BA1-06: A CMOS Imager with Intermediate Read-Out using Reconfigurable Counter/SRAM

Group Members: LAU, Hon Fung (04625494) LI, Pok Man (04625509) CHOI, Man Hon (04691003)

Project Code: BA1-06 Date: April 18, 2007

Project Supervisor: Professor Amine Berrak
**PROJECT OVERVIEW**

A CMOS imager with intermediate read-out using reconfigurable counter/SRAM is a new CMOS imaging technology that is used in this project. This RCM-based spiking pixel provides counting as well as in-pixel storage functionalities which allow for intermediate readout of digital pixel value. These advantages make the spiking pixel particularly suitable to be integrated into a wide range of consumer products.

**Aim and Objective**

The aim of our project is to design and test a CMOS image sensor based on a spiking pixel and Reconfigurable Counter Memory with binary coding as well as a CMOS imager. Spiking pixel architecture provides a relative insensitivity to power supply scaling with the following functionalities: in-pixel storage capability, in-pixel analog-to-digital conversion and random read-out of digital pixel values. The objective of our project is therefore to:

- minimize the size of one pixel
- larger fill factor
- higher dynamic range of illumination
- Less power consumption
- Higher readout speed
The proposed RCM combines a combinational incrementer, an 8-bit SRAM (bits B0–B7), and an 8-bit DRAM (bits A0–A7). The RCM circuitry has two functions, namely:

1) counting the number of incoming spikes or pulses Clk
2) storing the digital pulse count value

Each time a spike or pulse is detected (Clk high), pulse count X is updated (X=X+1) in the SRAM by incrementing the previous pulse count stored in the dynamic memory cell. At the end of the pulse (Clk low), the updated pulse count is latched back into the dynamic memory cell.
RCM-BASED SPIKING PIXEL
SIMULATION RESULTS

Layout of the RCM-based spiking pixel

- The analog and digital parts of the pixel are separated by guard rings
- Pixel size is 38x39um.
- Fill factor is larger than 25%

- The generated stream of spikes or pulse counting is directly proportional to the photo current.
- Illumination information will be a linear function of the pixel illumination level.

Results