Live Demonstration: Motion Detection Vision Sensor with Dynamic Background Rejection

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I. Introduction

In surveillance and monitoring applications, motion detection using commercial cameras with off-line high-level algorithm processing is not efficient. They have to force the high-level processor continuously analyze the acquired high-resolution images. This causes a large waste of power, since there are no events in most of the cases. Embedding low-level image processing on-chip will make the system to be more energy efficient. In this demonstration, we present a QVGA vision sensor embedding a low-power dynamic background subtraction algorithm [1]. The sensor detects anomalous motion and generates an alert event map as input for high-level processor. Several sensors reported in literatures detect motion events based on frame difference technique embedded on-chip, however they cannot suppress noisy zones of the scene such as swaying vegetation. Different from our previous fully analog implementation [2] - [3], this digital approach allows motion detection over a large range even in harsh outdoor scenarios. The chip consumes 1.6mW when operating at 15fps dispatching QVGA gray-scale image and event map. In this demonstration, we use FPGA module to control the vision sensor, for low power surveillance and monitoring application, it could be simply replaced with one low power processor to build a low power system which lasts for months with battery.

II. Demonstration Setup

The demonstration setup is depicted in Fig.1. The vision chip is mounted on one PCB hosting a 3D-printed C-mount lens holder. The demo is controlled by one FPGA board connected to a laptop, which is used to provide the power supply and to acquire gray-scale images together with their motion bitmaps. The images will be drawn in real-time on the Graphical User Interface (GUI) application running on the laptop.

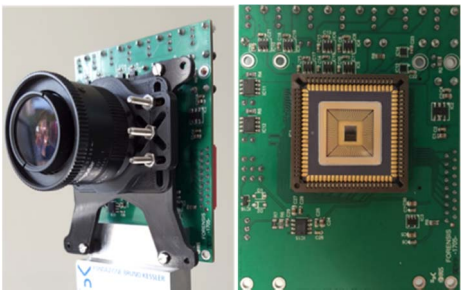

Fig. 1. The complete demo (left) contains: PCB board carrying vision chip (right), FPGA module and optical lens.

III. Visitor Experience

The visitor could interact freely with the demonstration. The GUI running on the laptop will show the visitor in real-time the gray image with its corresponding event map. By this way, the visitor could understand easily how the vision sensor detects motion events and updates its background information in real-time. An object with periodic movement could also be placed before the demo, then the visitor will verify that this vision sensor adapts even dynamic background (shown in Fig. 2).

IV. Conference Paper

This demonstration is related to the work that has been submitted to the IEEE SENSORS 2017 Conference. Paper ID:1467, Y. Zou, M. Gottardi, D. Perenzoni, M. Perenzoni, D. Stoppa, "A 1.6 mW 320x240-Pixel Vision Sensor with Programmable Dynamic Background Rejection and Motion Detection".

V. Acknowledgment

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VI. References

[1] Z. Smilansky, "Miniature Autonomous Agents for Scene Interpretation," 7,489,802 B2, US Patent Application, Feb. 2009.

[2] N. Cottini, M. Gottardi, N. Massari, R. Passerone, "A Bio-Inspired APS for Selective Visual Attention," IEEE Sensors Journal, vol. 13, no. 9, pp. 3341-3342, 2013.

[3] N. Cottini, M. Gottardi, N. Massari, R. Passerone, and Z. Smilansky, "A 33µW 64×64 pixel vision sensor embedding robust dynamic background subtraction for event detection and scene interpretation," IEEE J. Solid State Circuits, vol. 48, no. 3, pp. 850–863, 201

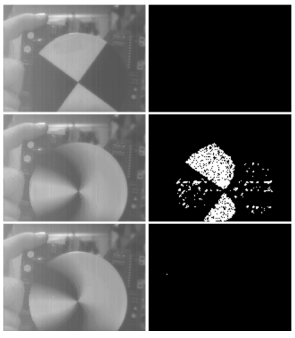

Fig. 2. The vision sensor with embeded processing on chip adapts its dynamic background (periodic rotating objects). Left parts show the acquired gray images, while right parts are their corresponding event bit-maps.