Patented research remotely detects nitrogen-rich explosives

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A Kansas State University engineer has developed a patented technique that improves military security and remotely detects improvised explosive devices. The same technique could help police during drug searches.

William Dunn, the Steven M. and Kay L. Theede chair in engineering and department head of mechanical and nuclear engineering, and his research team have created a template-based system that identifies explosives hidden underground or in car trunks. The distance detection method—called stand-off bomb detection—improves safety, particularly for soldiers in combat zones.

"We want to keep people out of harm's way," Dunn said.

Dunn's engineering team has spent several years developing a method to detect car bombs. The latest research involves improvised explosive devices, or IEDs, which are chemical explosives that can be left in places such as suitcases or cars.

The majority of chemical explosives are nitrogen-rich explosives, Dunn said. While 25 explosives contain high nitrogen content levels, four types of explosives do not.

Dunn created a template-matching technique—called signature-based radiation scanning—to determine the presence of explosives. The template-matching technique works similar to a bar code. Dunn's team

has created templates for nitrogen-rich explosives and if a material matches one of these templates, then it potentially contains nitrogen-rich explosives.

To detect explosives, soldiers can place a sensor on an unmanned vehicle or aircraft that travels ahead of troops and tests road surfaces and other areas for IEDs. The sensor uses the template-matching method to search for the presence of explosives. The sensor then uses red, green or yellow lights to communicate back to soldiers who are in a safe place. The red light tells soldiers that nitrogen-rich explosives are present, while a green light means there are no nitrogen-rich explosives and a yellow light means a material might contain nitrogen-rich explosives.

"The work focuses on quickly detecting improvised explosive devices as far away as possible," Dunn said.

Currently, the unmanned system can work for distances around 1 to 3 meters away, but the researchers would like to make the system effective at 100-meter distances, which is nearly the length of a football field, Dunn said.

The patented technique and templates could be modified to detect other substances, Dunn said. For instance, police can use the template technique to detect drugs through airport security or other points of border entry.

Dunn's research team continues to improve the detection technology. They are developing ways to more quickly detect explosives in different positions and different sizes.

"We are looking at what is the minimum number of templates we can have in our library that would differentiate the largest number of IEDs from inert targets," Dunn said.

The researchers are improving other measurements that are not directly related to radiation but affect the detection of explosives. For instance, humidity affects radiation's ability to infiltrate the air. If researchers can adjust the method based on a site's humidity conditions, they can improve the detection system's accuracy.

Provided by Kansas State University