Laser-based device offers alternative to video surveillance

Surveillance systems take on a new look with a technology developed by researchers at the Department of Energy's Oak Ridge National Laboratory.

The Laser-Based Item Monitoring System balances the need for high-resolution monitoring and personal safety with respect for confidentiality and personal privacy. This is especially important today with heightened emphasis on security and privacy and is possible because the system does not use video.

"Our system is specifically designed to address surveillance requirements in places where video would be unacceptable because of the presence of proprietary information or other privacy concerns," said Pete Chiaro, a member of the Engineering Science & Technology Division.

Using low-cost reflective tags placed on objects, LBIMS maps the precise location of high-value items. The laser can scan many points per second and can detect small changes – less than a centimeter – in the reflected signal, meaning tampering can be immediately detected.

The precision of the system is made possible by a high-resolution two-axis laser scanner capable of looking at a 60-degree field of view in 0.0005-degree increments, dividing the field of view into more than 10 billion individual pointing locations. A camera with comparable resolution over the same field of view would require a 10,000-megapixel detector.

Tests performed at the International Atomic Energy Agency in Vienna, Austria, and at the Joint Research Center in Ispra, Italy, have shown LBIMS to be relatively impervious to various attacks designed to foil the system. The Joint Research Center is involved in the development and testing of highly sophisticated laser scanning systems for a variety of applications. Even tests in highly reflective rooms such as one with stainless steel walls proved no challenge for LBIMS.

Chiaro notes that while other surveillance or monitoring products may include some of the features of the LBIMS technology, none provide its combination of capabilities. For example, in addition to being undesirable for the aforementioned privacy and security reasons, video with comparable resolution would be prohibitively expensive and impractical. Existing light detection and ranging (lidar) systems, which use scattered light, are optimized for detecting human-sized objects and offer angular resolution of only about 0.15 degree compared to the 0.0005-degree angular resolution of LBIMS.

Another competing technology is bar codes and radio frequency identification; however, in addition to being susceptible to jamming, the bar code reader or RFID antenna must typically be within a few centimeters of the tagged object. In addition, radio frequency transmissions necessary with RFID systems are subject to being intercepted.

Source: Oak Ridge National Laboratory