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SMARTPHONES

App Does The Dirty Work In Detecting Bombs

Phone Technology Harnessed
To Measure Radiation

By **JANICE PODSADA**

jpod sada@courant.com

EAST HARTFORD — What if your smartphone could detect a dirty bomb?

Eric Rubenstein, president of Image Insight Inc., asked that question two years ago.

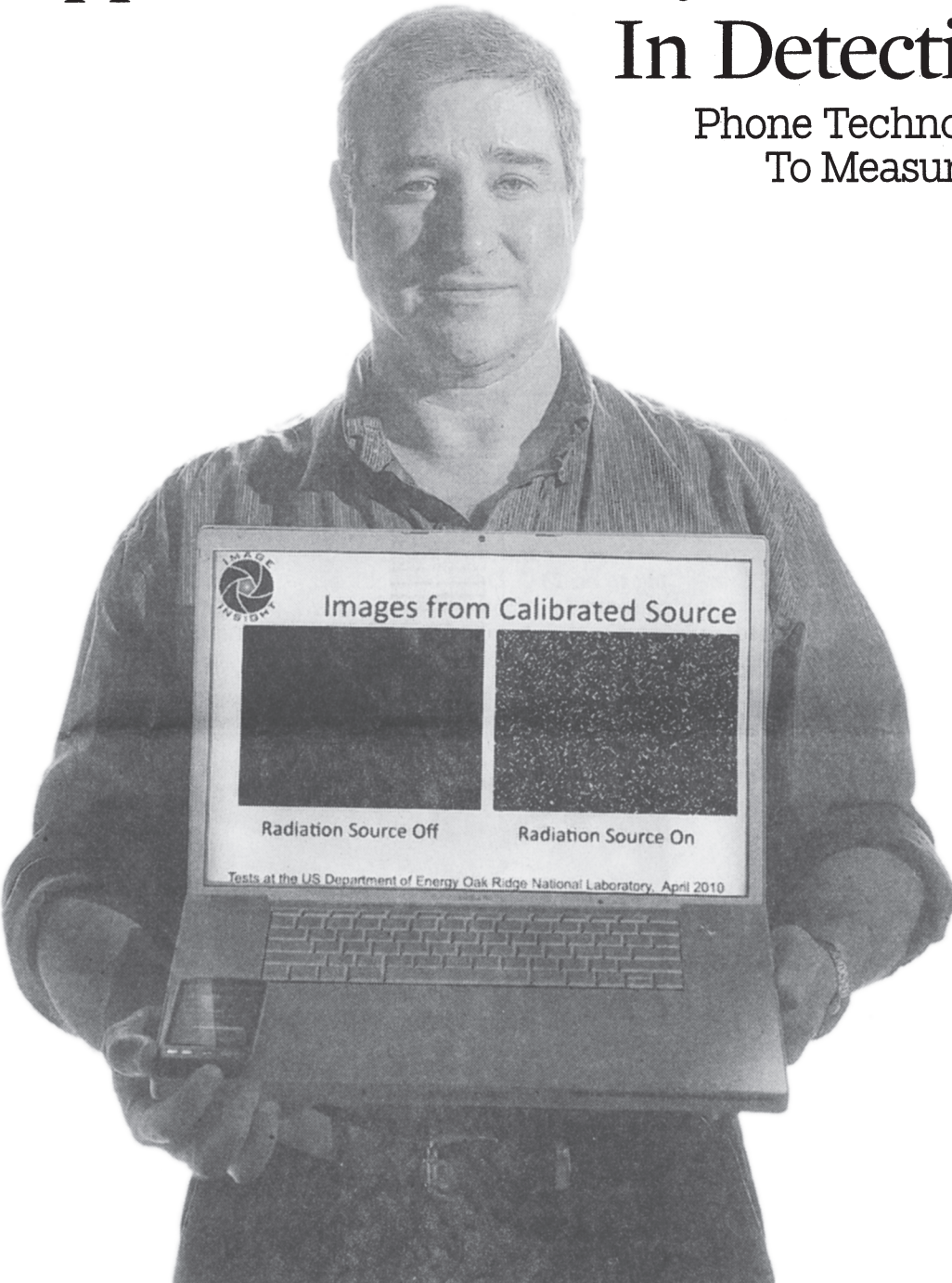
As a researcher at Advanced Fuel Research Inc. in East Hartford, Rubenstein had already invented a software system that used off-the-shelf digital cameras to detect radiation levels, so why not use a smartphone's on-board camera to do the same thing?

The resulting app, Gamma Pix, developed under a contract for the U.S. military, is the "equivalent of a Geiger counter," and while it isn't as sensitive as some instruments, it can tell you in a hurry whether you're in harm's way, said Peter Solomon, Image Insight's chief executive.

"If there is a dangerous amount of radiation, you'll know in 15 to 30 seconds," which is enough time to avoid harmful exposure, said Rubenstein.

In a few weeks, Gamma Pix will be available at Google Play and the Apple App store for under \$10.

The app, which detects gamma rays, uses the on-board camera's light-sensitive chip to measure radiation levels. When radioactive gamma rays hit the chip, they show up as bright pixels on a black background. The application's software "counts" the number of pixels, so the more pixels, the higher the radiation level, said Rubenstein.



AS AN ASTRONOMER, Eric Rubenstein was motivated after the 9/11 attacks to try to prevent more devastation. His laptop shows images similar to what a smartphone would display when his new app is in use.

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App Allows Smartphone To Detect Radiation Threat

Gamma rays are generated by radioactive atoms. And while radiation is a natural phenomenon — in fact radiation levels typically intensify as you rise above sea level due to cosmic radiation — the app is designed more to help people concerned about radioactivity terrorism.

The military “funded us to develop a smartphone application to put in the hands of troops. They have apps for location and operations and communication and now we’ve added radiation protection,” Solomon said.

Pre-App

An astronomer who taught classes at Smith College and Yale University, Rubenstein had the summer off in 2002. “I was just a soccer dad listening to reports of radiation threats after 9/11, and wondering: ‘How can I as an astronomer possibly help?’” he said.

He decided to leave academia and pursue applied science. In the fall he was hired by Advanced Fuel Research (AFR) to do research into alternative energy. But even before his start date, he was mulling a system to detect radiation levels.

“At my interview, I asked if it was OK if I work on projects other than alternative energy,” he said.

AFR, as it turned out, was the place to do just that. Founded by Solomon, his wife, Sally Solomon, and David Hamblen, AFR was the trio’s second company. Their first company, Online Technologies, founded in 1991 to develop equipment to test computer chips, sold for \$23 million in 2001.

“Our business model was to operate as a research lab and spin off companies,” Peter Solomon said.

Solomon liked his new employee’s idea.

Support for Rubenstein’s research, in the form of more than

\$1.2 million in grants, came from the National Academy of Sciences, the Department of Homeland Security and the Advanced Research Projects Agency, an arm of the U.S. Department of Defense that promotes new technologies.

Rubenstein’s training as an astronomer led him to his invention. As a stargazer, Rubenstein was accustomed to taking long-exposure photographs of the Milky Way’s star clusters to make high precision measurements of their brightness.

But making the stars stand out in those photographs required him to clean up the cosmic “clutter.” Radioactive cosmic rays and other radiation sources appear as little white spots on the photographs. For an astronomer, those white spots are a nuisance that are best scrubbed from the image.

But what is “clutter” in a photograph of a star cluster is a reliable indicator of gamma rays on a photograph or video taken by a surveillance camera.

In 2008, U.S. patent No. 7,391,028, “Apparatus and Method for Detection of Radiation,” was issued to Applied Fuel Research, listing Rubenstein as the inventor.

“The advantage of our system is it works on already available hardware,” Rubenstein said.

The system, which uses commercial security and surveillance cameras and computers with Web cams, is about to be deployed by the U.S. Department of Defense and by Homeland Security to protect borders, train stations, airports and other strategic locations. Its first deployment was the Washington, D.C., Metro system, Solomon said.

On The Phone

It wasn’t long before Rubenstein began thinking about developing a cellphone app based on his radiation detection software.

And it didn’t take a lot of persuasion to sell the idea to military officials, who quickly saw its value in protecting soldiers.

With the grant from the DOD, Rubenstein and Solomon formed Image Insight, a spinoff of AFR, and tucked the start-up into a corner of a red brick building, a former paper mill, overlooking the Hockanum River — also AFR’s headquarters.

In December 2010, Rubenstein began working on the project to adapt his software system for use in a smartphone.

Three months later, the project got a big, albeit unwanted, push when a tsunami and earthquake damaged two nuclear plants in Fukushima, Japan.

“Within three weeks of that accident, we accelerated our research,” said Rubenstein, who put in long days and gave up weekends to the project. “We owed it to our colleagues in Japan.”

The biggest challenge in adapting the system to operate on a smartphone “was the variation in cameras,” Rubenstein said.

The app, which has been translated into Japanese, has been laboratory and field tested by soldiers, Japanese researchers and the National Institute of Standards and Technology, Solomon said.

“It’s had a lot of real world testing,” Solomon said.

New Type of App

Gamma Pix joins a small, but growing number of apps that allow users to do more than check stock prices or emit a chorus of barnyard sounds.

Researchers at UCLA have developed a smartphone attachment that can detect the concentration of E. coli bacteria, according to a UCLA news release.

And Lifelens Project, run by students at various U.S. universities, has introduced a smart-

phone application that can detect, in a single drop of blood, the presence of the parasite that causes malaria, a boon for health care workers in developing countries.

And now border patrol agents and U.S. customs officials will be able to use Gamma Pix to detect the illegal movement of radioactive materials that could be made into dirty bombs, in which the radioactive material is packed into a conventional bomb and dispersed over a wide area. The app can help medical facilities prevent the theft of radioactive materials used to treat cancers.

The app can also be used to uncover “silent source” attacks, in which terrorists hide lethal pea-size radioactive materials in a stadium or other public space, exposing hundreds or thousands of people to deadly levels of radiation.

“It can identify radiation hot spots and people that have been contaminated with radioactive dust,” Solomon said.

“This has the potential of putting some degree of homeland security into people’s hands,” added Rubenstein.

Thousands of smartphones with the app and GPS locaters could be tied into a computer network and used to instantly map radiation levels throughout an area, Rubenstein said.

“As a citizen, this is something you can do. If everybody does this we’ll have a snapshot of what’s going on around the country,” Rubenstein said. “That’s why we’re aiming for a very low entry price — \$4.99.”

“It’s very exciting,” said Rubenstein. “We’re on the threshold of releasing it commercially. It’s taken a long time to get the science right. It’s been a labor of love and pain.”