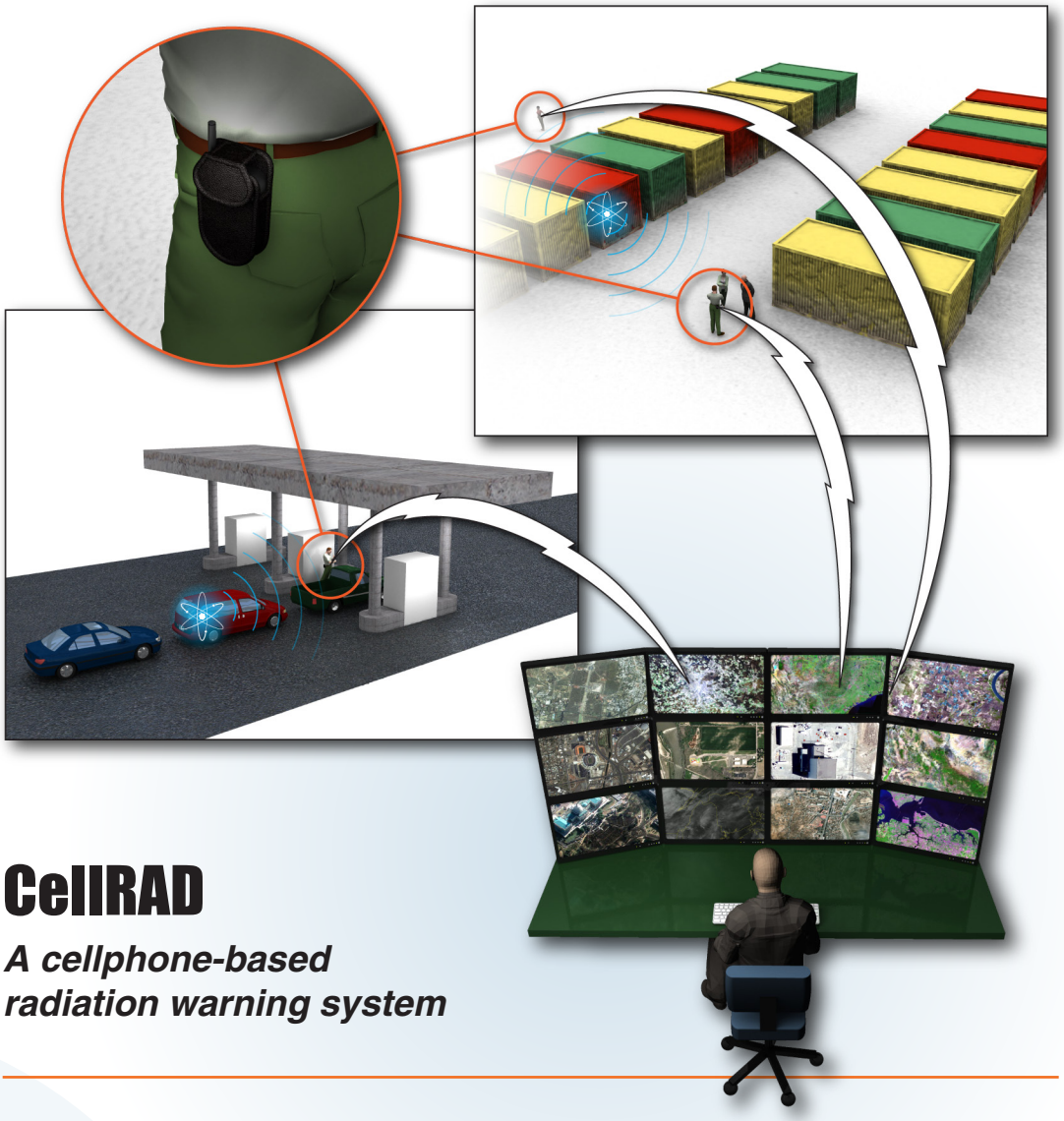
CellRAD is a system of software that runs on off-the-shelf unmodified Android cellphones. It uses the camera of the phone to detect gamma radiation.



CellRAD

A cellphone-based radiation warning system

One of the most harrowing prospects faced by homeland and international security and law enforcement personnel is the threat of radioactive contamination being intentionally dispersed in highly populated areas such as large metropolitan regions, sporting events and tourist locations.

CellRAD prototype is an early warning system for guarding against these types of radiological events. Idaho National Laboratory has developed the wireless, advanced nuclear detection software that puts radiation detection in the palm of your hand.

CellRAD is a system of software that runs on off-the-shelf unmodified Android cellphones with the lens covered and uses the camera of the phone to detect gamma radiation. Additional server side software is capable of determining approximate energy spectrum information from the pictures. These cellphone capabilities provide useful abilities for finding and characterizing unexpected or illicit radioactive material.

Radiation Detection Overview

For dealing with unexpected or illicit radioactive material, first responders need two key questions answered, what nuclides are present and in what quantity, that is, "What is it?" and "How much is there?"

Most radioactive material emits high-energy photons called gamma rays. Different nuclides emit different energy gamma rays. With sufficiently accurate measurement of the gamma ray energies (also known as the spectrum), the

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different nuclides can be distinguished. This measurement answers the "What is it?" question. The gamma rays and other high-energy photons are penetrating radiation and can go through inches of material, which is why the CellRAD system is capable of detecting radioactive material from a distance. Measuring the amount of gamma rays that interact in a material helps to answer the "How much is there?" question. Figure 1 indicates the ability of the CellRAD system to detect multiple sources.

The satellite image in Figure 2 depicts how the system tracks and reports on the location of unknown sources. The black and colored dots show the tracking of the movement of a person carrying a cellphone running CellRAD software. The colored dots are also indicative of the strength of a radiation source.

CellRAD Overview

The gamma rays interact with the camera system on the phone, and produce small traces of lighted-up pixels in the camera image. In order to see these events, the lens is covered so that visible light does not get to the camera sensor. This data enables the phone to determine the strength of radiation source.

With the additional computational power available on a server, INL developed algorithms that enable approximate energy levels and more accurate dose levels of the radiation to be determined. While this cannot identify the exact nuclide, it provides additional data on what the radiation source could be.

The pictures and location and time stamp information are stored on the cellphone until they are transmitted over the cellular network, or could be stored until a wifi network is available.

By equipping commercially available cellular technology with CellRAD software, the frequency of illicit radiological source detection could significantly increase. This approach also introduces a forward reach capability extending detection activities far beyond where current sensors can be deployed due to cost or logistical concerns.

The CellRAD system provides capabilities that improve the information available to first responders about what nuclides could be present and in what quantities when better detectors are not available.

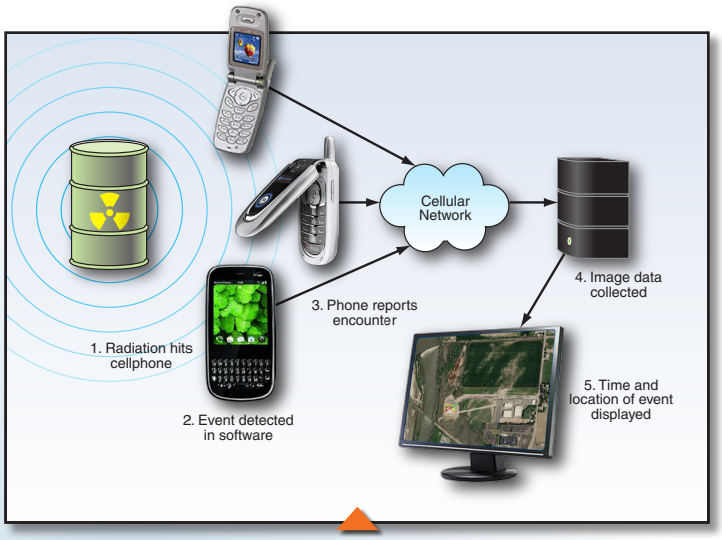

Figure 1. The CellRAD system has the ability to detect multiple sources.

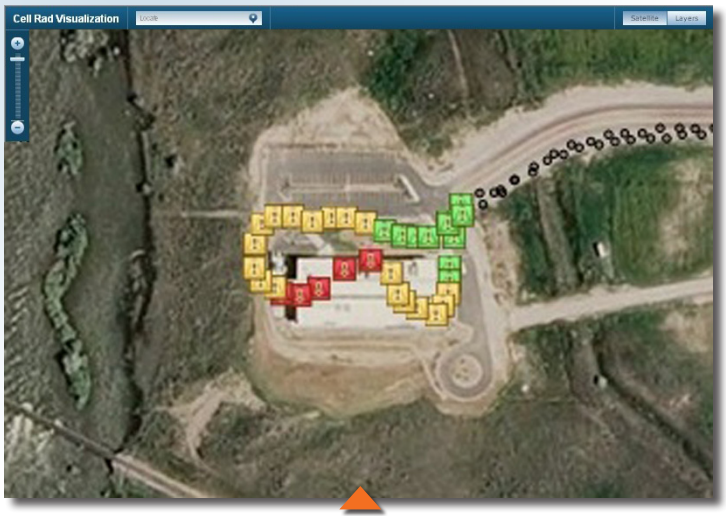

Figure 2. The black and colored dots show the tracking of the movement of a person carrying a cellphone running CellRAD software.

For more information

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