SAND2007-2075P

Sandia Compact Sensor Node

for Virtual Presence and Extended Defense

The Need

The challenge to protect our nation's infrastructure and borders includes the need for systems that can detect vehicles and people moving through sensitive areas. In remote places that are not serviced by power or communication lines, the detection and reporting functions must be self-contained.

SCSN with ground-mounted antenna and dust cap removed from 18-pin connector

Description

With these needs in mind, Sandia National Laboratories has developed a unique sensor system called the Sandia Compact Sensor Node (SCSN). The sensors are part of Sandia's concept of Virtual Presence and Extended Defense (VPED) systems, which allow facilities to place sensors and assessment capabilities beyond a site perimeter to detect adversaries.

SCSN can detect pedestrians and vehicles and differentiate between them using a built-in seismic detector. The SCSN is based on modified commercial hardware and enclosed in waterproof, off-the-shelf PVC pipe. Up to four external sensors can be connected using a flexible digital/analog interface through a waterproof connector. A built-in inertial sensor detects enclosure tampering. Individual sensors can be fused together to reduce nuisance and false alarms and the reporting rate can be controlled directly by the user. Two internal relays and a serial communication port can be commanded or configured to operate automatically in response to alarms for interfacing external devices such as illuminators, cameras, deterrents, or voice synthesizers.

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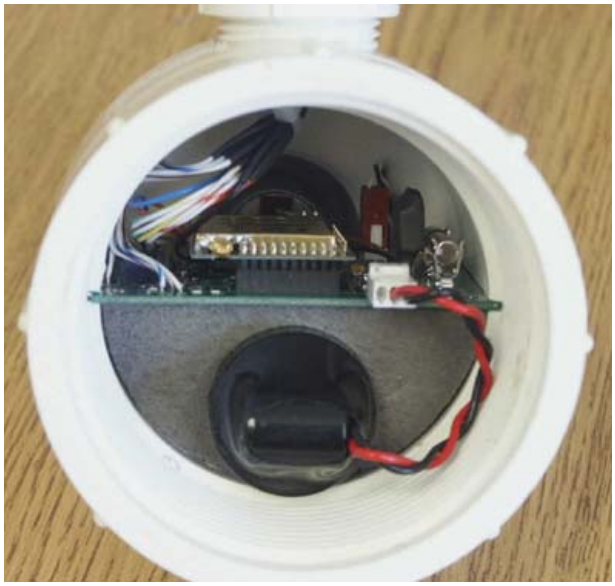
Operations

Thousands of SCSNs can be connected into a single network using a frequency-hopping, spread-spectrum radio transceiver in the 902 to 928MHz unlicensed band, which resists jamming and interception. Individual radios can communicate up to 15 miles over a line-of-sight path and SCSNs can be configured to relay messages to extend this range. Messages normally flow to a single collection node where the serial interface connects to an annunciator PC but command and reconfiguration messages can flow in the opposite direction to individual nodes or groups.

Messages are retransmitted if not acknowledged and each node can be configured to send state-of-health reports at time intervals ranging from every few minutes to several hours. The Advanced Encryption Standard (AES) is used for critical messages.



Interior view showing D-sized battery and printed circuit board with radio and microprocessor. The geophone and inertial switch are not visible.

Power and Functions

SCSN is powered from a single, D-sized lithium battery that provides 10 years of continuous operation. An RF jack permits various antennas to be used that trade off stealth, ruggedness, and communication range. Utility functions that support walk-testing, link-testing, and sensor adjustment are available either through hardwire or radio connection.

Availability and Cost

Field testing of prototype hardware is currently underway with commercialization to follow. A $300 cost per node is anticipated in production that will include a battery, antenna, and a smaller custom enclosure.

National Nuclear Security Administration

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