PRESS RELEASE

Drones can detect smoldering embers in forests

As part of the EU-funded PROACTIF project, 42 European partners from research and industry are collaborating with Nokia to develop a new multi-sensor system designed specifically for drones. The German consortium, led by Fraunhofer IZM, is developing an innovative multi-sensor module that automatically detects heat. This compact unit combines radar and infrared technology. The combination of short- and long-range radar with three innovative packaging technologies results in a lightweight, robust system that can detect the precise location of pockets of embers in forest fires, even beneath the tree canopy.

Forest fires are now one of the major challenges facing fire departments and disaster control organizations in Central Europe. A critical task is locating and extinguishing embers in the undergrowth. Conventional drones quickly reach their limits in this area because they are too large and heavy to fly through dense vegetation. Additionally, thermal imaging cameras are often not sensitive enough to provide reliable data on hidden sources of fire. Currently, firefighters often have to use shovels to manually locate embers buried up to 1.5 meters deep.

However, the German consortium working on the PROACTIF project is developing a new solution: a multi-sensor module that combines radar and infrared sensor technology in a unit weighing less than three kilograms and offering ultra-lightweight, compact design. Heimann Sensor GmbH is supplying the infrared sensors. Researchers from the Fraunhofer Institute for Reliability and Microintegration IZM are collaborating with InnoSenT GmbH to develop innovative radar sensor technology and integrate the infrared sensors into the system. The newly developed drone can detect obstacles in its immediate vicinity and survey larger forest areas with a fully automated 360-degree view by combining short- and long-range radar with ranges of 80 and 200 meters, respectively. For the first time, the drone can fly at 30 km/h, even under the tree canopy, while the infrared sensor detects hot spots.

Three packaging technologies to ensure the best possible implementation
The unique expertise at Fraunhofer IZM enables the combination of three key assembly and interconnection technologies:

- LTCC (low-temperature cofired ceramic) technology enables powerful high-frequency antennas and stable signal processing, even at high temperatures.

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- Molding technology allows three-dimensional shaping of antenna structures, minimizing signal losses, which is crucial for long-range radar.
- Embedding technology integrates short-range sensor technology into flexible materials in a space-efficient manner, reducing weight and size.

Project manager and Fraunhofer IZM scientist Dr.-Ing. Christian Tschoban summarizes: "It is only through the interaction of LTCC, molding, and embedding technologies that short- and long-range radar can be combined with infrared sensors in an ultra-compact module. The result is multi-sensor packaging: a lightweight sensor unit that combines high resolution, robustness, and energy efficiency."

Practical Demonstration in German Forests
The multi-sensor module will soon undergo testing in a practical scenario in Germany. In close consultation with the forestry office and fire department, researchers will test the use of drones in the Muensterland region and near Wiesenburg. In the simulated fire, special care will be taken to ensure it occurs outside of the dry seasons and that birds are protected. The drones will autonomously fly through the forest and detect obstacles and embers in real time. Ultimately, when a forest fire is reported, the drones will automatically take off, providing an accurate picture of the situation and information on how many helpers are needed before the emergency services arrive.

Additionally, this technology has applications for search and rescue operations and critical infrastructure monitoring. With around 25 percent of the total consortium in the PROACTIF project, the German consortium is making a significant contribution to the development of safer and more powerful autonomous systems in Europe.

PROACTIF will run from June 1, 2025, to April 30, 2028. It is funded by the Chips Joint Undertaking (Chips JU) with a total of €41.8 million, including €2.02 million from the German Federal Ministry of Research, Technology and Space (BMFTR), €320,000 from the Free State of Saxony, and €90,000 from the Free State of Thuringia. The project involves 42 European institutions, including five from Germany, and is part of the German strategy to secure technological sovereignty in quantum research. The overarching goal is to increase European competitiveness in technology for unmanned missions and increase the cost-efficiency and effectiveness of monitoring critical infrastructure autonomously.

PROACTIF project partners:
Nokia Solutions and Networks Oy, Asya AI, Riga Technical University, HUN-REN Számítástechnikai és Automatizálási Kutatóintézet, Sieć Badawcza Łukasiewicz - Instytut Mikroelektroniki i Fotoniki, Heimann Sensor GmbH, Captain AI B.V., ViNotion B.V., InnoSenT GmbH, Silicon Austria Labs GmbH, Acorde Technologies, S.A., Eindhoven University of Technology, VIA electronic GmbH, TST-Sistemas, Universidad de Granada, Skyability, Research Studios Austria Forschungsgesellschaft mbH, Fraunhofer IZM, Würth Electronic, Safran Electronics & Defense/ SED SPAIN S.L., DEMCON Unmanned Systems

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BV, Mellanox Technologies Ltd, Van Oord Ship Management B.V., Avular Innovations B.V., CISC Semiconductor GmbH, SSH Communications Security Oyj, Centre Suisse d'Electronique et de Microtechnique SA, Citymesh Integrator N.V., Saab Finland Oy, League Geophysics B.V., VTT Technical Research Centre of Finland Ltd., Ascento AG, YellowScan, FixPosition AG, Leonardo S.p.A, Innovation River, Gdansk University of Technology, Luna Geber Engineering SRL, AITEK SPA, Università degli Studi di Perugia, Dimetor GmbH, Stichting IMEC Nederland.

(Text: Lotta Jahnke)



The drone is designed to provide information about hot spots before the fire department arrives, thereby making the emergency services' work considerably easier. I ©Spinver I print-quality image: http://www.izm.fraunhofer.de/pics I Video on this topic

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About Fraunhofer IZM:
Highly integrated microelectronics are omnipresent and yet often evade the eye. With 4 central technology clusters**, Fraunhofer IZM** covers a wide range of areas in quantum, as well as medical, communications and high-frequency technology. With our world-leading expertise, we offer our customers cost-effective development and reliability assessment of electronic packaging technologies, as well as custom-tailored system integration technologies at wafer, chip and board level. For over 30 years and at 3 locations, we have been supporting start-ups as well as medium-sized and large international companies (with knowledge transfer) and researching key technologies for intelligent electronic systems of the future.

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