3:30pm - 4:00pm (Invited)
TuFF1

Concept, Development, Mass Production, and Applications of Artificial Retina Chips

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1. Concept and Operation Principle: The conventional image processing systems suffer from low speed, high power consumption, high cost, and large size, mainly because the sensing and processing are separated both spatially and temporally. We have proposed a novel type of image sensor named artificial retina LSIs (AR LSIs) which combine both functions of image sensing and image processing, similar to our human eyes. The operation principle is based on the optoelectronic vector/matrix multiplier, where the input image is corresponding to the matrix, and the electric control signal to the vector (Fig.1). The functions of the image processing include simple image capturing, edge extraction, 2D to 1D image projection, random access, resolution control and so on (Fig.2). These functions can be selected just by changing the pattern of the electric control signal. The optoelectronic multiplier operates in a semi-parallel and an analog mode.

2. AR LSI Family and Performance: We have developed four kinds of AR LSIs based on the CMOS technology (Fig.3). They are B&W low resolution types with 32 $\times$32 pixels and 128$\times$ 128 pixels, and color high resolution types with 352$\times$288 pixels (CIF) and 160 $\times$3$\times$144 (QCIF). The features of the AR LSIs over CCDs are image processing capabilities, low power consumption (typically 10 times lower), single power supply (5 or 3V), fast image processing, low cost, and integration with the peripheral circuits such as CDS, ADC. The low resolution types are suitable for the applications of image recognition because of the high frame rate (500fps). On the other hand, the high resolution types are suitable for the image monitoring and recording as well as image recognition because of the high SNR (54-60 dB). In response to the market's requirements, we have developed wired and wireless AR cameras which consist of AR LSIs, plastic lens, MCU and/or ASIC (for image recognition, AR control, color image processing and image compression), SRAM, and IF module. Several kinds of recognition algorithms such as motion detection, shape analysis, have been also developed for supporting various applications.

3. Applications: The applications of the AR LSIs are extending from games, portable phones, PDAs, PC peripherals, to security and surveillance systems (Fig.4). These applications are categorized into four groups by the use of the AR camera, that is, wired/wireless type and standalone/network type. The network system where many AR cameras are connected on a single transmission line is appeared in the practical fields for the first time using the distributed image processing by the AR cameras. In this talk, the applications to the games (Nintendo: Pocket Camera, Mitsubishi: Interactive Game using Sega Saturn), portable phone (Tu-Ka: take a picture and transmit), PC peripheral (Finger Print Recognition), security (SOK: Human Detection Sensor), transport system (Mitsubishi Precision: Parking Surveillance System, Traffic Flow for ITS) will be introduced in detail.

(Reference)

1)K.Kyuma,et.al.,nature,372,6502,197,1994. 2)E.Funatsu,et.al.,IEEE JED,44,1777,1997.

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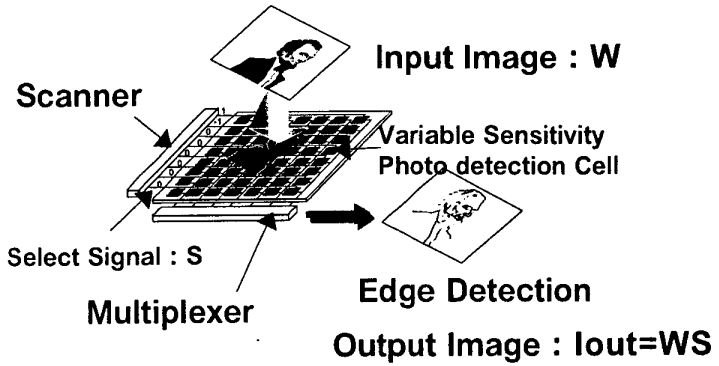

FIG.1 Basic Configuration of AR LSI

Name	M64285FP(Clear Mold) M64285K (Ceramic)	M64283FP(Clear Mold) M64283K (Ceramic)	M64287U (B&W) M64289U (Color)	M64270P (Color)
Pixels	32 x 32	128 x 128	352 x 288	160 x 3 x 144
Photo	(13mm×5.3mm)	(11.1mm×6.9mm)	(11.0mm×14.0mm)	(13.0mm×15.0mm)
Image			B&W Color	

FIG.3 AR LSI Families

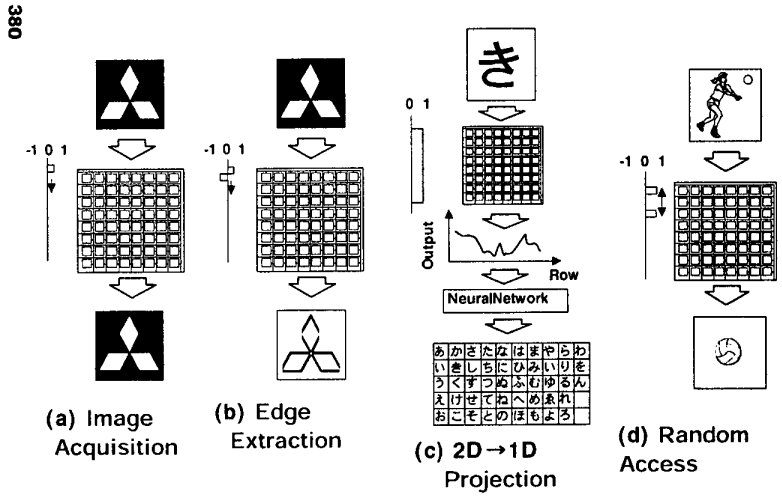

FIG.2 Function of Image Processing

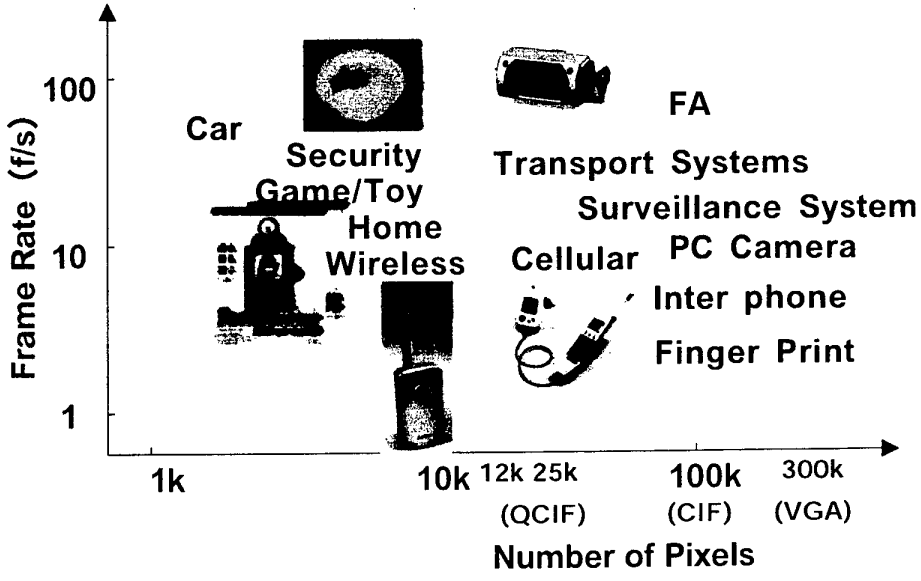

FIG.4 Applications of AR LSIs