4000 Scanning Line Ultrahigh-definition Camera

-Towards a future broadcasting system conveying a higher sense of reality-

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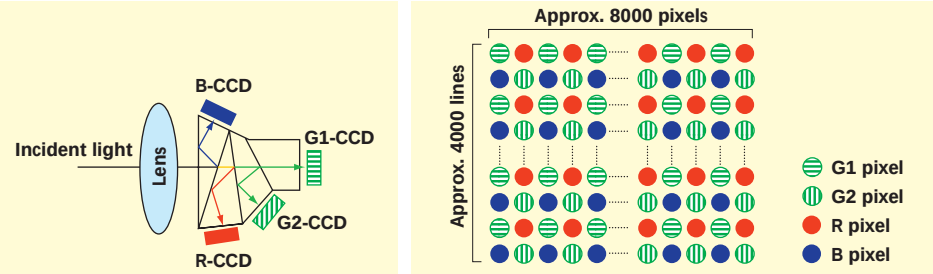
The Science & Technical Research Laboratories, with the goal of creating new broadcasting services, are studying an ultrahigh-definition image system as a medium for wide-angle/large-screen presentations conveying to the viewer a sensation of reality higher than that of the present HDTV systems and an image definition equivalent to gravure printing. We recently constructed a 4000 scanning line image system, this number of scanning lines being four times that of the present HDTV system. This video input/output system will be used to clarify the various requirements for an ultrahigh-definition image system.

Table 1 shows the 4000 scanning line image system and Hi-Vision (HDTV) signal formats. The system has four times the number of horizontal pixels and four times the vertical scanning lines of HDTV. The ultrahigh-definition image is processed by dividing it into signals the size of an HDTV signal, which makes it possible to employ the current HDTV signal processing circuit and peripherals. In this manner, the cost and development time of this system can be reduced.

A 4000 scanning line camera system with a 16:9 aspect ratio, which is the same as HDTV's, will necessitate approximately 32 million pixels (approx. 4,000 scanning lines × approx. 8,000 pixels) for an imaging device. However, no imaging device capable of shooting motion images with such a huge number of pixels, and at 60 frames/second, has been developed. For this reason, the 4000 scanning line imaging system uses four 8-million pixel CCDs (Charge Coupled Device) for the acquisition of the motion images that have already been composed.

As shown in Figure 1 (a), an optical image passing through a lens is separated with a color separation prism into three different spectra: two green (G1, G2), red (R), and blue (B). Each forms an image on its own 8-million pixel CCD. The four CCDs' relative positions are fixed in the prism with a half pixel offset, as Figure 1 (b) indicates. This gives a resolution equivalent to that of a 4000-scanning-line single CCD color camera that shoots in color by using 32 million pixels (8 million pixels × 4).

The external appearance of the prototype camera head is shown in Figure 2. The camera head weighs 76 kg, and it consumes approximately 600 W. It has a resolution limit of 2700 TV lines or higher. Further work, with the aim of creating a practical system that is durable enough for use outdoors, is needed to improve characteristics such as size, sensitivity, and resolution. We will also continue our studies on an advanced TV system conveying a higher sense of reality through quantitative evaluations of large-screen effects and the sensation of reality, by shooting various types of video material with this system.



(a) Color separation prism with four CCDs (b) Individual CCD pixels' relative positions and functions

Figure 1: 4000 scanning line imaging scheme using a color separation prism with four CCDs

Figure 2: External appearance of prototype camera

Table 1: Signal format comparison

Items	HDTV	4000 scanning line image system
Effective line number	1080	4320 (4096)*
Effective pixel number/line	1920	7680
Scanning scheme	Interlaced scanning	Progressive scanning
Display aspect ratio	16:9	16:9
Frame rate (Hz)	30	60

* The number is currently 4,096 due to a restriction on the effective number of lines for an imaging device.