Request for Information:
Controlling Crowd Flow for Standoff/Remote Explosives Screening

PROGRAM DESCRIPTION

The Department of Homeland Security, Science and Technology Directorate (DHS-S&T), Explosives Division, has been tasked to conduct operational field demonstrations of remotely operated and standoff explosives countermeasure technologies to address the threat from suicide bombers, as well as leave-behind and vehicle-borne improvised explosive devices. DHS-S&T's Standoff Technology Integration and Demonstration Program (STIDP) is designed to accelerate the development of standoff and remotely operated explosives countermeasures architectures for detecting these threats. A countermeasure architecture comprises detection technologies and how they are deployed and operated; how they integrate with the venue's operations; and technologies that enable the countermeasure to be operated as an integrated system (e.g., command, control, and communications; data management and recording). The ultimate goal of the program is to prevent explosives attacks in free-flowing crowds—such as those arriving for large public events and mass transit facilities –via an iterative approach of identifying technologies, integrating and testing them in crowd environments, and providing feedback for technology developers.

This Request for Information (RFI) seeks to identify interested parties or teams with experience in designing and implementing pedestrian control management techniques and methods, especially pertaining to the architectural design of the ingress environment at a large public event.

CROWD DYNAMICS PROBLEM STATEMENT

Crowd dynamics at large public events present a significant challenge in detecting and tracking person-borne improvised explosive devices. Most sensors developed to detect concealed objects such as explosives worn by suicide bombers require a direct line of sight between the sensor and the person being screened. But people often arrive at a venue in a group, walk beside one or more adjacent people while moving toward the entrance, and "bunch up" near the entrance. These conditions partially block the sensor's field of view, thereby preventing complete standoff screening.
Successful pedestrian management design requires an understanding of pedestrian flow in a variety of venues. Successful design implementation organizes pedestrian flow that reduces blocking effects from neighboring persons, separates tightly-coupled groups, maximizes the presentation of persons to the sensor technologies, and provides predictable pedestrian actions, all with an aesthetically pleasing architectural design.

STIDP seeks to obtain information on pedestrian flow characterization and pedestrian management design techniques focused on controlling and altering pedestrian movement while they are approaching a large public event. The patrons will be subject to pre-event security screening with standoff explosives detection sensors in a layered security environment. Screening of patrons far away from the entrance is preferred (>50 meters)

for better implementation of a layered security architecture. Screening sensors and devices should be able to accommodate the partial blocking of adjacent patrons. Other occlusions may include natural elements such as trees and shrubs or structural elements such as planters, light poles, and statues. Occlusions could also be used strategically for crowd separation or dispersion.

The primary intent of this RFI is to explore innovative technologies or models of how to characterize existing pedestrian flows and successfully control crowd flows with a minimal investment in infrastructure at the farthest fringes of the sensor detection zones. The STIDP is also interested in crowd monitoring/control closer to the venue entrances for implementing technologies such as geo-tracking and video anomaly detection (e.g. entry to exclusion zones, leave-behind baggage, crowd formations and dispersion, etc.).

This RFI is not soliciting input for video analytic anomaly detection, nor geo- tracking technologies per se, because those technologies have already been solicited under separate RFIs. This RFI is focused on identifying existing technologies that address the specific topics of crowd dynamics, flow, and management of crowd movement, which could be applied to a layered security approach at large public events.

The following solutions are sought:

1) Methods are needed to separate people arriving one behind another such that a direct line of sight from the sensor to the arriving patron is possible. Because sensors often require some dwell time to complete their scan, the unobstructed view of a person should persist for a minimum of 5 seconds. Methods are needed to "break up" lines of people one behind the other for at least 10 people in a row.
2) Methods are needed to increase the distance of people walking side by side in groups as large a six abreast so that the distance between people is 3 feet.
3) Methods are needed to characterize existing pedestrian flow at venues that host large public events to better understand the existing causes of crowd densification.

Some of the key challenges for tracking people at a large public event include:

1) There are multiple entry routes to the venue.
2) There are porous boundaries entering the venue's outer fringes.
3) Pedestrian traffic can range from single patrons to large groups arriving by mass transit.
4) Patrons will mix in and out of other patron groups depending on crowd flow and layout of the venue's paths of ingress/egress.
5) Paths of ingress/egress range from narrow, occluded walkways to wide-open grassy parks and parking lots.
6) Pedestrian traffic does not simultaneously flow in one direction.
7) Crowds typically get denser the closer they get to the venue patron entry point.
8) The number of people in the crowd increases steeply just before the event begins.

Valuable features in crowd flow management include simple and unobtrusive design that is both functional and aesthetically pleasing while facilitating predictable and repeatable actions from the patrons.

REQUIREMENTS

Operating Environment

The technology or system must meet the following operating requirements:

- Operate outdoors, with minimal impact from weather (heat, cold, rain, snow, wind)
- Operate in high and low light and in the presence of shadows, and at night

Key Words: Crowd, crowds, crowd dynamics, crowd flow, crowd behavior, pedestrians, foot traffic, people, people flow, venue, stadium, arena, path, pathway, walkway, control, management, organization, route, routing, direction, architecture, urban planning, urban design, outdoor, occlusion.

INTERESTED PARTIES

Parties with technologies, including models, that can address the problems and requirements above, are encouraged to respond. Please limit submission to a maximum of 5 pages (including a cover sheet) and provide the following information:

Cover Page (Page 1)

- Contact and company information
  - Name
  - Title
  - Company name
  - Date of incorporation
  - FY08 sales
  - Number of employees
  - Location
  - Mailing address
  - Phone number
  - Web page address
  - Email address
- Name/type of technology or model
- Technology maturity: Existing technology or technology concept
- Technology summary covering technical approach, operating principles, testing conducted to date, and commercial sales, if any

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- Technical background on how the technology/model works, and number and type of components
- Whether or not the technology is suitable for use outdoors with large crowds

- The types of crowds, and where and how this technology has been used, including
    - crowd densities
    - crowd flow rates
    - rural or urban environments
    - types of events where the technology was demonstrated (sporting events, supermarket, concerts, etc.)
    - patron characteristics
        - attire such as patrons wearing sport jerseys
        - mix of men/women/families, etc
        - groups
    - other challenging crowd effects
- Overview of how the technology would be deployed in an operational setting (e.g., to obtain coverage of a 150 meter X 150 meter area), including hardware, software, and labor requirements
- Overview of the testing and evaluation conducted to date and how these data support performance claims
- Current ongoing R&D and sources of funding (including amounts)
- Schedule for anticipated technology upgrades and associated testing
- How the technology is, has been, or can be integrated with sensor technologies to improve the overall countermeasure performance
- Government/academia/industrial partners or potential partners
- Previous work performed in the subject area being proposed, including but not limited to work performed for the U.S. government or other federal agencies (including international)
- How your technology would need to be adapted or integrated with concealed object detection technologies to provide a viable solution
- Description of the concealed object detection technologies that could be integrated with your technology to provide a viable solution.

Marketing brochures, fliers, published presentations or papers, and other materials that summarize the technology and more about your company are encouraged in addition to the submission, but should not be substituted as a replacement for the submission.

Responses to this request for information are to be submitted electronically to Pacific Northwest National Laboratory at stidp-rfi@pnl.gov. Please include the RFI number in the subject line of your email.