HOMELAND DEFENSE BAGGAGE INSPECTION

and other applications

Introduction

TACOM-ARDEC has developed a baggage inspection system utilizing unique and innovative technology developed for Non-Destructive Inspection applications (Patent 6018562). The system is designed to automatically find agriculture products in air-traveler check-in luggage at conveyor rates approaching 120 feet per minute. The design is a low resolution, multi-spectral, computed tomography (CT) system with autonomous decision making and learning ability. **The design is such that it needs one-tenth the x-ray flux of other systems.**

Baggage Inspection

The most advanced commercially available baggage inspection systems employ computed tomography (CT) and/or dual energy for creation of the images. CT provides an image of individual slices through the bag. Dual energy allows identification and separation of material based on the chemical composition, as well as, density.

The common method of acquiring data for tomography (an x-ray source rotating around the bag) limits CT acquisition to less than two slices per second. The common method of acquiring dual energy (filters and/or dual energy source) poorly differentiates between high and low energy. Absorption of x-rays by an object (necessary to create its image) creates scattered x-rays, which cloud the image. The common method of elimination of scatter (filters and grids) creates even more scatter.

Uniqueness of ARDEC System

ARDEC's system uses stationary pulsed x-ray sources to mimic a single rotating source. As a result, the system continuously acquires sixty tomographic slices per second, and hence, high throughput.

The ARDEC Baggage Inspection System (ABIS) uses a unique and patented detector that measures the energy of every photon. It creates images based on the number of photons detected in each of several energy bands. The sharpness of energy discrimination by ABIS is ten-fold greater than that of filters and dual energy source. This increased sharpness allows ABIS to eliminate scatter without creating additional scatter. The discrimination sharpness makes possible high precision identification of chemical composition (average atomic number in a voxel).

The ABIS has numerous applications other than USDA airport baggage inspection. With little or no modification, the ABIS can be used to inspect parcels, bags and crates for the postal system and at portals of Federal buildings. The ABIS can handle bags up to one-meter square cross-section. The ABIS can be scaled up for large crate inspection at port and border crossings or for truck body inspection. Modification to find explosives requires an increase in spatial resolution, which can be done by increasing the component count or by slowing the system's throughput.

Results

Good radiographic images have been acquired using one-tenth the x-ray flux of other systems. The prototype system creates 3-D volume projections for viewing of identified objects in context of the volume. The system identifies objects in the CT volume and includes a unique self-learning algorithm.

Leveraging Partners

The system was developed with strong support from the U.S. Department of Agriculture and the Federal Aviation Administration. In addition, small high technology companies were linked using the Small Business Innovative Research program to bring significant leap ahead technology to fruition. The capability of the system can be leveraged across a number of applications including military and numerous medical screening and non-invasive evaluation techniques.

The following companies are partners in the development of components and assembly of this system: ENSCO, Inc. of Springfield, VA, NOVA R&D, Inc of Riverside, CA and X-ray & Specialty Instruments, Inc. of Ypsilanti, MI.

For additional information, please contact

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