Sandia National Laboratories

Virtual Presence and Extended Defense Systems Enhance Security

Exceptional Service in the National Interest

Issue

Today's security challenges require facilities to do more than deter adversaries or detect them as they penetrate the fence. Facility personnel want to be alerted about adversary activity as soon as possible, and as far away from the protected area boundary as possible. Traditional security systems employ fences, clear zones, sensors, and cameras to detect adversaries at the perimeter. However, because of the aggressive and broad types of threats we face, we need to provide reliable information to response personnel as early and as quickly as possible in the event of an attack.

Solution

Sandia National Laboratories has developed "beyond-the-perimeter" sensor and assessment defense systems called Virtual Presence and Extended Defense (VPED) systems. Already deployed in varying field environments, our VPED systems are tailored to meet specific challenges.''Each VPED system consists of sensor nodes, which support

VPED seismic data collection in heavily wooded location.

various types of sensors. One of the most notable features of these systems is that sensors can be located almost anywhere, from a mountain ravine to along a paved road. Sensors communicate via radio frequency links with each other and send data to a Command Center, or to standalone systems in the field. Security operators can alert responders immediately, allowing evaluation of the situation before adversaries reach the perimeter.

For responders operating without a command and control system, the VPED systems can be deployed with a stand alone interface. The VPED user interface is an easy to use web-browser-based system that can be deployed almost anywhere on a user's network. For users with a command and control system, the VPED is designed to work with other display systems through standard network interfaces such as XML.

As a leading national laboratory under the U.S. Department of Energy/National Nuclear Security Administration, Sandia has long been involved in safekeeping the nuclear stockpile to secure the nation. Because of this experience in security and defense systems, we seek opportunities to leverage our expertise—our people, facilities, and capabilities—to help other agencies facing similar problems in protecting critical national-security assets.

Benefits

VPED systems work with existing perimeter security systems to create detection zones where none previously existed. They reach farther out than current systems, enhancing fixed-site security by enabling response forces to have earlier warning of adversary attacks. VPED systems provide detection and may include video assessment along potential avenues of approach (e.g., roads, trails, or ravines), and can let responders know of activity in observational positions and natural assembly areas.

VPED systems are flexible —they do not rely on any single sensor for detection. VPED systems are adaptable to the environment—whether it is a heavily wooded area or a sparse desert.

VPED systems are designed with the goal of minimizing nuisance alarms and employing quick and reliable assessment techniques to manage the alarms that are encountered.

VPED systems have low power needs and alleviate the need for traditional power supplies. Sensor nodes are powered by internal batteries and can last indefinitely when coupled with solar panels, which makes VPED systems ideal for placing in remote locations.

A VPED sensor node with a ground mounted antenna gathers data from a variety of sensors and processes information for the Command Center.

Optimal performance of VPED systems is achieved when sensor and assessment systems are tuned to maximize their performance in the local terrain. VPED systems are designed to be rapidly deployed and tuned during initial system installation. After installation, VPED sensor, fusion, and node parameters can be modified remotely, allowing operators to adjust sensitivity settings or algorithm settings without field maintenance.

Interior view showing battery and printed circuit board with radio and microprocessor.

Anticipate and Prepare

VPED systems are not designed to replace traditional Perimeter Intrusion Detection and Assessment Systems, but to augment them to provide better security system effectiveness for pedestrian and vehicle threats. VPED systems were designed for both temporary and permanent installation to accommodate long term physical surveillance needs and also function as a tactical security system for quick field deployment at mobile sites.

A complex threat scenario requiring extended detection can be mitigated using VPED technology.

Detect Attacks

VPED systems use a variety of technologies to detect intruders:

- Intelligent sensor algorithms attempt to classify detections as persons, vehicles, or "other."
- To avoid high nuisance-alarm rates, sensor-fusion algorithms combine multiple sensor input to differentiate between human intruders and environmental factors.
- Operators can use captured images from area cameras to determine the cause of an alarm without dispatching patrols.

Response

VPED systems allow facilities to detect adversaries through sensor placement and assessment capabilities beyond a site perimeter. Operators use video

VPED Camera Installation at a road junction.

images to assess the cause of alarms and deploy response forces as needed. The reliable "beyond-the-fence" warning provides more time for response-force deployment.
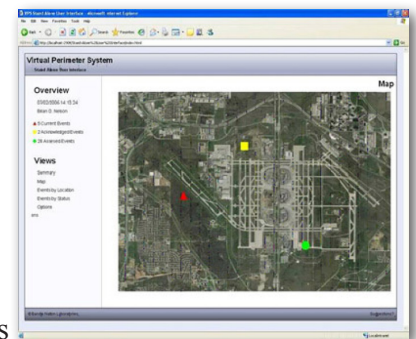
Making a Difference

The VPED systems work with existing perimeter security systems to give security officers more time to better detect and assess threats beyond their traditional

VPED stand alone user interface.

perimeter. First prototyped in 2005, the VPED system is now a second-generation system that has been demonstrated in several real-world applications to validate system operation.

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