XDrone
Haptic teleoperation of UAV with gamma-ray spectrometer for detection of radioactive materials in industrial plants

Duration      Start date      Total budget      Funding
3 years             01/01/2014              390,000 Euro        230,000 Euro

Scientific/Industrial objective
Large industrial installations requiring large warehouses for storage of materials such as steel, wood, building materials, or landfill and recycling industries, involve the possibility of including unwanted nuclear contaminants, and therefore the need for a monitoring technique secure for the operators involved. The same concept applies to the case of highly contaminated industrial sites and areas where incidents have occurred involving radiological or nuclear material. The objective of the project is the realization of a UAV equipped with a gamma ray detector for the fast localization and identification of nuclear material dispersed in the environment preventing the operator safety.

Ideas and solutions
A very innovative aspect of the project is the exploitation of a haptic user interface for remote control of an aerial vehicle (UAV). The user is able to provide 3D motion commands to the UAV and receive force feedback from the haptic interface. The UAV is also equipped with a novel CdZnTe-based custom radiation sensor, so that radiation sources can be localized and identified without a direct exposure of the human operator. By means of CdZnTe crystals, it is possible to realize solid-state radiation detectors whose limited weight and power consumption enable integration on UAV. Moreover, spectroscopic detectors can be realized, with the advantage to localize and identify the radiation source at once.

Results achieved
A commercial UAV has been acquired and equipped with a CZT-based gamma-ray detector. The UAV can be guided with a standard control unit and with a haptic commercial control device. The software for the haptic control of the system has been developed and implemented. Thanks to the cooperation with ARPA E-R, the new UAV has been tested and calibrated in the presence of a Iridium radiation source, located for this purpose in the service area of Emiltest, a company that operates in the field of non destructive testing. The haptic behaviour has been verified. Finally, the novel UAV has been tested in operational environments: a test flight has been performed in a S.A.B.A.R., a large waste disposal in Novellara (RE).
Follow up

- All the certifications required for flying with the UAV were obtained from Ente Nazionale per l’Aviazione Civile (ENAN) and two operators got the certifications for the flight.

- A web-site has been realized to describe the system (www.imem.cnr.it/xdrone)

- The prototype is now fully operational and is available for the exploitation by third parties. If you want to cooperate with us and/or you want to exploit the prototype in operational environments, do not hesitate to contact us through the website: www.imem.cnr.it/xdrone

Partnership

Istituto Materiali Elettronica e Magnetismo, IMEM-CNR, Parma

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