



ЛАБОРАТОРИЯ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ

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Imbaby I. Mahmoud

Chairman of Material and Nuclear Manufacturing Division
Egyptian Atomic Energy Authority, Cairo, Egypt

Studied Issues of WSNs for Nuclear Material Detection and Localization: - Channel Temperature for Radio Interference Handling - PF based Localization Algorithm

The talk presents a review of Wireless Sensor Networks (WSNs) Technology and interference/jamming model and effects. Anti-jamming techniques and taxonomy are presented. Interference Aware Routing Protocols basics are presented. OPNET modeler/simulator is introduced and how to use it for modelling jamming is explained. Channel temperature is used to model the interference and quantify its value by calculating Channel Availability Metric (CAM) using Baum-Welch (BW) trained Hidden Markov Model (HMM). Training probabilities for transition and emission matrices are generated from observations (in this work through simulation) using the default BW algorithm of Matlab `hmmtrain` function. As anti-jamming strategy, when communications are blocked in one channel, nodes can be switched to another channel with higher CAM in order to continue the data transmission. Interference Aware Routing Strategy based on Channel Availability Metric (CAM) calculation is outlined and its results using OPNET simulator is presented. The node selects the channel with highest channel availability metric to be used for transmission. Hence, the node can select preferable channel for communication from interference point of view. The results are separately validated by evaluating multiple simulations run from sensor node to measurement node. Comparison with PDR of channel surfing technique is conducted. Development of Data Fusion Algorithm based on Particle Filter (PF) approach is also presented. From measured intensities in count per minute (CPM), loci of candidate unknown intensity radioactive source location can be considered as the perimeter of Apollonius circle. The circle is used in likelihood function of PF to estimate candidate source location. Implementation of PF based localization algorithm in Xilinx FPGA is also presented. Future work plan includes security related studies, e.g. Watch Dog LEACH algorithm and complete WSN implementation using μ C/FPGA devices.