US006262769B1

(12) **United States Patent**
**Anderson et al.**

(10) **Patent No.: US 6,262,769 B1**
(45) **Date of Patent: *Jul. 17, 2001**

(54) **METHOD AND SYSTEM FOR AUTO ROTATING A GRAPHICAL USER INTERFACE FOR MANAGING PORTRAIT AND LANDSCAPE IMAGES IN AN IMAGE CAPTURE UNIT**

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( * ) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/903,898**

(22) Filed: **Jul. 31, 1997**

(51) **Int. Cl.**[7] ..... **H04N 5/222**

(52) **U.S. Cl.** ..... **348/333.1**; 348/231; 348/232; 348/233; 348/334; 348/374; 348/321; 348/362; 396/50; 396/311

(58) **Field of Search** ..... 348/231, 232, 348/333, 334, 374, 321, 362, 369; 396/50, 311

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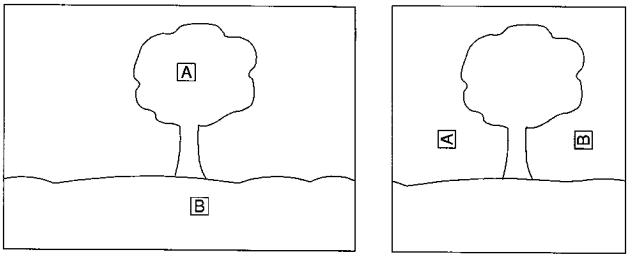
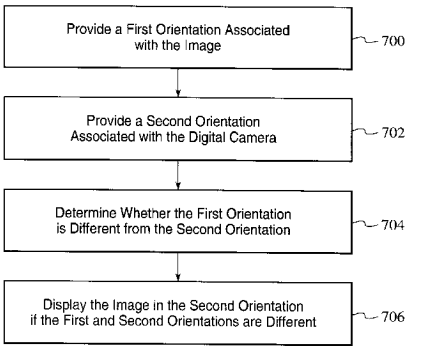
(57) **ABSTRACT**

The present invention provides a method and apparatus for automatically rotating a graphical user interface for managing portrait and landscape captures in an image capture unit. A method and apparatus for viewing an image in an image capture unit including a display comprises the steps of providing a first orientation associated with the image and providing a second orientation associated with the image capture unit. It is then determined whether the first orientation is different from the second orientation, and the image is displayed in the second orientation if the first and second orientations are different from each other.

**42 Claims, 14 Drawing Sheets**



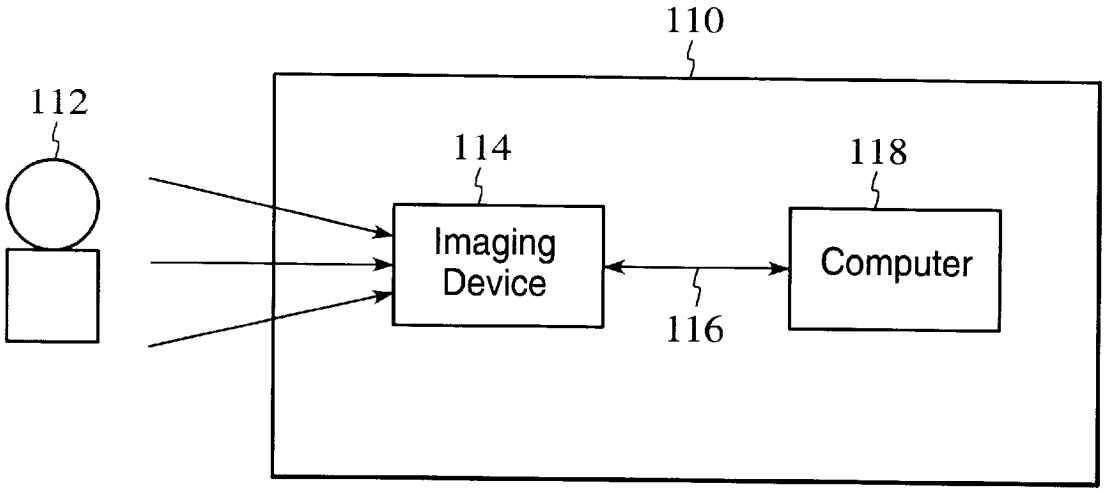



FIG. 1

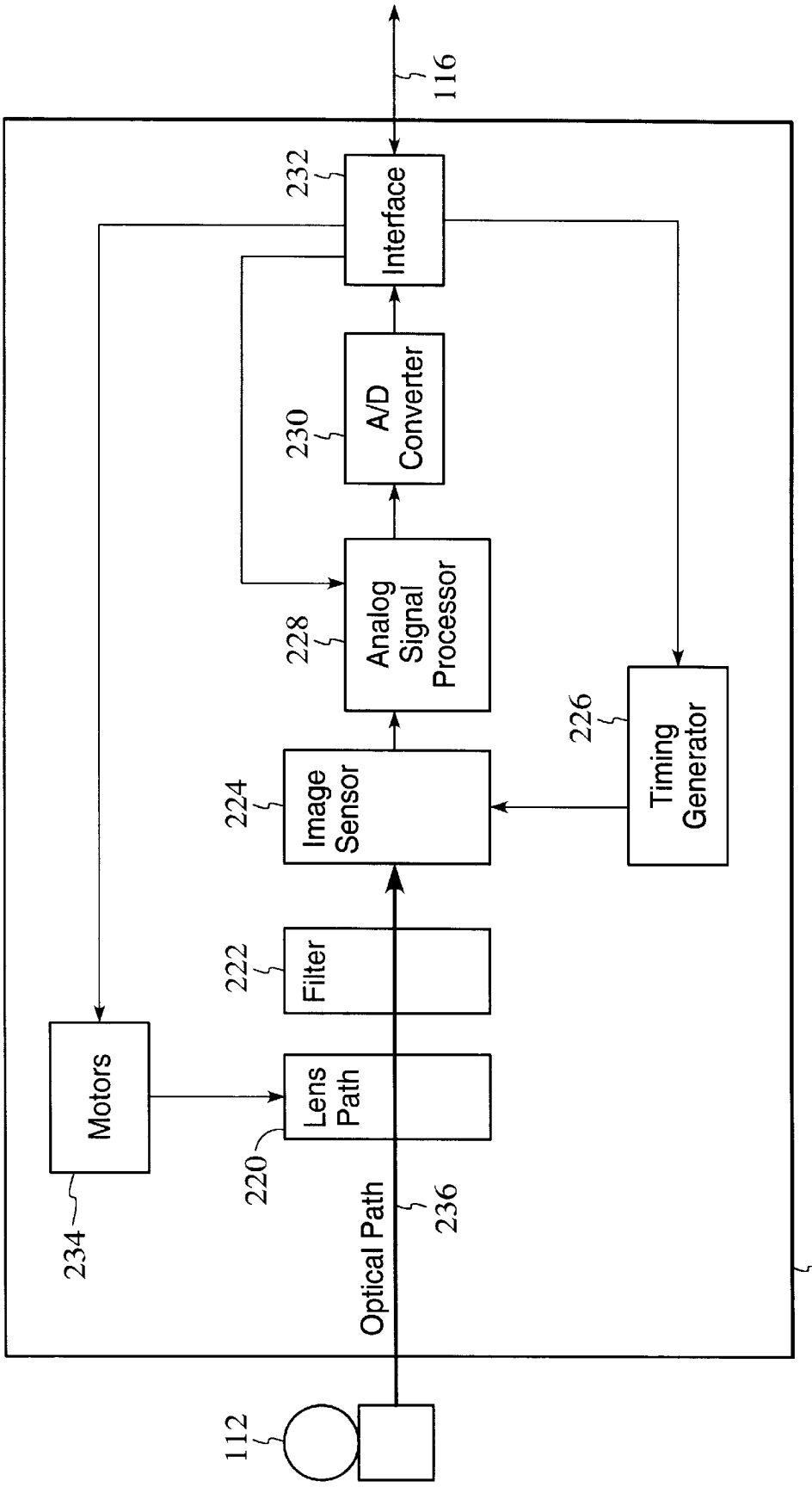

116
232
Interface
230
A/D Converter
228
Analog Signal Processor
226
Timing Generator
224
Image Sensor
222
Filter
Motors
Lens Path
220
234
Optical Path
236
114
112

FIG. 2

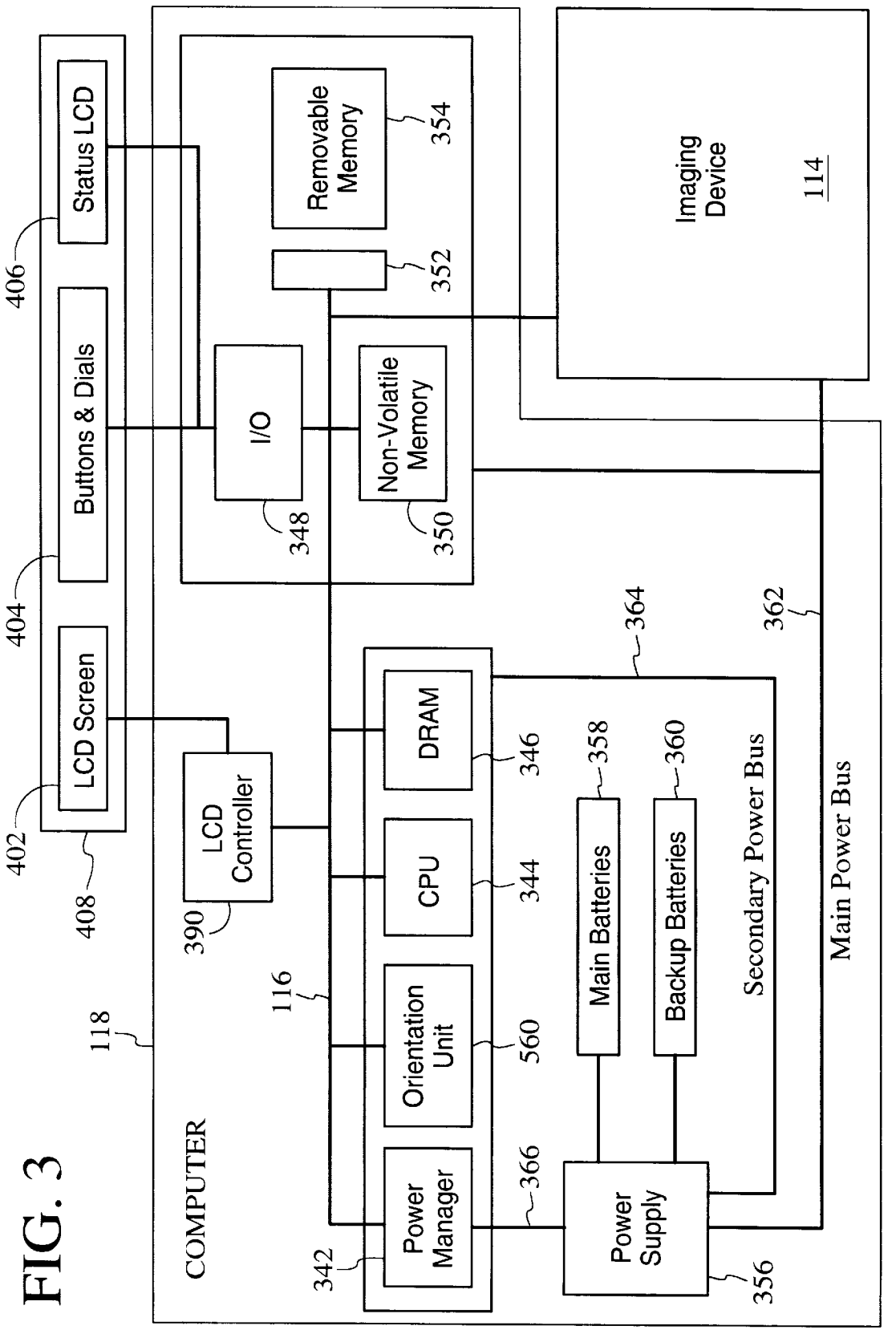

COMPUTER
118
Status LCD
406
Buttons & Dials
404
LCD Screen
402
408
LCD Controller
390
116
I/O
348
Removable Memory
354
352
Non-Volatile Memory
350
DRAM
346
CPU
344
Orientation Unit
560
Power Manager
342
366
Main Batteries
358
Backup Batteries
360
Power Supply
356
364
Secondary Power Bus
362
Main Power Bus
Imaging Device
114

FIG. 3

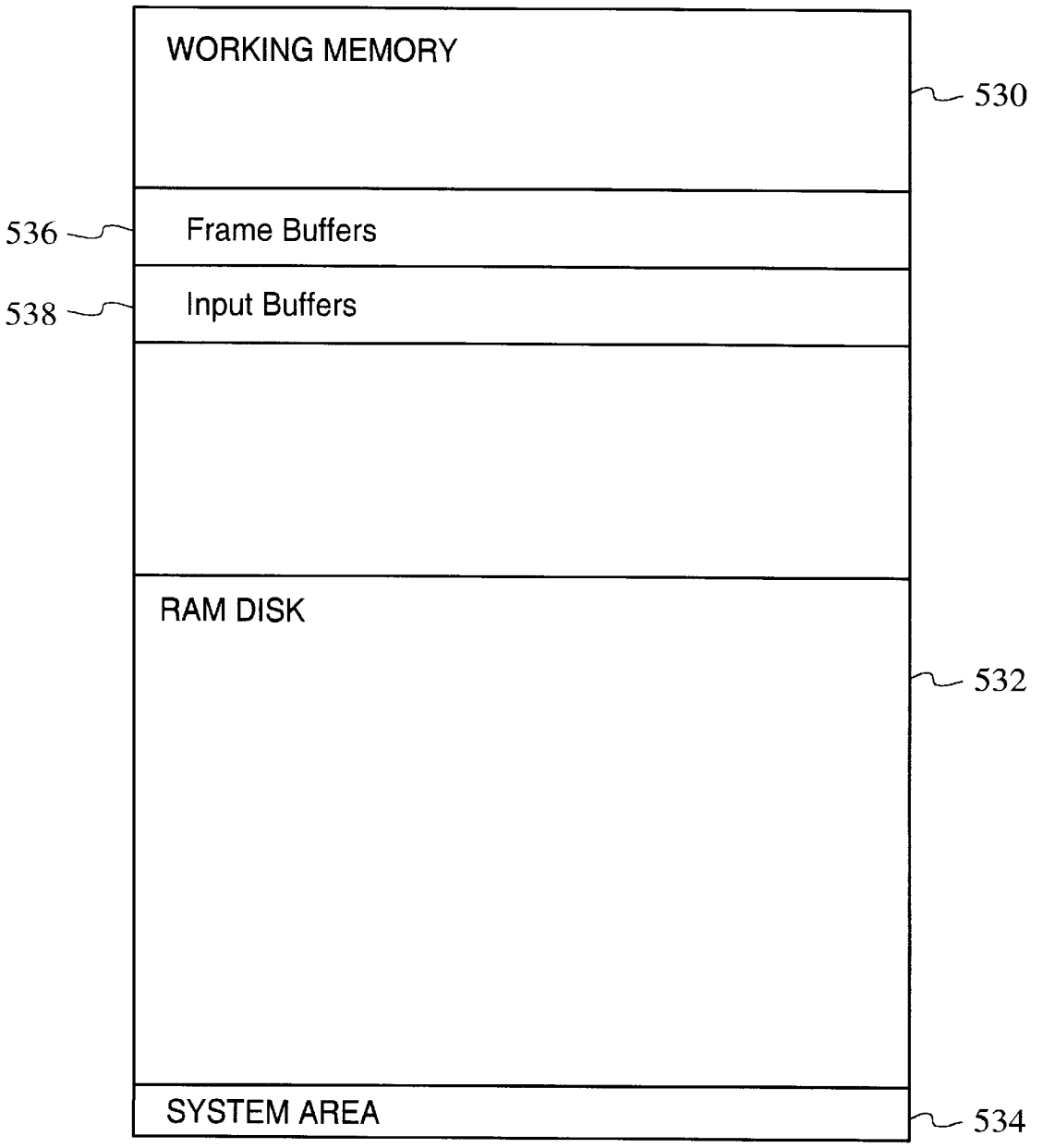

WORKING MEMORY
530
536
Frame Buffers
538
Input Buffers
RAM DISK
532
SYSTEM AREA
534

FIG. 4A

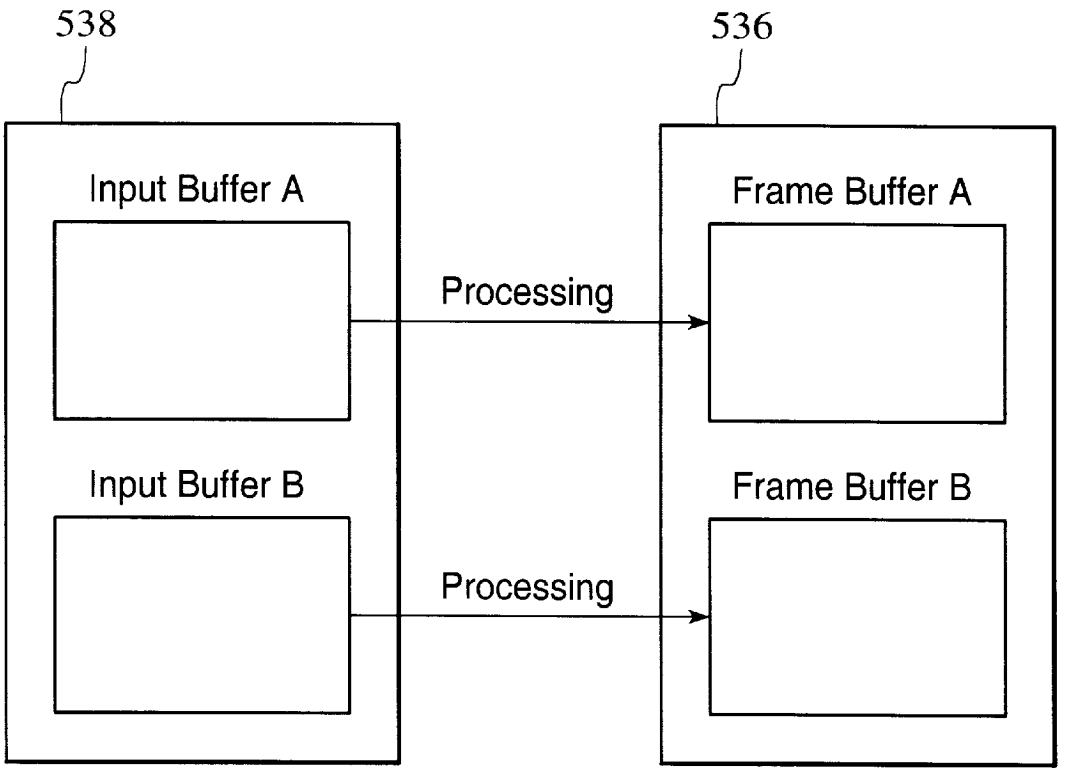

538
536
Input Buffer A
Frame Buffer A
Processing
Input Buffer B
Frame Buffer B
Processing

FIG. 4B

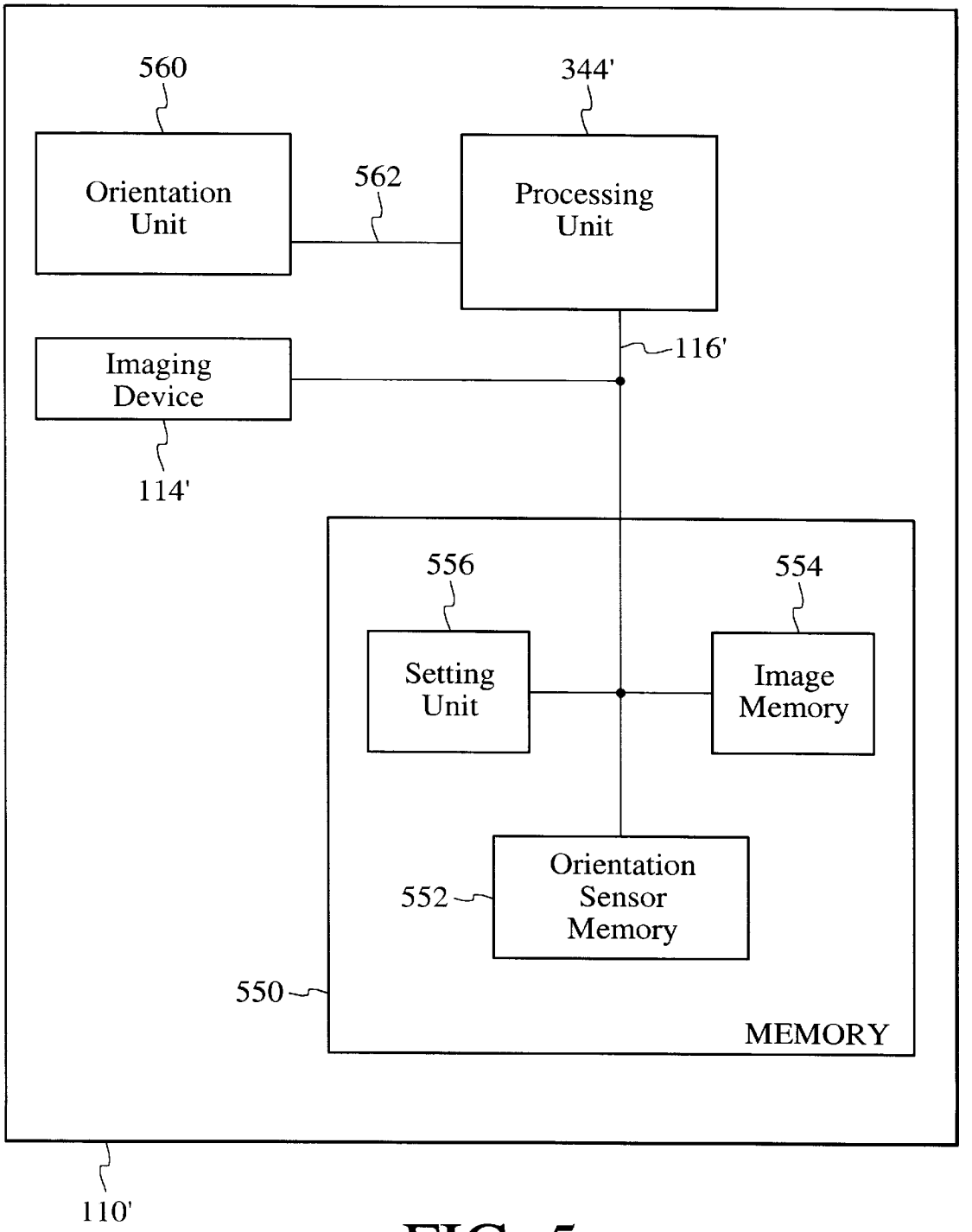
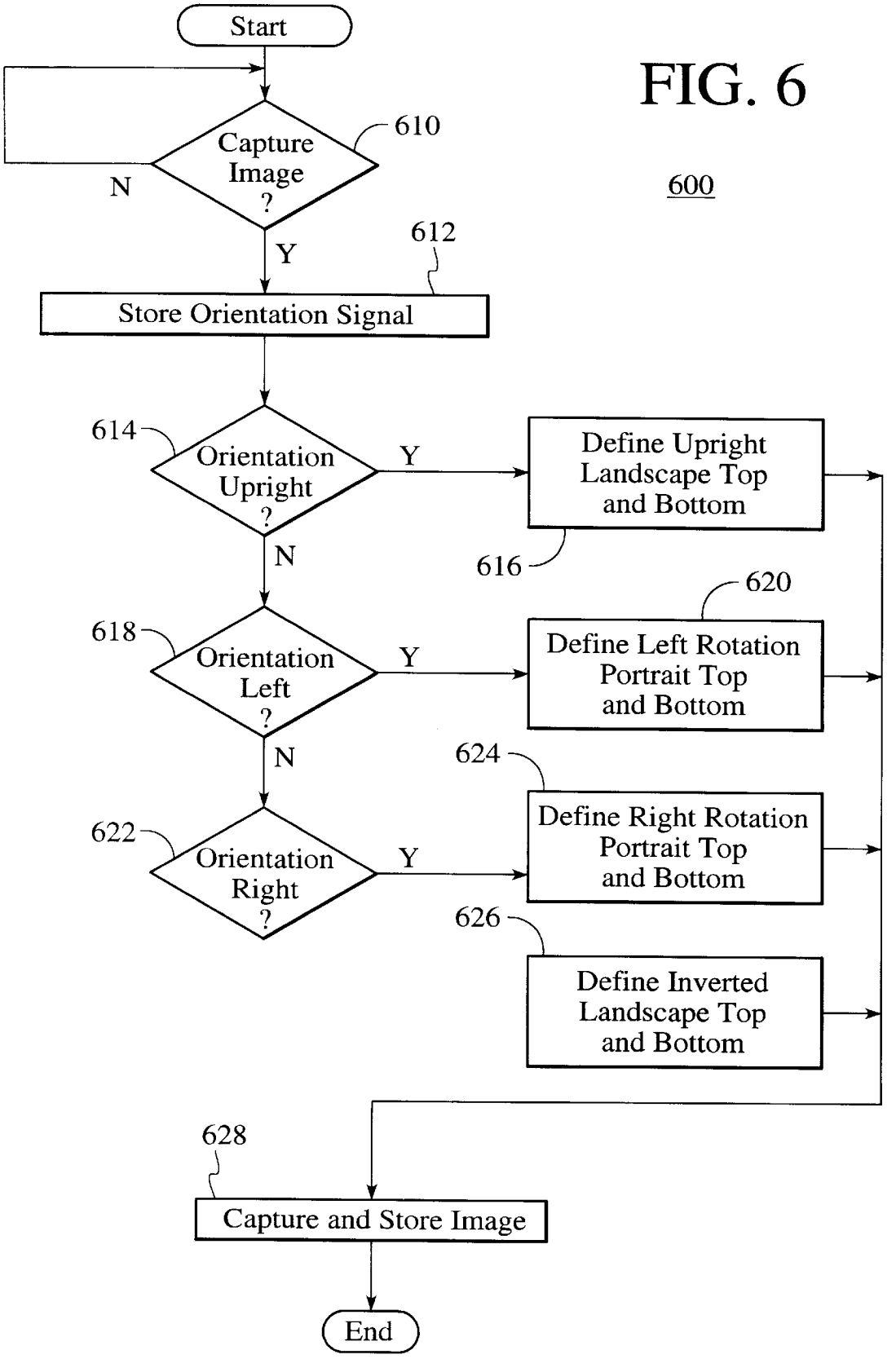

560
344'
Orientation Unit
562
Processing Unit
116'
Imaging Device
114'
556
554
Setting Unit
Image Memory
Orientation Sensor Memory
552
550
MEMORY
110'

FIG. 5

FIG. 6


600
Start
Capture Image ?
610
N
Y
612
Store Orientation Signal
614
Orientation Upright ?
Y
Define Upright Landscape Top and Bottom
616
N
618
Orientation Left ?
Y
620
Define Left Rotation Portrait Top and Bottom
N
624
Define Right Rotation Portrait Top and Bottom
622
Orientation Right ?
Y
626
Define Inverted Landscape Top and Bottom
628
Capture and Store Image
End

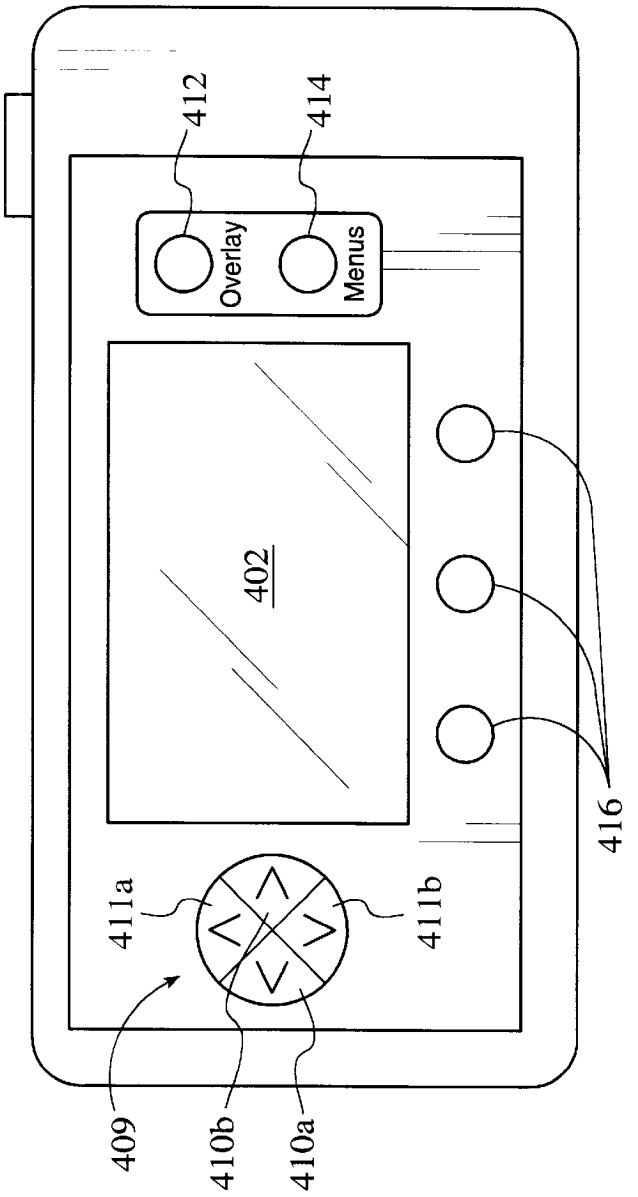

412
414
Overlay
Menus
402
416
411a
411b
409
410b
410a
408

FIG. 7A

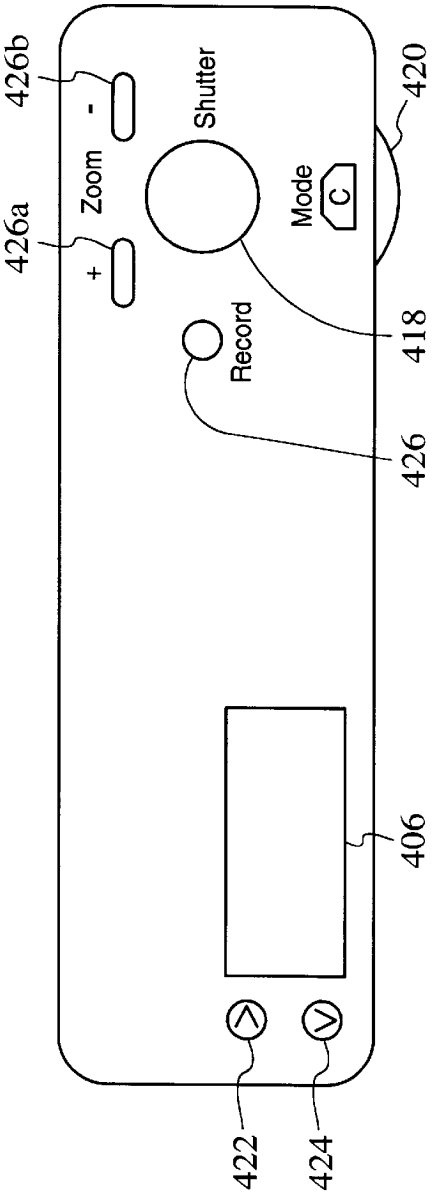

426b
426a
Zoom
-
+
Shutter
Mode
C
420
Record
418
426
406
422
424

FIG. 7B

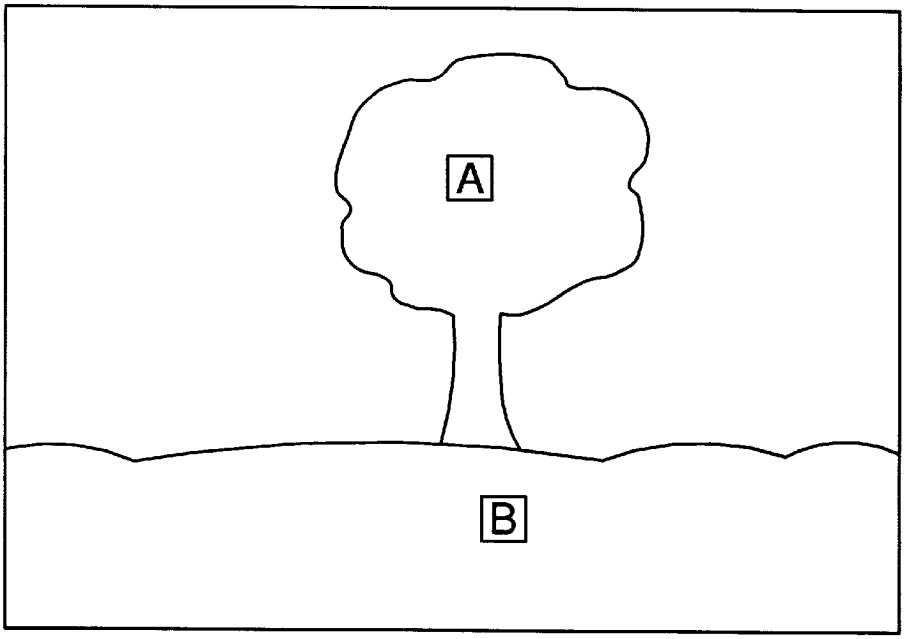



FIG. 8A

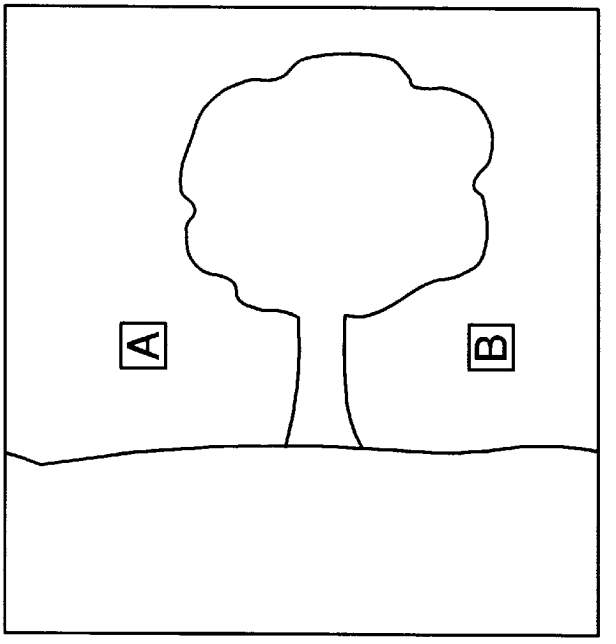



FIG. 8B

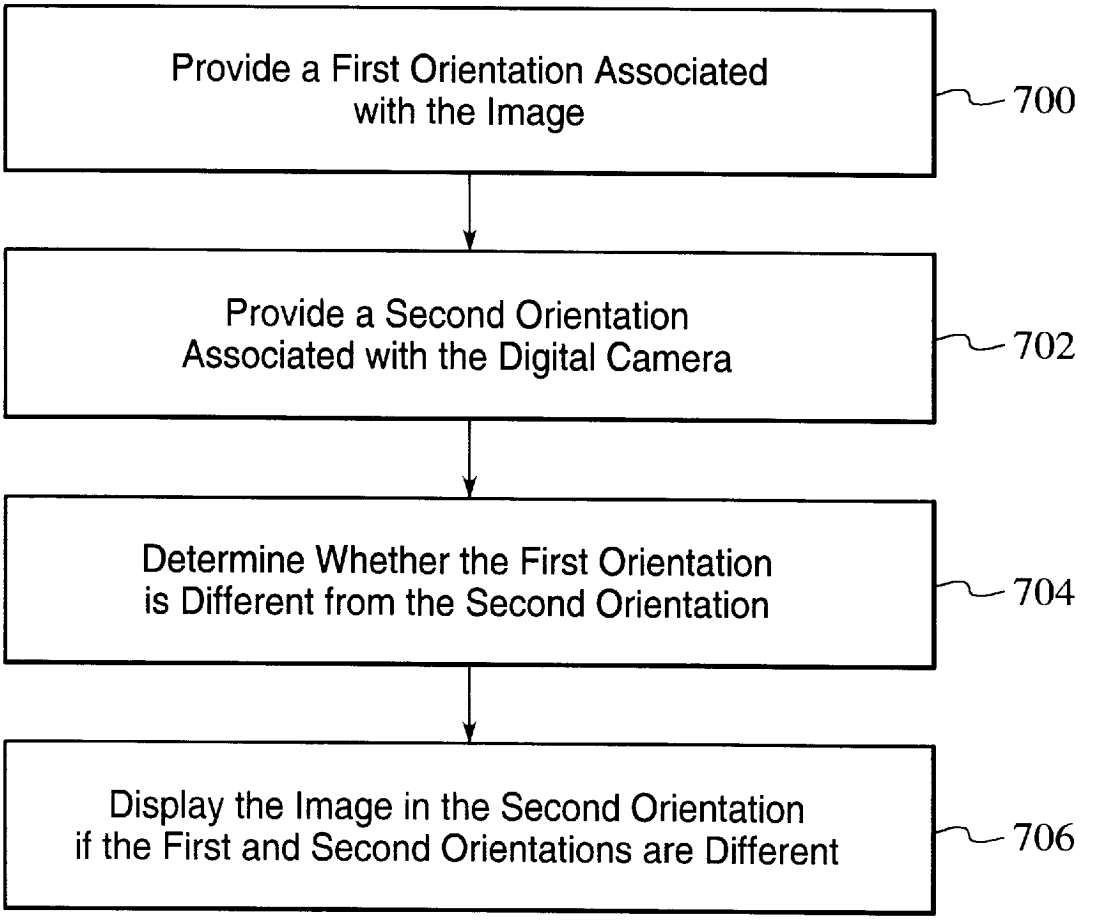

Provide a First Orientation Associated with the Image
700
Provide a Second Orientation Associated with the Digital Camera
702
Determine Whether the First Orientation is Different from the Second Orientation
704
Display the Image in the Second Orientation if the First and Second Orientations are Different
706

FIG. 9

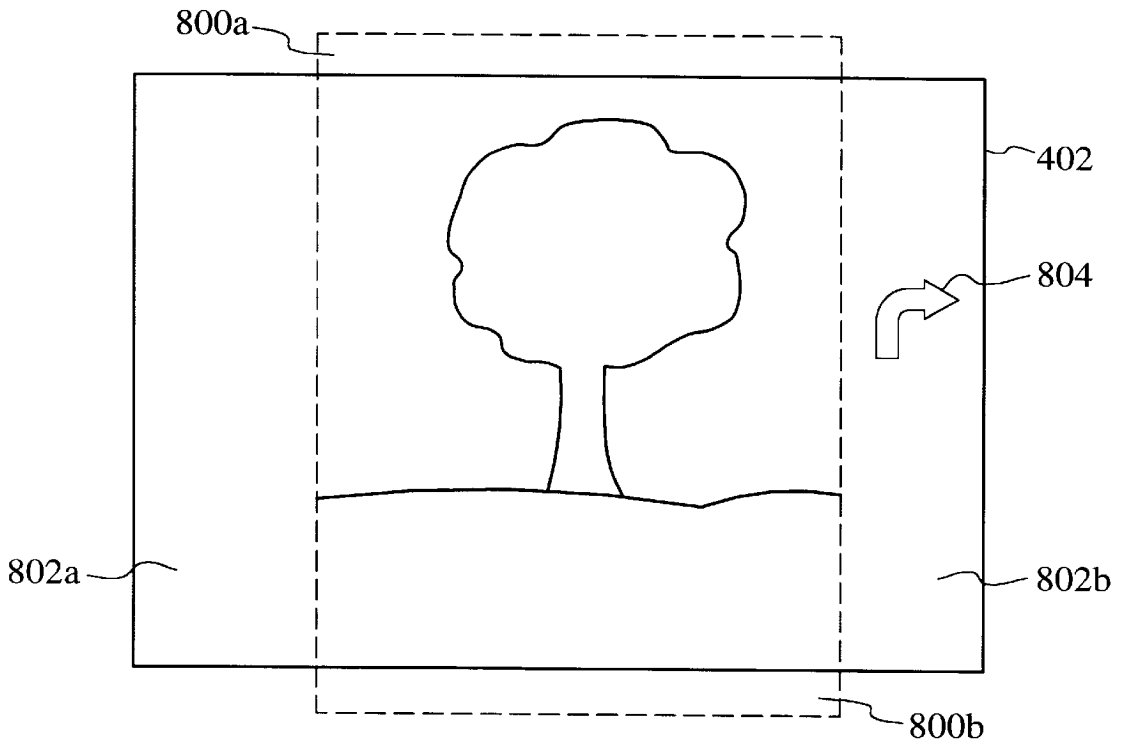



FIG. 10A

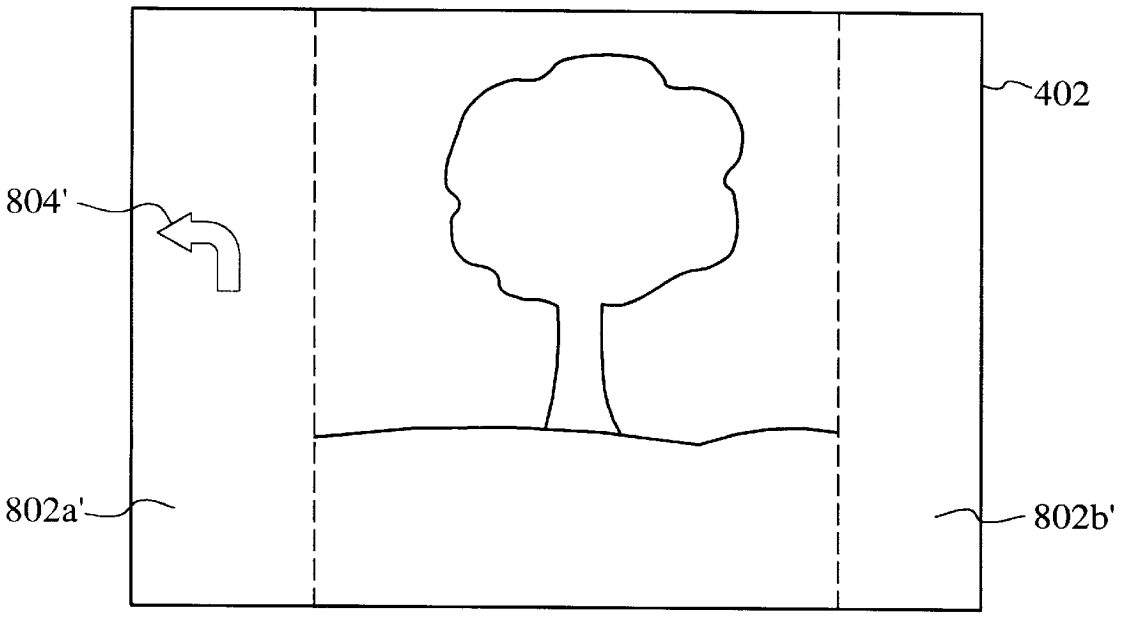



FIG. 10B

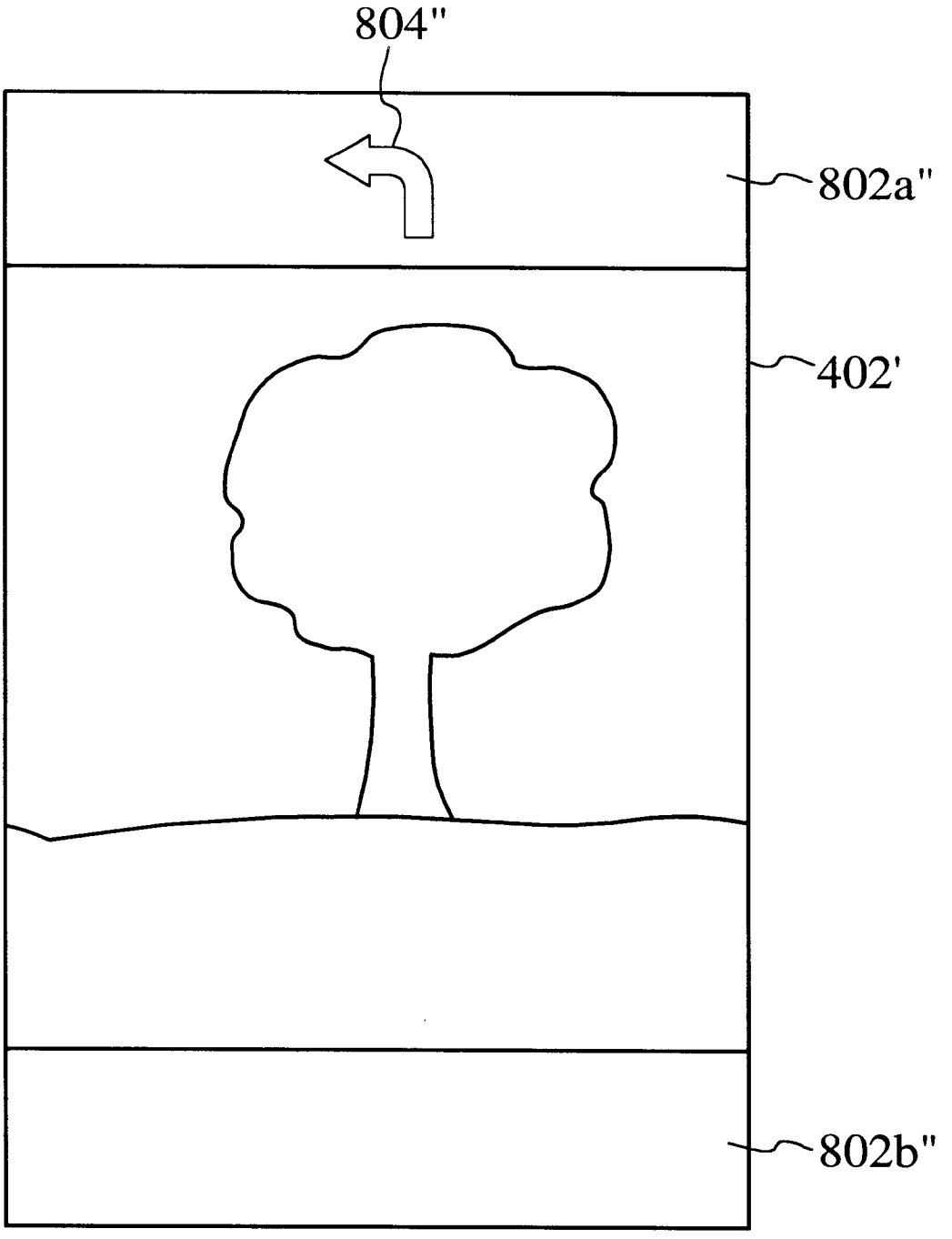



FIG. 11

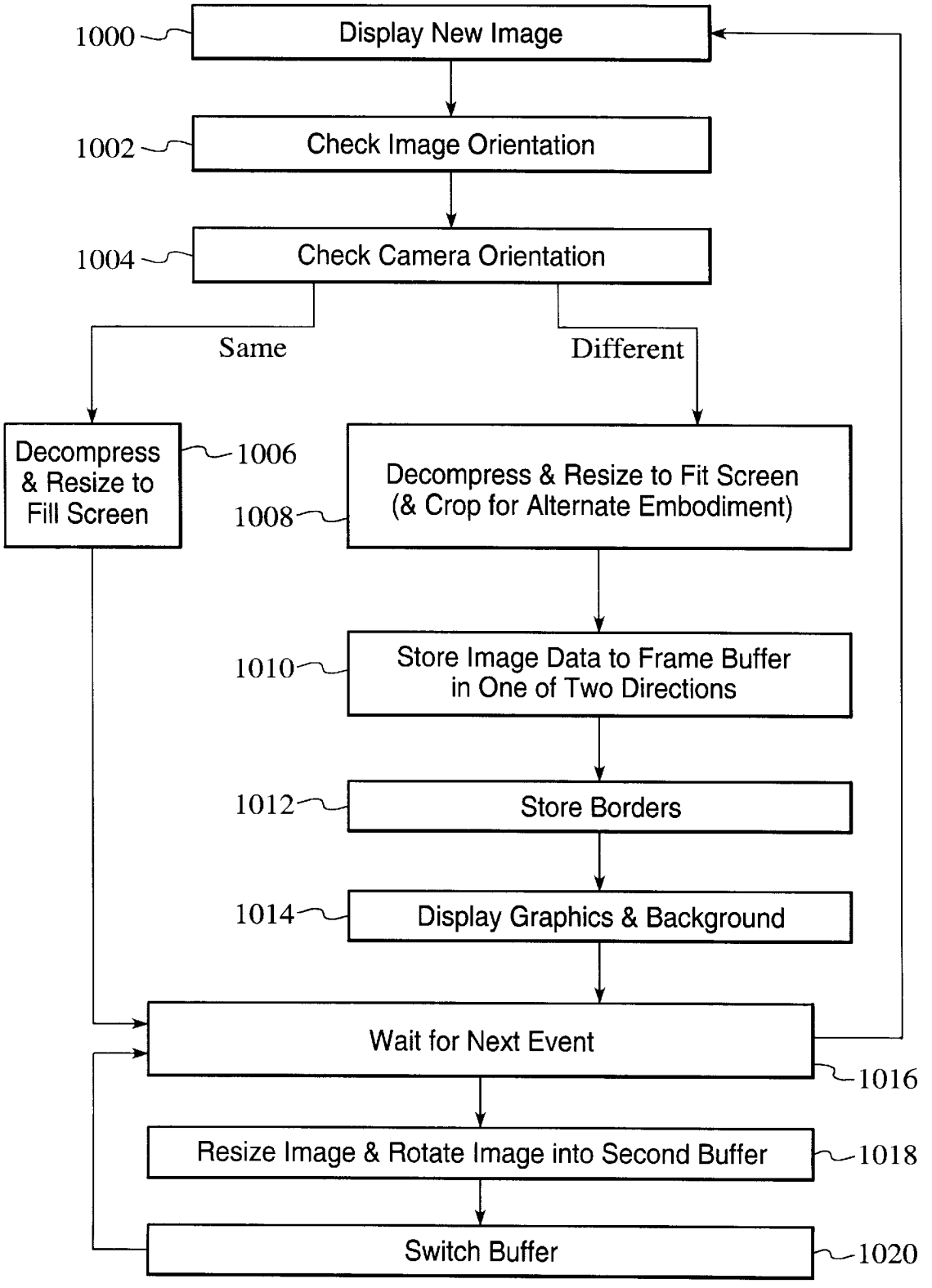

1000
Display New Image
1002
Check Image Orientation
1004
Check Camera Orientation
Same
Different
Decompress & Resize to Fill Screen
1006
1008
Decompress & Resize to Fit Screen (& Crop for Alternate Embodiment)
1010
Store Image Data to Frame Buffer in One of Two Directions
1012
Store Borders
1014
Display Graphics & Background
Wait for Next Event
1016
Resize Image & Rotate Image into Second Buffer
1018
Switch Buffer
1020

FIG. 12

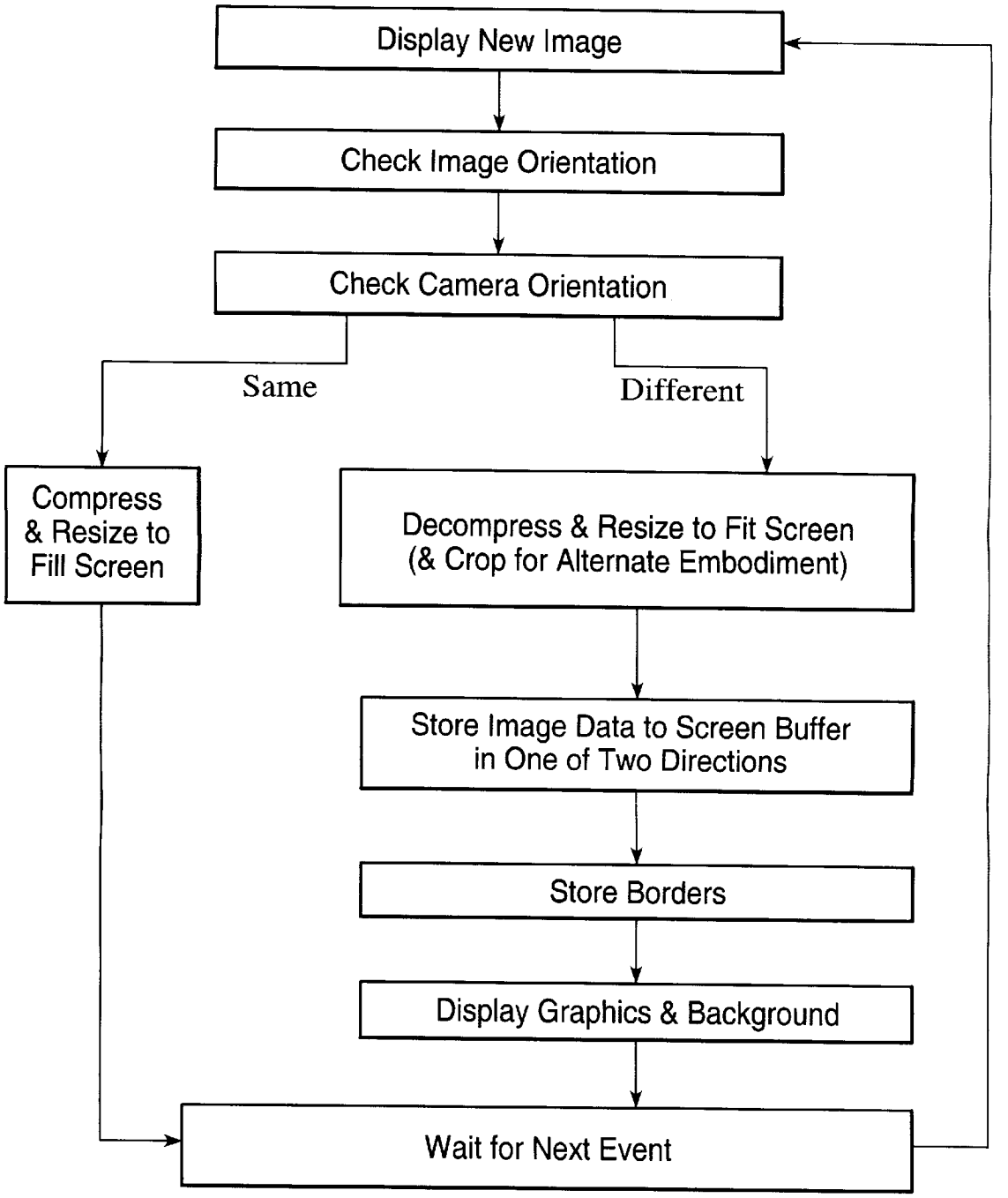

Display New Image
Check Image Orientation
Check Camera Orientation
Same
Different
Compress & Resize to Fill Screen
Decompress & Resize to Fit Screen (& Crop for Alternate Embodiment)
Store Image Data to Screen Buffer in One of Two Directions
Store Borders
Display Graphics & Background
Wait for Next Event

FIG. 13

# METHOD AND SYSTEM FOR AUTO ROTATING A GRAPHICAL USER INTERFACE FOR MANAGING PORTRAIT AND LANDSCAPE IMAGES IN AN IMAGE CAPTURE UNIT

## CROSS-REFERENCE TO RELATED APPLICATION

This application is related to U.S. Ser. No. 08/916186 (JAS 740P/P127), entitled "Method and System of Organizing DMA Transfers to Support Image Rotation." This application is also related to U.S. Ser. No. 08/795,587, filed Feb. 6, 1997, which is a continuation of Ser. No. 08/384,012, entitled "Apparatus and Method for Camera Image and Orientation Capture". Both applications are assigned to the same assignee as the instant application.

## FIELD OF THE INVENTION

The present invention relates generally to digital cameras, and more particularly to a method and apparatus for rotating a graphical user interface for managing portrait and landscape captures in a digital camera.

## BACKGROUND OF THE INVENTION

Most digital cameras today are similar in size to and behave like conventional point-and-shoot cameras. Unlike conventional cameras, however, most digital cameras store digital images in an internal flash memory or on external memory cards, and some are equipped with a liquid-crystal display (LCD) screen on the back of the camera. Through the use of the LCD, most digital cameras operate in two modes, record and play, although some only have a record mode. In record mode, the LCD is used as a viewfinder in which the user may view an object or scene before taking a picture. In play mode, the LCD is used as a playback screen for allowing the user to review previously captured images either individually or in arrays of four, nine, or sixteen images.

Digital camera user interfaces typically include a number of buttons or switches for setting the camera into one of the two modes and for navigating between images in play mode. One type of camera, for instance, includes two navigation buttons labeled "−" and "+", a mode button, a display button, a zoom button and a delete button. Play mode for this camera begins with a default screen displaying a full-sized individual image. Other images stored in the camera may then be displayed in a backward or forward sequence by pressing the "−" and "+" navigation buttons, respectively. Pressing the mode button during play mode causes four images to be displayed in a 2×2 array, and pressing the mode button again causes nine images to be displayed in a 3×3 array. The user can then "page" through screens of image arrays by pressing the navigation buttons, or the user can move from image to image in the arrays by first pressing the display button and then traversing across the images in the rows of the arrays using the navigation buttons. The user may have the full-sized image displayed of a chosen image by pressing the zoom button or can delete the image by pressing the delete button.

Digital cameras typically have a play mode in which a user can view a full-size image of a scene which has been previously captured. The user may choose to continuously view several images. It can be a nuisance, however, when some of the images are in landscape format, while other images are in portrait format. If the user is viewing several images one after another, the user must rotate the digital camera every time a landscape image appears after a portrait image, and vice versa.



What is needed is a method and apparatus for automatically rotating the images to a consistent format to avoid the user having to frequently rotate the camera. The present invention addresses such a need.

## SUMMARY OF THE INVENTION

The present invention provides a method and apparatus for automatically rotating a graphical user interface for displaying the image in the same orientation as the image capture unit. A method and apparatus for viewing an image in an image capture unit including a display comprises the steps of providing a first orientation associated with the image and providing a second orientation associated with the image capture unit. It is then determined whether the first orientation is different from the second orientation, and the image is displayed in the second orientation if the first and second orientations are different from each other.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a digital camera in which the present invention can reside.

FIG. **2** is a block diagram of an example of an imaging device of FIG. **1**.

FIG. **3** is a block diagram of an example of the computer of FIG. **1**.

FIGS. **4***a* and **4***b* are memory maps showing the dynamic access memory.

FIG. **5** is a block diagram of a portion of one embodiment of a digital camera including an orientation unit.

FIG. **6** is a flow chart of a method for camera image and orientation capture.

FIGS. **7***a* and **7***b* are diagrams depicting the back and top view, respectively, of a digital camera.

FIGS. **8***a* and **8***b* illustrate landscape and portrait images.

FIG. **9** is a flow diagram of a method according to the present invention of viewing an image in a digital camera.

FIGS. **10***a* and **10***b* are illustrations of the automatic rotation of a portrait capture to a landscape oriented camera.

FIG. **11** illustrates an example of an automatic rotation of a landscape capture shown in a portrait oriented camera.

FIG. **12** is another flow diagram of the method according to the present invention.

FIG. **13** is a flow diagram of an alternative method according to the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a method and apparatus for viewing an image in a digital camera. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Although the present invention will be described in the context of a digital camera, various modifications to the preferred embodiment will be readily apparent to those skilled in the art and the generic principles herein may be applied to other embodiments. That is, any image capture device which displays images, icons and/or other items, could incorporate the features described hereinbelow and that device would be within the spirit and scope of the

present invention. Thus, the present invention is not intended to be limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features described herein.

The present invention is a method and apparatus for automatically rotating a graphical user interface for managing portrait and landscape captures in a digital camera. According to the present invention, an apparatus and method is provided for providing a digital camera with the ability to present both landscape and portrait images which can be presented in an orientation consistent with the orientation of the camera. In operation, the user is no longer required to change the orientation of the camera by rotating the camera whenever a portrait image follows a landscape image, or vice versa, when the user is viewing a series of images in, for example, play mode or instant review mode.

Although the present invention is described in terms of a digital camera, the digital camera is merely an example of an image capture unit. It is to be understood that the present invention applies to any image capture unit, such as a digital scanner.

Referring now to FIG. **1**, a block diagram of a digital camera **110** is shown according to the present invention. Camera **110** preferably comprises an imaging device **114**, a system bus **116** and a computer **118**. Imaging device **114** is optically coupled to an object **112** and electrically coupled via system bus **116** to computer **118**. Once a photographer has focused imaging device **114** on object **112** and, using a capture button or some other means, instructed camera **110** to capture an image of object **112**, computer **118** commands imaging device **114** via system bus **116** to capture raw image data representing object **112**. The captured raw image data is transferred over system bus **116** to computer **118** which performs various image processing functions on the image data before storing it in its internal memory. System bus **116** also passes various status and control signals between imaging device **114** and computer **118**.

Referring now to FIG. **2**, a block diagram of an example of an imaging device **114** is shown. Imaging device **114** preferably comprises a lens **220** having an iris, a filter **222**, an image sensor **224**, a timing generator **226**, an analog signal processor (ASP) **228**, an analog-to-digital (A/D) converter **230**, an interface **232**, and one or more motors **234**.

Imaging device **114** captures an image of object **112** via reflected light impacting image sensor **224** along optical path **236**. Image sensor **224**, which is preferably a charged coupled device (CCD), responsively generates a set of raw image data in CCD format representing the captured image **112**. The raw image data is then routed through ASP **228**, A/D converter **230** and interface **232**. Interface **232** has outputs for controlling ASP **228**, motors **234** and timing generator **226**. From interface **232**, the raw image data passes over system bus **116** to computer **118**.

Referring now to FIG. **3**, a block diagram of an example of computer **118** is shown. System bus **116** provides connection paths between imaging device **114**, an optional power manager **342**, central processing unit (CPU) **344**, dynamic random-access memory (DRAM) **346**, input/output interface (I/O) **348**, non-volatile memory **350**, and buffers/connector **352**. Removable memory **354** connects to system bus **116** via buffers/connector **352**. Alternately, camera **110** may be implemented without removable memory **354** or buffers/connector **352**.

Power manager **342** communicates via line **366** with power supply **356** and coordinates power management operations for camera **110**. An orientation unit **560** is included to detect the orientation of the camera **110**. CPU **344** typically includes a conventional processor device for controlling the operation of camera **110**. In the preferred embodiment, CPU **344** is capable of concurrently running multiple software routines to control the various processes of camera **110** within a multi-threading environment. DRAM **346** is a contiguous block of dynamic memory which may be selectively allocated to various storage functions. LCD controller **390** accesses DRAM **346** and transfers processed image data to LCD screen **402** for display.

Co-pending patent application Ser. No. 08/795,587 filed Feb. 6, 1997, which is a continuation of Ser. No. 08/384,012 and assigned to the same assignee, entitled "Apparatus and Method for Camera Image and Orientation Capture" is incorporated herein by reference and provides a detailed discussion of the orientation unit **560**. The orientation unit **560** can sense which position the digital camera is currently in. The orientation unit **560** sends signals to the CPU **344** indicating the current orientation of the digital camera.

I/O **348** is an interface device allowing communications to and from computer **118**. For example, I/O **348** permits an external host computer (not shown) to connect to and communicate with computer **118**. I/O **348** also interfaces with a plurality of buttons and/or dials **404**, and an optional status LCD **406**, which in addition to the LCD screen **402**, are the hardware elements of the camera's user interface **408**.

Non-volatile memory **350**, which may typically comprise a conventional read-only memory or flash memory, stores a set of computer-readable program instructions to control the operation of camera **110**. Removable memory **354** serves as an additional image data storage area and is preferably a non-volatile device, readily removable and replaceable by a camera **110** user via buffers/connector **352**. Thus, a user who possesses several removable memories **354** may replace a full removable memory **354** with an empty removable memory **354** to effectively expand the picture-taking capacity of camera **110**. Removable memory **354** can be implemented by using a flash disk.

Power supply **356** supplies operating power to the various components of camera **110**. The power supply **356** provides operating power to a main power bus **362** and also to a secondary power bus **364**. The main power bus **362** provides power to imaging device **114**, I/O **348**, non-volatile memory **350** and removable memory **354**. The secondary power bus **364** provides power to power manager **342**, CPU **344** and DRAM **346**.

Power supply **356** is connected to main batteries **358** and also to backup batteries **360**. In the preferred embodiment, a camera **110** user may also connect power supply **356** to an external power source. During normal operation of power supply **356**, the main batteries **358** provide operating power to power supply **356** which then provides the operating power to camera **110** via both main power bus **362** and secondary power bus **364**. During a power failure mode in which the main batteries **358** have failed (when their output voltage has fallen below a minimum operational voltage level) the backup batteries **360** provide operating power to power supply **356** which then provides the operating power only to the secondary power bus **364** of camera **110**.

Referring now to FIG. **4A**, a memory map showing the dynamic random-access-memory (DRAM) **346** is shown. DRAM **346** is shown to include RAM disk **532**, a system area **534**, and working memory **530**.

RAM disk **532** is a memory area used for storing raw and compressed image data and typically is organized in a

"sectored" format similar to that of conventional hard disk drives. RAM disk **532** uses a well-known and standardized file system to permit external host computer systems, via I/O **348**, to readily recognize and access the data stored on RAM disk **532**. System area **534** typically stores data regarding system errors (for example, why a system shutdown occurred) for use by CPU **344** upon a restart of computer **118**.

Working memory **530** includes various stacks, data structures and variables used by CPU **344** while executing the software routines used within computer **118**. Working memory **530** also includes input buffers **538** for initially storing sets of raw image data received from imaging device **114** for image conversion, and frame buffers **536** for storing data for display on the LCD screen **402**.

The conversion process is performed by a live view generation program, which is stored in non-volatile memory **350** and executed on CPU **344**. However, the conversion process can also be implemented using hardware. Referring again to FIG. **3**, during the execution of the live view generation program (not shown), the CPU **344** takes the raw image data from the input buffers **538** in CCD format and performs color space conversion on the data. The conversions process performs gamma correction and converts the raw CCD data into either a RGB or YCC color format which is compatible with the LCD screen **402**. After the conversion, CPU **344** stores the image data in the frame buffers **536**. The LCD controller **390** then transfers the processed image data from the frame buffers to the LCD screen **402** (via an optional analog converter) for display.

Referring now to FIG. **4**B, the contents of input buffers **538** and the frame buffers **536** are shown. Both the input buffers **538** and the frame buffers **536** can utilize two separate buffers, called ping-pong buffers, to improve the display speed of the digital camera and to prevent the tearing of the image in the display **402**. As shown, input buffers **538** include an input buffer A and an input buffer B, and frame buffers **536** include a frame buffer A and a frame buffer B.

The input buffers A and B alternate between an input cycle and a processing cycle. During the input cycle, the input buffers **538** are filled with raw image data from the image device **114**, and during the processing cycle, CPU **344** processes the raw data and transmits the processed data to the frame buffers **536**. More specifically, while input buffer A is filling with image data, the data from input buffer B is processed and transmitted to frame buffer B. At the same time, previously processed data in frame buffer A is output to the LCD screen **402** for display. While input buffer B is filling with image data, the data from input buffer A is processed and transmitted to frame buffer A. At the same time, previously processed data in frame buffer B is output to the LCD screen **402** for display.

FIG. **5** depicts a portion of one embodiment of the camera **110'** including an orientation unit **560**. Components similar to those discussed with respect to FIGS. **1** through **3** are labeled similarly. The digital camera **110'** includes a processing unit **344'** having at least one orientation input, at least one setting input and a bidirectional communications port; and an imaging device **114'**. The orientation unit **560** has at least one orientation output. A memory **550** includes an image memory **554**, a setting unit **60**, and an orientation memory **552**. The memory **550** can be included in one or more of the components of the camera **110**, including the DRAM **346** or the non-volatile memory **350**.

Each orientation output of the orientation unit **560** is coupled to a corresponding orientation input of the processing unit **344'** via an orientation signal line **562**. The bidirectional communication port of the processing unit **344'**, the memory **550**, and the output of the imaging device **114'** are coupled via common bus **116'**. In an alternative embodiment, the orientation unit **560** may also be coupled to the processing unit **344'** through the common bus **116'**. The processing unit **344'**, the imaging device **114'**, the orientation unit **560**, and the memory **550** are also coupled to a power source, not shown.

In one embodiment, the orientation unit **560** includes first and second orientation sensors (not shown). In this embodiment, the first orientation sensor determines whether the camera **110'** is rotated to the left or right orientation. Thus, the first orientation sensor determines whether the camera has been rotated to a left rotation portrait, a right rotation portrait, an upright or an inverted position. In this embodiment, the first orientation sensor outputs a left orientation signal for left rotation portraits and a right orientation signal for right rotation portraits. The second orientation sensor determines whether the camera **110'** is tilted forward or backward. In such an embodiment, the second orientation sensor outputs a forward and a backward orientation signal.

Referring now to FIG. **6**, a flow chart of one method **600** for camera image and orientation capture is shown. The method **600** is used for capture of four orientations: upright landscape, inverted landscape, left orientation (for a left rotation portrait image), and right orientation (for a right rotation portrait image). When only one orientation unit **560** of FIG. **3** is used, if the camera is tilted forward or backward, then a predetermined orientation, such as upright landscape, can be selected. The predetermined orientation is preferred to be used when the camera is tilted forward or backward because the orientation unit **560** of FIG. **3** may not operate properly if the camera is tilted.

First, the processing unit **344'** determines whether the image is to be captured via step **610**. In one embodiment, this determination is made based on ascertaining whether an image capture button, not shown, has been depressed. The processing unit **344'** may determine whether the image capture button has been depressed by monitoring the value of a shutter activation signal, not shown. If an image is not to be captured, then subsequent steps are not executed. If an image is to be captured, the processing unit **344'** stores the right and left orientation signals in the orientation signal memory **552** via step **612**. In one embodiment, the stored orientation signals include the left and right orientation signals as well as the forward and backward orientation signals. Next, the setting unit **556** receives the orientation signals determines whether the camera **110'** is in an upright orientation in step **614**. It the camera **110'** is in an upright orientation, the setting unit **556** defines the top portion and the bottom of the image as the top and bottom, respectively, of an upright landscape image via step **616**.

If the setting unit **556** determines in step **614** that the camera **110'** is not in an upright orientation, then the setting unit **556** determines whether the camera **110'** is in a left orientation in step **618**. If the camera **110'** is in a left orientation, the setting unit **556** defines the top and bottom of the image as the top and bottom, respectively, of a left rotation portrait image via step **620**.

If the setting unit **556** determines in step **618** that the camera **110'** is not in a left orientation, then the setting unit **556** determines whether the camera **110'** is in a right orientation in step **622**. If the camera **110'** is in a right orientation, the setting unit **556** defines the top and bottom

of the image as the top and bottom, respectively, of a right rotation portrait image via step **624**.

If the setting unit **556** determines in step **622** that the camera **110'** is not in a right orientation, the setting unit **556** defines the top and bottom of the image as the top and bottom, respectively, of an inverted landscape image. After each of the steps **616**, **620**, **624**, or **626**, the processing unit **344'** issues an image capture command via step **628**, transferring the pixel signals output by the imaging device **114'** to the image memory **554'**.

Referring again to FIG. **5**, portions of the memory **550**, such as image memory **554**, may be included in the DRAM **346**. In addition, the functions of the setting unit **556**, such as determining the orientation of the camera and setting the top and bottom of the image, may be performed by another component, such as the CPU **344**. Certain functions and components of the camera **110**, such as the input buffer **538**, frame buffers **536**, or image processing and compression, are not discussed with respect to the method **600**. However, in a preferred embodiment, these functions are performed in conjunction with the method **600**. Consequently, the method **600** is independent of the hardware used. Finally, the method **600** may be used to define, for example, only the top or the bottom of a particular image rather than both the top and the bottom of the image.

FIGS. **7**A and **7**B are diagrams depicting the hardware components of the camera's **110** and **110'** user interface **408**. FIG. **7**A is back view of the camera **110** showing the LCD screen **402**, a four-way navigation control button **409**, an overlay button **412**, a menu button **414**, and a set of programmable soft keys **416**. FIG. **7**B is a top view of the camera **110** showing a shutter button **418**, and a mode dial **420**. The camera may optionally include status LCD **406**, status LCD scroll and select buttons **422** and **424**, a sound record button **426**, and zoom-in, zoom-out buttons **426***a* and **426***b* .

The user interface **408** can include several different operating modes for supporting various camera functions. In play mode, the camera **100** displays an image. In review mode, the camera **100** supports the actions of reviewing camera contents, editing and sorting images, and printing and transferring images. In menu mode, the camera **100** allows the user to manipulate camera settings and to edit and organize captured images. In capture mode, the camera **100** supports the actions of preparing to capture an image, and capturing an image through the use of either the LCD screen **402** or the status LCD **406**.

The user switches between the play, review, menu, and capture modes, using the mode dial **420**. Orientation unit **560** of FIG. **3** can be used for both play mode and capture mode. When the camera is placed into a particular mode, that mode's default screen appears in the LCD screen **402** in which a set of mode-specific items, such as images, icons, and text, are displayed.

FIGS. **8***a*–**8***b* show landscape and portrait images. FIG. **8***a* shows a landscape image while FIG. **8***b* shows a portrait image. Points a and b show a top center point and a bottom center point of a display on the digital camera.

FIG. **9** is a flow diagram of a method according to the present invention for automatically rotating a graphical user interface for managing portrait and landscape captures. A first orientation associated with the image is provided via step **700**. The first orientation is preferably either landscape or portrait. A second orientation associated with the digital camera is provided via step **702**. The second orientation is preferably either an orientation where a horizontal axis of the digital camera is substantially parallel to the surface of the earth, or the horizontal axes of the digital camera is substantially perpendicular to the surface of the earth. An example of one orientation associated when the camera is held by the user in a manner in which a landscape image would be recorded. Another example of an orientation of the digital camera would be if a portrait image would be recorded.

It is then determined whether the first orientation is different from the second orientation via step **704**. The image is then displayed in the second orientation if the first and second orientation are found to be different via step **706**. FIGS. **10***a* and **10***b* illustrate the rotation of a portrait image onto a landscape orientation. Portions **800***a* and **800***b* of the image can be cropped in order to fit the portrait image onto a landscape oriented display **402** of a digital camera. The remaining space on the display **402** can be covered with borders **802***a* and **802***b*. The borders **802***a*–**802***b* can be either blank, colored, or include designs or icons for conveying information to the user. For example, an icon **804** can be used to indicate to the user that the digital camera can be rotated to view the image in its original portrait form.

FIG. **10***b* shows another method for rotating a portrait image onto a landscape oriented display **402**. The portrait image can be reduced in size to display the entire image on the display **402**. In this instance, no portion of the image would be cut for display. Again, borders **802***a'* and **802***b'* can be displayed along with the image.

FIG. **11** shows an example of a landscape image being displayed on a portrait oriented display **402'**. The landscape image can also have portions of the image cut to fit onto the portrait oriented display **402'**. Alternatively, the landscape image may be reduced in size, as shown, to fit onto a portrait oriented display **402'**. Borders **802***a"* and **802***b"* can be placed above and below the image. Additionally, icons, such as the arrow **804"**, can be used to convey information for the user.

Text and graphics may also be rotated as well as the image. Accordingly, a user should be able to view the image as well as text and graphics in the same orientation as the camera.

FIG. **12** is a flow diagram of a method of viewing an image in an image capture unit according to the present invention. A new image is displayed via step **1000**. An image orientation is determined via step **1002**, and a camera orientation is also determined via step **1004**. Alternative to first displaying an image via step **1000**, the method according to the present invention can begin with the image orientation being determined via step **1002**.

If the image orientation and the camera orientation are the same, then the image is decompressed and resized to fill the display via step **1006**. If, however, the image orientation is different from the camera orientation, then the image is decompressed and resized to fit the display via step **1008**. Alternatively, the image can be cropped, rather than resized, in order to fit the display.

The image data is then stored in the frame buffer **536** of FIG. **4**A in one of two directions via step **1010**. Determining which of the two directions depends upon how the image is to be rotated. For instance, if the image is to be resized from a portrait image to a landscape oriented display, then the image would need to be rotated as the image is being stored in the buffer. Likewise, a landscape portrait would also need to be rotated if it is being displayed on a portrait oriented display. Filling a buffer in a manner which rotates one orientation to another is well known in the art.

The borders can also be stored via step **1012**. Graphics and background can also be displayed via step **1014**. The graphics can include various icons, and/or directional arrows. While the digital camera system is waiting for the next event via step **1016**, the image can be resized and rotated into a second frame buffer as shown in FIG. **4**B, via step **1018**. The two buffers can then be switched via step **1020**.

What is meant by the frame buffers being switched is that the functions of the frame buffers are switched. For instance, while data is being transmitted to frame buffer A, previously processed data is output to the LCD screen for display. When the two buffers are switched, then image data is transmitted to frame buffer B while the previously processed data now located in frame buffer A is output to the LCD screen for display.

FIG. **13** is a flow diagram of another method according to the present invention. The method of FIG. **13** includes all of the steps shown in FIG. **12** except for those involving a second buffer via steps **1018** and **1020**. The method of FIG. **12** is the preferred method since it requires less coding. However, the method of FIG. **13** can be executed with a single buffer.

The new image can be refreshed, or presented, in increments while in view of the user. Alternatively, the image and background can be fully prepared in the buffer prior to presentation on the display, and displayed as a complete image to the user.

Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. For example, the integrated user interface also applies to cameras having only two modes, but that have multiple navigation screens within the "play mode" Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

**1**. A method for viewing an image in an image capture unit including an integrated display, the method comprising the steps of:

determining a first orientation associated with the image at capturing of the image, the image being a captured image;

storing the image, including storing the information relating to the first orientation associated with the image;

determining a second orientation associated with the image capture unit at a display time corresponding to displaying the image after the image is captured, the second orientation capable of being different from the first orientation;

determining whether the first orientation is different from the second orientation;

displaying the image in the second orientation on the integrated display of the image capture unit; and

if the image capture unit is rotated to a third orientation during display of the image, the method further includes,

determining the third orientation of the image capture unit,

determining whether the third orientation is different from the second orientation, the first orientation, or both, and

rotating the image to be displayed in the third orientation if the third orientation is different from the second orientation.

**2**. The method of claim **1**, wherein the image is rotated to the second orientation when the first orientation is different from the second orientation.

**3**. The method of claim **1**, wherein the first orientation is a landscape orientation.

**4**. The method of claim **1**, wherein the first orientation is a portrait orientation.

**5**. The method of claim **1**, wherein the second orientation is an orientation in which a horizontal axis of the image capture unit is substantially parallel to a surface of the earth.

**6**. The method of claim **1**, wherein the second orientation is an orientation in which a horizontal axis of the image capture unit is substantially perpendicular to a surface of the earth.

**7**. The method of claim **1**, wherein the image is resized to fit the display.

**8**. The method of claim **1**, wherein the image is cropped to fit the display.

**9**. The method of claim **1**, wherein data related to the image is stored in a buffer in a manner which allows the image to be displayed in the second orientation.

**10**. The method of claim **1**, wherein borders are displayed between an edge of the image and an edge of the display.

**11**. The method of claim **1**, wherein at least one graphic is displayed on the display.

**12**. The method of claim **1**, wherein at least one icon is displayed on the display.

**13**. The method of claim **1**, wherein at least one directional icon is displayed on the display.

**14**. The method of claim **1**, wherein data associated with the image is stored in a first buffer.

**15**. The method of claim **14**, wherein data associated with the image is also stored in a second buffer.

**16**. The method of claim **1**, further comprising a step of displaying text in the second orientation.

**17**. The method of claim **1**, further comprising a step of displaying a graphic in the second orientation.

**18**. A system for viewing images in an image capture unit comprising:

an image associated with a first orientation determined at capturing of the image, the image being a captured image;

means for storing the image, including storing information relating to the first orientation associated with the image;

a second orientation associated with the image capture unit determined at a display time corresponding to displaying the image after the image is captured, the second orientation capable of being different from the first orientation, wherein it is determined whether the first orientation is different from the second orientation;

a display, in the image capture unit, to display the image in the second orientation;

wherein the image is rotated from the first orientation to the second orientation when the first orientation is different from the second orientation for viewing on the display of the image capture unit; and

if the image capture unit is rotated to a third orientation during display of the image, the system further includes,

means for determining the third orientation of the image capture unit,

means for determining whether the third orientation is different from the second orientation, the first orientation, or both, and

means for rotating the image to be displayed in the third orientation if the third orientation is different from the second orientation.

**19**. The system of claim **18**, wherein the first orientation is a landscape orientation.

**20**. The system of claim **18**, wherein the first orientation is a portrait orientation.

**21**. The system of claim **18**, wherein the second orientation is an orientation in which a horizontal axis of the image capture unit is substantially parallel to a surface of the earth.

**22**. The system of claim **18**, wherein the second orientation is an orientation in which a horizontal axis of the image capture unit is substantially perpendicular to a surface of the earth.

**23**. The system of claim **18**, further comprising an image orientation sensor for determining the second orientation associated with the image capture unit and the first orientation of the image.

**24**. The system of claim **18**, further comprising a buffer to store data associated with the image.

**25**. The system of claim **22**, further comprising a buffer to store data associated with the image.

**26**. The system of claim **18**, wherein the image is resized to fit the display.

**27**. The system of claim **18**, wherein the image is cropped to fit the display.

**28**. The system of claim **18**, wherein data related to the image is stored in a buffer in a manner which allows the image to be displayed in the second orientation.

**29**. The system of claim **18**, wherein borders are displayed between an edge of the image and an edge of the display.

**30**. The system of claim **16**, wherein at least one graphic is displayed on the display.

**31**. The system of claim **18**, wherein at least one icon is displayed on the display.

**32**. The system of claim **18**, wherein at least one direction icon is displayed on the display.

**33**. A digital camera capable of displaying an image having a first orientation, the digital camera comprising:

means for capturing the image, the image having the first orientation at capturing of the image, the image being a captured image;

means for storing the image in a compressed format image and storing the first orientation;

means for determining a second orientation associated with the digital camera at a display time corresponding to displaying the image after the image is captured, the second orientation capable of being different from the first orientation;

means coupled with the determining means for comparing the first orientation and the second orientation;

means coupled with the determining means for rotating the image from the first orientation to the second orientation if the first orientation is different from the second orientation;

an integrated display coupled with the rotating means for displaying the image in the second orientation; and

if the digital camera is rotated to a third orientation during display of the image, the digital camera further includes,

the second orientation determining means determines the third orientation of the digital camera;

the comparing means determines whether the third orientation is different from the second orientation, the first orientation, or both, and

the rotating means rotates the image to be displayed in the third orientation if the third orientation is different from the second orientation.

**34**. The digital camera of claim **33** further comprising:

means coupled with the comparing means and the rotating means for decompressing the image.

**35**. The method of claim **1** wherein the step of displaying the image includes the steps of:

retrieving the image that was previously stored;

decompressing the image if the image was compressed during the storing step; and

displaying the image in the second orientation currently associated with the camera on the display of the image capture unit.

**36**. The system of claim **18** wherein the image is a previously stored image that is retrieved, decompressed the image if the image was compressed during the storing step and displayed in the second orientation currently associated with the camera on the display of the image capture unit.

**37**. The digital camera of claim **33** wherein the image is a previously stored image that is retrieved, decompressed the image if the image was compressed during storage and displayed in the second orientation currently associated with the camera on the integrated display of the digital camera.

**38**. The method of claim **1** wherein the first orientation of the image and the second orientation of the image capture unit are determined using at least one orientation sensor.

**39**. The digital camera of claim **33** wherein the second orientation determining means further include at least one orientation sensor for determining the orientation of the image capture unit.

**40**. A method for viewing an image in an image capture unit including an integrated display, the method comprising the steps of:

determining a first orientation associated with the image at capturing of the image, the image being a captured image;

storing the image, including storing the information relating to the first orientation associated with the image;

determining a second orientation associated with the image capture unit at a display time corresponding to displaying the image after the image is captured, the second orientation capable of being different from the first orientation;

determining whether the first orientation is different from the second orientation; and

displaying the image in the second orientation on the integrated display of the image capture unit, wherein the first orientation of the image is capable of being a landscape orientation or a portrait orientation, wherein the second orientation of the image capture unit is capable of being the landscape orientation or the portrait orientation, and wherein the displaying step includes the steps of:

rotating the image to be in the landscape orientation if the second orientation is the landscape orientation and the first orientation is the portrait orientation,

rotating the image to be in the portrait orientation if the second orientation is the portrait orientation and the first orientation is the landscape orientation,

displaying the image in the landscape orientation if the first orientation and the second orientation are each the landscape orientation, and

displaying the image in the portrait orientation if the first orientation and the second orientation are each the portrait orientation.

**41**. A system for viewing images in an image capture unit comprising:

an image associated with a first orientation determined at capturing of the image, the image being a captured image;

means for storing the image, including storing information relating to the first orientation associated with the image;

a second orientation associated with the image capture unit determined at a display time corresponding to displaying the image after the image is captured, the second orientation capable of being different from the first orientation, wherein it is determined whether the first orientation is different from the second orientation; and

a display, in the image capture unit, to display the image in the second orientation;

wherein the image is rotated from the first orientation to the second orientation when the first orientation is different from the second orientation for viewing on the display of the image capture unit, wherein the first orientation of the image is capable of being a landscape orientation or a portrait orientation, wherein the second orientation of the image capture unit is capable of being the landscape orientation or the portrait orientation, and wherein

the image is rotated to be in the landscape orientation if the second orientation is the landscape orientation and the first orientation is the portrait orientation,

the image is rotated to be in the portrait orientation if the second orientation is the portrait orientation and the first orientation is the landscape orientation,

the image is displayed in the landscape orientation if the first orientation and the second orientation are each the landscape orientation, and

the image is displayed in the portrait orientation if the first orientation and the second orientation are each the portrait orientation.

**42**. A digital camera capable of displaying an image having a first orientation, the digital camera comprising:

means for capturing the image, the image having the first orientation at capturing of the image, the image being a captured image;

means for storing the image in a compressed format image and storing the first orientation;

means for determining a second orientation associated with the digital camera at a display time corresponding to displaying the image after the image is captured, the second orientation capable of being different from the first orientation;

means coupled with the determining means for comparing the first orientation and the second orientation;

means coupled with the determining means for rotating the image from the first orientation to the second orientation if the first orientation is different from the second orientation; and

an integrated display coupled with the rotating means for displaying the image in the second orientation, wherein the first orientation of the image is capable of being a landscape orientation or a portrait orientation, wherein the second orientation of the image capture unit is capable of being the landscape orientation or the portrait orientation, and wherein the rotating means further rotates the image to be in the landscape orientation if the second orientation is the landscape orientation and the first orientation is the portrait orientation, rotate the image to be in the portrait orientation if the second orientation is the portrait orientation and the first orientation is the landscape orientation, display the image in the landscape orientation if the first orientation and the second orientation are each the landscape orientation, and display the image in the portrait orientation if the first orientation and the second orientation are each the portrait orientation.

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