Application Specific Image Sensors

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The steady decrease in CMOS circuit line widths has altered the economics of image sensor design. We have fabricated a 256 × 256 Active Pixel Sensor (APS) in a 0.9 micron process with a 20 micron pitch, and a 1024 × 1024 APS in 0.5 micron technology with a 10 micron pitch. We are planning to make use of further line width and circuit design improvements to achieve an effective pixel size of 5 microns in the near future. At this point the APS approach provides an area efficiency comparable to that of CCD with the added benefits of CMOS integration, low power (3V supply), and random accessibility for electronic panning.

We are taking advantage of this trend to develop an Application Specific Image Sensor (ASIS) capability. By integrating area-efficient APS arrays with CMOS digital circuitry we can generate a completely new set of system design options. Imager arrays may be sized to meet application-specific resolution and sensitivity, and placed on a single chip with one or more other functions: timing and control, A/D conversion, digital signal processing, and custom system I/O interfaces.

In this talk I will outline our recent progress including:

- A viable Color Filter Array (CFA) process based on died photoresists has been developed within Bell Labs. A 256 × 256 color video camera based on a CMOS sensor has been demonstrated.

- A 1024 × 1024 pixel image sensor has been fabricated and undergone early testing. This device holds great promise in applications as diverse as document imaging, still photography, and high resolution photography.

- Operation of APS imagers in frame-to-frame differential mode has been demonstrated and is being evaluated for motion detection and compression applications.