MiSPIA: Microelectronic Single-Photon 3D Imaging Arrays for low-light high-speed Safety and Security Applications

3D cameras, based on the measurement of the Time-of-Flight of single photons by means of Single-Photon Avalanche Diode imagers, for automotive safety driving and security surveillance application

MiSPIA will develop beyond state-of-the-art photonics technology for array imagers of smart-pixels able to detect single photons. Intelligent in-pixel pre-processing will simultaneously provide ultra high sensitivity (single-photon level), very high frame-rate (up to 200,000fps) and advanced multi-spectral (300-900nm) three-dimensional (3D) distance ranging and two-dimensional (2D) imaging of fast moving objects. MiSPIA detectors will be used in two key applications: long-range (200-1,000m) 2D and 3D active identification in low light level surveillance operations; and very fast (over 200fps) short-range (10-50m) 3D monitoring in automotive pre-crash safety systems. Instead of (slow and noisy) CCDs and CMOS active pixels (with poor sensitivity and noisy electronics), MiSPIA will exploit the ultimate performances of truly-single photon detectors: the Single-Photon Avalanche Diodes (SPAD). MiSPIA imagers will be based on four different SPAD smart-pixels: “photon-counting” pixels for 2D imaging; LIDAR pixels for 3D direct “time-of-flight” (dTOF); two different phase-sensitive pixels for 3D indirect time-of-flight (iTOF) depth acquisitions. Full-size imager chips will be manufactured, characterized and eventually integrated into two 3D ranging cameras deployed into the two end-users applications for validation. MiSPIA technologies will be both highly-advanced and cost-effective: a high-voltage 0.35µm CMOS processing for front-side illuminated imagers; and a new flipped-chip Silicon-on-Insulator (SOI) CMOS technology for back-side illuminated imagers. Both will prove beyond state-of-the art co-integration of photonic SPAD detectors and CMOS microelectronics for intelligent and dense 2D imaging and 3D ranging high-performance cameras. Such cameras will provide imaging at the quantum limit and on-chip pre-processing at the most effective speed at a drastic reduction of manufacturing costs, down to 5€ per imager chip. The developments of the MiSPIA Project will be published on the official website www.mispia.eu.

Contact info
ZAPPA Franco
Via Golgi 40
20133 Milano
ITALY
Tel. +39 02 23996149
Fax. +39 02 2367604
E-mail: franco.zappa@polimi.it

Participants
Coordinator: POLITECNICO DI MILANO, ITALY

Participating partners:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLITECNICO DI MILANO</td>
<td>ITALY</td>
</tr>
</tbody>
</table>

Project ID card
- Funded under: Information and Communication Technologies
- Area: ICT-2009.3.7 - Photonics
- Total Cost: €3.40m
- EU Contribution: €2.63m
- Project Reference: 257646
- Execution: From 01/06/2010 to 31/05/2013
- Project status: Running
- Contract type: Information and Communication Technologies CP Collaborative Project

Links
- MiSPIA
- Multimedia
- Poster
- JPG | 1740 kBytes

News
- E-newsletter 2011 01/07/2011
- MISPIA news 01/01/2011

Publications
- FP7-257646-MISPIA: