New research could possibly identify 'face' of terrorism

November 15 2005

Grumpy, sleepy, happy and bashful may sound like the names of some of the vertically-challenged mine workers from "Snow White and the Seven Dwarfs," but to a Kansas State University professor, they could also be the facial expressions of potential terrorists guarding their plans.

Akira Tokuhiro, a K-State associate professor of mechanical and nuclear engineering, is combining two research areas, biometrics -- including facial expressions -- and robotics, to combat terrorism.

"There are about six or seven basic facial expressions, such as happy, sad and angry, that you find anywhere in the world," Tokuhiro said. "We have some preliminary results with a limited database of digitalized images of Japanese females making facial expressions that the software tool can recognize and identify as a happy or sad expression."

A different project involves using a robotic arm to look at reactor components that are radioactive but need to be inspected for wear. According to Tokuhiro, inspection is complicated when inspectors can't get close enough to the radioactive material to examine it. Instead, the robotic arm can do most of the handling of the material and the inspection of the components.

"One of the things I have in mind is to put several cameras on the robotic arm and to program the arm to randomly stack, for example, cubes," Tokuhiro said. "However, the cubes may not be aligned at first. With the cameras looking for a facial expression or voice command from the

operator, the arm could then perform the final fine rotations to align the cubes."

Tokuhiro said a robotic arm with biometric capabilities has all kinds of applications related to security.

"You could use a robotic arm with biometrics when you have a person with a suspicious suitcase," Tokuhiro said. "Conceivably, you could use the robotic arm to survey the suitcase and simultaneously use biometrics to monitor the suspect's facial reactions."

According to Tokuhiro, the biometrics, combined with voice stress recognition technology, could come into play when questioning a potential suspect, since facial expressions, pupils and voice stress levels can change constantly while someone is being interrogated.

"One approach is to just look at and inspect the suitcase," Tokuhiro said. "But when you put the person with the suitcase, it makes the situation much more interesting. You could tell them, 'We've seen from our radiation sensors that there is something in your suitcase. Who are you working for?' The biometrics may be able to assist in catching a suspect in a lie or in extracting information from the suspect."

In addition to homeland security issues, both of Tokuhiro's projects potentially have applications for use by law enforcement and transportation officials in training and field work.

"If you're a state trooper who has stopped somebody for potentially aggressive driving and you look in the backseat and see some suspicious materials, it's within the officer's purview to ask the driver a few questions," Tokuhiro said. "In these types of situations, you really want to know whether a person is being cooperative or noncooperative."

Another application could lead to enhanced safety on highways and in the air by recognizing a driver or pilot who is tired or marginally intoxicated.

"You could install a camera on the dashboard with an onboard computer that indicates that the operator is tired or not as alert as they should be," Tokuhiro said. The technology could also someday be used for telemedicine and job training by biometrically characterizing the state of health of a person remotely or to confirm understanding of training materials.

"We're not too far away from being able to do these things," Tokuhiro said. "It's kind of scary but interesting to realize that we can digitally monitor human characteristics and behavior via information technology-based means."

Tokuhiro's work is just one way K-State is becoming a leader in research to combat terrorism.

Already, K-State's Douglas McGregor, associate professor of mechanical and nuclear engineering, is working to make the job of nuclear weapons inspectors easier by developing a small, portable device that detects neutrons, which are commonly emitted by some nuclear weapons-grade materials. And, K-State's Bill Dunn, also an associate professor of mechanical and nuclear engineering, has been recruited by the Marines to develop a way to improve bomb detection without having to get in close proximity to suspicious containers, such as cars, knapsacks or briefcases, that may conceal explosives.

Source: Kansas State University