Live Demo: Encoding very bright illumination levels with a linear HDR image sensor

Juan A. Leñero-Bardallo, Ricardo Carmona-Galán, Ángel Rodríguez-Vázquez

Institute of Microelectronics of Seville (CSIC – Universidad de Sevilla), Avda. Américo Vespucio s/n
Seville (Spain)

Contact: juanle@imse-cnm.csic.es

Abstract.- We will display the capabilities of a linear High Dynamic Range (HDR) sensor with hybrid operation [1]. It operates in a similar manner to a conventional APS (Active Pixel Sensor) sensor. The novelty is that pixels are never overexposed because whenever the voltage at the integration capacitance reaches a voltage threshold, the pixel self-resets and stars over integrating charge again. The number of overexposures of each pixel is transmitted off-chip with asynchronous circuitry that implements the AER (Address Event Representation) protocol. At the end each integration time, the remaining voltage at each pixel integration capacitance is digitized and readout. This data in combined with the number of exposures of each pixel to encode linearly illumination values.

The system demonstrator will showcase the sensor possibilities to measure very high illumination levels within the visual scene, preserving the details of darker regions. A neon tube will be placed in front of the sensor to measure the illumination levels inside it, as it is shown in Fig. 1. The visitant will notice how the illumination levels differ when the neon tube is hot, reaching a steady state. The sensor performance (see Fig. 1(b)) will be compared against a cell-phone camera operating in HDR mode (see Fig. 1.(c)) and to an infrared camera (see Fig. 1.(d)). During the demonstration, the visitor can also use his/her own cell phone camera to compare its performance against the developed HDR image sensor.

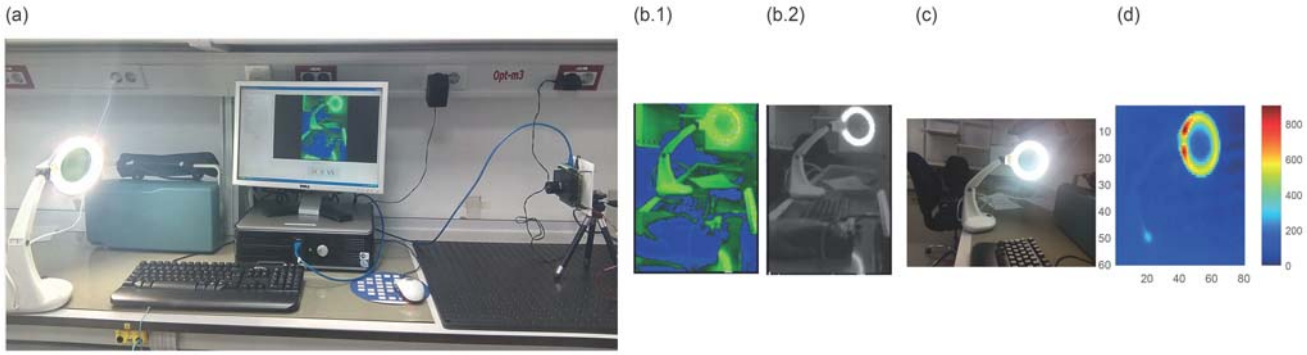

Figure 1: (a) Demonstrator experimental setup. (b) Snapshot of the visual scene taken with our sensor. In the picture (b.1), measured illumination levels are represented with a color code (24-bit depth). In the figure (b.2), sensor outputs are processed with a tone mapping algorithm to represent illumination levels with 8 bits. (c) Snapshot of the visual scene taken with a conventional CMOS camera. (d) Snapshot of the visual scene taken with an infrared camera.

References

[1] Juan A. Leñero-Bardallo, Ricardo Carmona-Galán, and Ángel Rodríguez-Vázquez, "*A wide linear dynamic range image sensor based on asynchronous self-reset and tagging of saturation events*", IEEE Journal of Solid-State Circuits, September 2015, vol. 52, Issue 6, pp. 1605-1617, April 2017, ISSN**:** 0018-9200. DOI: 10.1109/JSSC.2017.2679058.

Acknowledgements

This work was supported in part by the Spanish Ministry of Economy and Competitiveness under Grant TEC2015-66878-C3-1-R, Co-Funded by ERDF-FEDER; in part by Junta de Andalucía CEICE under Grant TIC 2012-2338 (SMARTCIS-3D); and in part by ONR under Grant N000141410355 (HCELLVIS).