# VIDEO WORKSTATION AND ITS APPLICATIONS TO IMAGE SIMULATION SYSTEM

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ABSTRACT

Video Workstation is a newly - developed video processing system that features both cost-effectiveness and versatile applications.

The system, consists of a personal computer, a high speed image processing board, a video-image storing device, a color image scanner, and a color printer. The characteristics of the system are the high-speed image processor, multimedia processing, and several new image simulation software, such as Eye-glass Frame Video System and making color overhead transparencies.

## I. Introduction

With rapid progress of memory chip, image processing LSI, and personal computers (PC), cost-effective PC-based image processor is sufficiently realizable.

This paper describes Video Workstation, a newly-developed video processing system, that features both a high-speed image processing board which contains a microprogrammable VLSI chip, and multimedia processing.

The system consists of a personal computer, a high speed image processing board, a video-image storing device, a color-image scanner, and a color printer.

Fig. 1 and Fig. 2 show the system blockdiagram and exterior view of the Video Workstation, respectively. Software configuration, shown in Fig. 3, consists of OS, utility program for microprogrammable VLSI T9506, utility program for language C and text editor, and several application programs.

## II. Video image store

The video image store (VIS), illustrated in a block diagram Fig. 4, has an A/D-D/A converter, luminance/chrominance separator, 2 video image memory systems which interface to the personal computer, and cursol signal display controller.

The VIS has the feature of hardware supercomposition of color video images, PC text, and graphics images. The input signal is NTSC color video signal.

Sampling frequency (fs) is 14.3 MHz for luminance, and 3.58 MHz for chrominance, each signal is 8 bits/pixel. The each image memory can hold one video image with 768 pixels (horizontal) x 480 lines (vertical).

Output signal is R, G, B video signals.

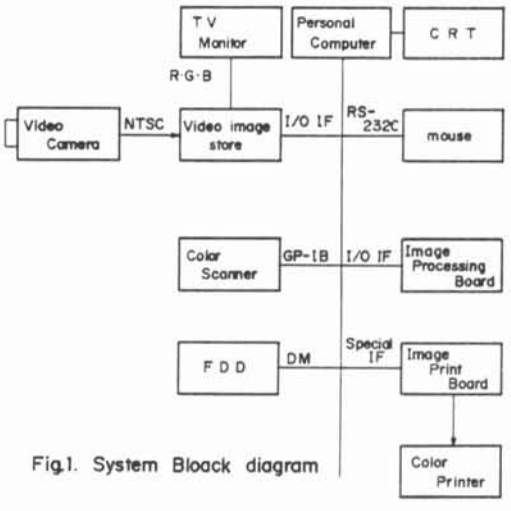


Fig.1. System Bloack diagram

Fig. 2. Exterior view of the Video Workstation

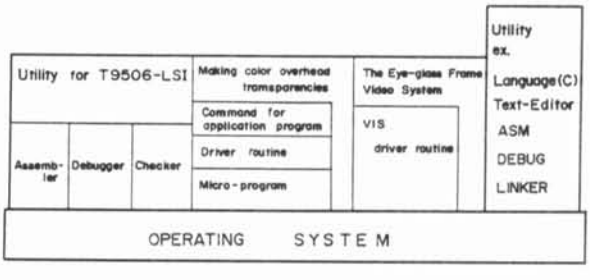


Fig. 3. Software configuration of the Video Workstation

III. High-speed image processing board

The image processing board, both compact and multi-functional, contains micro-programmable VLSI chip T9506 and a three mega-byte memory.

Block diagram and exterior view of the board are shown in Fig. 5, Fig. 6., respectively.

The T9506 is fabricated with a 1.2 μm double-layer metal CMOS process. It contains 170 KTr, and works with a single 5 V power supply. The T9506 is a general purpose processor for image analysis with writable control memory.

It supports especially high-speed image processings such as FFT (Fast Fourier Transform), spatial filter, Affine transform, and histogram.

T9506 has three external data memory ports and each port reads or writes data. Each data memory can be up to 1 M word x 32 bit.

Address generators (AG1, AG2, AG3) calculate 20 bit data addresses. PROC has 32 x 32 bit multiplier and 64 bit ALU. PROC and AG1 to 3 work as parallel pipelines.

Besides the conventional image processing functions such as image enlarging, reducing and shifting, the three mega-byte memory enables the system to store image data that can be used for both scanning and printing.

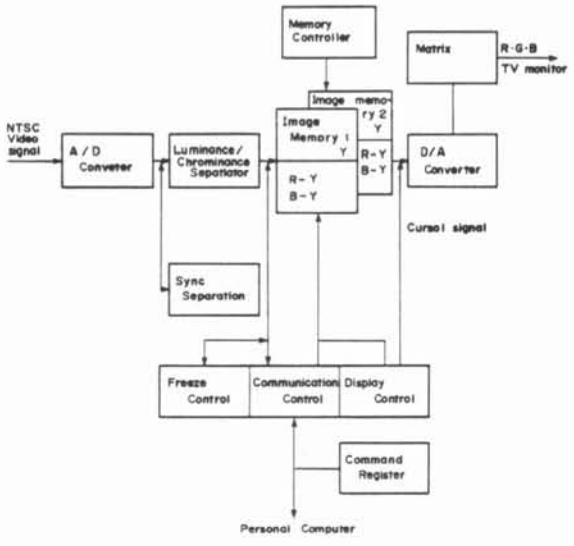


Fig. 4. Hardware blockdiagram of video image store

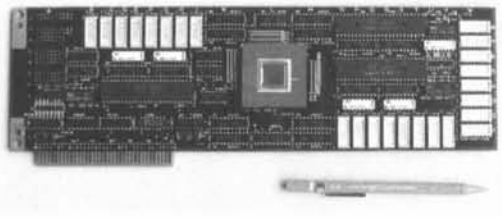

Fig. 6. Exterior view of the image processing board

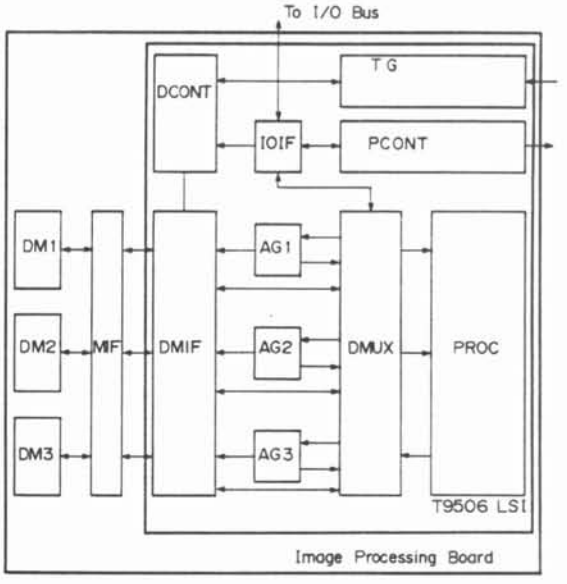


Fig. 5. Block diagram of the image processing board

TG : Timing generator
DCONT: Data transfer control unit
PCONT: Program control unit
PROC : Processor unit
AG1-3: Address generator 1-3
DMUX : Data multiplexer
DMIF : Data memory interface
IOIF : Input/output interface
MIF : Memory interface (Buffer)
DM1-3: Data memory 1-3 (1024*1024*8 bit*3)

IV. Application to the Eye-glass Frame Video System

The Eye-glass Frame Video System is composed of a video camera, a video image store, a TV monitor and a personal computer.

The system has the following features; simple aggregation of the eye-glass frame data base using from the video camera input, natural image composition of the human-face and frame, and rapid coloring of tinted lens. Fig. 7 shows the image composition process.

The benefits of using the Eye-glass Frame Video system would include its simple procedure to create eye-glass frame database.

With the system's powerful image processing function, users can create the database by simply capturing image of eye-glass frames from the video camera.

Fig. 8 shows the flow of image processing for making Eye-glass Frame database.

After binarization, the camera image is automatically divided into three parts, part of eye-glass frame, inside part of the frame, and outside part of the frame. The obtained frame pattern data and the frame video image data are both recorded on a floppy disket.

Fig. 9 shows an example of the super imposed video image of human-face and eye-glass image stored on a floppy disket, which is seen very realistic.

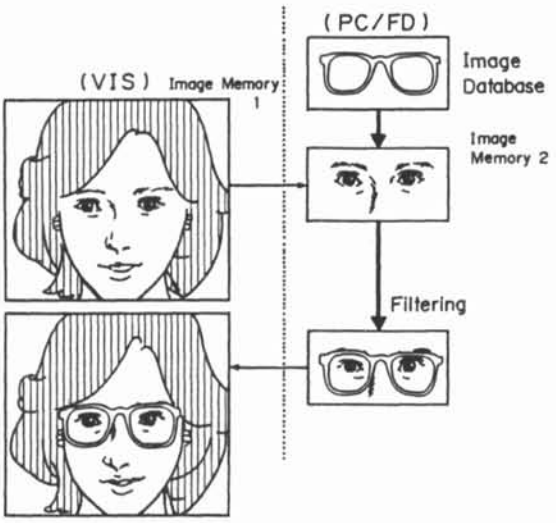


Fig. 7 Image composition of the face and Eye-glass frame, and coloring of tinted lens.

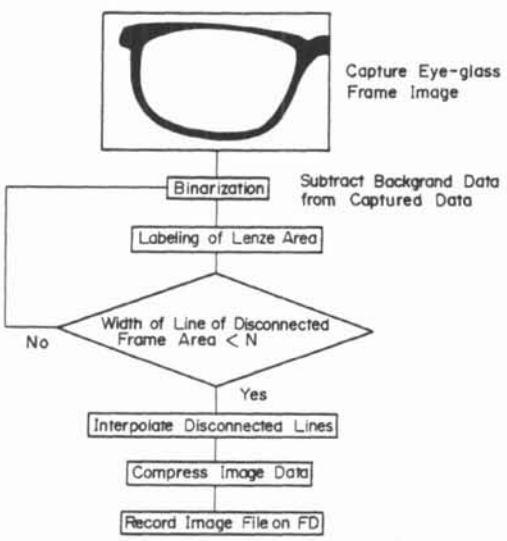


Fig. 8. Flow of Making Eye-glass Frame Database

Fig. 9. Example of super-imposed video image.

V. Application to making color overhead transparencies.

Further application is for making presentation materials, such as overhead transparencies.

On an imaginary blank sheet displayed on the CRT monitor, users can easily layout images from various media, such as images obtained from video camera, a color scanner, a computer graphics, and text editors.

The system consists of a color image scanner, a color printer and the T9506 image processing unit, in addition to the Eye-glass Frame Video System.

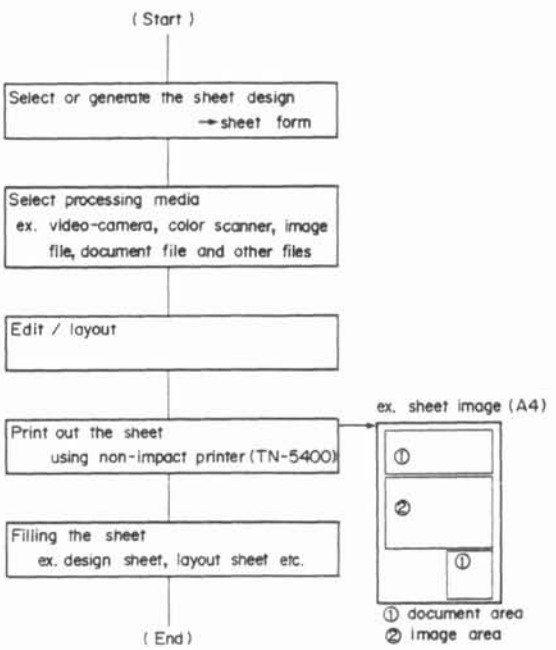


Fig. 10 Flowchart of making color presentation materials

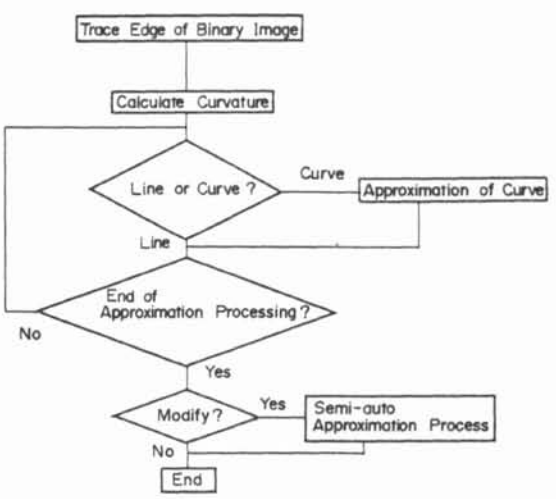


Fig. 11 Flow of redrawing the original outline image

Each image editing process can be accomplished virtually on a real-time base.

Fig. 10 illustrates the flowchart of making color overhead transparencies.

The system has another useful function that redraws the original outline images into smoother curvatures and line segments. Fig. 11 shows the flow of redrawing the outline image. With this function, the system can automatically modify raw image data obtained from scanner , such that the output image has sharper edges.

This function is particulary useful for editing logo marks and figure pattern images.

## VI. Conclusion

This paper describes a newly-developed video processing system, Video Workstation, that features both cost-effectiveness and versatile applications. There are three attractive characteristics, such as high-speed image processor containing T9506 microprogrammable VLSI chip, multi-media processing, and several image simulation programs.

This apparatus could be successfully applied to another image simulation system.

## References

1. S. Abe et al., "Development of a High Speed Image Processing Board", National Convention of the IECE Japan, D. 189, 1988
2. A. Kanuma et al., "32-bit CMOS Pipelined Image Processor, T9506" Toshiba Review pp. 828-830, No. 10, Vol. 41, 1986
3. M. Tamura et al., "Image composition system of the face and eye-glass frame", Proceedings of the 18th Joint Conference on Image Technology, 15-8, 1987
4. S. Abe et al., " A Color presentation system", National Convention of the ITE of Japan, 19-5, 1988