

Wireless Sensor Network for Forest Fire Detection and Localization

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Abstract : WSNs may provide a fast and reliable solution for the early detection of environment events like forest fires. This is crucial for alerting and calling for fire brigade intervention. Sensor nodes communicate sensor data to a host station, which enables a global analysis and the generation of a reliable decision on a potential fire and its location. A WSN with TinyOS and nesC for the capturing and transmission of a variety of sensor information with controlled source, data rates, duration, and the records/displaying activity traces is presented. We propose a similarity distance (SD) between the distribution of currently sensed data and that of a reference. At any given time, a fire causes diverging opinions in the reported data, which alters the usual data distribution. Basically, SD consists of a metric on the Cumulative Distribution Function (CDF). SD is designed to be invariant versus day-to-day changes of temperature, changes due to the surrounding environment, and normal changes in weather, which preserve the data locality. Evaluation shows that SD sensitivity is quadratic versus an increase in sensor node temperature for a group of sensors of different sizes and neighborhood. Simulation of fire spreading when ignition is placed at random locations with some wind speed shows that SD takes a few minutes to reliably detect fires and locate them. We also discuss the case of false negative and false positive and their impact on the decision reliability.

Keywords : forest fire, WSN, wireless sensor network, algorithm

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