New security scanners safely detect threats from people on the move

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Credit: AI-generated image (disclaimer)

With increased threats to soft targets, security personnel need tools to detect menaces in fast moving, crowded environments. The EU-funded SPIDERS project introduces 'MM-Imager', a safe approach working in real-time which can scan bodies at short distances for hidden objects.

With increased and evolving threats against soft targets and critical infrastructures across Europe, comes a commensurate need for increased vigilance. This relies partly on the detection of concealed items which present possible threats to citizens and assets. Current solutions are proving to no longer be fit for purpose as they often involve bulky scanning devices and result in long checkpoint queues. At the same time, the number of transportation hubs and traffic through them, is growing.

The EU-funded SPIDERS project, has developed a 'passive scanning' solution which is based on a real time (up to 16 images by second), imaging system, working at millimetre wave frequencies and able to see through clothes and detect hidden objects such as liquids, powders or solids (metal or not). Crucially, the system dubbed 'MM-Imager', does not emit any radiation.

The mechanical over electronic scanning solution

SPIDER's millimetre wave passive technology is based on the measurement of the natural radiation emitted by bodies at microwave frequencies (around 0.1THz). The underlying principle is comparable to that of an infrared camera which measures infrared waves emitted by bodies. The solution collects these THz waves and then applies signal processing techniques.

Yet, as project coordinator Mr Nicolas Vellas points out, "The tricky part concerns the amplitude of the emitted microwaves which, being five orders below infra red waves, are hard to detect." Getting around this required the use of ultra-sensitive and stable sensors, built within a tailored architectures of microwave circuits and an adapted in situ calibration which caters for changing environmental parameters, such as temperature variations.

Obtaining a radiometric image using the 'synthetic aperture

interferometric radiometer' (SAIR) technology which underpins SPIDERS, is typically based on the simultaneous electronic sampling of these signals, collected by all the system sensors. These sampled signals are then intercorrelated with one another, with the resulting matrix transformed into a radiometric image. The system sensitivity is proportionate to the number of samples collected by each sensor; and herein lies the limitation.

A simplified prototype developed by the project demonstrated that this electronic scanning required a complicated array of digital boards along with a huge quantity of RAM memory, increasing the cost and complexity of building deployable devices.

The SPIDERS solution built on work undertaken by a previous EU-funded project, EFFISEC. As Mr Vellas explains, "We designed an innovative mechanical – as opposed to electronic - scanning solution resulting in simplified digital boards, with the ability to work in real-time, while still guarantying a high level of reliability."

This approach offered several additional advantages such as the efficiency of its in-situ calibration, which is more sensitive than alternatives thanks to its optical system which is capable of obtaining double the field of view.

A solution aiming to be equal to the threat

The main advantage of the SPIDERS system is its capability to work in real time, which means being able to scan moving people, unlike alternatives which can only scan people stationary for several seconds. This feature makes the technology applicable to a wide range of potential soft-target scenarios, (such as airports, train stations, stadiums) where increased security is sought without the consequent slowing of human traffic, such as the formation of long queues.

Another advantage is its safety aspect, in contrast to competitive solutions which actually emit microwave or X ray radiations whose impact on health is still not wholly understood.

All this against a backdrop where the nature of threats is changing. As Mr Vellas outlines, "Increased checkpoint vigilance, such as at transport hubs, has had an impact, so terrorists now target softer options such as concert venues. Until now there wasn't an appropriate, dynamic screening response, but the SPIDERS solution meets the necessary requirements to offer one."

Currently, MC2-Technologies, the company developing the SPIDERS technology, is continuing its R&D efforts to optimise efficiency. It is specially focused on improvements to image processing, as well as the integration of a threat identification technique which draws on artificial intelligence (using a deep learning approach), as well as the development of a special scanning corridor which incorporates an array of sensors.

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