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(54) **Image processor with size-variable cursor for various display resolutions.**

(57) An image processor includes a cursor data memory (10) for providing cursor data having a predetermined size, a display memory (11) for providing display data, a cursor size converter (12) for correcting the size of the cursor data in accordance with the resolution of a display (22) for displaying the display data, and a mixer (18) for mixing the cursor data corrected by the cursor size converter with the display data to supply the mixed data to the display.

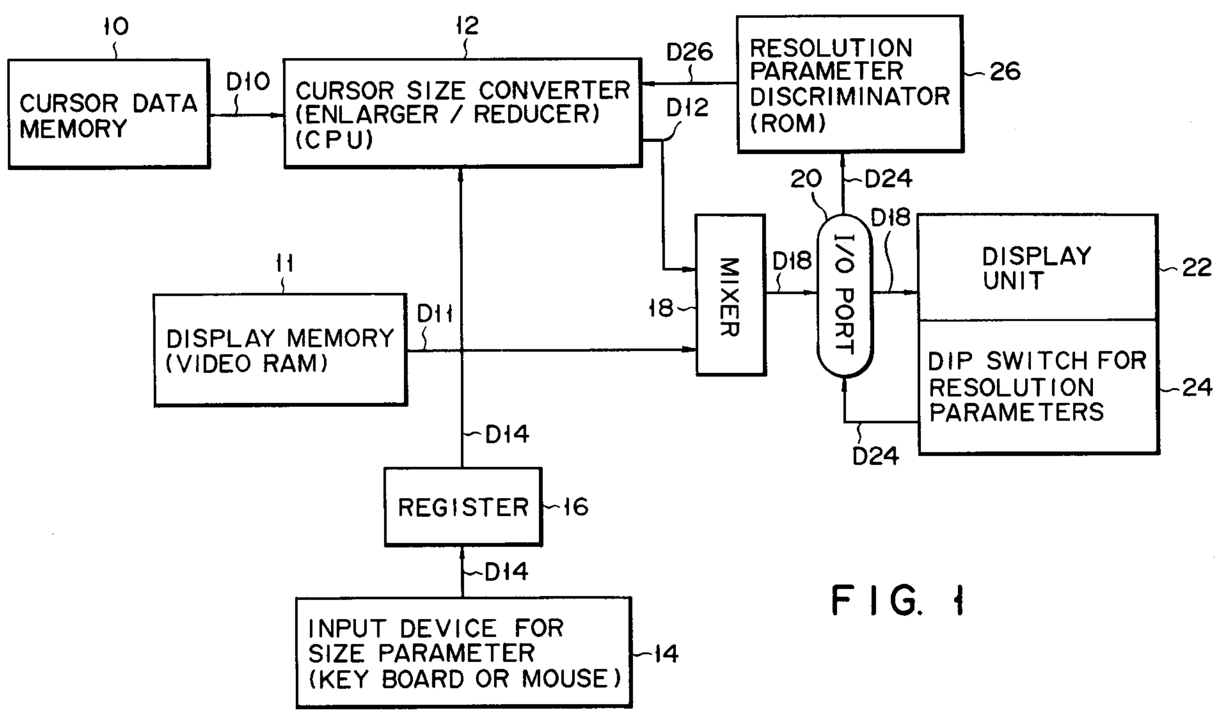

FIG. 1

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The present invention relates to an image processor which can improve visibility of a cursor or a pointer on displays having various resolutions.

An image processor utilized in, e.g., an optical filing system, a graphic work station, or the like generally comprises a bit-map display for displaying vector fonts, picture patterns, and the like. Bit-map displays having various sizes and various resolutions are available.

In displays having the same size, as the resolution is increased (the number of display dots is increased), the display size of a cursor (or a pointer) constituted by a predetermined number of dots is relatively decreased. Therefore, in a conventional image processor, when displays having various resolutions are selectively used depending on applications in a single system, as the display resolution is increased, the cursor size is decreased, and visibility of the cursor for a user is impaired.

It is an object of the present invention to provide an image processor which can substantially prevent a cursor or pointer size observed by a user from being changed even when the resolution of a display to be used is changed when displays having various resolutions are selectively used.

In order to achieve the above object, an image processor of the present invention comprises means for providing cursor data having a predetermined size; means for providing display data; correction means for correcting the size of the cursor data in accordance with a visual resolution of a display for displaying the display data; and means for supplying the cursor data corrected by the correction means to the display together with the display data.

In the image processor, assume that a cursor size to be bit-map displayed is, e.g., 32 × 32 dots, and high-resolution display A having a resolution of 2,432 × 2,432 dots, and middle-resolution display B having a resolution of 1,216 × 1,216 dots are selectively used. In this case, with the function of the correction means, a 32 × 32 (dot) cursor is displayed on display B, while a 64 × 64 (dot) cursor is displayed on display A.

For example, if the dot pitch of display A is 0.15 mm, and the dot pitch of display B is 0.30 mm, a 9.6 × 9.6 (mm) cursor is displayed on display A, and a 9.6 × 9.6 (mm) cursor is also displayed on display B by using the processor of the present invention. That is, a user can perform a desired screen operation using the cursors which appear to have the same size regardless of the resolutions of the displays to be used.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram showing an arrangement of an image processor according to an embodiment of the present invention; and

Fig. 2 is an explanatory view for explaining a correction method of a cursor display by the arrangement shown in Fig. 1.

Fig. 1 is a block diagram showing an arrangement of an image processor according to an embodiment of the present invention, and Fig. 2 is an explanatory view for explaining a correction method of a cursor display by the arrangement shown in Fig. 1.

In the arrangement shown in Fig. 1, cursor data D10 shown in Fig. 2 is stored in cursor data memory (e.g., SRAM, EPROM, or the like) 10, and image data D11 to be displayed is stored in display memory (e.g., VRAM) 11. Cursor data D10 output from memory 10 is subjected to size conversion (enlargement) by cursor size converter 12, and converted cursor data D12 is supplied to mixer 18. In mixer 18, cursor data D12 is mixed with image data D11 from memory 11 at a predetermined timing according to the position of the cursor on a screen. Mixed cursor/image data D18 is supplied to bit-map display unit (a liquid crystal or plasma display, or a CRT monitor) 22 via I/O port 20.

When four different data, e.g., black, white, background, and inverted background data are to be used as cursor data D12 to be processed by mixer 18, two bits can be assigned per dot (pel). A cursor may be formed as a sprite.

A case will be examined below wherein high-resolution display A and middle-resolution display B (Fig. 2) are selectively used as display unit 22.

Display unit 22 is provided with dip switch 24 for setting a resolution parameter, as needed. When the resolution of display unit 22 is designated using switch 24, resolution parameter data D24 (e.g., 2-bit data) by switch 24 is supplied to resolution parameter discriminator 26 via I/O port 20.

The relationship between resolution parameter data D24 and a cursor size (enlargement factor) is as follows. That is, if 2-bit resolution parameter data D24 is "00", the cursor size is not changed; if it is "01", the horizontal size of the cursor is enlarged twice without enlarging its vertical size; if it is "10", the vertical size of the cursor is enlarged twice without enlarging its horizontal size; and if it is "11", both the vertical and horizontal sizes of the cursor are enlarged twice.

When resolution parameter data D24 is 2-bit data, a maximum of 4 different parameters can only be designated. If data D24 consists of three or more bits, eight or more different parameters can be designated. The size may be set using a special-purpose hardware component (e.g., a ROM including a parameter/size conversion table), or may be set in a software manner using a CPU.

When input resolution parameter data D24 is "00", resolution parameter discriminator 26 outputs data D26 for setting both vertical and horizontal sizes of cursor size converter 12 to be "1" (when display unit 22 is middle-resolution display B). When input resolution parameter data D24 is "11", resolution parameter discriminator 26 outputs data D26 for setting both vertical and horizontal sizes of cursor size converter 12 to be "2" (when display unit 22 is high-resolution display A).

In this manner, cursor data D12 whose size is corrected according to resolution parameter data D24 is mixed with image data D11, and mixed data D18 is displayed on display unit 22.

More specifically, when middle-resolution display B is used, a cursor having a 32 × 32 dot size is displayed on the 1,216 × 1,216 (dot) display screen in accordance with the resolution parameter "00". On the other hand, when high-resolution display A is used, a cursor having a 64 × 64 dot size is displayed on the 2,432 × 2,432 (dot) display screen in accordance with the resolution parameter "11" to have the same visual size as the cursor displayed on display B.

In the above description, the cursor size is automatically corrected in accordance with the type (specification) of display unit 22 connected through I/O port 20. The cursor size may be manually corrected according to a user's favor.

More specifically, a user switches an input mode of the image processor shown in Fig. 1 to a "cursor size correction" mode using a keyboard (or a pull-down menu selected by a mouse). When the cursor size correction mode is started, the user inputs a desired cursor size as the numbers of dots in the vertical and horizontal directions using, e.g., a ten-key pad (when various cursor sizes are set as default values, a desired cursor size can be selected from a menu using a mouse in place of the ten-key pad).

Input cursor size data D14 is temporarily stored in register 16. When cursor size data D14 which is not zero is stored in register 16, cursor size converter 12 places priority on designation based on cursor size data D14 in register 16 over designation of the size based on data D26 from discriminator 26, thereby determining the size of cursor data D12 to be supplied to mixer 18.

More specifically, even when the vertical and horizontal sizes = 2 are designated by discriminator 26 on the basis of the resolution parameter "11", when a cursor size of, e.g., 48 × 64 dots is designated from, e.g., a keyboard in the cursor size correction mode, a cursor having a 48 × 64 dot size is displayed on display unit 22.

As described above, since a means for manually setting a cursor size is arranged, even when display unit 22 does not comprise dip switch 24 for setting a resolution parameter, a user can desirably change and correct a cursor size according to the resolution of display unit 22.

In the above embodiment, a reference cursor size (32 × 32 dots) is subjected to predetermined enlargement to cope with displays having various resolutions. When a large reference cursor size (e.g., 64 × 64 dots) is set, reduction is performed by converter 12 in place of enlargement so as to cope with displays having various resolutions.

Upon combination of enlargement./reduction, a 23 × 32 (dot) cursor may be reduced to 16 × 16 dots or may be enlarged to 64 × 64 dots.

For example, when a 32 × 32 (dot) cursor is used on a display having a resolution of 1,000 × 750 dots, if a cursor having the same dimensions is to be displayed on a 2,000 × 750 (dot) display, the cursor need not always be uniformly enlarged in the vertical and horizontal directions, but may be nonuniformly enlarged to have, e.g., 64 × 32 dots.

For example, when a 32 × 32 (dot) cursor is used on a 1,000 × 750 (dot) 14" display, if a cursor having the same dimensions is to be displayed on a 1,000 × 750 (dot) 28" display, the display cursor size is visually increased although the two displays have the same physical resolution. In this case, the cursor size can be reduced to, e.g., 16 × 16.

Furthermore, even when displays having the same resolution and the same size are used, a visual cursor size is changed if intervals between the user and the displays are respectively 0.5 m and 1.0 m. In this case, when the user watches the display at a distance of 1.0 m, the cursor size can be enlarged almost twice that when the user is at a distance of 0.5 m from the display.

More specifically, the meaning of the "resolution" of the present invention is not limited to the physical number of dots of a display, but also includes a "resolution" visually sensed by a user when the size of the display (the diagonal length of the display screen of a CRT in units of inches) is changed, or when the distance between a user and a display is changed.

According to the image processor of the present invention, since the number of dots of cursor (or pointer) data to be bit-map displayed can be corrected in accordance with the resolution of a display used for displaying the data, or the ratio of the numbers of dots in the vertical and horizontal directions, a cursor having a preferable size for a user can be displayed on various displays.

Claims

1. An image processor characterized by comprising:

means (22) for displaying cursor data and image data with a predetermined display resolution;

means (10) for providing the cursor data (D10) to be displayed, said cursor data having a predetermined size;

means (11) for providing the image data (D11) to be displayed;

means (12) for correcting the size of the cursor data (D19) in accordance with the display resolution of said displaying means (22); and

means (18) for supplying the cursor data (D12) corrected by said correcting means (12) to said displaying means (22) together with the image data (D11).

2. A processor according to claim 1, characterized by further comprising:

means (14-16; 24, 20, 26) for outputting cursor size correction data (D14, D26) indicating contents of correction of the size of the cursor data (D10).

3. A processor according to claim 2, characterized in that said outputting means (24, 20, 26) includes:

means (24) for outputting resolution parameter data (D24) corresponding to the display resolution of said displaying means (22);

means (26) for discriminating the resolution parameter data (D24) so as to output the cursor size correction data (D26) corresponding to the display resolution of said displaying means (22); and

means (20) for connecting said displaying means (22) to said supplying means (18) so as to supply the resolution parameter data (D24) to said discriminating means (26).

4. A processor according to claim 2, characterized in that said outputting means (14-16) includes:

means (14) for inputting size parameter data (D14) indicating a desired cursor size; and

means (16) for holding the size parameter data (D14) so as to output to said correcting means (12) the held size parameter data (D14) as the cursor size correction data (D14).

5. A processor according to claim 2, characterized in that said outputting means (14-16; 24, 20, 26) includes:

means (24) for outputting resolution parameter data (D24) corresponding to the display resolution of said displaying means (22);

means (26) for discriminating the resolution parameter data (D24) so as to output first cursor size correction data (D26) corresponding to the display resolution of said displaying means (22);

means (14) for inputting size parameter data (D14) indicating a desired cursor size; and

means (16) for holding the size parameter data (D14) so as to output to said correcting means (12) the held size parameter data (D14) as second cursor size correction data (D14).

6. A processor according to claim 5, characterized in that said correcting means (12) includes:

means for correcting the size of the cursor data (D10) on the basis of the second cursor size correction data (D14) when both the first and second cursor size correction data (D26, D14) are input.

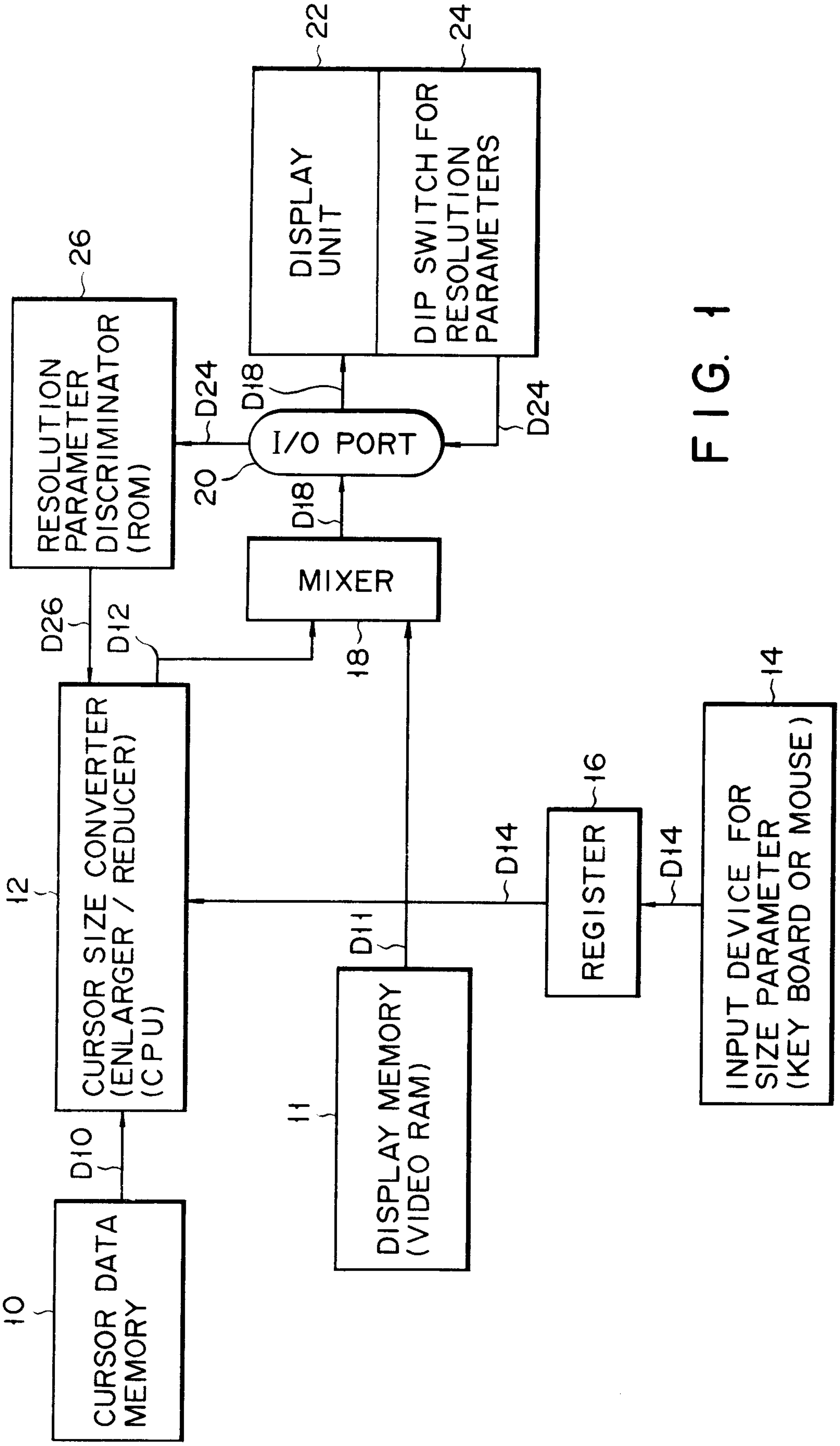
CURSOR DATA MEMORY
10
D10
CURSOR SIZE CONVERTER (ENLARGER / REDUCER) (CPU)
12
D26
D12
RESOLUTION PARAMETER DISCRIMINATOR (ROM)
26
D24
I/O PORT
20
D18
MIXER
18
DISPLAY MEMORY (VIDEO RAM)
11
D11
DISPLAY UNIT
22
DIP SWITCH FOR RESOLUTION PARAMETERS
24
D24
D18
REGISTER
16
D14
D14
INPUT DEVICE FOR SIZE PARAMETER (KEY BOARD OR MOUSE)
14

FIG. 1

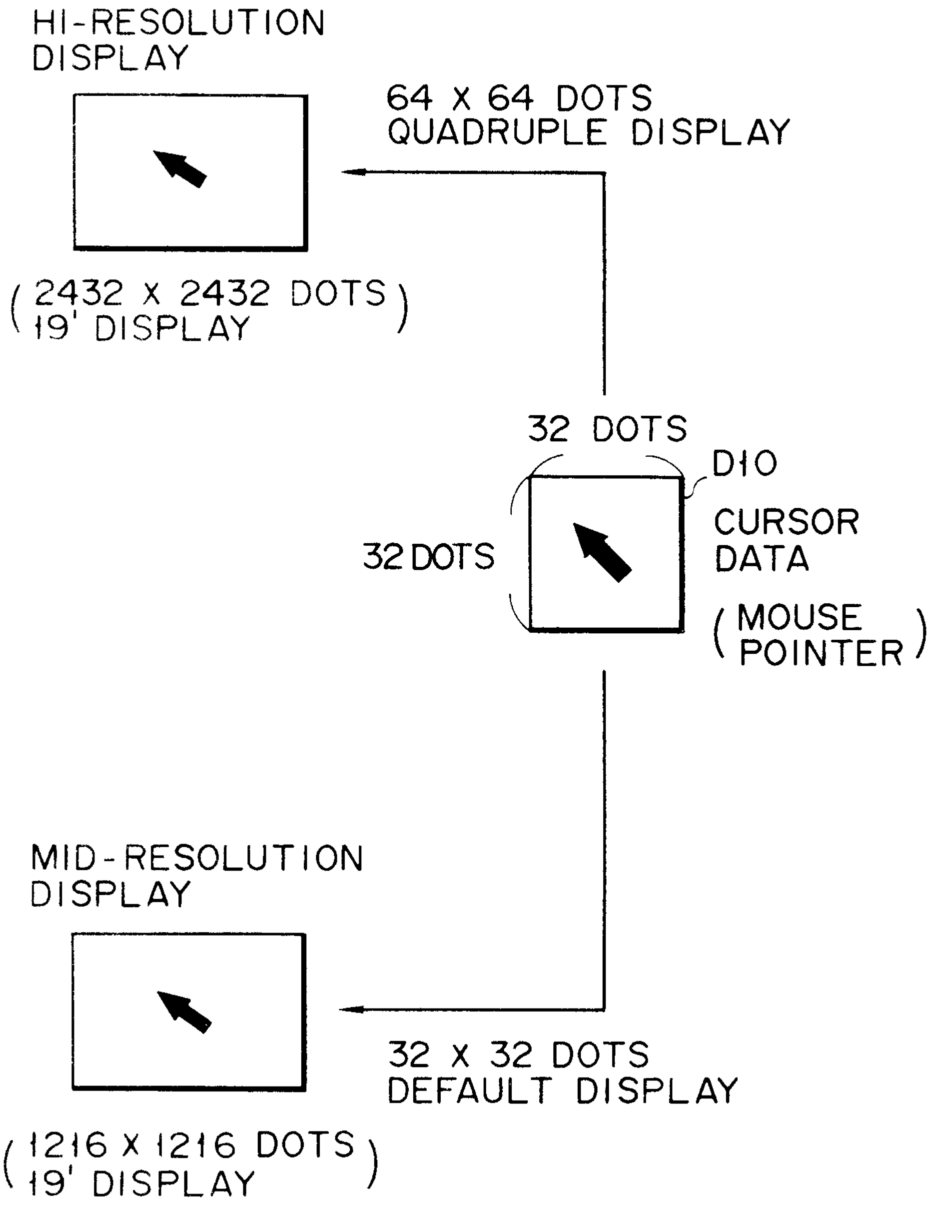
HI-RESOLUTION
DISPLAY
64 X 64 DOTS
QUADRUPLE DISPLAY
(2432 X 2432 DOTS
19' DISPLAY)
32 DOTS
D10
32 DOTS
CURSOR
DATA
(MOUSE
POINTER)
MID-RESOLUTION
DISPLAY
32 X 32 DOTS
DEFAULT DISPLAY
(1216 X 1216 DOTS
19' DISPLAY)

FIG. 2