FOR IMMEDIATE RELEASE

Press Release - "MiSPiA"

November 2011

The MiSPiA Project ("Microelectronic Single-Photon 3D Imaging Arrays for low-light high-speed Safety and Security Applications"; **www.mispia.eu**) is a 3 years program coordinated by Politecnico di Milano, Dipartimento di Elettronica e Informazione, Italy, which was launched on June 1st 2010. It is supported by a 2.6 Mil.€ grant from the European Union Seventh Framework Program (FP7). It involves 7 partners (Universities, Research Centers and SMEs) from four different countries in a highly collaborative network. Expertises include Single-Photon Avalanche Diode (SPAD) technology, SPAD arrays and single-photon instrumentation, CMOS sensors fabrication and advanced SOI processes, design and fabrication of microlens arrays, development of time-correlated single-photon counting detection modules and imaging cameras, safety applications in the automotive field and security surveillance of sensitive areas.

Concept of MiSPiA project

The MiSPiA context is to deploy an enabling technology for those many social needs requiring the acquisition of 3D scenes at ultra-low light levels, at video or even higher frame rates, and also with centimeter distance-resolution. In fact, nowadays the imager market offers a broad portfolio of either commercial or scientific-grade cameras, ranging from consumer CMOS Active Pixel Sensor cameras up to high-end CCD imagers. None of them simultaneously offer high-speed and ultra-high sensitivity: CCDs reach sensitivity close to single-photon level, but require cooling and long integration times (i.e. very low frame rates); CMOS APS imagers provide video-rates, but with relatively limited detection efficiency, thus requiring bright illumination scenes. .

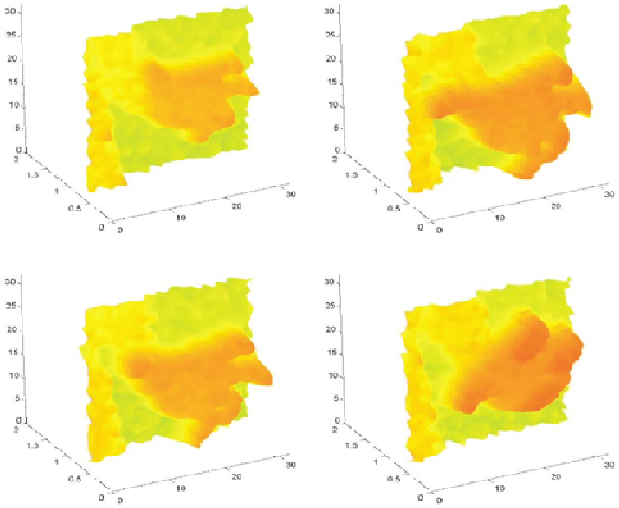
First Prototype of MiSPiA 3D camera (imager plus illuminator) for the indirect TOF (Time-of-Flight) laboratory tests.

Acknowledgement of support from the EC contract number 257646 (MiSPiA) FP7

Main achievements in the first 18 months

In the first 18 months of the MiSPiA project, many important results have been achieved, the most important one being to have fabricated working SPAD detectors with outstanding performances.

At the beginning of the project, the "*Requirements, constraints and specifications for the 3D SPAD imagers*" were fully defined for both the 3D ranging imagers (based on direct and indirect Time-of-Flight TOF techniques) and the 2D imagers (based on photon counting). The characteristics and specifications of individual SPAD detectors, smart pixels, array chips and full imagers were defined, based on the accurate exploitation of a cost-effective standard CMOS fabrication technology.



Example of a 3D acquisition movie, at 25 fps, showing fast movements of a hand.

The design of "*Test structures for SPADs, smart-pixels and mini-arrays for 2D imaging*" promptly started in month 2 and was completed by the end of the first year of the project.

The first design of "*SPAD smart-pixels and mini-arrays for 3D imaging*" was completed at the end of the first year. Different smart-pixels for TOF-based 3D ranging imagers were proposed and implemented: i) direct dTOF, with in-pixel Time-to-Digital Converter able to provide the round-trip time of flight of each single photon; ii) an indirect iTOF with pulsed excitation of the scene; iii) an indirect iTOF with a sinusoidal-modulated scene illumination. Different light sources (highly efficient LEDs and pulsed lasers) were considered and evaluated for assessing the best candidates for the Safety 3D short-range (20 m) automotive ranging applications and the Security 3D long-range (1 km) applications. The most promising smart-pixels and illuminators are being selected for the final design of smart-pixels and arrays for the 3D ranging imagers.

As a conclusion, the launching of MiSPiA was a success and the first results are emerging, with very excellent results.

Acknowledgement of support from the EC contract number 257646 (MiSPiA) FP7