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(54) Title: DIGITAL CAMERA ALLOWING USER SELECTION OF ASPECT RATIO AND STORING SELECTION AS METADATA

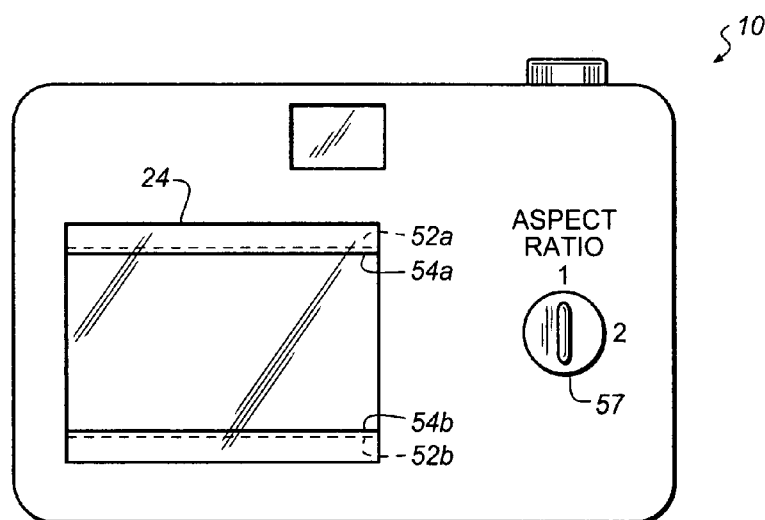


FIG. 2

(57) Abstract: A digital camera includes a display for viewing a scene; a processor for directing one or more indicators to be displayed on the display each indicator representative of an aspect ratio; and memory for storing a captured image and for storing metadata of the indicator selected by a user that is associated with the captured image.

DIGITAL CAMERA ALLOWING USER SELECTION OF ASPECT RATIO AND STORING SELECTION
AS METADATA**FIELD OF THE INVENTION**

5 The present invention generally relates to image processing and more particularly to image processing that permits a user to view on the camera display in real time the actual cropping effects that will occur when the images are printed in hardcopy form or viewed in a display with an aspect ratio that differs from that of the image source.

BACKGROUND OF THE INVENTION

10 When a digital image is created regardless of the source: scanner, digital camera, or computer generated, it has an aspect ratio. When the image is displayed or viewed it can be on the context of various aspect ratios. Common prints sizes: 4x6, 5x7, 8x10 or 11x17 for example, all have different aspect ratios.

15 Computer monitors and home televisions typically have either: 4:3 or 9:16 aspect ratios. When an image is displayed on a device with an aspect ratio that differs from the source, the image can be either "letterboxed" or "pillar boxed" by scaling the longest dimension of the image to match the longest dimension of the display. In this case, the shorter dimension will not fill the screen, thus requiring some area of the display to be filled with non-image data. Another strategy is to fill the display by scaling the shorter dimension to fill the display, thus making the longer dimension too large to fit on the screen. In this case, some decision must be made as to what area of the image should be removed or cropped to fit the display. Currently fixed rules are applied; for example, it can retain the center portion of the image and remove the edge image data. This method fails to consider the scene content potentially resulting in an area of interest being removed while a less important part of the scene is retained.

25 Another method is to use automatic subject detection at the time of display to determine the most important region to retain. These approaches, at best, attempt to guess the intentions of the creator of the digital image.

30

Consequently, a need exists for an apparatus and method which more accurately identifies the user's intention of aspect ratio.

SUMMARY OF THE INVENTION

5 The present invention is directed to overcoming one or more of the problems set forth above. Briefly summarized, according to one aspect of the present invention the present invention resides in a digital camera having a display for viewing a scene; a processor for directing one or more indicators to be displayed on the display each indicator representative of an aspect ratio; and memory for storing a
10 captured image and for storing metadata of the one or more indicators that is associated with the captured image.

 Another solution which is the focus of this invention is to record at image creation time, or some other point prior to re-display, data that either specifies cropping boundaries for various aspect ratios or regions of the image that are not-
15 expendable.

 This object is achieved by recording cropping information that may be known prior to actually removing pixel information. For example, at capture time, cropping gradicules may be present on the camera live preview to indicate a print boundary, automated subject detection may provide information for cropping, or the
20 user may indicate regions of the image that must be saved or may be cropped. Such information can be stored as either print size dependent where the actual crop boundaries are recorded or independent where a region of the image is defined as crop-out at last resort.

 These and other objects, features, and advantages of the present
25 invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings wherein there is shown and described an illustrative embodiment of the invention.

Advantageous Effect of the Invention

The present invention has the advantage of preventing the removal of important image information at any image exchange where a display aspect ratio change can occur downstream.

5

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features, and advantages of the present invention will become more apparent when taken in conjunction with the following description and drawings wherein identical reference numerals have been used, where possible, to designate identical features that are common to the figures, and wherein:

10

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter of the present invention, it is believed that the invention will be better understood from the following description when taken in conjunction with the accompanying drawings, wherein:

15

FIG. 1 is a block diagram of a camera of the present invention;

FIG. 2 is a back view of the camera of the present invention illustrating the display;

FIG. 3 is the camera of the present invention having an alternative embodiment for the display;

20

FIG. 4 is a table illustrative of data in electronic memory that is used in conjunction with FIG. 3;

FIG. 5A is a back view of an alternative embodiment of the camera of the present invention; and

FIG. 5B is FIG. 5A after re-composing the scene for eventual capture.

25

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, a block diagram of an exemplary digital camera 10 in accordance with a first embodiment of the present invention is shown. As shown in FIG. 1, the digital camera 10 includes a lens 12 which directs image light from a subject (not shown) through an aperture/shutter controller 13 upon an image sensor 14

30

having a discrete number of photosensitive sites or pixels arranged in a two-dimensional array to form individual photosensitive sites corresponding to the pixels of the image. The image sensor 14 can be a charge coupled device (CCD) sensor or a complementary metal oxide semiconductor (CMOS) imager. The photosensitive sites
5 of the image sensor 14 collect charge in response to incident. Each photosensitive site is overlaid with a color filter array (CFA), such as the Bayer CFA described in commonly-assigned U.S. Patent No. 3,971,065, the disclosure of which is herein incorporated by reference. The Bayer CFA has 50% green pixels in a checkerboard mosaic, with the remaining pixels alternating between red and blue rows. The
10 photosensitive sites respond to the appropriately colored incident light illumination to provide an analog signal corresponding to the intensity of illumination incident on the photosensitive sites.

The analog output of each pixel is amplified and analog processed by an analog signal processor (ASP) 16 to reduce the image sensor's output amplifier
15 noise. The output of the ASP 16 is converted to a digital image signal by an analog-to-digital (A/D) converter 18, such as, for example, an 8 bit A/D converter which provides an 8 bit signal in the sequence of the Bayer CFA.

The digitized image signal is temporarily stored in a frame memory 20, and is then processed and compressed by a digital signal processor (DSP) 22. The
20 image processing typically includes white balance, color correction, tone correction, and image sharpening. The DSP 22 also decimates (or re-samples) the digitized image signal for each still image to produce a thumbnail image having fewer pixels (i.e., lower resolution) than the original captured image as described in commonly-assigned U.S. Patent No. 5,164,831 to Kuchta et al., the disclosure of which is herein
25 incorporated by reference. The image file containing both the full resolution image and the thumbnail image is stored in a data memory 26, and then transferred through a memory card interface 32 to a memory card 28 that is present in a memory card slot 30 of the digital camera 10. The thumbnail image is also sent to an image display 24 through an LCD controller 25 where the user can view the image. Although the
30 display is shown as an LCD display, OLED displays may also be used. The image

display 24, which is shown in more detail in FIG. 2 and which will be discussed later, includes a conventional arrangement for displaying the captured image. The image display 24 may, alternatively, utilize many other types of raster image displays, including miniature CRT's, organic light emitting diode (OLED) arrays, or field
5 emission displays.

The memory card 28 can be adapted to the PCMCIA card interface standard, such as described in the PC Card Standard, Release 2.0, published by the Personal Computer Memory Card International Association, Sunnyvale, Calif., September 1991. The memory card 28 can also be adapted to the Compact Flash
10 interface standard, such as described in the CompactFlash Specification Version 1.3, published by the CompactFlash Association, Palo Alto, Calif., Aug. 5, 1998.

Electrical connection between the memory card 28 and the digital camera 10 is maintained through a card connector (not shown) positioned in the memory card slot 30. The memory card interface 32 and the card connector provide,
15 e.g., an interface according to the aforementioned PCMCIA card or CompactFlash interface standard. The image file may also be sent to a host computer (not shown), which is connected to the digital camera 10 through a host computer interface 34.

In operation, a camera microprocessor 36 receives user inputs 48, such as from a shutter release (not shown), and initiates a capture sequence by signaling a
20 timing generator 38. The timing generator 38 is connected generally to the elements of the digital camera 10, as shown in FIG. 1, for controlling the digital conversion, compression, and storage of the image signal. The camera microprocessor 36 also processes a signal from a photodiode 44 for determining a proper exposure, and accordingly signals an exposure driver 46 for setting the aperture and shutter speed
25 via the aperture/shutter controller 13 and triggers a flash unit 42 (if needed). The image sensor 14 is then driven from the timing generator 38 via a sensor driver 40 to produce the image signal. The user inputs 48 are used to control the operation of the digital camera 10 in a well-known manner.

Referring to FIG. 2, there is shown a back view of the camera 10 of the
30 present invention having an exploded view of the display 24. The display 24,

preferable 4:3 aspect ratio, may be made of well known display materials such as LCD, OLED and the like. The processor 36 (see FIG. 1) is programmed to instruct the display 24 to display straight cropping lines or substantially straight cropping lines 52a, 52b, 54a and 54b (hereinafter referred to as gradicules) on the display 24. These gradicules are mated (52a with 52b; and 54a with 54b) in pairs at opposite ends of the display 24 so that the area between the mated gradicules (52a, 52b, 54a and 54b) represents a particular hardcopy print size. It is noted for clarity that that area between the mated gradicules 52a, 52b, 54a and 54b is the same aspect ratio (not necessarily the exact same size) of the particular print size. For example, gradicules 54a and 54 b represent the image that would be printed on a 4x6 inch hardcopy print. Each pair of mated gradicules represents a different hardcopy print size – 5x7 inches (52a and 52b); 8x10 inches and the like. Although only two mated pairs of gradicules are shown, three or more may be shown depending on the desired number of aspect ratios. This conveniently alerts and informs the user as to that actual hardcopy image that would be printed with this particular capture thus assisting them with image composition at capture time.

Summarizing this embodiment in its intended application, the plurality of gradicules 52a, 52b, 54a and 54b are displayed on the back of a digital camera live view display 24. At capture time, these gradicules 52a, 52b, 54a and 54b can be used to indicate the aspect ratio of various print sizes or other downstream viewing conditions. The user would then frame the subject in a way that would be appropriate for the desired aspect ratios. The user selects the desired aspect ratio by manually turning the user interface 57. This information would then be recorded in metadata in the form of a table that describes the boundaries for each destination print size. At print or display time on another device, the metadata and image information could then be used to decide what image information could be cropped from the image.

Referring to Figs. 3 and 4, there is shown a display of an alternative embodiment of the present invention (FIG. 3) and a table (FIG. 4) that is stored in memory 26 and/or 28 and that works in cooperation with the display 24. The display 24 includes a display area 56 in which one or more subjects 58 (a woman in this case)

are contained from a scene to be captured. The user selects an aspect ratio as described above. The processor 36 executes "subject detection" routines that detect the one or more subjects 58. Subject detection software routines are well known in the art and will not be discussed in detail herein. For example, U.S. Patent No.

5 6,940,545 discloses examples of subject detection routines which may be used with the present invention. Once the subject 58 is detected, the processor 36 retrieves the table 60 and analyzes what area or areas of the to-be-captured image (or captured if already captured) will be cropped for each hardcopy print size according to the table 60. This crop region is adjusted so that the detected subjects 58 are not altered and
10 only or substantially only background areas 62 of the image are cropped. This information would then be stored and recorded in memory 26 and/or 28 as metadata that describes the boundaries for each destination print size. It is noted that the table in FIG. 4 using normalized coordinates where the top left corner normalized to (0,0) and the bottom right corner is (1,1). The crop values are two points: Top Left (x,y) and
15 Bottom Right (x,y).

Referring to FIG. 5A, in another embodiment, the user could identify the subject area, identified by the electronic brackets 65 displayed on the display 24, at the time of image composition. Experienced users of digital cameras will center the subject (enclose the primary subject with the brackets 65) and press the shutter
20 button 70 half-way to lock in exposure and focus. A disclosure for locking in exposure and control is found in U.S. Patent 5,103,254 and will not be discussed in detail herein. Referring to FIG. 5B, then the user will recompose the image by adjusting the capture range of the camera to include any other scene to be captured (such as the automobile and tree) and complete the capture. In this case, the camera
25 would track the subject within the brackets 65 (which tracking is represented by the brackets moving with the subject) during image re-composition and record its location. This data would then be stored in memory and used by a downstream cropping process as an indicator that image data in the recorded, bracketed region should not be removed from the display image.

PARTS LIST

10	Camera
12	Lens
13	aperture/shutter controller
14	Image Sensor
16	Analog Signal Processor
18	A/D converter
20	Frame Memory
22	Digital Signal Processor
24	image display
25	LCD controller
26	Data Memory
28	memory card
30	memory card slot
32	memory card interface
34	Host Computer Interface
36	Camera Microprocessor
38	Timing Generator
40	Driver
42	Flash
44	Photodiode
46	Driver
48	User Inputs
50	Status Display
52a-52b	Lines
54a – 54b	Lines
56	Display Area
57	User Interface
58	Subject
60	table

62	Background
65	electronic brackets
70	Shutter Button

CLAIMS:

1. A digital camera comprising:
 - (a) a display for viewing a scene;
 - 5 (b) a processor for directing one or more indicators to be displayed on the display each indicator representative of an aspect ratio; and
 - (c) memory for storing a captured image and for storing metadata of the indicator selected by a user that is associated with the captured image.
- 10 2. The digital camera as in claim 1 further comprising cropping lines visual on the display as the indicator.
3. The digital camera as in claim 2, wherein the memory stores a plurality of images and stores the metadata of the indicator that is associated with
15 each captured image.
4. The digital camera as in claim 3, wherein the display has a 4:3 aspect ratio.
- 20 5. A digital camera comprising:
 - (a) a display for viewing a scene;
 - (b) one or more indicators on the display each for indicating an aspect ratio one of which is selectable by a user;
 - (c) a processor for detecting a subject on the display; and
 - 25 (d) one or more memory modules for storing the captured image and metadata of the selected aspect ratio and for storing a table containing a plurality of aspect ratios and a corresponding crop area for each aspect ratio.
6. The digital camera as in claim 5 further comprising cropping
30 lines visual on the display as the indicator.

7. The digital camera as in claim 6, wherein the memory stores a plurality of images and stores the metadata of the indicator that is associated with each captured image.

5 8. The digital camera as in claim 7, wherein the display is a 3 inch by 4 inch display.

9. A digital camera comprising:
(a) a display for viewing a scene;
10 (b) an electronic bracket on the display for permitting a user to select a subject;
(c) a processor for permitting tracking of the selected subject during re-composition; and
(d) a shutter control for capturing the recomposed scene and the
15 selected subject in a single image.

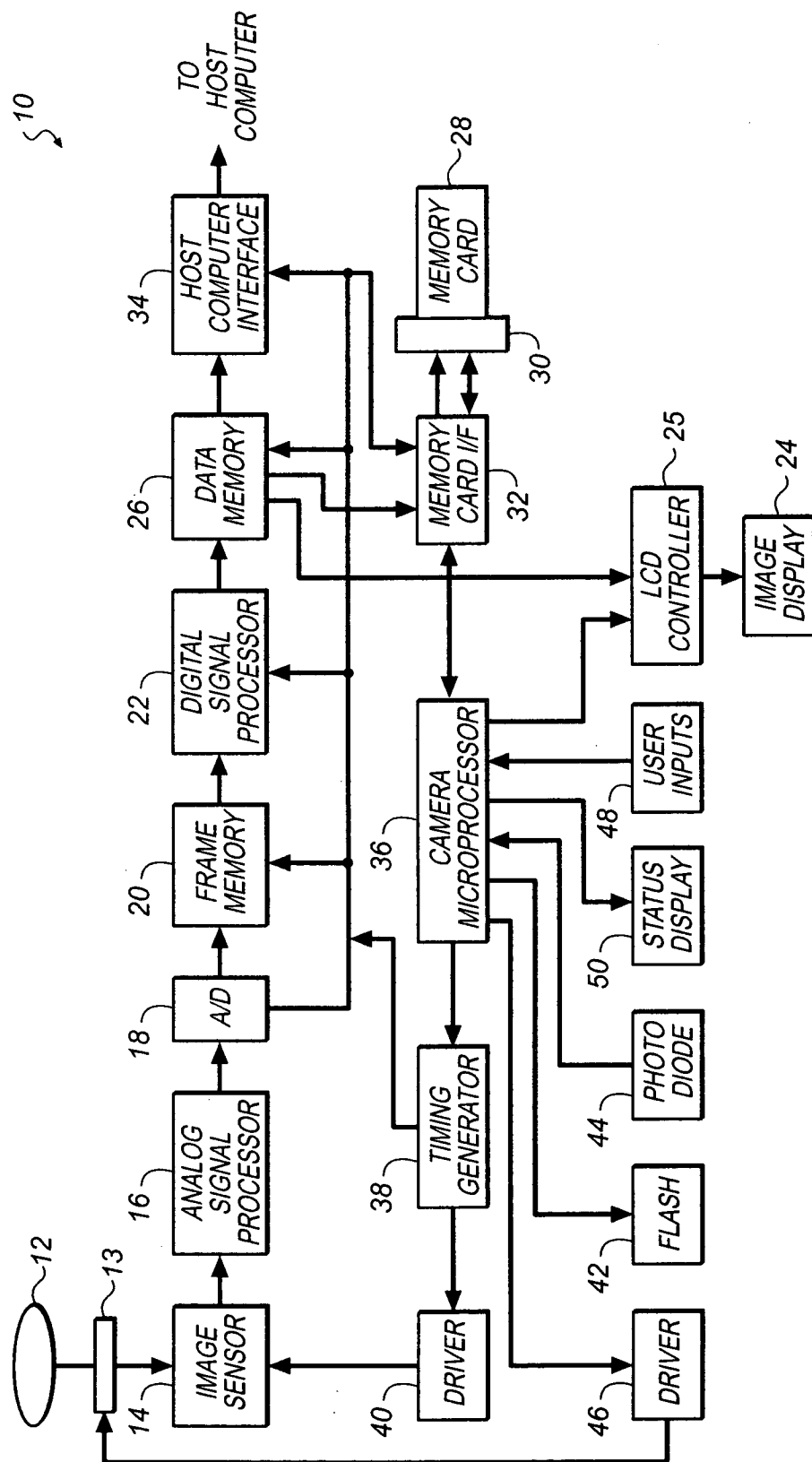


FIG. 1

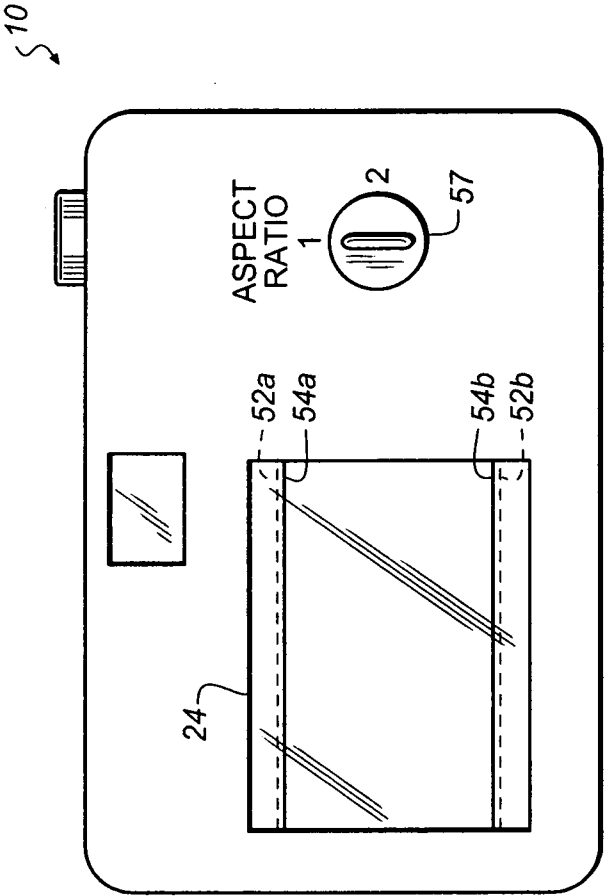


FIG. 2

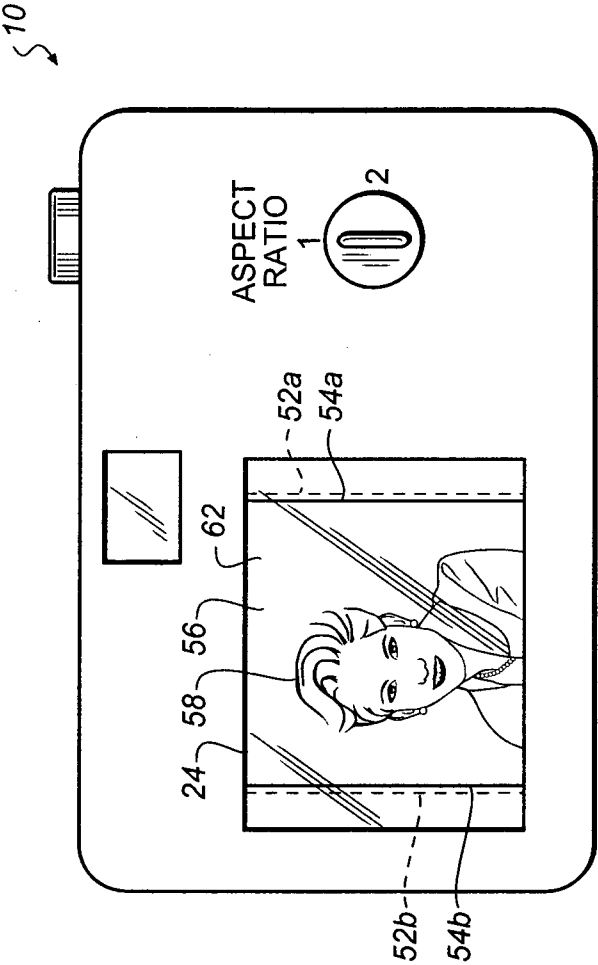


FIG. 3

60

PRINT SIZE OR TARGET ASPECT RATIO	CROP REGION			
	TOP	LEFT	BOTTOM	RIGHT
4"X6"	0.055556	0	0.944444	1
8"X10"	0	0.03125	1	0.96875
5"X7"	0.02381	0	0.97619	1
16:09	0.125	0	0.875	1

FIG. 4

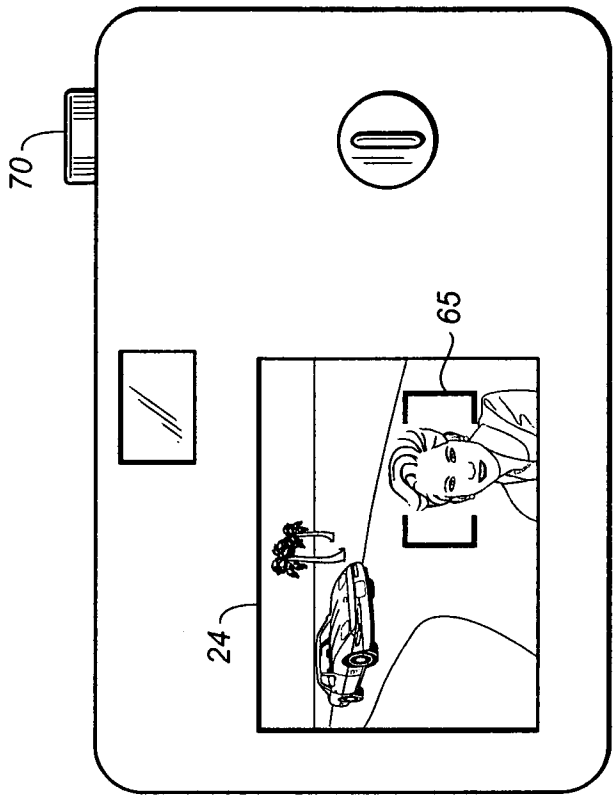


FIG. 5B

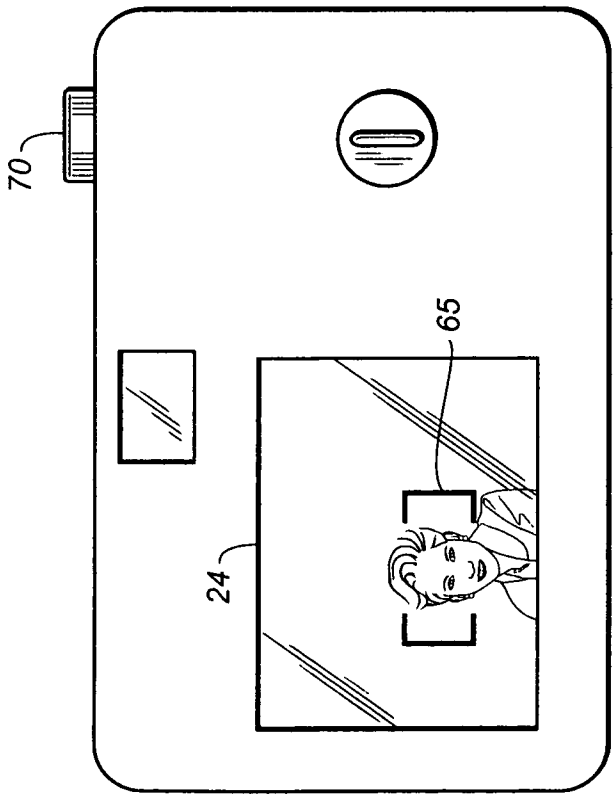


FIG. 5A

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/005830

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04N1/00 H04N1/21 H04N1/32 H04N5/232 G06K9/00
G06T7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04N G06K G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 2005/146631 A1 (SHELTON MICHAEL J [US] ET AL) 7 July 2005 (2005-07-07) the whole document	1-3, 5-8 4, 6-8 9
X Y A	EP 1 420 289 A1 (EASTMAN KODAK CO [US]) 19 May 2004 (2004-05-19) the whole document	1-3 6-8 4-5, 9
X Y A	US 2004/257458 A1 (HUANG MAX [TW] ET AL) 23 December 2004 (2004-12-23) the whole document	1-4 4 5-9
	----- -/-	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

3 February 2010

Date of mailing of the international search report

09/02/2010

Name and mailing address of the ISA/

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Moorhouse, David

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/005830

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 739 832 B2 (CANON KK) 18 October 2001 (2001-10-18)	9
A	figures 1, 3, 13A-13D page 11, line 5 - page 13, line 4 -----	1-8
X	US 2008/181460 A1 (TAMARU MASAYA [JP]) 31 July 2008 (2008-07-31)	9
A	the whole document -----	1-8
A	US 2006/204054 A1 (STEINBERG ERAN [US] ET AL) 14 September 2006 (2006-09-14) the whole document -----	1-9
A	US 2008/013787 A1 (KOBAYASHI KOJI [JP]) 17 January 2008 (2008-01-17) the whole document -----	1-9
A	US 6 654 507 B2 (LUO JIEBO [US]) 25 November 2003 (2003-11-25) the whole document -----	1-9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/005830

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8

Digital camera with display indicating one or more selectable image aspect ratios. Selected aspect ratio stored as metadata with image.

2. claim: 9

Digital camera with display allowing user to select a subject which is then tracked until an image is captured.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/005830

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
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