSR-SL forward data through symmetrical links only. Moreover, we apply the Mutual Witness (MW) fix to the Gabriel Graph (GG) planarization, to enable a correct perimeter routing on a N-UDG. Simulation results show that the proposed protocol achieves higher packet delivery ratio by up to 3.63%, energy efficiency and satisfactory latency when compared to the same protocol based on the original GPSR.

Keywords: Radio Irregularity, Link Asymmetry, Network Boundary Nodes,

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