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Project Title

IDEAS for WIND

Project Objective

Investigate DEtectors designs, Algorithms, and System-level approaches for Wearable Intelligent Nuclear Detection.

Project Description

A radiological search consists of detection, localization, and identification. The time to detection of a potential radiological threat to operator action should be minimized to maximize the frequency of favorable scenario outcomes.

The current focus of the project is to simulate and characterize a given detector array's system performance in a radiological search scenario. The system performance can be described by a variety of metrics, but the design metrics and simulation scenarios which best represent the operational environment has yet to be answered. Furthermore, there is potential to use aggregating groups of measurements to make instantaneous estimates in conjunction to aggregating measurements from a bird's eye view. This project intends to suggest approaches and detail their implications and inherent assumptions.

Future focus includes the use of other data types, such as video and lidar, to aid in detection of Improvised Nuclear Devices (INDs) or Radiological Dispersal Devices (RDDs), as well as develop the next generation of radioisotope identification, detection, and localization algorithms. All of which aims at improving operator performance where actions are time critical.

Project Relevance to Nuclear Nonproliferation

Radiological searches for INDs or RDDs are hard to do in relatively inaccessible environments (such as the cargo hold of a ship or a baseball stadium). Handheld units inherently have low detection sensitivity inherently due to the lack of active detector volume. Creating a new backpack would maintain a similar level of accessibility in these challenging environments while increasing the sensitivity to these potential threats.

Products and Outcomes of Project

- Radiation detector design suggestions, as well as simulations for said design.
- Synthetic data generation framework.
- Design metrics for this particular scenario
- Localization algorithms catered to this scenario

Publications and Reports

B. AYAZ-MAIERHAFER, C.G. BRITT, A.J. AUGUST, H. QI, C. E. SEIFERT, J.P. HAYWARD, "Design optimization for a wearable, gamma-ray and neutron sensitive, detector array with directionality estimation," *Nuclear Inst. and Methods in Physics Research, A* (2017), http://dx.doi.org/10.1016/j.nima.2017.07.020

Presentations

C. BRITT, B. AYAZ-MAIERHAFER, A. AUGUST, E. GREENLEE, C. E. SEIFERT, H. QI, J. P. HAYWARD, "Trade-Off Analysis for Radiation Detector Array Configurations," *Defense Nuclear Nonproliferation Research and Development University Program Review 2017*, Walnut Creek, CA, June 6-8, 2017.

C. BRITT, B. AYAZ-MAIERHAFER, A. AUGUST, E. GREENLEE, C. E. SEIFERT, H. QI, J. P. HAYWARD, "Trade-Off Analysis for Radiation Detector Array Configurations," *Nuclear Science Symposium and Medical Imaging Conference*, Atlanta, GA, October 21-28, 2017. IEEE NPSS (2017).

B. AYAZ-MAIERHAFER, C.G. BRITT, A.J. AUGUST, H. QI, C.E. SEIFERT, J.P. HAYWARD, "Design optimization for a wearable, gamma-ray and neutron sensitive, detector array with directionality estimation," *Nuclear Science Symposium and Medical Imaging Conference*, Atlanta, GA, October 21-28, 2017. IEEE NPSS (2017).