System developed to detect plastic anti-personnel mines

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This is a US soldier practicing placing a claymore anti-personnel mine. Credit: Sgt. Thomas Kielbasa

A team of European researchers has devised a method for locating plastic anti-personnel mines, which are manufactured to avoid detection by metal detectors. The technique involves analysing the temperature of the ground in three dimensions using specific software and hardware, according to a study published in the journal *Computers & Geosciences*.

"Detecting anti-personnel mines is a very important and costly area of humanitarian work, and uncovering plastic mines is particularly hard, because they cannot be located using metal detectors, although there are alternatives", Fernando Rafael Pardo Seco, a researcher at the Electronic Technology Department of the University of Valladolid, tells SINC.

"Nowadays, nearly all anti-personnel mines are plastic, or have only a very small metal content, while anti-tank mines, which are larger, still have a significant metal content", explains the scientist.

Pardo Seco has incorporated a detection algorithm into a hardware platform, which has been developed by Paula López, a researcher at the University of Santiago de Compostela. Other researchers from the Galician university and others from the University of La Sapienza, Italy, also took part in the study, which has been published in Computers & Geosciences.

The temperatures of the plastic mine and the ground are very different, and although it is very difficult to measure thermal variations at computational level, the scientists have managed to find the right formula for doing so.

The team has applied an own software written with specific programming languages for this task (Handel-C and VHDL) to a programmable semiconductor device known as a Field Programmable Gate Array (FPGA).

The technique makes it possible to generate 3D thermal maps of the ground, making it easier to detect mines, and permitting a 34-fold reduction in the number of calculations required to measure the thermal variations compared with other systems available. "This gives us much greater speed than normal programmes on a personal computer, helping to facilitate the application of this system on the ground", stresses Pardo Seco.

The new method is a non-destructive evaluation technique, part of an interdisciplinary field of study focused on developing technologies to quantitatively classify materials and structures in a non-invasive way. These can be applied for anything from non-invasive medical diagnoses and examinations to the detection of faults within parts in an assembly line.

More information: F. Pardo, P. López, D. Cabello y M. Balsi. "Efficient software-hardware 3D heat equation solver with applications on the non-destructive evaluation of minefields". Computers & Geosciences 35 (11): 2239-2249, 2009.

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