Evaluation of a Data Fusion Algorithm for Detecting and Locating a Radioactive Source through Monte Carlo N-Particle Code Simulation and Experimental Measurement

Authors : Hadi Ardiny, Amir Mohammad Beigzadeh

Abstract : Through the utilization of a combination of various sensors and data fusion methods, the detection of potential nuclear threats can be significantly enhanced by extracting more information from different data. In this research, an experimental and modeling approach was employed to track a radioactive source by combining a surveillance camera and a radiation detector (NaI). To run this experiment, three mobile robots were utilized, with one of them equipped with a radioactive source. An algorithm was developed in identifying the contaminated robot through correlation between camera images and camera data. The computer vision method extracts the movements of all robots in the XY plane coordinate system, and the detector system records the gamma-ray count. The position of the robots and the corresponding count of the moving source were modeled using the MCNPX simulation code while considering the experimental geometry. The results demonstrated a high level of accuracy in finding and locating the target in both the simulation model and experimental measurement. The modeling techniques prove to be valuable in designing different scenarios and intelligent systems before initiating any experiments.

Keywords : nuclear threats, radiation detector, MCNPX simulation, modeling techniques, intelligent systems
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