Eastman Kodak Company v. HTC Corporation et al Doc. 1 Att. 1

EXHIBIT A

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Parulski et al.

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(45) **Date of Patent: *Sep. 18, 2001**

(54) **ELECTRONIC CAMERA FOR INITIATING CAPTURE OF STILL IMAGES WHILE PREVIEWING MOTION IMAGES**

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(73) Assignee: **Eastman Kodak Company**, Rochester, NY (US)

(*) 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.

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(22) Filed: **Jul. 16, 1997**

Related U.S. Application Data

(62) Division of application No. 08/367,399, filed on Dec. 30, 1994.

(51) **Int. Cl.**[7] **H04N 5/225**; H04N 5/222

(52) **U.S. Cl.** **348/220**; 348/333.11

(58) **Field of Search** 348/220, 221, 348/222, 333, 321, 223, 333.11, 333.12

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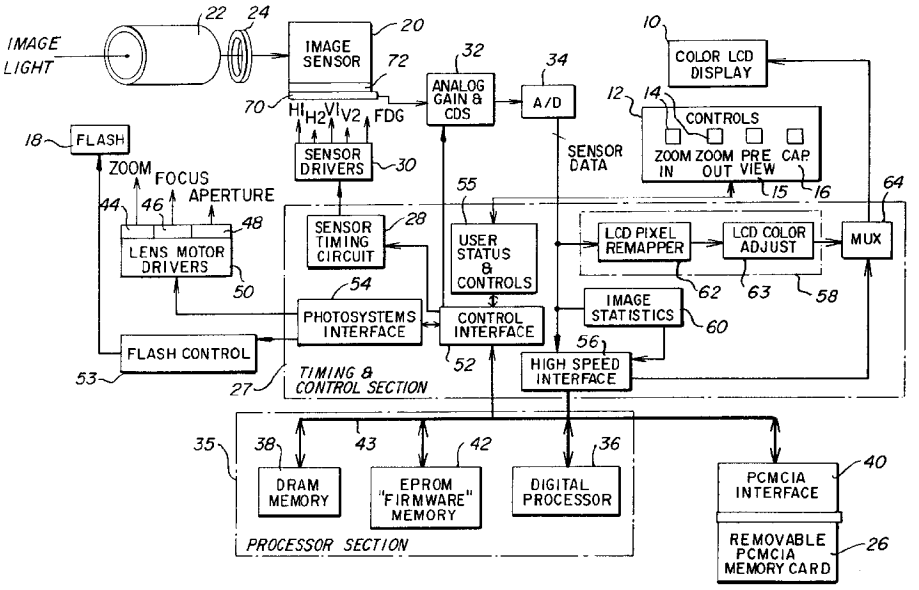
(57) **ABSTRACT**

An electronic camera uses a relatively more complex digital image processing technique in a still image mode to produce high quality still images, and a relatively more simple image processing technique in a motion preview mode to produce preview images of acceptable quality prior to initiation of the still image mode. The more complex digital technique is done in software in a general purpose processor section **35**, while the more simple digital technique is implemented in a fixed digital circuit in an application specific integrated circuit **27**, which also implements timing and control functions. The motion preview mode uses a shorter image readout period than the still mode and further involves mapping image sensor pixels into a fewer number of color display pixels on a color LCD display **10**. The mapping further converts color pixel signals from a mosaic array into a different color pattern on the color LCD display **10**.

28 Claims, 10 Drawing Sheets



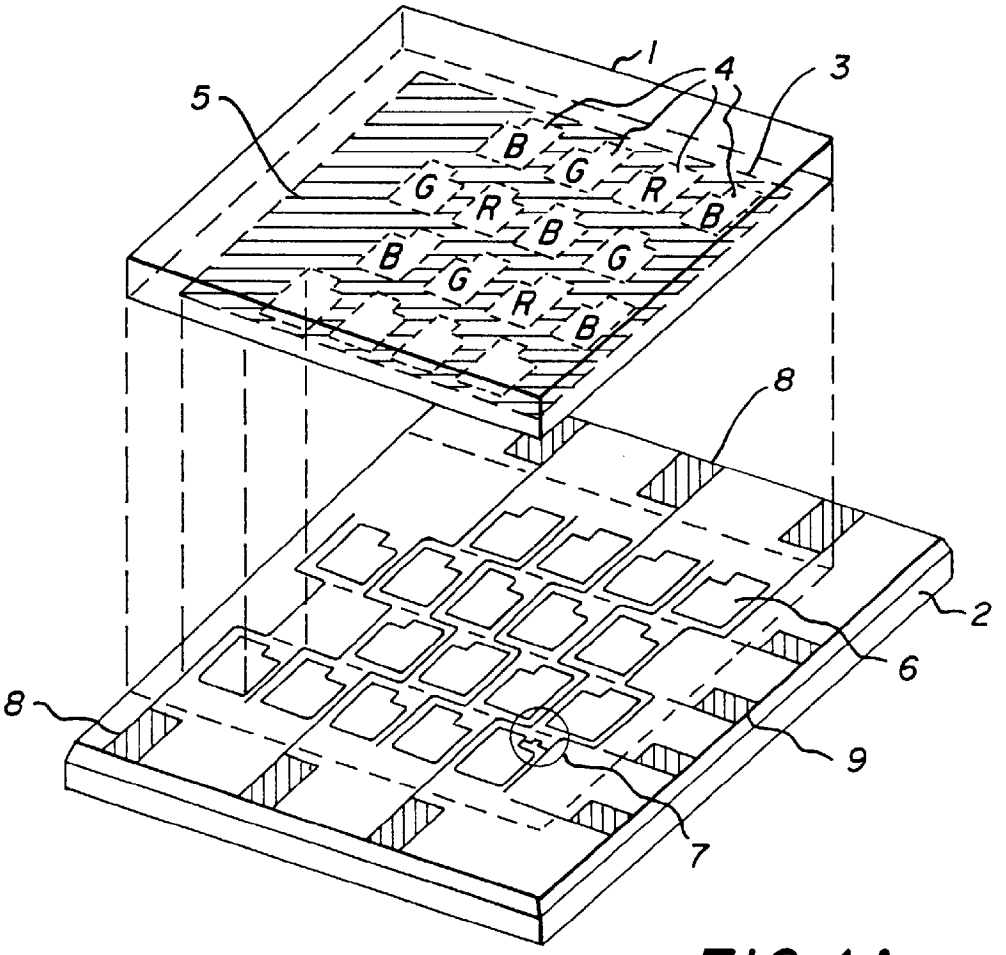


FIG. 1A

G	R	B	G	R	B	G	R
B	G	R	B	G	R	B	G
R	B	G	R	B	G	R	B
G	R	B	G	R	B	G	R

FIG. 1B

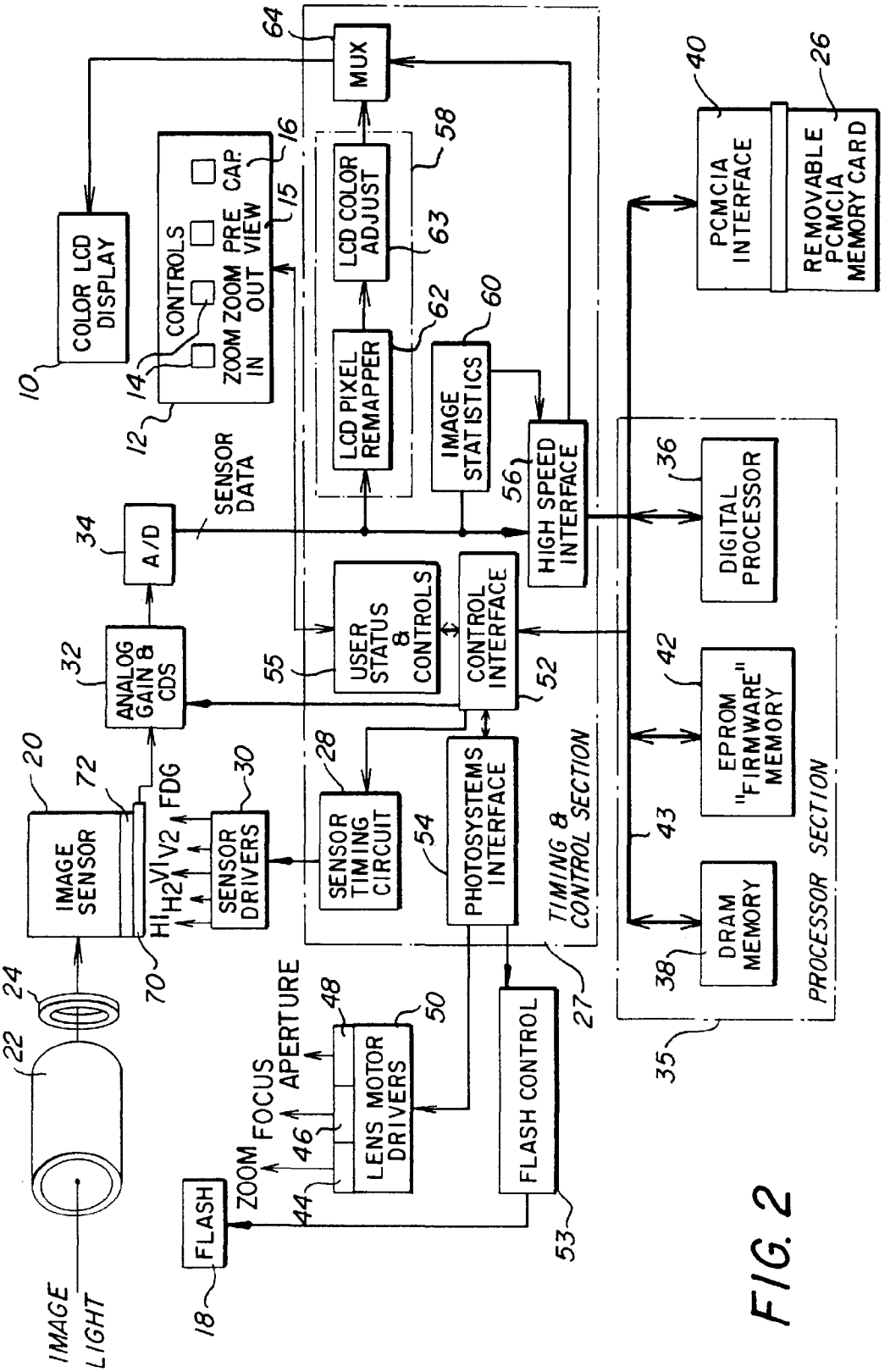


IMAGE LIGHT
22
24
IMAGE SENSOR
20
72
70
H1 H2 V1 V2 FDG
SENSOR DRIVERS
30
ANALOG GAIN & CDS
32
A/D
34
SENSOR DATA
FLASH
18
ZOOM
FOCUS
APERTURE
46
44
48
LENS MOTOR DRIVERS
50
FLASH CONTROL
53
SENSOR TIMING CIRCUIT
28
54
PHOTOSYSTEMS INTERFACE
TIMING & CONTROL SECTION
27
USER STATUS & CONTROLS
55
CONTROL INTERFACE
52
HIGH SPEED INTERFACE
56
IMAGE STATISTICS
60
LCD PIXEL REMAPPER
62
LCD COLOR ADJUST
63
58
MUX
64
COLOR LCD DISPLAY
10
CONTROLS
14
ZOOM IN
ZOOM OUT
PRE VIEW
CAP.
12
15
16
PCMCIA INTERFACE
40
REMOVABLE PCMCIA MEMORY CARD
26
DIGITAL PROCESSOR
36
EPROM "FIRMWARE" MEMORY
42
DRAM MEMORY
43
38
35
PROCESSOR SECTION

FIG. 2

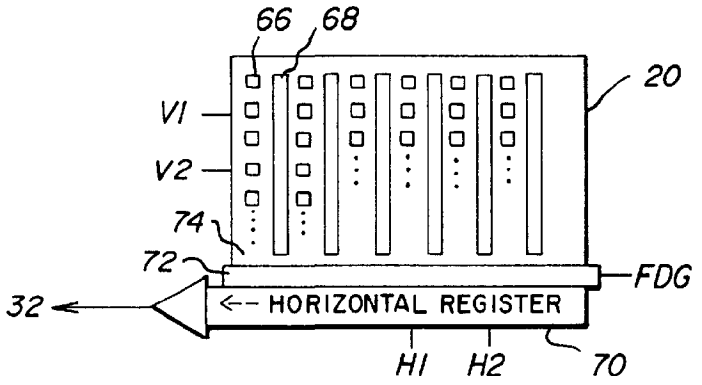


FIG. 3A

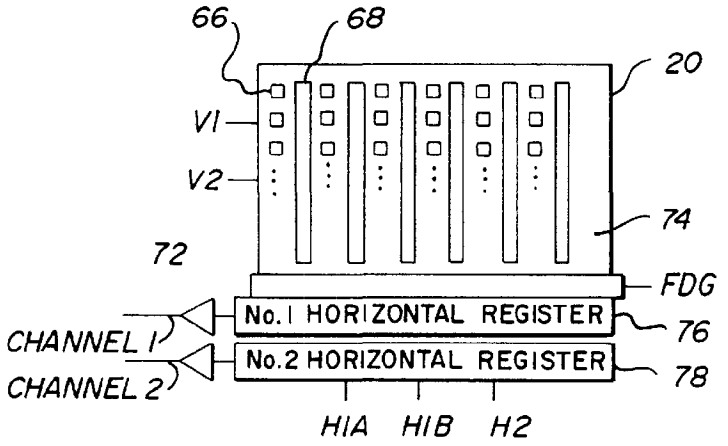


FIG. 3B

CCD LINES

LINE 1	G	R	G	R	G	R	G	R
LINE 2	B	G	B	G	B	G	B	G
LINE 3	G	R	G	R	G	R	G	R
LINE 4	B	G	B	G	B	G	B	G
LINE 5	G	R	G	R	G	R	G	R
LINE 6	B	G	B	G	B	G	B	G
LINE 7	G	R	G	R	G	R	G	R
LINE 8	B	G	B	G	B	G	B	G

FIG. 4

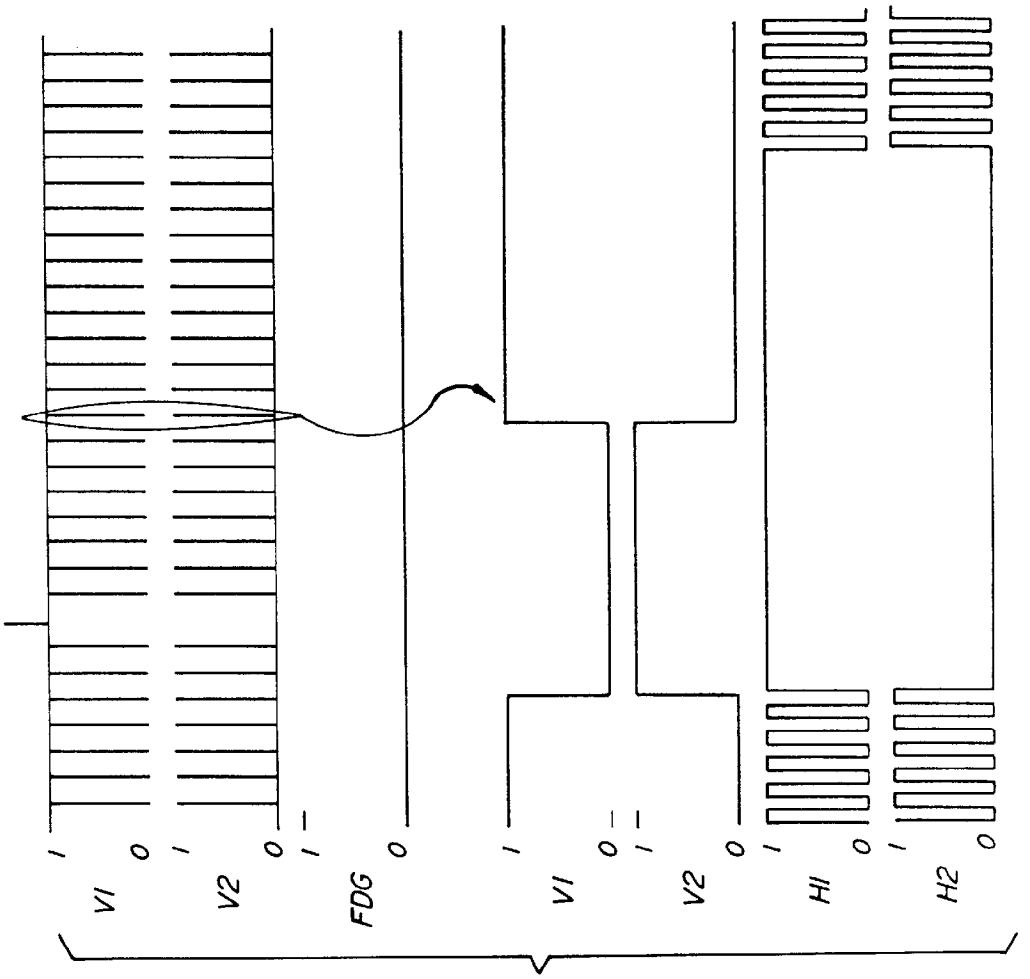


FIG. 5

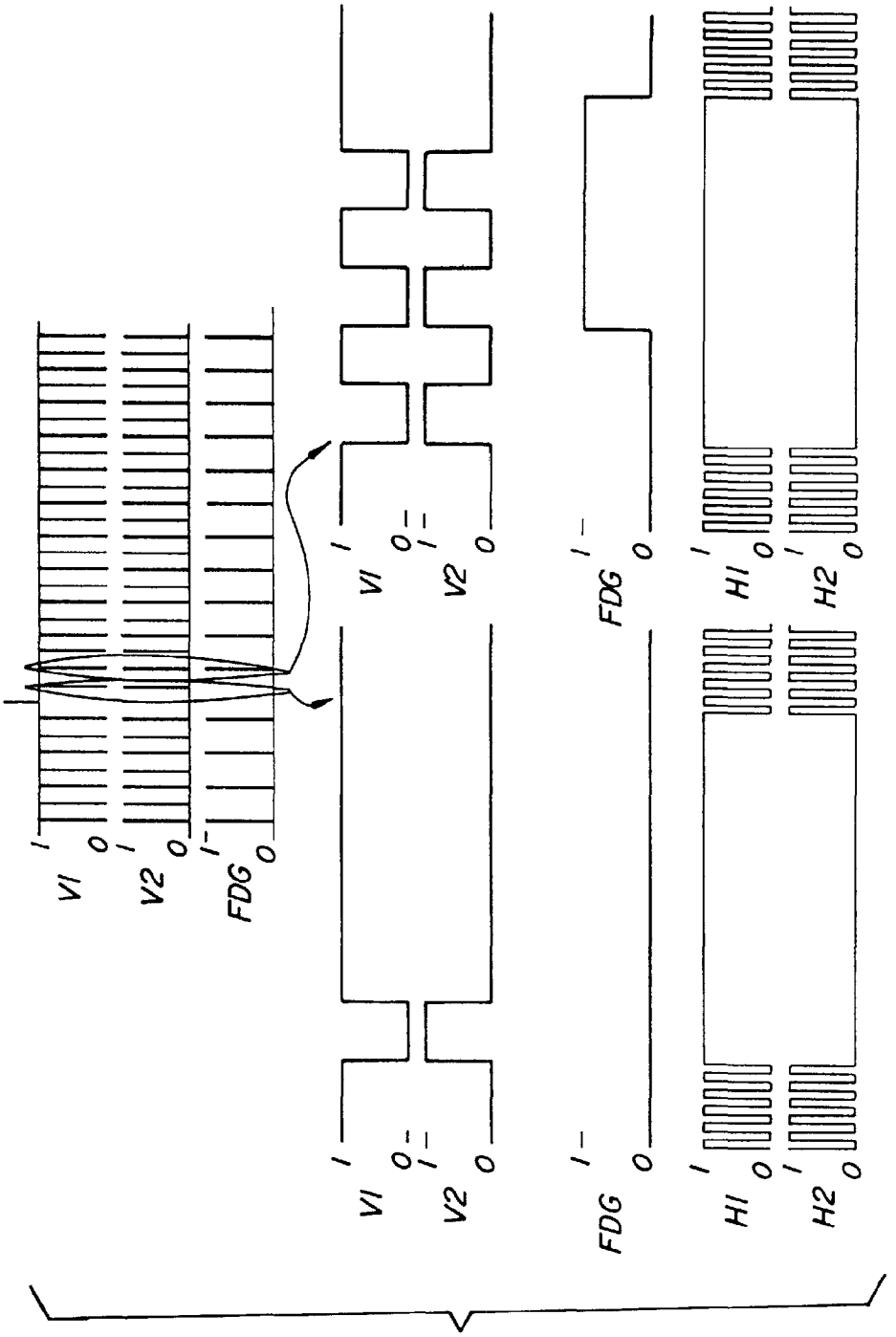


FIG.6a

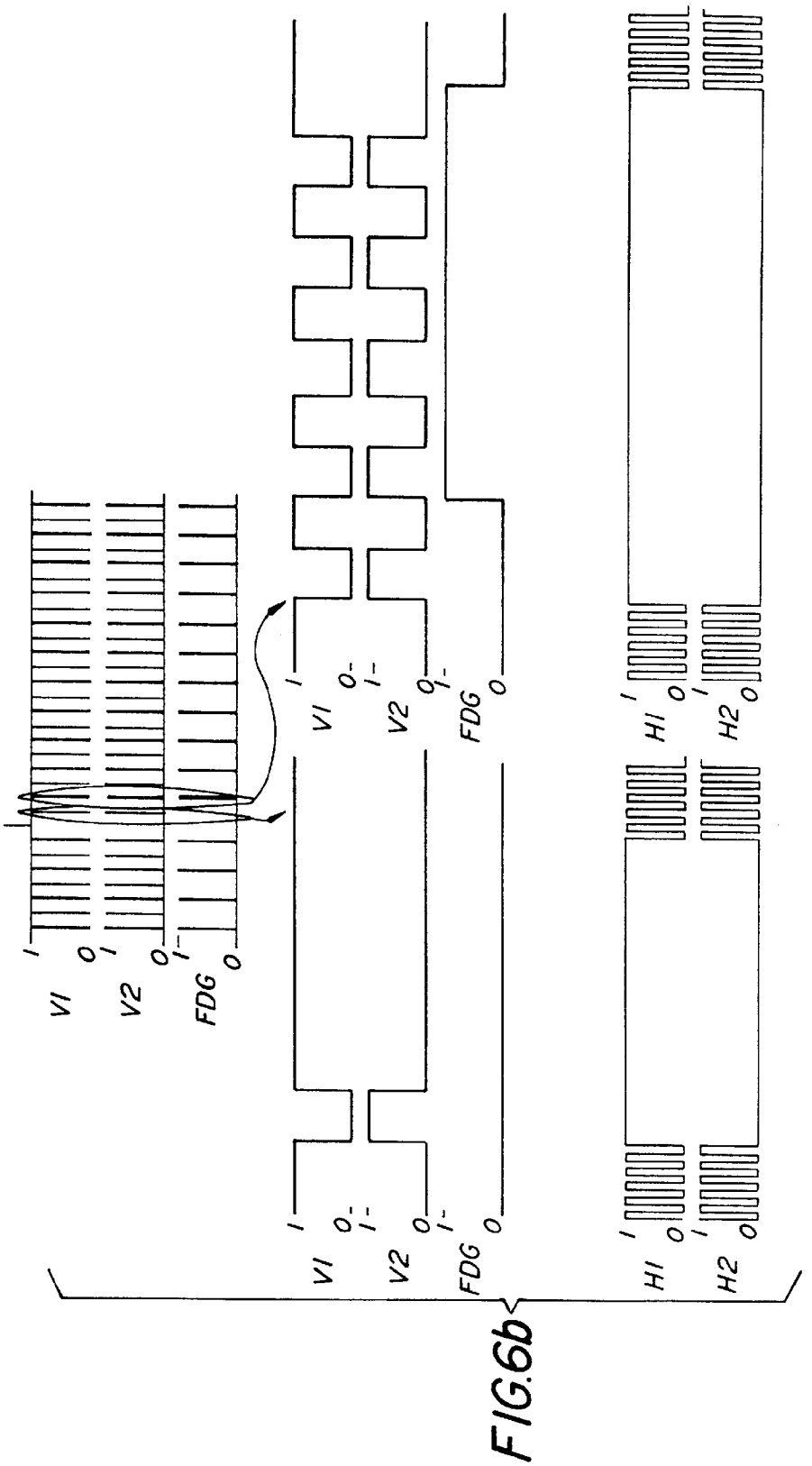


FIG.6b

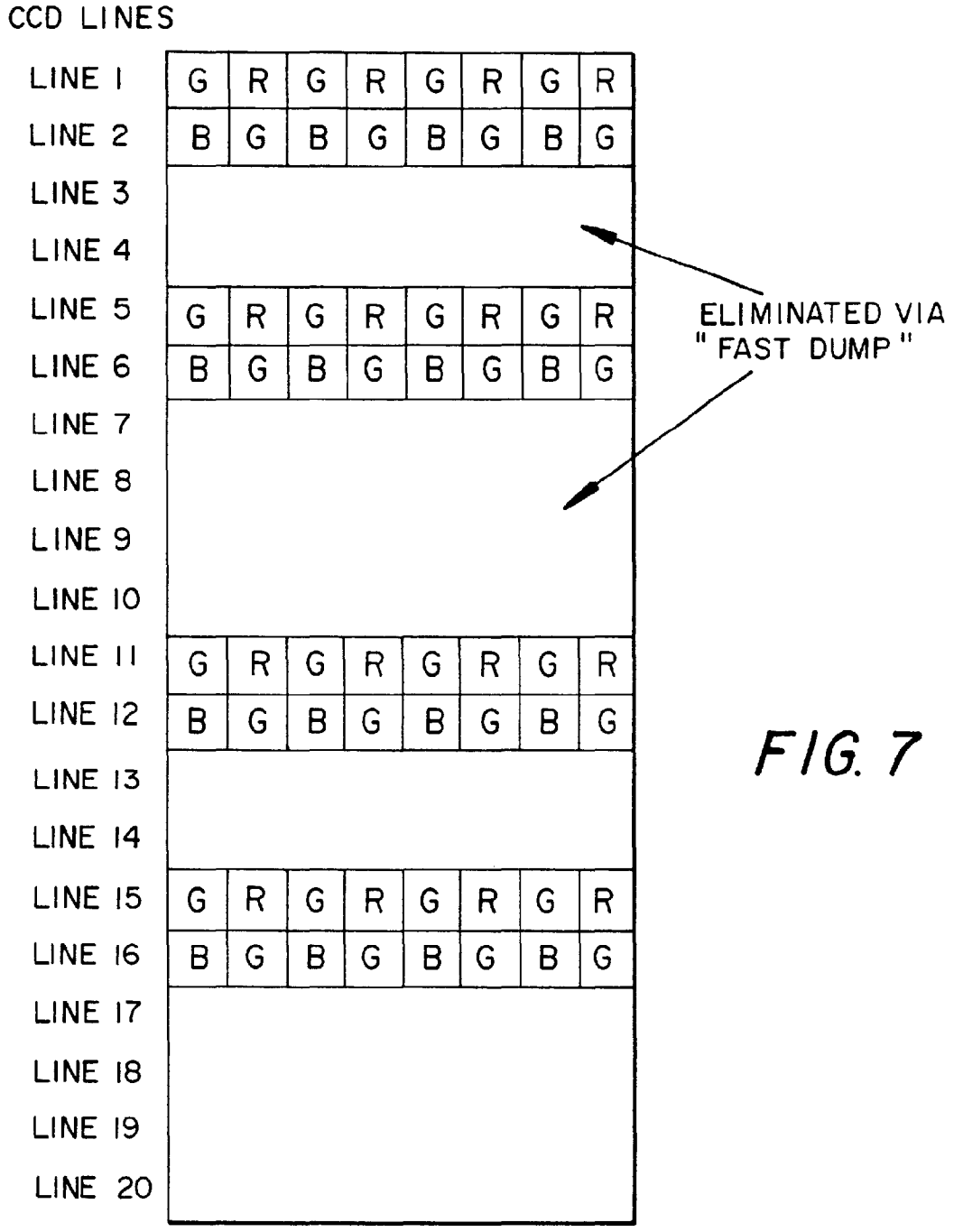

CCD LINES
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
LINE 7
LINE 8
LINE 9
LINE 10
LINE 11
LINE 12
LINE 13
LINE 14
LINE 15
LINE 16
LINE 17
LINE 18
LINE 19
LINE 20
G R G R G R G R
B G B G B G B G
ELIMINATED VIA
" FAST DUMP "

FIG. 7

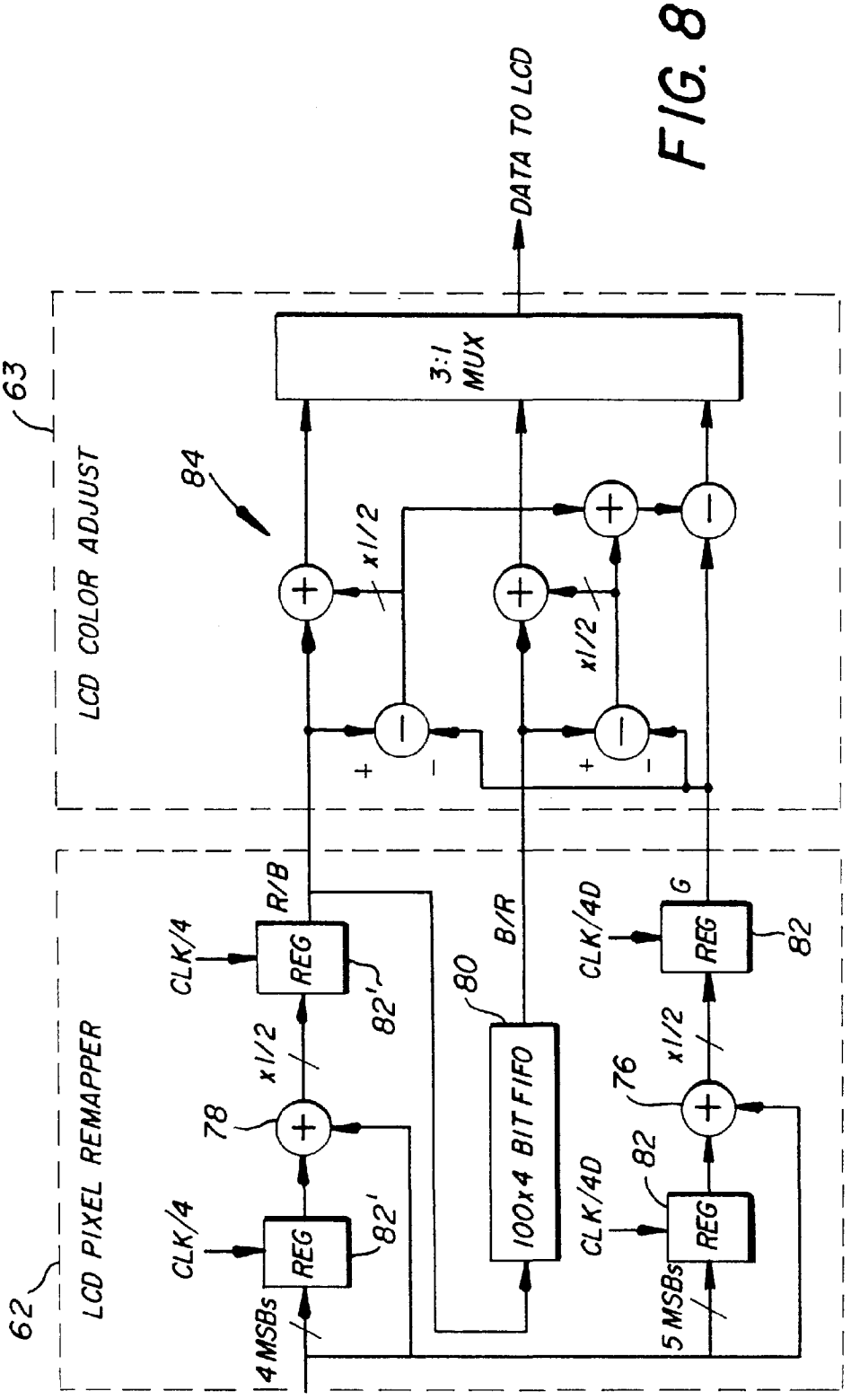

62
LCD PIXEL REMAPPER
63
LCD COLOR ADJUST
4 MSBs
5 MSBs
CLK/4
CLK/4D
REG
R/B
B/R
G
82'
82
78
76
80
x1/2
100x4 BIT FIFO
84
3:1 MUX
DATA TO LCD

FIG. 8

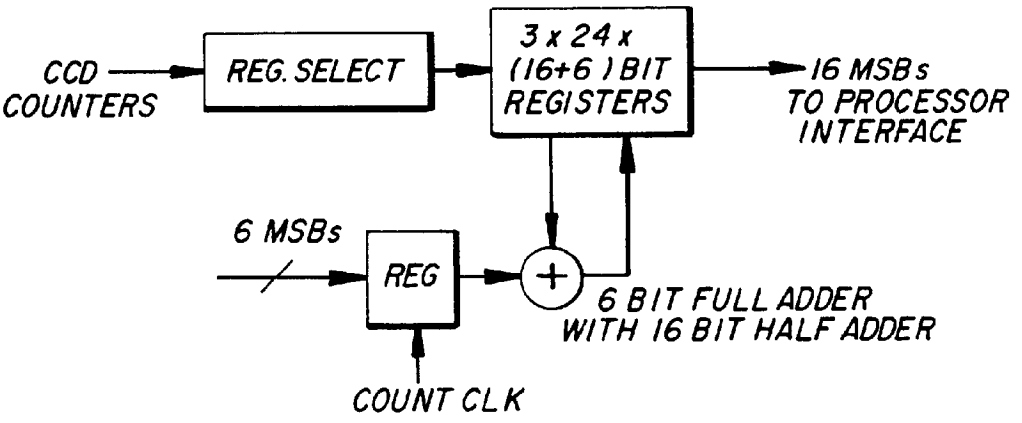

CCD COUNTERS
REG. SELECT
3 x 24 x (16+6) BIT REGISTERS
16 MSBs TO PROCESSOR INTERFACE
6 MSBs
REG
6 BIT FULL ADDER WITH 16 BIT HALF ADDER
COUNT CLK

FIG. 9A

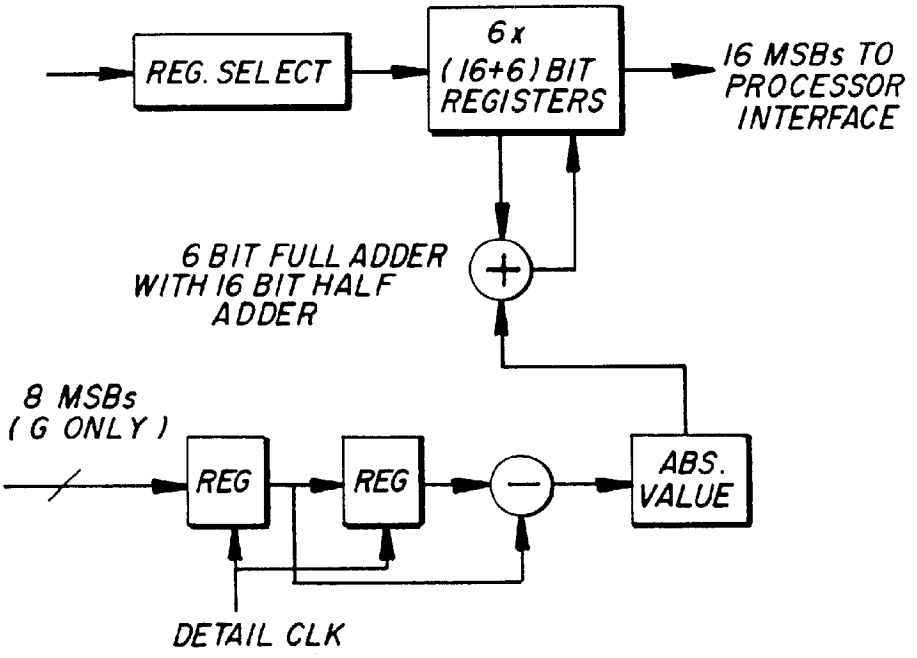

REG. SELECT
6 x (16+6) BIT REGISTERS
16 MSBs TO PROCESSOR INTERFACE
6 BIT FULL ADDER WITH 16 BIT HALF ADDER
8 MSBs (G ONLY)
REG
REG
ABS. VALUE
DETAIL CLK

FIG. 9B

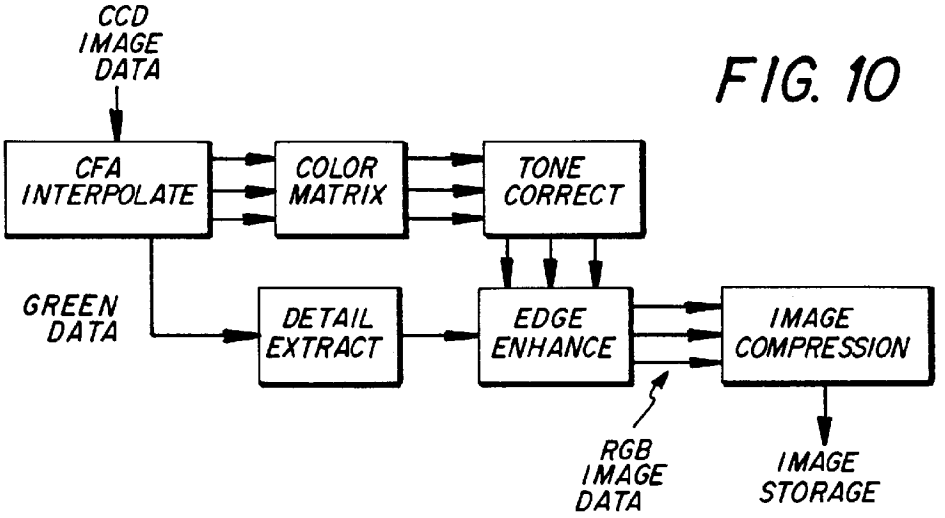


FIG. 10

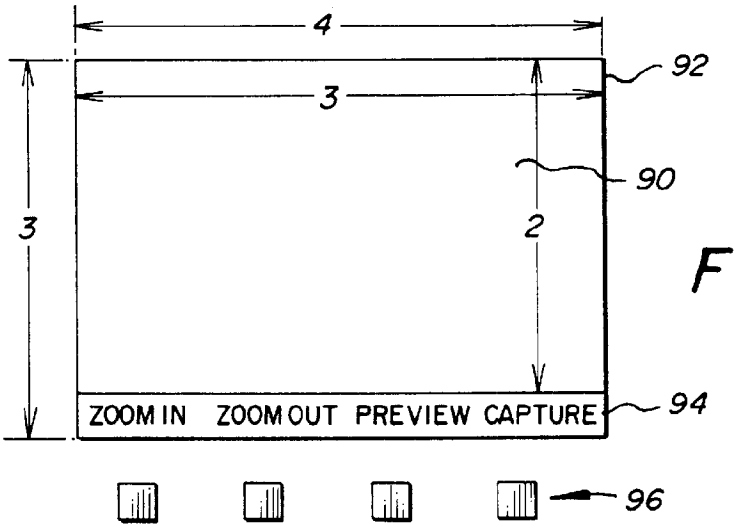


FIG. 11

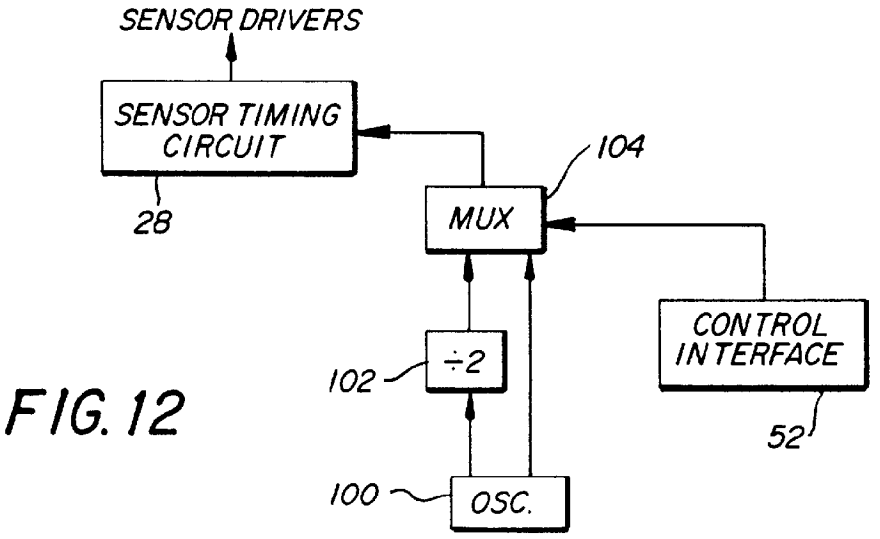


FIG. 12

ELECTRONIC CAMERA FOR INITIATING CAPTURE OF STILL IMAGES WHILE PREVIEWING MOTION IMAGES

This application is a division of 08/367,399 filed Dec. 30, 1994.

FIELD OF THE INVENTION

The invention pertains to an electronic still camera for composing and capturing still images, and, more particularly, to an electronic camera having a "motion" mode for previewing a scene and a "still" mode for capturing a particular image in the scene.

BACKGROUND OF THE INVENTION

Consumer camcorders which include the capability of recording analog motion and/or still images on 8mm or VHS videotape have been developed by a number of companies. Motion images are recorded in the same manner as in any standard camcorder. These cameras include a single chip charge coupled device (CCD) sensor having a color filter array that provides a spatially color-sampled image. To record still images, the user pushes a "still capture" button at the desired instant. The image obtained from the CCD sensor is temporarily stored in a digital memory. The image is then read from the memory and recorded onto the videotape. Some camcorders include color liquid crystal displays (LCD), which are also spatially color-sampled devices. Some are relatively large, for example, ranging from approximately 2.5" to 4" in diagonal. Such a display is used, instead of a normal eyepiece viewfinder, to allow the user to properly frame the subject and view the images as they are being recorded. It is also used to view the recorded images as the videotape is played back.

FIG. **1A** shows a typical color LCD display, in which the liquid crystal material is trapped between an upper glass plate **1** and a lower glass plate **2**. The upper plate **1** has a common transparent electrode **3** and an array **4** of color filters surrounded by a black mask **5**. The lower plate **2** includes an array **6** of transparent pixel electrodes juxtaposed underneath the array **4** of color filters. Individual pixel electrodes are activated via thin film transistors (TFT) **7** that are controlled from a video signal on the source lines **8** and a scanning signal on the gate line **9**. The LCD display includes the usual polarizer layers (not shown) on the glass plates **1** and **2**, such that activation of selected transparent pixel electrodes allows light to pass through the corresponding color filters and reflect to the viewer, thereby creating a color image. A typical LCD display such as the Epson LB 2F-BC00, manufactured by Seiko-Epson Company, Japan, has about 240 lines of pixels and about 300 pixels per line, with an image aspect ratio of 4:3. Such an aspect ratio allows the entire area of the image obtained from the 4:3 aspect ratio NTSC format CCD sensor to be displayed on the LCD screen, so that the LCD screen composition will be the same as the image that is recorded by the camcorder NTSC format recorder, for later display on an NTSC format television display. Note that because the LCD has only 240 lines of pixels, the interlaced NTSC signal is displayed using a "repeat field" technique, where both the odd and even fields from the NTSC format sensor are displayed using the same lines of pixels on the LCD. This LCD, like most commercially available LCDS, has "rectangular" pixels, rather than square pixels, where the distance between pixels in the horizontal direction is for example ⅔ the distance in the vertical direction. The LCD pixels are overlaid with a diagonal RGB stripe pattern as shown in FIG. **1B**.

In camcorders, the processing for both the still images and the motion images is identical. Such processing is normally implemented by hardwired analog integrated circuits, although camcorders which use digital image processing integrated circuits have been produced. Such camcorders convert the signal from the CCD sensor into an NTSC composite or component format signal, which is provided to a video recording subsystem or a video output jack. The color LCD display includes circuitry to decode the NTSC composite or component signal back into spatially subsampled RGB signals to drive the individual RGB pixels on the LCD sensor.

In a system oriented toward still photography, and in particular a digital still system, it would be desirable to avoid the necessity of generating an NTSC format signal in order to reduce the complexity of the required circuitry. In a totally digital system, that is, both the recording and display channels are digital, it is further desirable to minimize incompatibility between the channels. The problem is to achieve these objective in an architecture that minimizes cost and complexity and maximizes user handling.

SUMMARY OF THE INVENTION

This problem is solved according to the invention by a number of features. In one aspect, the electronic camera is operable in a still image mode according to a relatively more complex digital image processing technique to produce high quality still images, and in a motion preview mode according to a relatively more simple digital image processing technique to produce a preview image of acceptable quality prior to initiation of the still image mode. Such an architecture is particularly adapted to mapping an array of color image pixels from a sensor into an array of color display pixels on an LCD display comprising discrete LCD display pixels fewer in number than image sensor pixels. In that case, a relatively simple digital processing technique combines samecolored image pixel signals into a fewer number of intermediate pixels that correspond to the arrangement of the color display pixels.

The advantage of the invention is that the two modes can be tailored for a relatively low quality "motion" mode and a much higher quality "still" mode. The motion mode images from the CCD sensor are processed by a hardwired digital signal processing circuit that generates low resolution, spatially subsampled digital image data which can directly drive the relatively low resolution LCD display. This reduces the complexity and clock frequency of the required circuitry, compared to generating an NTSC format signal, as is normally done in the prior art. The still mode image from the CCD sensor is processed by a general purpose processor (CPU) which executes an image processing software program in order to produce a high quality digital still image.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in relation to the drawings, whereon

FIGS. **1A** and **1B** show the structure and color filter pattern of a known color liquid crystal display (LCD);

FIG. **2** is a block diagram of an electronic camera incorporating dual modes for composing and capturing a still image according to the invention;

FIGS. **3A** and **3B** are diagrams of progressive scan image sensors useful with the camera of FIG. **2**;

FIG. **4** is a diagram of the Bayer color filter geometry for the sensor used with the camera of FIG. **1**;

FIG. **5** shows the line timing for the still mode of operation;

FIGS. **6**A and **6**B show the line timing for the preview mode of operation;

FIG. **7** shows the special line skipping pattern used in the preview mode;

FIG. **8** shows further detail of the preview mode processing circuit shown in FIG. **2**;

FIGS. **9**A and **9**B show further detail of the image statistics processor shown in FIG. **2**;

FIG. **10** shows one example of still mode image processing;

FIG. **11** shows the effect of pixel mapping from a sensor to an LCD display, each having different aspect ratios; and

FIG. **12** shows an enhancement to the block diagram of FIG. **2** in which a different sensor clock frequency is used in each of the dual modes.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A block diagram of a camera incorporating dual modes of processing according to the invention is shown in FIG. **2**. The camera includes an electronic color display, for example, a color liquid crystal (LCD) display **10** of the type shown in FIG. **1**A, and a user control section **12** having a number of user control buttons, including zoom buttons **14**, a preview button **15** and a capture button **16**. To take a still picture, the user turns on the camera (using a power switch (not shown), which may be automatically enabled when the user depresses the zoom buttons **14** or the preview button **15**, or partially depresses the capture button **16**). The user composes the picture by depressing the "zoom in" or "zoom out" buttons **14**, and by adjusting the position of the camera, while observing the display image. When the user is satisfied with the composition on the color LCD display **10**, the user depresses the capture button **16**. The camera then captures a single still image, firing a flash **18** if necessary when the ambient illumination level is low. The still image is focused upon an image sensor **20** by a motor driven zoom lens **22**. The intensity of the image light upon the sensor **20** is regulated by a motor-driven, variable, mechanical aperture **24**, while exposure time is regulated electronically by appropriate clocking of the sensor **20**. The still image from the image sensor **20** is processed and digitally stored on a removable memory card **26**.

Control of the sensor is provided by a timing and control section **27**, which is an application specific integrated circuit (ASIC) with processing and timing functions, for both capture and preview operating modes. For instance, the timing and control section **27** includes a sensor timing circuit **28** for controlling the image sensor functions. The sensor timing circuit **28** provides the signals to enable sensor drivers **30**, which provide horizontal clocks (H1, H2), vertical clocks (V1, V2), as well as a signal FDG for activating a drain structure on the sensor **20**. The output of the image sensor **20** is amplified and processed in an analog gain and sampling (correlated double sampling (CDS)) circuit **32**, and converted to digital form in A/D converter stage **34**. The A/D output signal is provided to a processor section **35**, which includes a digital processor **36** for temporarily storing the still images in a DRAM memory **38**. The digital processor **36** then performs image processing on the still images, and finally stores the processed images on the removable memory card **26** via a memory card interface circuit **40**, which may use the PCMCIA 2.0 standard interface. An EPROM memory **42** is used to store the firmware which operates the processor **36**. The components of the processor **35** are interconnected through a data bus **43**, which also connects to the timing and control section **27** and to the card interface **40**.

The motor-driven zoom lens **22** includes a zoom motor **44**, a focus motor **46**, and an aperture motor **48** (all controlled by lens motor drivers **50**). The timing and control section **27** further includes a control interface **52** connected to the lens motor drivers **50** and to a flash control circuit **53** via a photosystem interface block **54**, which controls the operation of the zoom lens **22** and the flash **18**. The lens zoom position is controlled by the photosystem interface block **54** based on position input from the zoom control buttons **14** through a user status and control section **55**. The focusing, exposure control, and white balance is done automatically, as is typically the case in consumer camcorders. This is done by computing "image statistics" in an image statistics processor **60** in the real-time ASIC (timing and control section **27**) as preview images are continuously read out of the image sensor **20**. The computed values are then used by a program implemented in the digital processor **36**, which decides how to adjust the focus motor, aperture, analog gain control, and analog white balance controls via the control interface **52** and the photosystems interface **54** on the ASIC timing and control section **27**. Although the digital processor **36** and the control interface **52** are shown as being within two separate sections, in some implementations the same component could be used to perform both of these functions (as well as other of the recited functions). Sensor image data is passed to the processor section **35** through a high speed interface **56** in the timing and control section **27**. The sensor image data is also directed to the color LCD display **10** through a preview mode processing circuit **58**.

The timing and control section (ASIC) **27** is operable in two modes, a relatively low quality "motion" mode and a much higher quality "still" mode. In the motion mode, images from the sensor **20** are processed by the preview mode processing circuit **58**; in the still mode, images from the sensor **20** are processed in the processor **35**. The processor **35** is a software driven digital processing system that is slower than the ASIC **27**. The preview mode processing circuit **58** is a hardwired digital signal processing circuit (part of the ASIC **27**) that generates low resolution, spatially subsampled digital image data which can directly drive the relatively low resolution color LCD display **10**. This reduces the complexity and clock frequency of the required circuitry, compared to generating an NTSC format signal, as is normally done in the prior art. The preview mode processing circuit includes a pixel remapper **62** for mapping the greater number of image pixels from the sensor **20** into the lesser number of display pixels (i.e., corresponding to the array **6** of transparent pixel electrodes in FIG. **1**) in the color LCD display **10**. The color saturation of the remapped pixels is then adjusted in a color adjustment circuit **63** and its output is applied to a multiplexer **64**. The multiplexer **64** selects image data either from the preview mode processing circuit **58**, producing a preview image, or from the high speed interface **56**, which allows for suitably preprocessed viewing of stored images.

In this camera, the image processing used to create the preview mode is done in the timing and control ASIC **27**, since the processing must be done rapidly. About **60** images per second are processed in preview mode. However, since the image quality of the displayed image is limited by the resolution and color gamut of the LCD screen of the LCD color display **10**, there is no need for elaborate image

processing. Therefore, simple "preview mode" image processing is performed in a fixed digital circuit embedded in the preview mode processing circuit **58** (which is part of the ASIC). The quality requirements for the still mode are much greater, since these images will be downloaded to a computer, and may be displayed on a high resolution CRT display, or printed on a high quality thermal printer. Therefore, the digital image processing must be more elaborate. By using the digital processor **36** to implement software procedures stored in the firmware memory **42**, complex procedures can be implemented. These procedures can take several seconds to complete, since real-time operation is not required. Use of firmware-stored software allows the still mode image processing to be upgraded without requiring a new ASIC design. In effect, what happens is that a relatively less complex digital image processing technique is used in the motion preview mode, but at a higher data rate, and a relatively more complex digital image processing technique is used in the still mode, but at a slower data rate.

Since the update rate, that is, the number of images that need to be supplied per unit time, is different for the still mode than for the motion mode, it is beneficial to use different clock frequencies for the different modes of operation. For example, as shown in FIG. **12**, a system oscillator **100** produces a 12 mHz clock frequency for use in the motion mode to obtain more updates/second (e.g., 60 images per second), while a divider **102** divides by two to provide a 6 mHz clock frequency for the still mode. The lower frequency allows more time to accurately position the clamp and sample pulses so as to avoid CCD output signal transitions. This increases noise immunity in the still mode. A multiplexer **104** is enabled by the control interface **52** to determine which clock frequency is applied to the sensor timing circuit **28**. Though not specifically shown, the changed timing is also communicated to the A/D stage **34** and other timing and control circuits.

The sensor **20** is a progressive scan interline image sensor having a noninterlaced architecture, as shown in more detail in FIG. **3**A. The sensor comprises a two-dimensional array of photosites **66**, e.g. photodiodes, arranged in rows and columns of image pixels, a plurality of vertical registers **68** adjacent photosite columns for transferring rows of image pixel charge from the photosites **66** to a horizontal register **70** for readout responsive to clock signals from the sensor drivers **30**, and a charge drain (specifically, a fast dump structure **72**) interposed between the output of the vertical registers **68** and the horizontal register **70** for eliminating complete rows of image pixels at a time from the image sensor **20**. A preferred image sensor is the Kodak model CCD KAI-0400CM image sensor, which has approximately 512 active lines with approximately 768 active pixels per line and an image aspect ratio of 3:2. This sensor is described in a Performance Specification document available from Eastman Kodak Company, Rochester, N.Y. Each pixel is 9 microns "square", since both the vertical and horizontal distances between the centers of adjacent pixels are 9 microns. The 3:2 image aspect ratio of the CCD sensor, although wider than the 4:3 aspect ratio of the display, is considered to be a preferred aspect ratio for still photography, in that the standard 35 mm film format, and standard 4R (4"×6") prints also have a 3:2 image aspect ratio. The sensor uses a color filter array pattern known as the "Bayer checkerboard" pattern, described in U.S. Pat. No. 3,971,065, which is shown in FIG. **4**. Such a color filter array is characterized by a mosaic pattern in which the filter colors alternate in both line and column directions. In the normal operating mode, all of the image pixels on the sensor are transferred as color image pixels to the horizontal register **70**, which delivers a stream of color pixel signals to the analog gain and CDS circuit **32** (see FIG. **2**). The color pixel signals are subsequently converted to digital pixel signals in the A/D converter **34**.

The sensor **20** uses a progressive scan readout method, which allows the entire image to be read out in a single scan. The accumulated or integrated charge for the photodiodes comprising the pixels **66** is transported from the photosites to light protected vertical (parallel) registers **68** by applying a large positive voltage to the phase-one vertical clock (**V1**). This reads out every row, or line, into the vertical registers **68**. The image pixel charge is then transported from the vertical registers **68** to the horizontal register **70** by two-phase clocking of the vertical clocks (**V1**, **V2**). Between the vertical and horizontal registers is the fast dump structure **72**, which is further described in the Performance Specification document for the KAI-0400CM sensor. By setting a suitable positive potential on a fast dump gate line FDG, charge from the row of pixel values currently adjacent to the fast dump structure **72** is transferred from the CCD directly into the sensor substrate **74** rather than to the horizontal register **70**. This dump, or line clear, is accomplished during the vertical-to-horizontal transfer time. When properly controlled by the sensor timing circuit **28**, the fast dump structure **72** allows lines of charge to be eliminated.

The timing and control section **27** operates the electronic camera shown in FIG. **2** in the two aforementioned modes, including a first "still" mode wherein all rows of image pixel charge corresponding to each line are progressively read out through the horizontal register **70** during a single scan, and a second "motion" mode wherein some of the rows of image pixel charge corresponding to some lines are eliminated through the fast dump structure **72** prior to readout. As applied to the embodiment of FIG. **2**, the first mode corresponds to a high quality still imaging mode while the second mode corresponds to a special "line skipping" mode for driving the color LCD display **10**. In the second mode, the timing and control section **27** controls the fast dump structure **72** to eliminate two or more consecutive lines of image charge from the image sensor **20** for every one or more lines of image charge that are transferred to the horizontal register **70** for readout, thereby generating a pattern of lines (shown in FIG. **7**) suitable for driving the LCD display in a "repeat field" mode. An appropriate video signal which displays the entire 3:2 aspect ratio sensor image on the 4:3 aspect ratio LCD, without introducing geometric distortion, is generated by alternately eliminating two or four consecutive lines of image charge for every pair of lines of image charge that are transferred to the horizontal register **70**.

The sensor timing circuit **28** is controlled by the control interface **52** to provide the clock signals **V1**, **V2**, **H1**, **H2**, and the gate signal FDG according to the two modes of operation. The timing signals for the first mode are shown in FIG. **5**; those for the second mode are shown in FIGS. **6***a* and **6***b*. The two-phase cycling of signals **V1** and **V2** control the transfer of lines of image pixel charge from the vertical registers **68** to the horizontal register **70**. The two-phase cycling of signals **H1** and **H2** control the transfer of a stream of color pixel signals from the horizontal register **70** to subsequent circuits in the camera. The level of the signal FDG determines whether the image charge is dumped to the substrate **74** or transferred to the horizontal register **70**. When the sensor **20** is clocked using the first timing mode shown in FIG. **5** for all lines of the sensor, all lines of the sensor are clocked out, one after the other, through the horizontal register **70**, processed in subsequent camera

circuitry, and stored in the removable memory **26**. This timing mode provides a high quality progressive scan still image, but may take 1/30 second or longer to read out the still image. Such timing, however, is acceptable for still mode usage, and, as mentioned before, does not require unusually high speed components and, indeed, may benefit from a lower speed lock.

To provide an image to the color LCD display **10**, a lower resolution image is suitable, but the update rate must be sufficient to provide good motion rendition and eliminate display flicker. Moreover, the sensor **20** includes the aforementioned array of color filters arranged in a particular mosaic color pattern (e.g., the checkerboard Bayer pattern of FIG. **3**), and the lines of image charge that are transferred to the horizontal register **70** should preserve that particular color pattern in the pattern of lines that are generated for the line-skipping readout. To provide this kind of image, the sensor is read out in the second mode as shown in FIG. **7**, using the timing shown in FIGS. **6**A and **6**B. As shown in FIG. **6**A, the first two lines (**1** and **2**) are read out as in the normal mode. These provide a green-red and a blue-green line. The next two lines (**3** and **4**) are eliminated by turning on the fast dump structure **72** during the time that these lines are transferred past the fast dump structure **72**. Next, as shown in FIG. **6**B, lines **5** and **6** are read out normally, and then lines **7**, **8**, **9**, and **10** are eliminated. Next, the FIG. **6**A timing is used to read out lines **11** and **12**, while eliminating lines **13** and **14**, and then the FIG. **6**B timing is used to read out lines **15** and **16**, while eliminating lines **17–20**. This process proceeds for the entire image readout period, during which **102** pairs of lines are read out, and 154 pairs of lines are eliminated.

This special "line skipping" readout mode, as shown in FIG. **7**, allows the sensor 3:2 aspect ratio image to be fully displayed on a 4:3 aspect ratio LCD without "geometric distortion", that is, without stretching the image vertically, and without cropping off the horizontal edges of the image from the image sensor. This allows the LCD to properly show the entire 3:2 aspect ratio image captured by the sensor, so that an image can be properly composed.

As the 512 lines of the CCD imager are read out using the special "line skipping" mode, they are displayed using only 204 out of the approximately 240 LCD lines of pixels. The remaining approximately 36 lines can either be masked behind a bezel, so that they are not visible, or preferably may be used to display status information, such as the time-of-day, image number, or a "push-button menu" for the user buttons. FIG. **11** shows a useful application of such conversions. A sensor having a 3:2 aspect ratio is shown mapped into an image area **90** of an LCD display screen **92** having a 4:3 aspect ratio. A proportional remapping leaves a status area **94** available for other purposes, specifically to show text indicating the function of a set of reconfigurable control buttons **96** in the control section **12**. The function of the buttons is specified by the user status and control section **55** (FIG. **2**). This status information graphics data can be supplied by the digital processor to the LCD **10** via high speed interface **56**, when the MUX **64** is controlled so as to use the digital data from interface **56**, rather than from circuit **58**, for supplying data to the final approximately **32** lines of the display **10**.

The "line skipping" readout causes some minor vertical sampling artifacts, but these are not noticeable in the small LCD displays. The pixels output for the sensor **20** in line skipping mode continue to have the Bayer-type color filter repeating pattern, so that they can be processed using processing techniques designed for the Bayer pattern.

The processing complexity of the camera of FIG. **2** is considerably simplified by directly mapping the RGB sensor pixels **66** to the RGB pixels of the display **10**. The easiest way to do this for the image sensor **20** (512 lines×768 pixels and 3:2 aspect ratio) is to have an LCD display with 512×768 pixels and the same aspect ratio and color filter pattern. However, this would be a custom, costly LCD. Instead, LCDs have fewer display pixels than image pixels on the image sensor, normally have a 4:3 image aspect ratio, and use the diagonally striped RGB pattern shown in FIG. **1**B. In this discussion, an LCD pixel array of about 240 lines×312 pixels per line is assumed.

Therefore, the sensor pixels are processed in a "pixel mapping circuit", such as the LCD pixel remapper **62**. A block diagram of this circuit is shown in FIG. **8**. Note that there are 768/2=384 green or red/blue pixels per line on the sensor (see FIG. **4**). There are about 300/3=100 green, red, or blue pixels per line on the LCD (see FIG. **1**B). Thus, there are approximately ¼ as many LCD pixels per line (per color) as there are sensor pixels per line. Therefore, the basic plan is to combine same-colored image pixels into a fewer number of intermediate, combination pixel signals that are then mapped into the color display pixels. For instance, a simple "pixel mapping" circuit maps four green sensor pixel signals into one green LCD pixel for one line by summing two green sensor values, spaced apart by 4 CCD pixel positions, in the green pixel summer **76** and dividing by two via bit-shift wiring. The necessary delay is provided by the registers **82** clocked at one fourth the pixel rate, further delayed by one pixel clock. It also maps four red sensor pixels into one LCD pixel in the same manner (using the red/blue summer **78**), and also stores this value in a 100 pixel FIFO **80**. The FIFO **80** compensates for the fact that the sensor has line sequential red and blue pixels, by supplying blue pixels on the red sensor lines, and red pixels on the blue sensor lines. Four pixel delays are provided by the registers **82'** clocked at one fourth pixel rate (CLK/4). The mapping process is basically, therefore, a process which, in its simplest form, involves averaging of signals to produce a smaller number of output color pixels than input color pixels. (The CFA interpolation algorithm discussed in reference to FIG. **10**, on the other hand, produces a larger number of "output" color pixels than input color pixels.) Alternate groups of 2 or 4 lines of sensor values are discarded during preview mode by using the fast dump gate shown in FIG. **3**A, as described in connection with the "line skipping" mode. This allows the sensor readout time to be decreased by more than ½ during the preview mode.

Another feature of the design is that by removing the NTSC rate driving circuitry from the color LCD display **10**, the active matrix LCD can be updated at a slower frequency than is normally used. This reduces the cost and power consumption of the LCD driver circuits (not shown). For example, the LCD can be updated at 30 Hz (provided the LCD active matrix display is designed so as not to exhibit noticeable flicker at this update rate), instead of 60 Hz.

Once the LCD pixel values are calculated, the LCD color adjust circuit **63** increases the color saturation of the image by forming R-G and B-G color difference signals, and adding or subtracting a fraction of these signals in an array **84** of adders and subtractors from the original RGB signals in order to increase the color saturation of the displayed image. This circuit performs a similar function as a 3×3 color matrix, but uses less hardware and provides less color accuracy. The color accuracy is not critical for the LCD display, however, due to the limited color reproduction quality of such displays. The color reproduction of the still

image is much more important, and is done with a more complicated and precise color correction method with the stored firmware in EPROM **42**.

FIGS. **9**A and **9**B show the processing in the image statistics processor **60**, which computes real-time values for both still and motion image capture, all during the preview mode. These values include 24 R, G, and B averages used to set white balance and exposure, and 6 average high frequency "detail" values used to set focus. The 24 RGB averages for white balance are calculated for a group of 4×6 rectangular image regions, for each of R, G, and B; a block diagram of the calculation in one color is shown in FIG. **9**A. The 6 average "detail" values for focusing are calculated for green pixels only by accumulating the absolute value of the differences between nearby green values; a block diagram of this calculation is shown in FIG. **9**B. These values are computed for each preview image and downloaded to the processor **36**. The processor **36** implements a firmware stored procedure which determines the optimum exposure parameters (exposure time, f/stop, and analog gain), white balance settings, and lens focus setting. For the still mode, the processor **36** also decides, based on the last preview images, whether to fire the flash, and determines the optimum exposure parameters, white balance settings, and lens focus setting for the still mode.

Once the still image is captured, the digital processor **36** implements the stored firmware procedures to process and store the still image. FIG. **10** shows a diagram of one possible still image processing method. The CFA interpolation diagram may include the green interpolation method described in U.S. patent application Ser. No. 085,520, filed Jun. 30, 1993, in the name of the same assignee as the present application, and the chrominance interpolation method described in U.S. Pat. No. 4,642,678, both of which are incorporated herein by reference. The color matrix, tone correction, and edge enhancement steps may be similar to those described in U.S. Pat. No. 5,189,511, also incorporated herein by reference. The image compression method may be the JPEG standard compression technique.

The foregoing description envisions taking a single still picture following the motion preview mode. The camera can also optionally capture "bursts" of high quality still images into the DRAM memory during the "still" mode, which are then processed as shown in FIG. **10**. Owing to the flash recharge time and other limitations of the "burst" mode, the "burst" mode could utilize different exposure parameters (exposure time, aperture, analog gain, flash, and digital processing) than either the motion or the single still mode.

The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention. For instance, FIG. **3**B shows a progressive scan sensor with two readout registers **86** and **88** (which corresponds to the Performance Specification document for the Kodak KAI-031CM image sensor; the preferred embodiment of FIG. **3**A simply uses but one register). The purpose is to eliminate the FIFO line delay **80** in the LCD pixel remapper **62**. The pairs of lines read out by the registers include both a green/red line and a blue/green line. Therefore, by adding an analog multiplexer between the outputs of the two channels and the analog gain and CDS block **32**, which is switched at ½ the sensor horizontal clock rate, it is possible to obtain a GRBG sequence of sensor data values at the output of the A/D stage **34**. The LCD pixel remapper **62** can then be designed to map from the CCD sensor color pixel pattern to the required RGBRGB LCD pixel pattern, without using a line delay. Since two CCD lines are read out in parallel, for each LCD line, fewer lines are eliminated via the fast dump gate than for the single-register sensor shown in FIG. **3**A.

In particular, if the dual register CCD in FIG. **3**B had 512×768 square pixels with a 3:2 aspect ratio, and the LCD had approximately 240 display lines and a 4:3 aspect ratio, the CCD readout would involve fast dumping one pair of lines for every four pairs of lines read out from the CCD sensor. The pixel readout procedure for the horizontal registers can then be varied depending on the mode of operation: both registers are used for the motion imaging mode and one register is used for the still imaging mode. Furthermore, although the Bayer pattern was described, other mosaic-type filter patterns could be used to advantage, for example, complementary patterns involving cyan, magenta, yellow and green filters. The processing for the LCD pixel remapper **62** and the LCD color adjust circuit **63** would be accordingly modified to account for the different color arrangement.

PARTS LIST

1 upper plate
2 lower plate
3 common transparent electrode
4 array of color filters
5 black mask
6 array of transparent pixel electrodes
7 thin film transistors
8 source lines
9 gate line
10 color LCD display
12 control section
14 zoom buttons
15 preview button
16 capture button
18 flash
20 progressive scan interline
22 zoom lens
24 mechanical aperture
26 memory card
27 timing and control section
28 sensor timing circuit
30 sensor drivers
32 analog gain and CDS
34 A/D converter
36 digital image processor
38 DRAM memory
40 card interface
42 EPROM memory
44 zoom motor
46 focus motor
48 variable aperture
50 lens motor drivers
52 control interface
53 flash control circuit
54 photosystems interface
55 user status and control section
56 high speed interface
58 preview mode processing circuit
60 image statistics processor
62 pixel remapper
63 color adjustment circuit
64 multiplexer
66 pixel
68 vertical readout register
70 horizontal register

72 fast dump structure
74 sensor substrate
76 green pixel summer
78 red/blue summer
80 fifo
82 two pixel delay registers
84 array
86 first readout register
88 second readout register
90 image area
92 LCD display screen
94 status area
96 reconfigurable buttons
100 oscillator
102 divider
104 multiplexer

What is claimed is:

1. An electronic still camera for initiating capture of a still image while previewing motion images on a display, comprising:

(a) an image sensor having a two-dimensional array of photosites covered by a mosaic pattern of color filters including at least three different colors for capturing images of a scene, each captured image having a first number of color pixel values provided in a first color pattern;

(b) motion processing means for generating from the captured images, a second number of color pixel values provided in a second color pattern having at least three different colors and representative of a series of motion images to be previewed, the second number of color pixel values being less than the first number of color pixel values, and the second color pattern being different from the first color pattern;

(c) a color display for presenting at least some of the motion images of the series of motion images corresponding to the captured images of the scene, the color display having an arrangement of color display pixels including at least three different colors in a pattern different from the first color pattern;

(d) a capture button for initiating capture of a still image while previewing the motion images presented on the color display;

(e) still processing means for generating a third number of color pixel values including at least three different colors representative of a processed captured still image; and

(f) a digital memory for storing the processed captured still image.

2. The electronic still camera of claim 1 further including a multiplexer having first and second inputs and an output, wherein the first input is coupled to the first processing means, the second input is coupled to the second processing means, and the output is coupled to the display so that a captured still image can be viewed on the display.

3. The electronic still camera of claim 1 wherein the first processing means and the second processing means are integrated into a single integrated circuit.

4. The electronic still camera of claim 1 wherein the motion processing means and the still processing means produce the second number of pixels and the third number of pixels, respectively, prior to transferring the image pixels to the display and the digital memory, respectively.

5. The electronic still camera of claim 1 wherein the second number of pixel values representative of the series of motion images are transferred to the display in a digital format.

6. The electronic still camera of claim 1 wherein the second number of pixel values representative of the series of motion images are mapped into a form suitable for display.

7. The electronic still camera of claim 6 wherein after the second number of pixel values representative of the series of motion images are mapped into a form suitable for display, the signals representing the captured images are converted back into an analog form.

8. The electronic still camera of claim 1 further including a firmware memory, a processor, and an application specific integrated circuit, and wherein the first processing means is provided in the application specific integrated circuit, and the second processing means is provided using the processor which implements software procedures stored in the firmware memory.

9. The electronic still camera of claim 1 wherein the image sensor includes a color filter array to produce color image data, the second processing means processes the color image data and performs JPEG image compression on the captured still image, and the JPEG compressed still image is stored in the digital memory.

10. The electronic still camera of claim 9 wherein the digital memory is a removable memory card.

11. The electronic still camera of claim 1 wherein the first color pattern includes substantially one-half green color filters.

12. The electronic still camera of claim 11 wherein the color display pixels are arranged in a pattern having substantially one-third green color filters.

13. The electronic still camera of claim 1 wherein the first color pattern is a Bayer checkerboard pattern.

14. The electronic still camera of claim 1 wherein the distance between adjacent image sensor photosites in the horizontal direction are substantially equal to the distance between the adjacent image sensor photosites in the vertical direction, and wherein the distance between the adjacent color display pixels in the horizontal direction is different than the distance between the adjacent color display pixels in the vertical direction.

15. An electronic still camera for initiating capture of a still image while previewing motion images on a display, comprising:

(a) an image sensor having a two-dimensional array of photosites covered by a mosaic pattern of color filters including at least three different colors for capturing images of a scene, each captured image having a first number of color pixel values provided in a first color pattern;

(b) a motion processor for generating from the captured images, a second number of color pixel values provided in a second color pattern having at least three different colors and representative of a series of motion images to be previewed, the second number of color pixel values being less than the first number of color pixel values, and the second color pattern being different from the first color pattern;

(c) a color display for presenting at least some of the motion images of the series of motion images corresponding to the captured images of the scene, the color display having an arrangement of color display pixels including at least three different colors in a pattern different from the first color pattern;

(d) a capture button for initiating capture of a still image while previewing the motion images presented on the color display;

(e) a still processor for generating a third number of color pixel values including at least three different colors representative of a captured still image; and

(f) a digital memory for storing the processed captured still image.

16. The electronic still camera of claim **15** further including a multiplexer having first and second inputs and an output, wherein the first input is coupled to the first processor, the second input is coupled to the second processor, and the output is coupled to the display so that a captured still image can be viewed on the display.

17. The electronic still camera of claim **15** wherein the first processor and the second processor are integrated into a single integrated circuit.

18. The electronic still camera of claim **15** wherein the motion processor and the still processor produce the second number of pixels and the third number of pixels, respectively, prior to transferring the image pixels to the display and the digital memory, respectively.

19. The electronic still camera of claim **15** wherein the second number of pixel values representative of the series of motion images are transferred to the display in a digital format.

20. The electronic still camera of claim **15** wherein the second number of pixel values representative of the series of motion images are mapped into a form suitable for display.

21. The electronic still camera of claim **20** wherein after the second number of pixel values representative of the series of motion images are mapped into a form suitable for display, the signals representing the captured images are converted back into an analog form.

22. The electronic still camera of claim **15** further including a firmware memory, and an application specific integrated circuit, and wherein the first processor is provided in the application specific integrated circuit, and the second processor implements software procedures stored in the firmware memory.

23. The electronic still camera of claim **15** wherein the image sensor includes a color filter array to produce color image data, the second processor processes the color image data and performs JPEG image compression on the captured still image, and the JPEG compressed still image is stored in the digital memory.

24. The electronic still camera of claim **23** wherein the digital memory is a removable memory card.

25. The electronic still camera of claim **15** wherein the first color pattern includes substantially one-half green color filters.

26. The electronic still camera of claim **25** wherein the color display pixels are arranged in a pattern having substantially one-third green color filters.

27. The electronic still camera of claim **15** wherein the first color pattern is a Bayer checkerboard pattern.

28. The electronic still camera of claim **15** wherein the distance between adjacent image sensor photosites in the horizontal direction are substantially equal to the distance between the adjacent image sensor photosites in the vertical direction, and wherein the distance between the adjacent color display pixels in the horizontal direction is different than the distance between the adjacent color display pixels in the vertical direction.

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(45) **Certificate Issued: Sep. 6, 2011**

(54) **ELECTRONIC CAMERA FOR INITIATING CAPTURE OF STILL IMAGES WHILE PREVIEWING MOTION IMAGES**

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(58) **Field of Classification Search** ..... None
See application file for complete search history.

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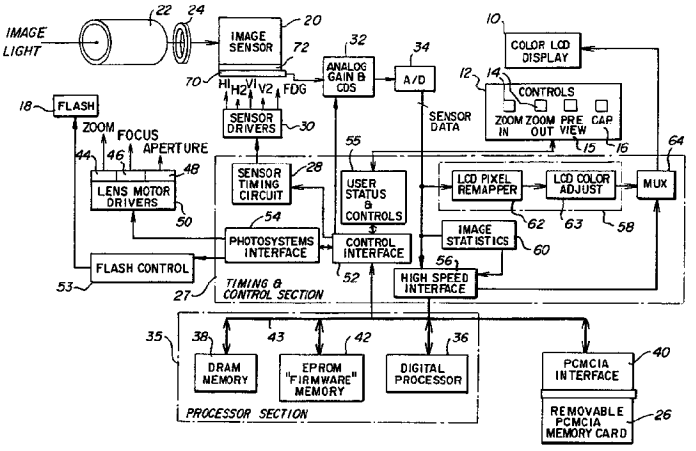
(57) **ABSTRACT**

An electronic camera uses a relatively more complex digital image processing technique in a still image mode to produce high quality still images, and a relatively more simple image processing technique in a motion preview mode to produce preview images of acceptable quality prior to initiation of the still image mode. The more complex digital technique is done in software in a general purpose processor section **35**, while the more simple digital technique is implemented in a fixed digital circuit in an application specific integrated circuit **27**, which also implements timing and control functions. The motion preview mode uses a shorter image readout period than the still mode and further involves mapping image sensor pixels into a fewer number of color display pixels on a color LCD display **10**. The mapping further converts color pixel signals from a mosaic array into a different color pattern on the color LCD display **10**.



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EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

NO AMENDMENTS HAVE BEEN MADE TO THE PATENT

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims **15** and **23-27** is confirmed.

Claims **1-14**, **16-22**, and **28** were not reexamined.

* * * * *

EXHIBIT B

US007210161B2

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

(10) **Patent No.: US 7,210,161 B2**
(45) **Date of Patent: *Apr. 24, 2007**

(54) **AUTOMATICALLY TRANSMITTING IMAGES FROM AN ELECTRONIC CAMERA TO A SERVICE PROVIDER USING A NETWORK CONFIGURATION FILE**

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(73) Assignee: **Eastman Kodak Company**, Rochester, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 917 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/855,375**

(22) Filed: **May 15, 2001**

(65) **Prior Publication Data**

US 2001/0022618 A1 Sep. 20, 2001

Related U.S. Application Data

(63) Continuation of application No. 09/004,046, filed on Jan. 7, 1998, now Pat. No. 6,784,924.

(60) Provisional application No. 60/037,962, filed on Feb. 20, 1997.

(51) **Int. Cl.**
H04N 7/173 (2006.01)
H04N 5/76 (2006.01)

(52) **U.S. Cl.** **725/105**; 348/231.3

(58) **Field of Classification Search** 348/207.99, 348/207.1, 207.2, 220.1, 14.01, 14.02, 14.03, 348/14.07, 14.08, 231.99, 231.3; 709/203; 725/105

See application file for complete search history.

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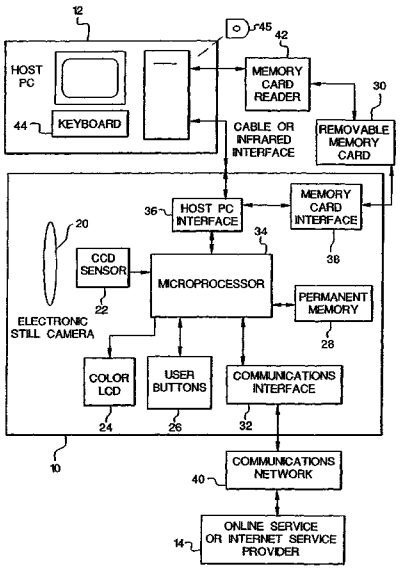
(57) **ABSTRACT**

A network configuration file is generated at a host computer and downloaded to a digital camera. This file contains instruction information for communicating with a selected destination via a communications interface. The digital camera includes a "send" button or LCD icon which allows the user to easily transmit one or more images via a wired or wireless communications interface to a desired destination, which among other possibilities may be an Internet Service Provider or a digital photofinishing center. When the user selects this option, the communications port settings, user account specifics, and destination connection commands are read from the network configuration file on the removable memory card. Examples of these settings include serial port baud rate, parity, and stop bits, as well as account name and password.

11 Claims, 4 Drawing Sheets



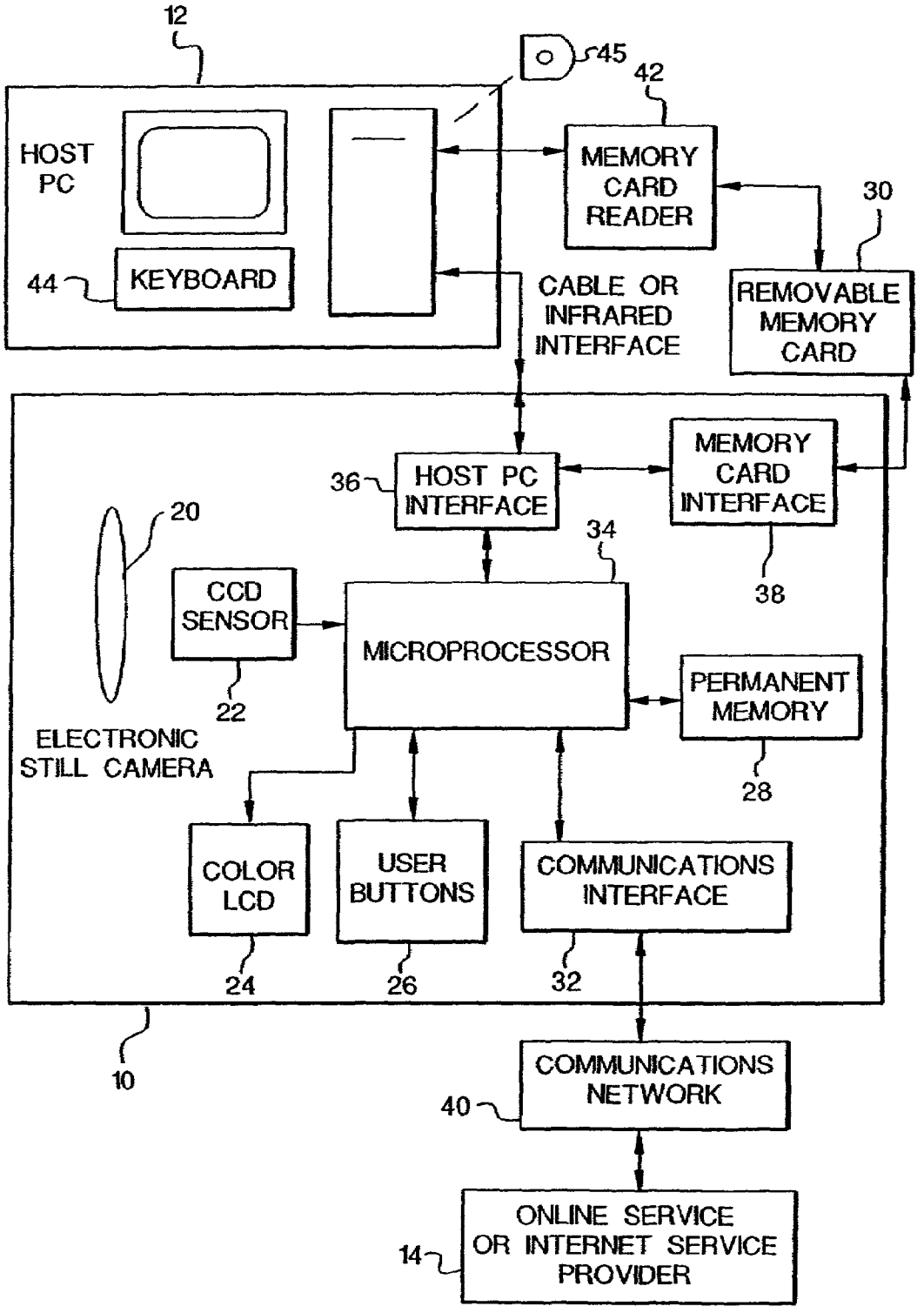

12
45
42
HOST PC
MEMORY CARD READER
30
44
KEYBOARD
CABLE OR INFRARED INTERFACE
REMOVABLE MEMORY CARD
36
HOST PC INTERFACE
MEMORY CARD INTERFACE
20
34
CCD SENSOR
MICROPROCESSOR
38
PERMANENT MEMORY
22
ELECTRONIC STILL CAMERA
28
COLOR LCD
USER BUTTONS
COMMUNICATIONS INTERFACE
24
26
32
10
COMMUNICATIONS NETWORK
40
ONLINE SERVICE OR INTERNET SERVICE PROVIDER
14

FIG. 1

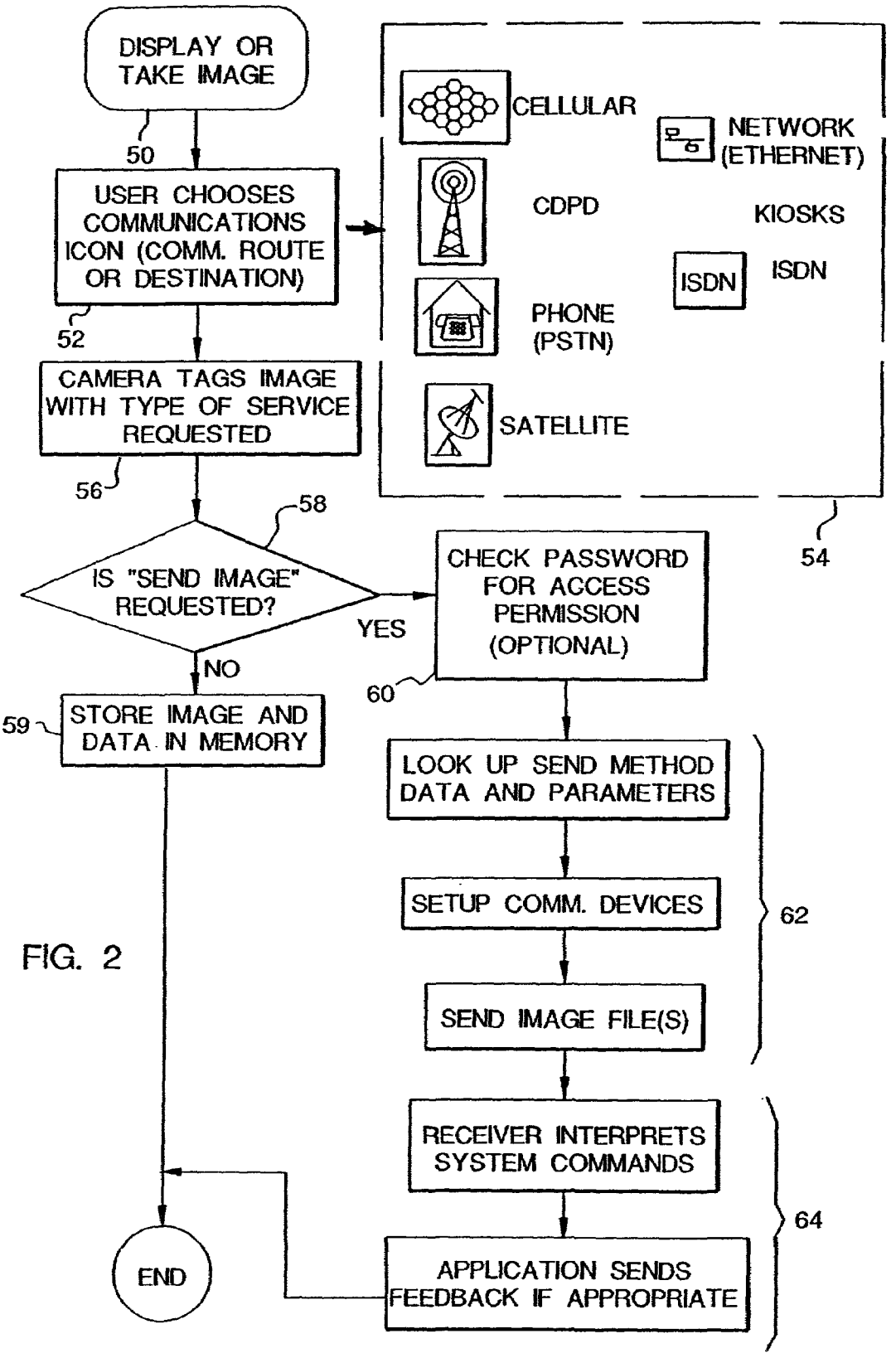

DISPLAY OR TAKE IMAGE
50
USER CHOOSES COMMUNICATIONS ICON (COMM. ROUTE OR DESTINATION)
52
CAMERA TAGS IMAGE WITH TYPE OF SERVICE REQUESTED
56
58
IS "SEND IMAGE" REQUESTED?
YES
NO
CHECK PASSWORD FOR ACCESS PERMISSION (OPTIONAL)
60
STORE IMAGE AND DATA IN MEMORY
59
LOOK UP SEND METHOD DATA AND PARAMETERS
SETUP COMM. DEVICES
SEND IMAGE FILE(S)
62
RECEIVER INTERPRETS SYSTEM COMMANDS
APPLICATION SENDS FEEDBACK IF APPROPRIATE
64
END
CELLULAR
CDPD
PHONE (PSTN)
SATELLITE
NETWORK (ETHERNET)
KIOSKS
ISDN
ISDN
54

FIG. 2

FIG. 3

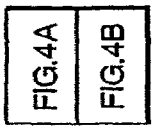
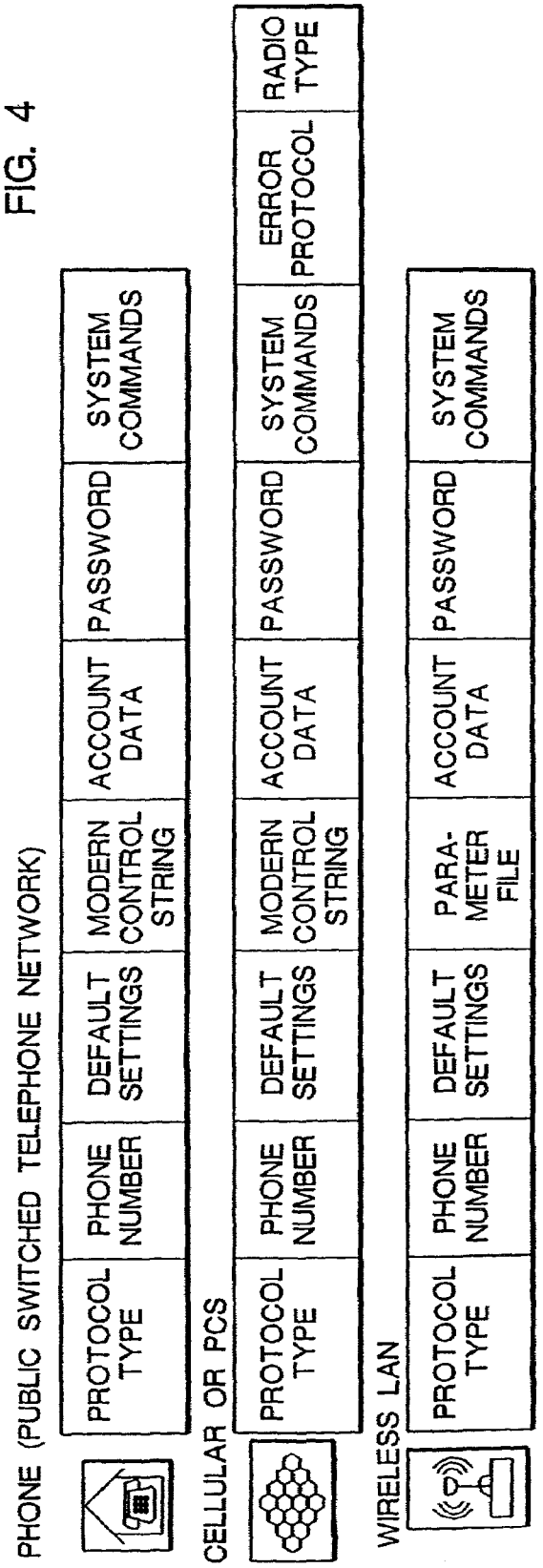


FIG. 4

FIG. 4A



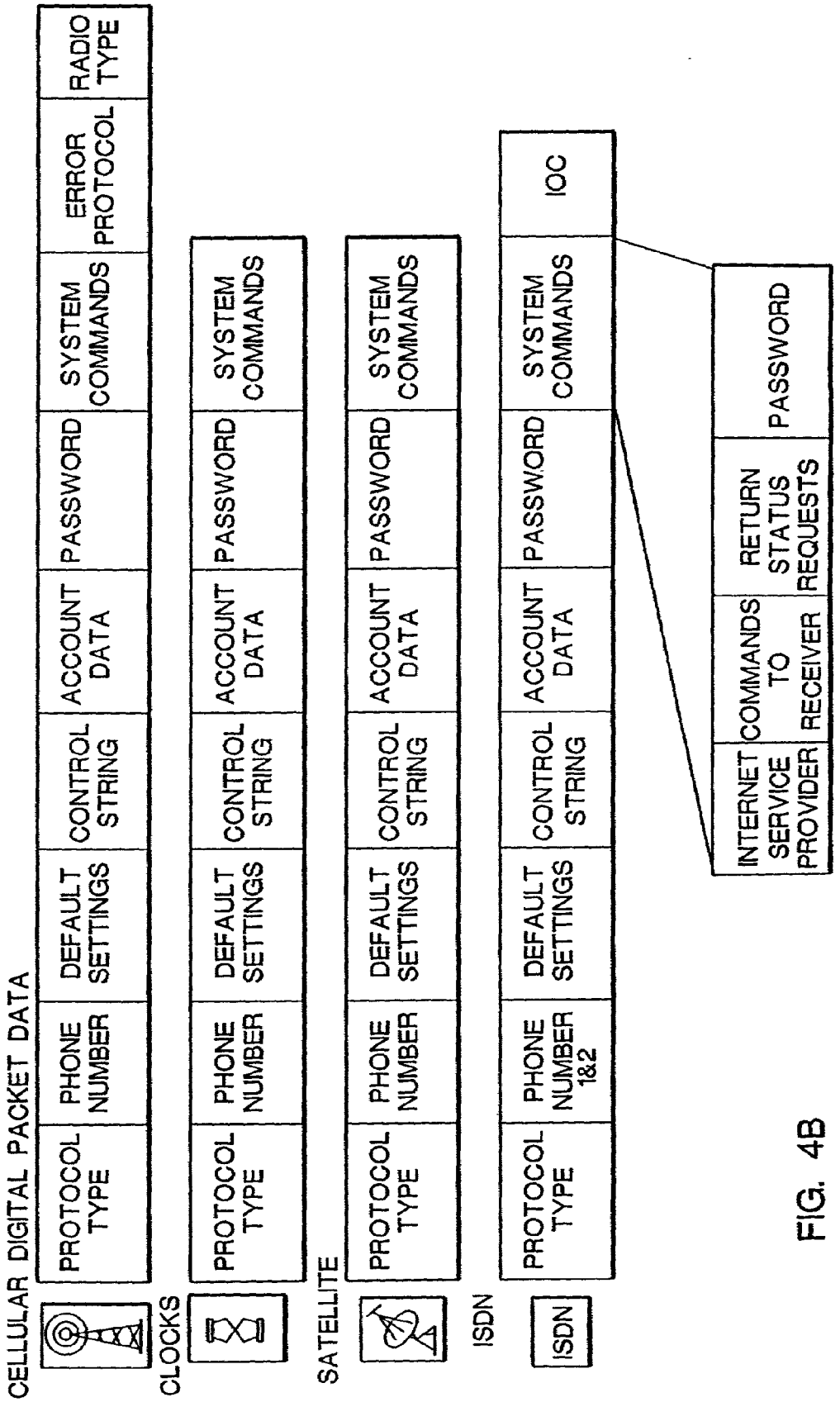

CELLULAR DIGITAL PACKET DATA
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
ERROR PROTOCOL
RADIO TYPE
CLOCKS
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
SATELLITE
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
ISDN
ISDN
PROTOCOL TYPE
PHONE NUMBER 1&2
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
IOC
INTERNET SERVICE PROVIDER
COMMANDS TO RECEIVER
RETURN STATUS REQUESTS
PASSWORD

FIG. 4B

AUTOMATICALLY TRANSMITTING IMAGES FROM AN ELECTRONIC CAMERA TO A SERVICE PROVIDER USING A NETWORK CONFIGURATION FILE

CROSS REFERENCE TO RELATED APPLICATION

Reference is made to and priority claimed from U.S. Provisional Application Ser. No. 60/037,962, filed Feb. 20, 1997, entitled NETWORK CONFIGURATION FILE FOR AUTOMATICALLY TRANSMITTING IMAGES FROM AN ELECTRONIC STILL CAMERA.

CROSS-REFERENCE TO RELATED APPLICATION(S)

This is a continuation of application Ser. No. 09/004,046 filed Jan. 7, 1998 now U.S. Pat. No. 6,784,924 entitled "Network Configuration File For Automatically Transmitting Images From An Electronic Still Camera".

FIELD OF THE INVENTION

The invention relates generally to the field of photography, and in particular to electronic photography. More specifically, the invention relates to a digital camera that interfaces with a host computer.

BACKGROUND OF THE INVENTION

Digital cameras, such as the Kodak Digital Science DC25™ camera, allow images to be utilized on a home computer (PC) and to be incorporated into e-mail documents and personal home pages on the World Wide Web. Presently, images must be copied to the PC and transmitted as e-mail, for example using an online service or an Internet Service Provider (ISP), via a modem from the user's PC. It would be desirable to be able to transmit pictures directly from the digital camera instead of first transferring the pictures to a PC. For instance, on a vacation trip, it is desirable to immediately share pictures with friends or relatives via e-mail or Internet access. It is also desirable to transmit pictures from a location without PC access in order to free up camera storage to take additional pictures. There are a wide variety of connection means to online services such as America On Line, ISPs, and bulletin board services. Each of these services typically requires an account name and password, as well as local telephone access numbers, and specific communications settings. It would be difficult to provide an easy-to-use means with buttons or menus on a small digital camera to input and/or modify all of these required settings.

SUMMARY OF THE INVENTION

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, a network configuration file is generated at a host computer and downloaded to a digital camera. This file contains instruction information for communicating with a selected destination via a communications interface. The digital camera includes a "send" button or LCD icon which allows the user to easily transmit one or more images via a wired or wireless communications interface to a desired destination, which among other possibilities may be an Internet Service Provider or a digital photofinishing center. When the user selects this option, the communications port settings, user account specifics, and destination connection commands are read from the network configuration file. Examples of these settings include serial port baud rate, parity, and stop bits, as well as account name and password.

In addition, information about which image or images to transmit is entered using the user buttons on the digital camera. This information is used to automatically establish a connection, log-in to the desired destination, and to transmit the image. The transmission may occur immediately after the pictures are taken, for example if the camera has a built-in cellular phone modem, or at a later time, when the camera is connected to a separate unit (such as a dock, kiosk, PC, etc.) equipped with a modem. In the latter case, a "utilization file" is created to provide information on which images should be transmitted to which account.

These and other aspects, objects, features and advantages of the present invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a system block diagram of the invention.

FIG. **2** is a diagram showing the steps used to automatically transmit images using the network configuration file.

FIG. **3** is a diagram of an image file.

FIG. **4** is a diagram showing several versions of the network configuration file.

DETAILED DESCRIPTION OF THE INVENTION

Because imaging systems and devices are well known, the present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. Elements not specifically shown or described herein may be selected from those known in the art. Some aspects of the present description may be implemented in software. Unless otherwise specified, all software implementation is conventional and within the ordinary skill in the programming arts.

A system block diagram of the invention is shown in FIG. **1** including an electronic still camera **10**, a host computer (PC) **12** and a service provider **14**. The camera includes an optical section **20** for imaging a scene upon a CCD sensor **22** and generating an image signal, a liquid crystal display (LCD) **24** for displaying images and other information, a number of user input buttons **26**, both permanent memory **28** and removable memory **30**, and an internal communications interface **32** (e.g., modem). This interface may connect to a variety of known networks, such as a public switched telephone network (PSTN), ISDN, an RF cellular phone network, or Ethernet. The camera **10** also includes a microprocessor **34** for generally controlling the camera functions, as well as the interchange of data with the host PC **12** and the memory card **30** through a host PC interface **36** and a memory card interface **38**, respectively. Besides the host PC **12**, the system includes a network connection **40** to the online service or ISP (Internet Service Provider) **14**. Alternately, the network **40** can connect to the user's home PC **12**.

When the camera **10** is first purchased (or at any time thereafter), it is connected to the PC **12** via the host PC **36** interface and a software application (stored on a disc **45**) running on the host PC **12** will enable the user to specify the

name of a destination ISP or online service and to input from the host PC keyboard **44** the appropriate communication settings and account information. This information generates a network configuration file, which then can then be downloaded to the camera **10** through the host PC interface **36**, which may be a wired or infrared (e.g., IrDA) interface, and written to the camera's internal memory **28** and/or the removable memory card **30**. Alternatively, a host PC equipped with a memory card reader/writer **42** can write the information directly to the card **30** without connecting the camera through its host PC interface **36**. Also, this information could be predetermined by the user and stored in a "preferences" file on the host PC **12** and then transferred to the camera **10** from this file without further intervention by the user. Multiple sets of destination services can be stored on the memory card **30**. Typically, keyword or graphic descriptors (e.g., icons) accompany the information in the network configuration file about destination services to enable easy access by the camera user.

The steps used to automatically transmit images using the network configuration file are shown in FIG. **2**. After disconnecting the camera from the host PC, the user operates the camera to take pictures (step **50**). This is typically done at a remote location, for example while traveling to another city. As the user takes or reviews images on the image LCD display, the decision can be made to transmit one or more images (step **52**). This is done by choosing one of the keywords or icons in a menu **54** shown in FIG. **2**, which are displayed on the LCD **24** and selected, e.g., through the user buttons **26**. (Note that a camera will typically only include a subset (only those desired by the user) of all the different services shown.) The selected image files may be tagged with a code (step **56**) indicating which service is requested, as shown in FIG. **3**. (Alternately, an "image utilization" file can be created in the camera storing a list of images to be transmitted by a particular method, as described in the cross-referenced copending patent application (U.S. Ser. No. 60/037,963). As described in that patent application, the details of an order, e.g., number of print copies to be made from an image and the size of the prints and/or a list of images to be e-mailed to various recipients, is written into the "utilization" file, which identifies the order and includes pointers to the image files that store the images required to "fulfill" the order. The "utilization" file is stored in the internal memory **28** or the memory card **30**.)

Next, the system determines whether a request exists to send an image (step **58**). If no request is present, the image and associated data is stored in either permanent memory **28** or the memory card **30** (step **59**). (Typically, all images are initially saved in memory whether eventually sent or not.) Otherwise, if there is a request to send an image, the user ensures that the camera is connected to the appropriate service (wired telephone line, cellular phone, kiosk, etc.) and pushes a "send" button in the user button section **26**, or selects a "send" menu option on the LCD **24**. The camera then utilizes the appropriate network configuration file, shown in FIG. **4**. Each network configuration file contains items such as the protocol type, phone number, etc., as described in Appendix I. The user password may be checked against the password in the network configuration file to ensure that the user is authorized to connect the camera to the desired service (step **60**). Alternately, the stored password in the appropriate configuration file can be used. Next, the camera uses the parameters in the configuration file to establish communications with the service and send one or more image files as selected by the user (steps **62**). The service receiver interprets the system commands issued by the camera from the network configuration file list and sends appropriate feedback (such as "transfer in progress" and "transfer complete") which are interpreted by the camera and displayed on the LCD **24** (steps **64**).

For example, when the camera uses a normal wired telephone (Public Switched Telephone Network) connection (i.e., network **40**) to the camera's internal modem **32**, after the user selects the images to be sent and presses the "send" button, the camera performs the following steps without user intervention:

1) Read the appropriate connection parameters from the network configuration file (on the memory card **30** or internal camera memory **28**), dial the phone and establish the connection to the destination service **14**.
2) Read the user's account name and password and transmit these to "log-on" to the service **14**.
3) Using the appropriate communications protocol (FTP, mailto, etc.), transmit the selected image or images to the destination service **14**.

The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

APPENDIX I

These are descriptions of the tags listed in the previous drawing:

Protocol Type

Each communication method has its own protocol, or rules to communicate. This tag identifies that protocol and where to find it. For example, the Network may use TCP/IP and a modem may use XModem.

Phone Number

This is the number of the receiving service. If internet access is requested, this could be the number of the Internet Service Provider. For ISDN, some systems require two phone numbers, dialed and connected to in sequence.

Default Settings

Standard settings that make the communications device compatible with the imaging device.

Modem Control String

Modem and communications devices have a command language that can set them up before they are used. For example, modems have many options controlled by command strings including volume level, the amount of time the carrier is allowed to fail before the system hangs up, and so on.

Account Data

This can be internet account data, charge number data, phone card data, billing address, and data related to the commerce part of the transmission.

Password

Any password needed to get into the communications system. Other passwords to get into the remote application or destination are located in the System Commands section.

System Commands

These are commands that control the end destination.

Error Protocol

In cellular and some other wireless communications, error protocols are used to increase the robustness of the link. For example, MNP10 or ETC may be used for cellular links.

Radio Type

The type of radio used for this communications feature may be identified here. Some cell phones have modems built in, others will have protocols for many communications functions built in. The radio type will make the imaging device adapt to the correct interface.

IOC

ISDN Ordering Code identifies what features are available on the ISDN line provided by the teleco. It is used to establish the feature set for that communications link.

Internet Service Provider

This identifies the actual service provider and any specific information or sequence of information that the service wants to see during connection and logoff. It also tells the device how to handle the return messages, like "time used" that are returned by the server.

Commands to Receiver

This may be a list of commands to control the receiving application. For example, a command to print one of the images and save the data to a particular file on a PC may be embedded here.

Return Status Requests

This tag can set up the ability of the application to tell if an error has occurred, or what the status of the application might be. The data here will help the device decide if it should continue communicating and a set user interface response can be developed around this feedback.

What is claimed is:

1. A method of transferring one of more images from an electronic camera to a service provider, the camera including optics and an image sensor for generating an image signal, a display for displaying images, a plurality of user inputs, a first digital memory for storing digital images, a second digital memory for storing a network configuration file, and a communications interface, the method comprising the steps of:

(a) storing the network configuration file for the service provider in the second digital memory;

(b) subsequently using the optics and image sensor to generate a plurality of image signals which are stored as a plurality of digital images in the first digital memory;

(c) viewing at least one of the plurality of digital images on the display of the electronic camera;

(d) using at least one of the plurality of user inputs to select at least one digital image for transfer to the service provider;

(e) using at least one of the plurality of user inputs to initiate transfer of the selected at least one digital image to the service provider;

(f) using the network configuration file, the electronic camera automatically establishing communications with the service provider and transferring the selected digital image(s) from the electronic camera to the service provider using the communications interface;

(g) transferring from the service provider to the electronic camera, feedback indicating the status of the transfer process; and

(h) displaying the status on the display of the electronic camera.

2. The method as claimed in claim **1** wherein the network configuration file includes a protocol type identifier.

3. The method as claimed in claim **2** wherein protocol type identifier identifies a TCP/IP protocol.

4. The method as claimed in claim **1** wherein the network configuration file includes account data.

5. A method of transferring one or more digital images from an electronic camera to a service, the camera including optics and an image sensor for generating an image signal, a display for displaying images, a plurality of user inputs, a first digital memory for storing digital images, a second digital memory for storing a network configuration file, and a communications interface, the method comprising:

(a) storing the network configuration file for the service in the second digital memory, wherein the network configuration file includes a protocol type identifier identifying a TCP/IP protocol;

(b) subsequently using the optics and image sensor to generate a plurality of image signals which are stored in the first digital memory as a plurality of digital images representative of the plurality of image signals;

(c) displaying a representation of at least one of the plurality of digital images on the display of the electronic camera;

(d) selecting at least one digital image for transfer to the service in response to the use of at least one of the plurality of user inputs;

(e) initiating transfer of the selected at least one digital image to the service in response to use of at least one of the plurality of user inputs; and

(f) using the network configuration file to automatically establish communications with the service and to transfer the selected at least one digital image from the electronic camera to the service using the communications interface.

6. The method of claim **5** further including:

(g) receiving feedback indicating the status of the transfer process from the service; and

(h) displaying the status on the display of the electronic camera.

7. The method of claim **5** wherein the network configuration file includes account data.

8. The method of claim **5** wherein the network configuration file is generated at least in part by a host device.

9. A method of transferring one or more digital images from an electronic camera to a service, the camera including optics and an image sensor for generating an image signal, a display for displaying images, a plurality of user inputs, a first digital memory for storing digital images, a second digital memory for storing a network configuration file, and a communications interface, the method comprising:

(a) storing the network configuration file for the service in the second digital memory;

(b) subsequently using the optics and image sensor to generate a plurality of image signals which are stored in the first digital memory as a plurality of digital images representative of the plurality of image signals;

(c) displaying a representation of at least one of the plurality of digital images on the display of the electronic camera;

(d) selecting at least one digital image for transfer to the service in response to the use of at least one of the plurality of user inputs;

(e) initiating transfer of the selected at least one digital image to the service in response to use of at least one of the plurality of user inputs;

(f) using the network configuration file to automatically establish communications with the service and to transfer the selected at least one digital image from the

electronic camera to the service using the communications interface;

(g) receiving information indicating the status of the transferring at least one digital image from the electronic camera to the service; and

(h) displaying an indication of the status.

10. The method of claim **9** wherein the network configuration file includes account data.

11. The method of claim **10** wherein the network configuration file is generated at least in part by a host device.

* * * * *

EXHIBIT C

US007742084B2

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

(10) **Patent No.: US 7,742,084 B2**
(45) **Date of Patent: *Jun. 22, 2010**

(54) **NETWORK CONFIGURATION FILE FOR AUTOMATICALLY TRANSMITTING IMAGES FROM AN ELECTRONIC STILL CAMERA**

(75) Inventors: **Joseph Ward**, Rochester, NY (US); **Kenneth A. Parulski**, Rochester, NY (US); **James D. Allen**, Rochester, NY (US)

(73) Assignee: **Eastman Kodak Company**, Rochester, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 258 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/692,224**

(22) Filed: **Mar. 28, 2007**

(65) **Prior Publication Data**

US 2007/0285523 A1 Dec. 13, 2007

Related U.S. Application Data

(60) Continuation of application No. 09/783,437, filed on Feb. 14, 2001, now Pat. No. 7,256,823, which is a division of application No. 09/004,046, filed on Jan. 7, 1998, now Pat. No. 6,784,924.

(60) Provisional application No. 60/037,962, filed on Feb. 20, 1997.

(51) **Int. Cl.**
H04N 5/76 (2006.01)

(52) **U.S. Cl.** **348/231.3**; 348/333.02

(58) **Field of Classification Search** 348/207.1, 348/333.01–333.11

See application file for complete search history.

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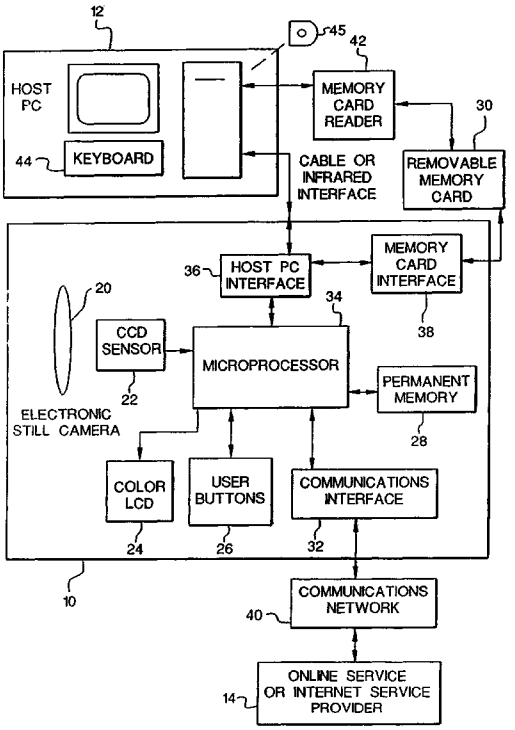
Primary Examiner—Tuan Ho
(74) *Attorney, Agent, or Firm*—Thomas J. Strouse; Peyton C. Watkins

(57) **ABSTRACT**

A network configuration file is generated at a host computer and downloaded to a digital camera. This file contains instruction information for communicating with a selected destination via a communications interface. The digital camera includes a "send" button or LCD icon which allows the user to easily transmit one or more images via a wired or wireless communications interface to a desired destination, which among other possibilities may be an Internet Service Provider or a digital photofinishing center. When the user selects this option, the communications port settings, user account specifics, and destination connection commands are read from the network configuration file on the removable memory card. Examples of these settings include serial port baud rate, parity, and stop bits, as well as account name and password.

11 Claims, 4 Drawing Sheets



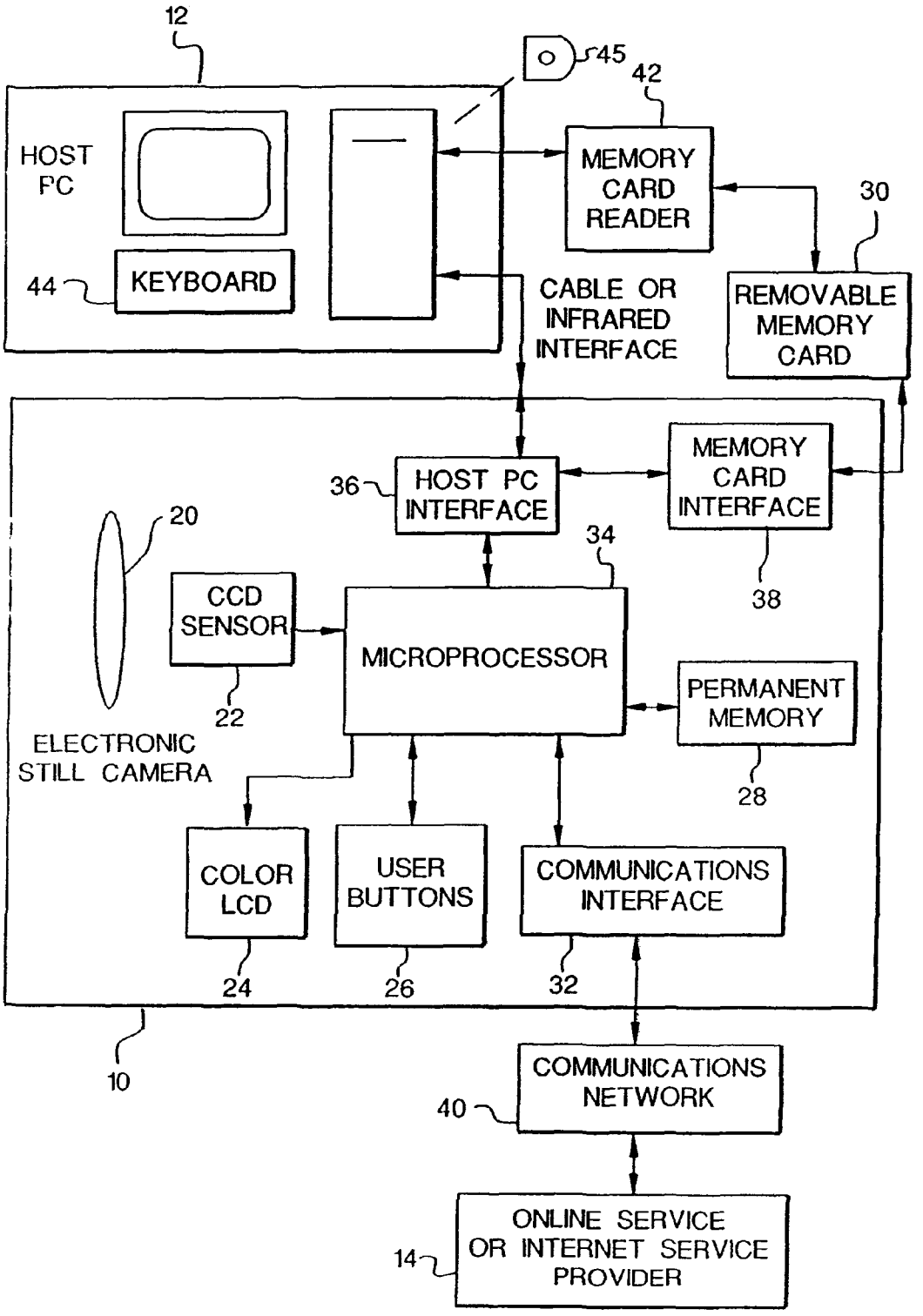

12
45
42
HOST PC
MEMORY CARD READER
30
44
KEYBOARD
CABLE OR INFRARED INTERFACE
REMOVABLE MEMORY CARD
MEMORY CARD INTERFACE
36
HOST PC INTERFACE
20
34
38
CCD SENSOR
MICROPROCESSOR
PERMANENT MEMORY
22
ELECTRONIC STILL CAMERA
28
COLOR LCD
USER BUTTONS
COMMUNICATIONS INTERFACE
24
26
32
10
COMMUNICATIONS NETWORK
40
ONLINE SERVICE OR INTERNET SERVICE PROVIDER
14

FIG. 1

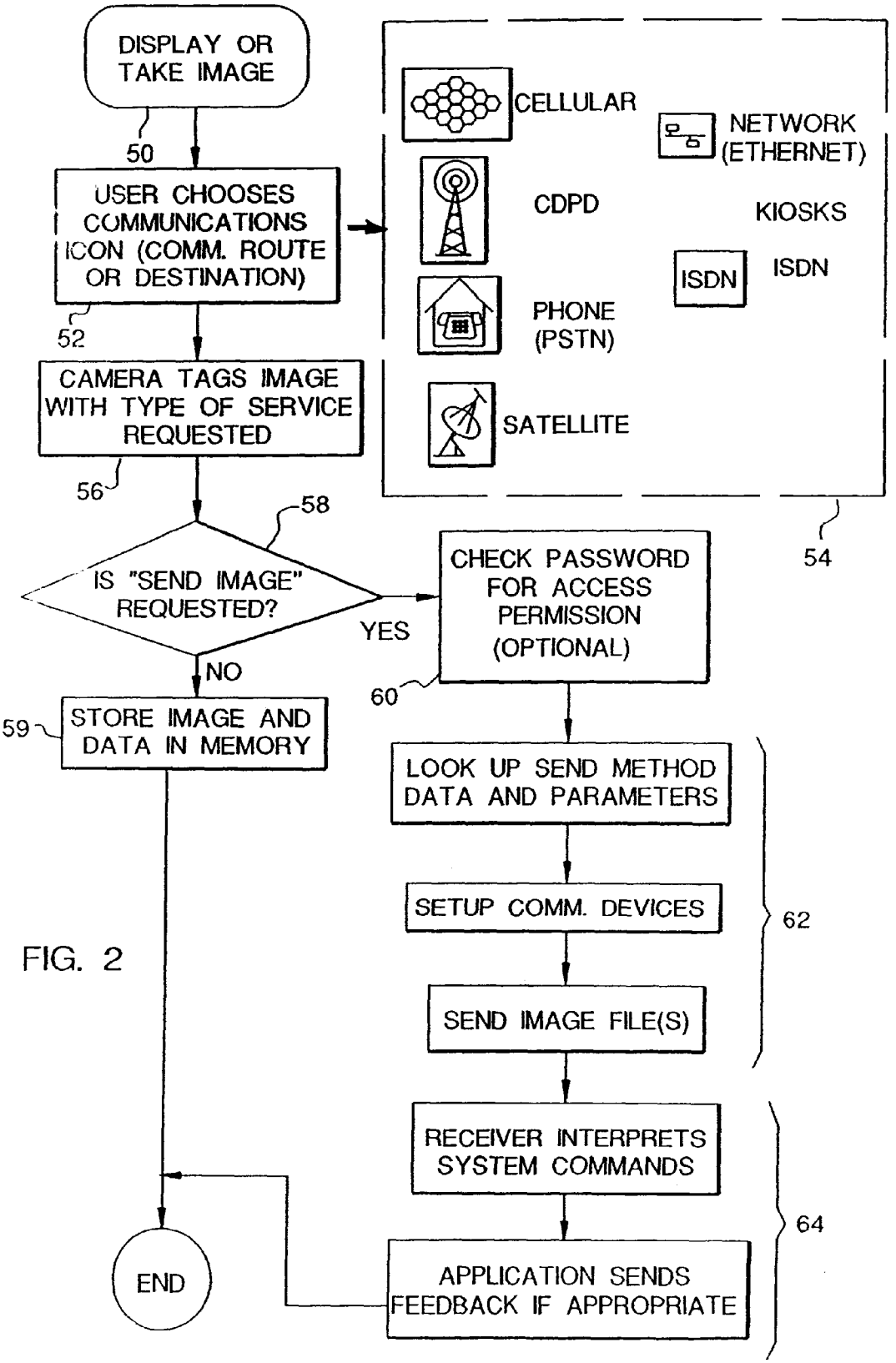

DISPLAY OR TAKE IMAGE
50
USER CHOOSES COMMUNICATIONS ICON (COMM. ROUTE OR DESTINATION)
52
CAMERA TAGS IMAGE WITH TYPE OF SERVICE REQUESTED
56
58
IS "SEND IMAGE" REQUESTED?
YES
NO
CHECK PASSWORD FOR ACCESS PERMISSION (OPTIONAL)
60
59
STORE IMAGE AND DATA IN MEMORY
LOOK UP SEND METHOD DATA AND PARAMETERS
SETUP COMM. DEVICES
SEND IMAGE FILE(S)
62
RECEIVER INTERPRETS SYSTEM COMMANDS
APPLICATION SENDS FEEDBACK IF APPROPRIATE
64
END
CELLULAR
NETWORK (ETHERNET)
CDPD
KIOSKS
ISDN
ISDN
PHONE (PSTN)
SATELLITE
54

FIG. 2

FIG. 3

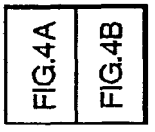


FIG. 4

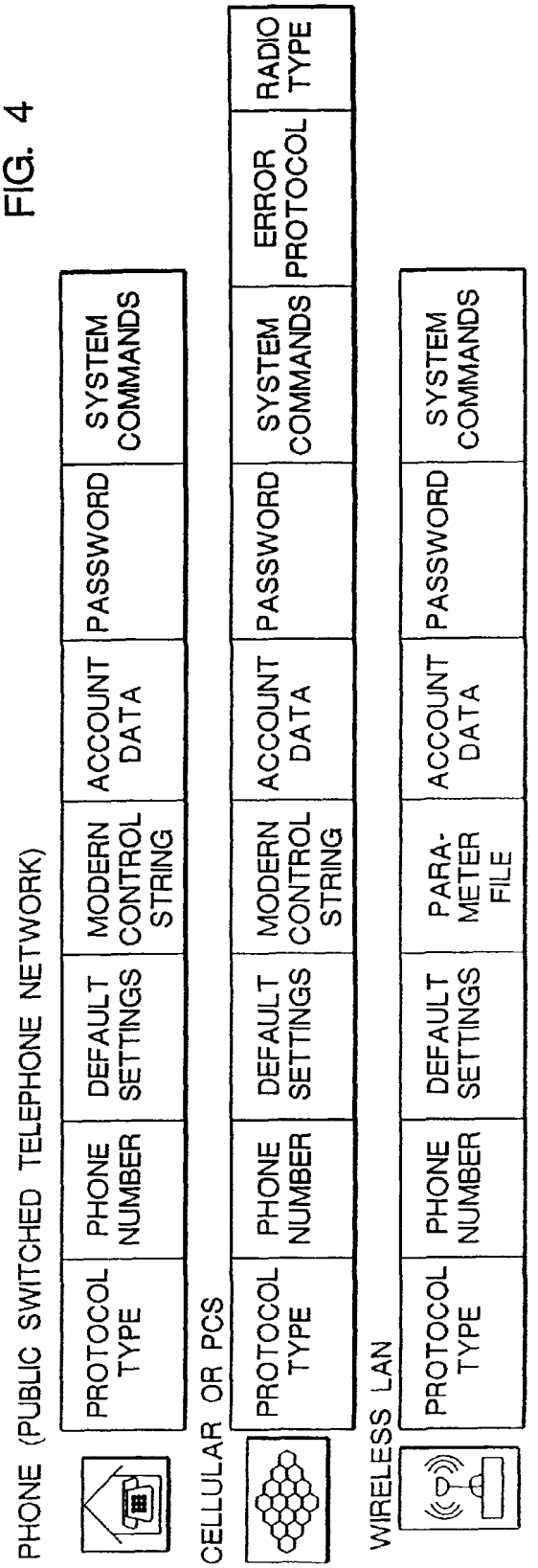


FIG. 4A

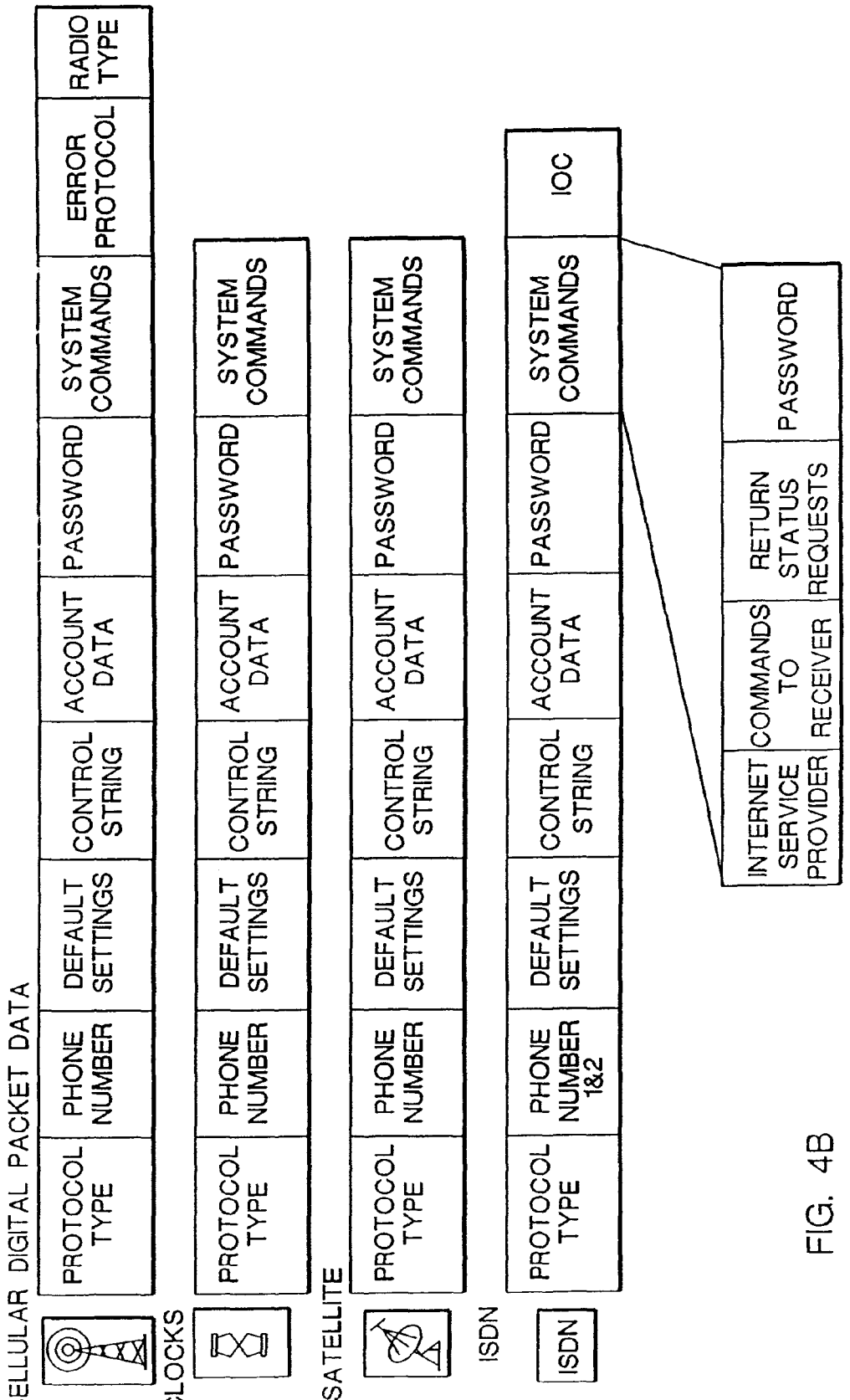

CELLULAR DIGITAL PACKET DATA
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
ERROR PROTOCOL
RADIO TYPE
CLOCKS
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
SATELLITE
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
ISDN
ISDN
PROTOCOL TYPE
PHONE NUMBER 1&2
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
IOC
INTERNET SERVICE PROVIDER
COMMANDS TO RECEIVER
RETURN STATUS REQUESTS
PASSWORD

FIG. 4B

NETWORK CONFIGURATION FILE FOR AUTOMATICALLY TRANSMITTING IMAGES FROM AN ELECTRONIC STILL CAMERA

CROSS-REFERENCE TO RELATED APPLICATION(S)

This is a continuation of U.S. Ser. No. 09/783,437 filed Feb. 14, 2001 (which issued as U.S. Pat. No. 7,256,823 on Aug. 14, 2007, which is now Reissue application Ser. No. 12/540,610) which is a divisional of U.S. Ser. No. 09/004,046 filed Jan. 7, 1998 (now U.S. Pat. No. 6,784,924 which issued on Aug. 31, 2004) which claims the benefit of U.S. Provisional Application No. 60/037,962 filed Feb. 20, 1997.

FIELD OF THE INVENTION

The invention relates generally to the field of photography, and in particular to electronic photography. More specifically, the invention relates to a digital camera that interfaces with a host computer.

BACKGROUND OF THE INVENTION

Digital cameras, such as the Kodak Digital Science DC25™ camera, allow images to be utilized on a home computer (PC) and to be incorporated into e-mail documents and personal home pages on the World Wide Web. Presently, images must be copied to the PC and transmitted as e-mail, for example using an online service or an Internet Service Provider (ISP), via a modem from the user's PC. It would be desirable to be able to transmit pictures directly from the digital camera instead of first transferring the pictures to a PC. For instance, on a vacation trip, it is desirable to immediately share pictures with friends or relatives via e-mail or Internet access. It is also desirable to transmit pictures from a location without PC access in order to free up camera storage to take additional pictures. There are a wide variety of connection means to online services such as America On Line, ISPs, and bulletin board services. Each of these services typically requires an account name and password, as well as local telephone access numbers, and specific communications settings. It would be difficult to provide an easy-to-use means with buttons or menus on a small digital camera to input and/or modify all of these required settings.

SUMMARY OF THE INVENTION

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, a network configuration file is generated at a host computer and downloaded to a digital camera. This file contains instruction information for communicating with a selected destination via a communications interface. The digital camera includes a "send" button or LCD icon which allows the user to easily transmit one or more images via a wired or wireless communications interface to a desired destination, which among other possibilities may be an Internet Service Provider or a digital photofinishing center. When the user selects this option, the communications port settings, user account specifics, and destination connection commands are read from the network configuration file. Examples of these settings include serial port baud rate, parity, and stop bits, as well as account name and password.

In addition, information about which image or images to transmit is entered using the user buttons on the digital camera. This information is used to automatically establish a connection, log-in to the desired destination, and to transmit the image. The transmission may occur immediately after the pictures are taken, for example if the camera has a built-in cellular phone modem, or at a later time, when the camera is connected to a separate unit (such as a dock, kiosk, PC, etc.) equipped with a modem. In the latter case, a "utilization file" is created to provide information on which images should be transmitted to which account.

These and other aspects, objects, features and advantages of the present invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a system block diagram of the invention.

FIG. **2** is a diagram showing the steps used to automatically transmit images using the network configuration file.

FIG. **3** is a diagram of an image file.

FIG. **4** is a diagram showing several versions of the network configuration file.

DETAILED DESCRIPTION OF THE INVENTION

Because imaging systems and devices are well known, the present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. Elements not specifically shown or described herein may be selected from those known in the art. Some aspects of the present description may be implemented in software. Unless otherwise specified, all software implementation is conventional and within the ordinary skill in the programming arts.

A system block diagram of the invention is shown in FIG. **1** including an electronic still camera **10**, a host computer (PC) **12** and a service provider **14**. The camera includes an optical section **20** for imaging a scene upon a CCD sensor **22** and generating an image signal, a liquid crystal display (LCD) **24** for displaying images and other information, a number of user input buttons **26**, both permanent memory **28** and removable memory **30**, and an internal communications interface **32** (e.g., modem). This interface may connect to a variety of known networks, such as a public switched telephone network (PSTN), ISDN, an RF cellular phone network, or Ethernet. The camera **10** also includes a microprocessor **34** for generally controlling the camera functions, as well as the interchange of data with the host PC **12** and the memory card **30** through a host PC interface **36** and a memory card interface **38**, respectively. Besides the host PC **12**, the system includes a network connection **40** to the online service or ISP (Internet Service Provider) **14**. Alternately, the network **40** can connect to the user's home PC **12**.

When the camera **10** is first purchased (or at any time thereafter), it is connected to the PC **12** via the host PC **36** interface and a software application (stored on a disc **45**) running on the host PC **12** will enable the user to specify the name of a destination ISP or online service and to input from the host PC keyboard **44** the appropriate communication settings and account information. This information generates a network configuration file, which then can then be downloaded to the camera **10** through the host PC interface **36**, which may be a wired or infrared (e.g., IrDA) interface, and written to the camera's internal memory **28** and/or the removable memory card **30**. Alternatively, a host PC equipped with a memory card reader/writer **42** can write the information

directly to the card **30** without connecting the camera through its host PC interface **36**. Also, this information could be predetermined by the user and stored in a "preferences" file on the host PC **12** and then transferred to the camera **10** from this file without further intervention by the user. Multiple sets of destination services can be stored on the memory card **30**. Typically, keyword or graphic descriptors (e.g., icons) accompany the information in the network configuration file about destination services to enable easy access by the camera user.

The steps used to automatically transmit images using the network configuration file are shown in FIG. **2**. After disconnecting the camera from the host PC, the user operates the camera to take pictures (step **50**). This is typically done at a remote location, for example while traveling to another city. As the user takes or reviews images on the image LCD display, the decision can be made to transmit one or more images (step **52**). This is done by choosing one of the keywords or icons in a menu **54** shown in FIG. **2**, which are displayed on the LCD **24** and selected, e.g., through the user buttons **26**. (Note that a camera will typically only include a subset (only those desired by the user) of all the different services shown.) The selected image files may be tagged with a code (step **56**) indicating which service is requested, as shown in FIG. **3**. (Alternately, an "image utilization" file can be created in the camera storing a list of images to be transmitted by a particular method, as described in the cross-referenced copending patent application (U.S. Ser. No. 60/037,963). As described in that patent application, the details of an order, e.g., number of print copies to be made from an image and the size of the prints and/or a list of images to be e-mailed to various recipients, is written into the "utilization" file, which identifies the order and includes pointers to the image files that store the images required to "fulfill" the order. The "utilization" file is stored in the internal memory **28** or the memory card **30**.)

Next, the system determines whether a request exists to send an image (step **58**). If no request is present, the image and associated data is stored in either permanent memory **28** or the memory card **30** (step **59**). (Typically, all images are initially saved in memory whether eventually sent or not.) Otherwise, if there is a request to send an image, the user ensures that the camera is connected to the appropriate service (wired telephone line, cellular phone, kiosk, etc.) and pushes a "send" button in the user button section **26**, or selects a "send" menu option on the LCD **24**. The camera then utilizes the appropriate network configuration file, shown in FIG. **4**. Each network configuration file contains items such as the protocol type, phone number, etc., as described in Appendix I. The user password may be checked against the password in the network configuration file to ensure that the user is authorized to connect the camera to the desired service (step **60**). Alternately, the stored password in the appropriate configuration file can be used. Next, the camera uses the parameters in the configuration file to establish communications with the service and send one or more image files as selected by the user (steps **62**). The service receiver interprets the system commands issued by the camera from the network configuration file list and sends appropriate feedback (such as "transfer in progress" and "transfer complete") which are interpreted by the camera and displayed on the LCD **24** (steps **64**).

For example, when the camera uses a normal wired telephone (Public Switched Telephone Network) connection (i.e., network **40**) to the camera's internal modem **32**, after the user selects the images to be sent and presses the "send" button, the camera performs the following steps without user intervention:

1) Read the appropriate connection parameters from the network configuration file (on the memory card **30** or internal camera memory **28**), dial the phone and establish the connection to the destination service **14**.
2) Read the user's account name and password and transmit these to "log-on" to the service **14**.
3) Using the appropriate communications protocol (FTP, mailto, etc.), transmit the selected image or images to the destination service **14**.

The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

APPENDIX I

These are descriptions of the tags listed in the previous drawing:

Protocol Type

Each communication method has its own protocol, or rules to communicate. This tag identifies that protocol and where to find it. For example, the Network may use TCP/IP and a modem may use XModem.

Phone Number

This is the number of the receiving service. If internet access is requested, this could be the number of the Internet Service Provider. For ISDN, some systems require two phone numbers, dialed and connected to in sequence.

Default Settings

Standard settings that make the communications device compatible with the imaging device.

Modem Control String

Modem and communications devices have a command language that can set them up before they are used. For example, modems have many options controlled by command strings including volume level, the amount of time the carrier is allowed to fail before the system hangs up, and so on.

Account Data

This can be internet account data, charge number data, phone card data, billing address, and data related to the commerce part of the transmission.

Password

Any password needed to get into the communications system. Other passwords to get into the remote application or destination are located in the System Commands section.

System Commands

These are commands that control the end destination.

Error Protocol

In cellular and some other wireless communications, error protocols are used to increase the robustness of the link. For example, MNP **10** or ETC may be used for cellular links.

Radio Type

The type of radio used for this communications feature may be identified here. Some cell phones have modems built in, others will have protocols for many communications functions built in. The radio type will make the imaging device adapt to the correct interface.

IOC

ISDN Ordering Code identifies what features are available on the ISDN line provided by the teleco. It is used to establish the feature set for that communications link.

Internet Service Provider

This identifies the actual service provider and any specific information or sequence of information that the service wants to see during connection and logoff. It also tells the device how to handle the return messages, like "time used" that are returned by the server.

Commands to Receiver

This may be a list of commands to control the receiving application. For example, a command to print one of the images and save the data to a particular file on a PC may be embedded here.

Return Status Requests

This tag can set up the ability of the application to tell if an error has occurred, or what the status of the application might be. The data here will help the device decide if it should continue communicating and a set user interface response can be developed around this feedback.

What is claimed is:

1. An electronic camera comprising:

a communication interface;

a sensor for capturing images;

a first memory for storing images;

a second memory for storing information for communicating with a plurality of destinations via the communications interface; and

a user interface for selecting an image destination and for commanding the camera to send the images to the selected destination via the communications interface using the information, and wherein the user interface displays a plurality of descriptive icons representative of the plurality of destinations and selection is made by reference to at least one of the icons.

2. The camera of claim **1**, wherein both first and second memories are memory locations on the same removable memory card.

3. The camera of claim **1**, wherein the second memory permanently resides in the camera and can be loaded with a network configuration file from a host PC.

4. The camera of claim **3**, wherein the network configuration file further includes information to enable connection to an identified Internet Service Provider.

5. The camera of claim **1**, wherein the communications interface connects to PSTN (Public Switched Telephone Network).

6. The camera of claim **1**, wherein the communications interface connects to ISDN.

7. The camera of claim **1**, wherein the communications interface connects to an RF cellular phone network.

8. The camera of claim **1**, wherein the communications interface connects to a data network.

9. The camera of claim **8**, wherein the data network is an Ethernet.

10. The camera of claim **1**, wherein the communications interface is located internal to the camera.

11. The camera of claim **1**, wherein the user interface displays a feedback indicating the status of the image transfer.

* * * * *

EXHIBIT D

US007453605B2

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

(10) **Patent No.: US 7,453,605 B2**
(45) **Date of Patent: Nov. 18, 2008**

(54) **CAPTURING DIGITAL IMAGES TO BE TRANSFERRED TO AN E-MAIL ADDRESS**

(75) Inventors: **Kenneth A. Parulski**, Rochester, NY (US); **Joseph Ward**, Hilton, NY (US); **Michael C. Hopwood**, Mountain View, CA (US)

(73) Assignee: **Eastman Kodak Company**, Rochester, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 663 days.

(21) Appl. No.: **11/174,370**

(22) Filed: **Jul. 1, 2005**

(65) **Prior Publication Data**

US 2005/0243189 A1 Nov. 3, 2005

Related U.S. Application Data

(63) Continuation of application No. 09/821,152, filed on Mar. 29, 2001, now Pat. No. 7,034,871, which is a continuation of application No. 08/977,382, filed on Nov. 24, 1997, now Pat. No. 6,573,927.

(51) **Int. Cl.**
H04N 5/76 (2006.01)

(52) **U.S. Cl.** **358/402**; 348/231.2; 348/231.3

(58) **Field of Classification Search** 358/402, 358/1.9, 1.15, 1.16, 906, 505, 474; 396/319; 348/231.99, 231.2, 231.3, 231.7, 231.9, 231.1, 348/14.12, 64, 14.06, 207.1, 231.6, 552; 347/2

See application file for complete search history.

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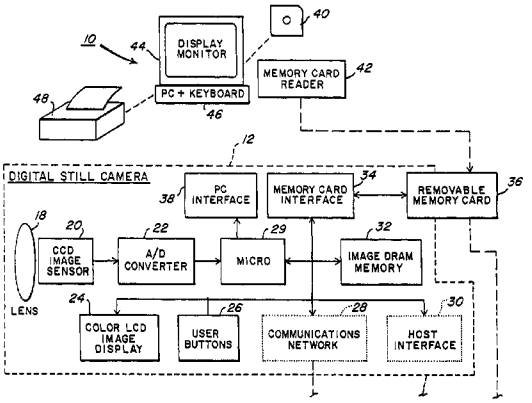
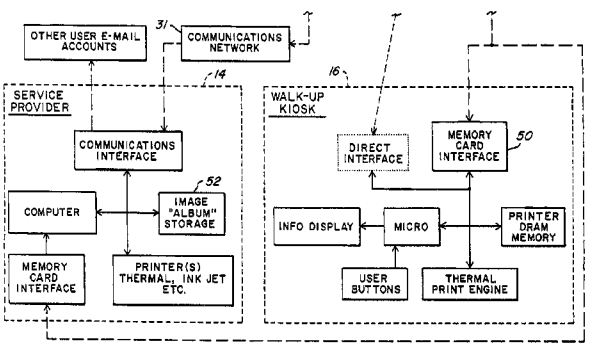
Primary Examiner—David K. Mooe
Assistant Examiner—Henry Dahbour
(74) *Attorney, Agent, or Firm*—Pamela R. Crocker

(57) **ABSTRACT**

An electronic still camera for capturing images to be transferred to at least one e-mail address is disclosed. The electronic still camera includes an image sensor for capturing a plurality of images of scenes and for producing image signals representative of the corresponding scenes; an analog-to-digital converter for digitizing the image signals to produce digital images; and a removable memory card for storing a plurality of digital image files corresponding to the digital images. The electronic still camera also includes an internal memory for storing at least one digital image to be displayed and a plurality of e-mail addresses; a processor for controlling the transfer of the digital images from the removable memory card to the internal memory and for producing a utilization file; and a display coupled to the internal memory for displaying at least one digital image. The electronic still camera further includes a user interface for selecting at least one e-mail address and for scrolling through the plurality of digital images stored on the removable memory card in order to display and select particular digital images to be transferred to the selected at least one e-mail address, wherein the utilization file includes the at least one selected e-mail address and the name of at least one digital image file to be transferred to the at least one selected e-mail address and the processor stores the utilization file on the removable memory card separate from the digital image files.

20 Claims, 5 Drawing Sheets





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7,034,871	B2 *	4/2006	Parulski et al.	348/231.3

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FIG. 1A
FIG. 1B

FIG. 1

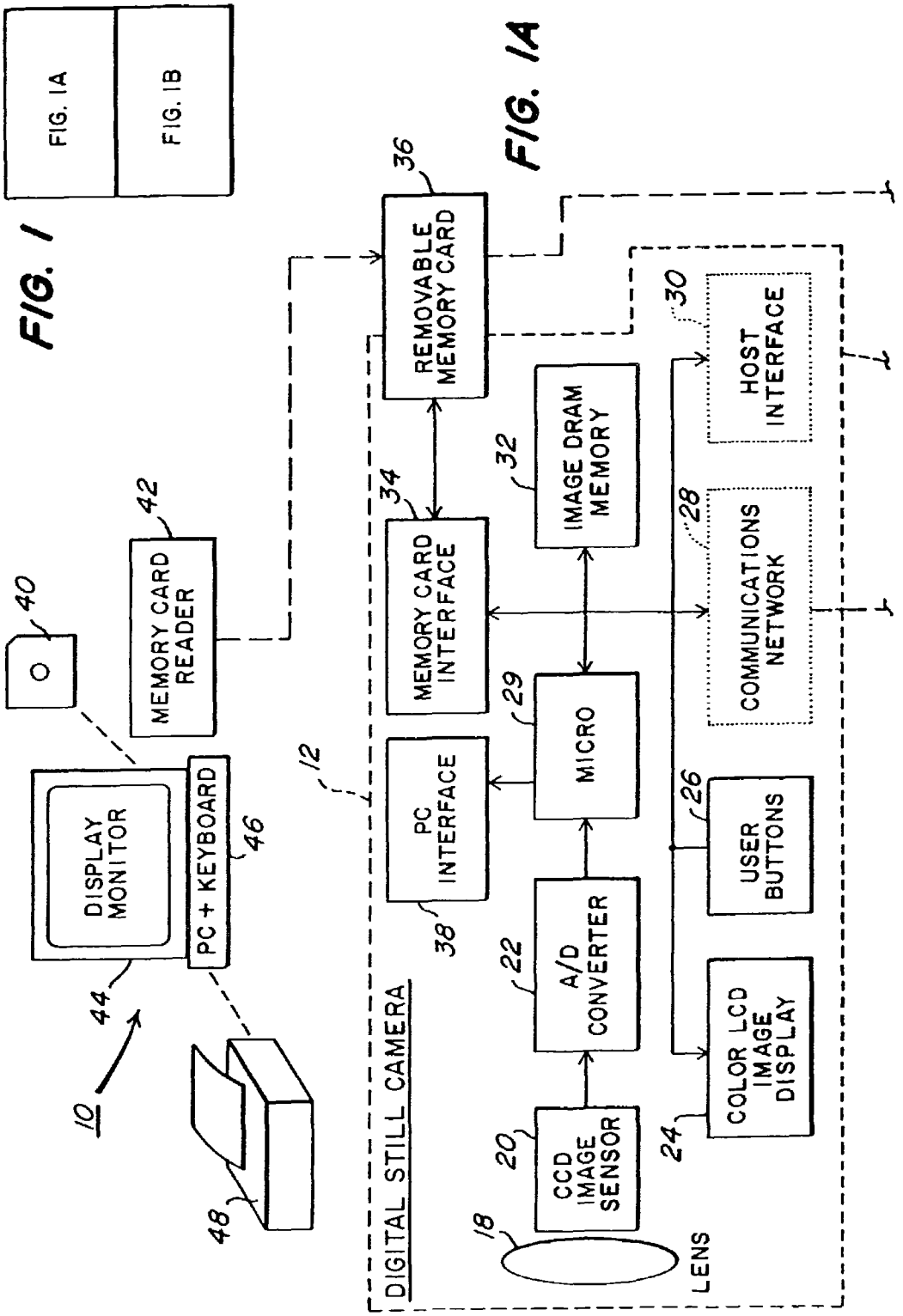
DIGITAL STILL CAMERA
12
LENS
18
CCD IMAGE SENSOR
20
A/D CONVERTER
22
COLOR LCD IMAGE DISPLAY
24
USER BUTTONS
26
COMMUNICATIONS NETWORK
28
MICRO
29
PC INTERFACE
38
MEMORY CARD INTERFACE
34
IMAGE DRAM MEMORY
32
HOST INTERFACE
30
REMOVABLE MEMORY CARD
36
MEMORY CARD READER
42
40
DISPLAY MONITOR
PC + KEYBOARD
46
44
10
48

FIG. 1A

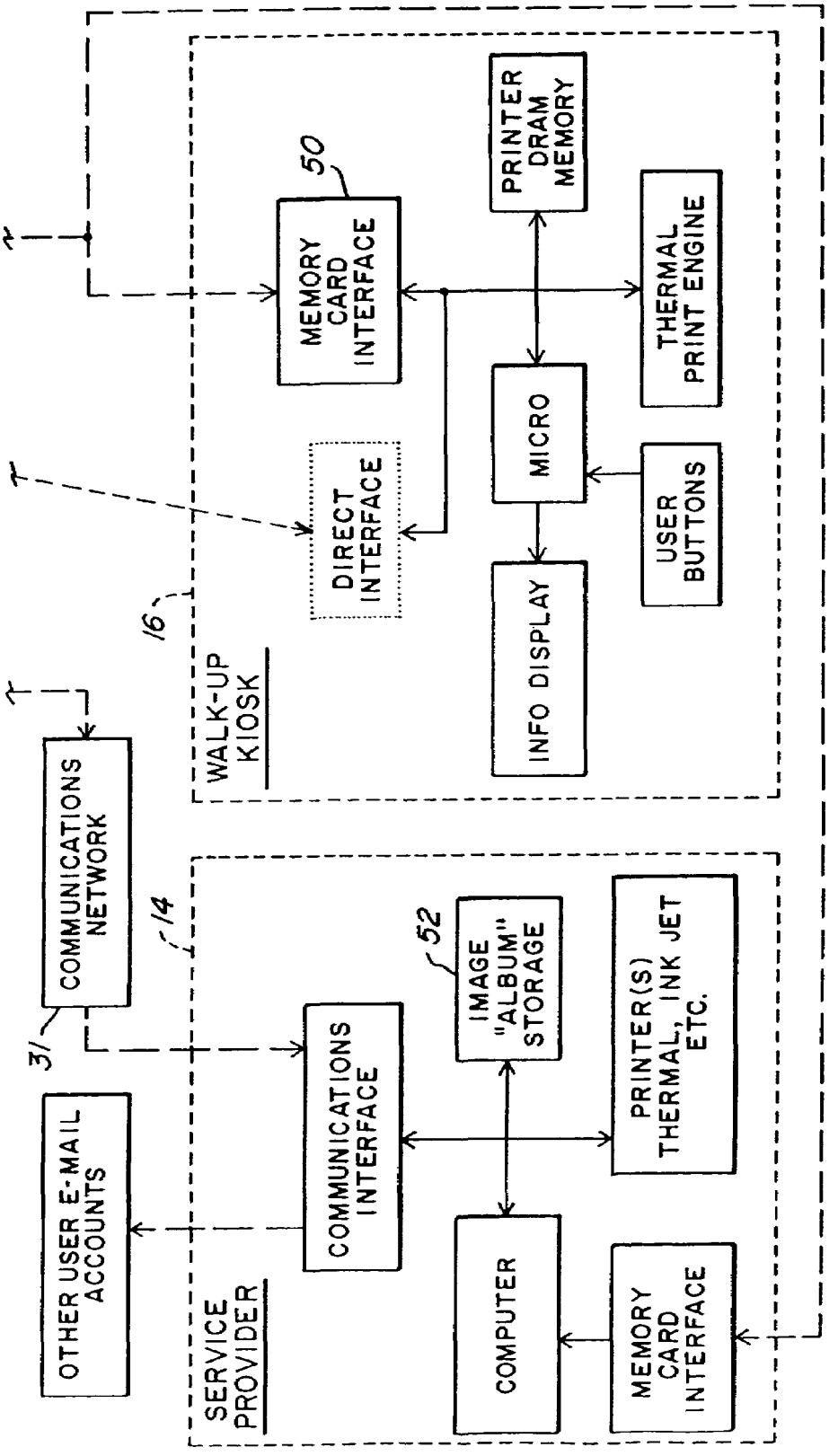
WALK-UP KIOSK
16
MEMORY CARD INTERFACE
50
PRINTER DRAM MEMORY
THERMAL PRINT ENGINE
MICRO
USER BUTTONS
DIRECT INTERFACE
INFO DISPLAY
COMMUNICATIONS NETWORK
31
SERVICE PROVIDER
14
COMMUNICATIONS INTERFACE
IMAGE "ALBUM" STORAGE
52
PRINTER(S) THERMAL, INK JET ETC.
OTHER USER E-MAIL ACCOUNTS
COMPUTER
MEMORY CARD INTERFACE

FIG. 1B

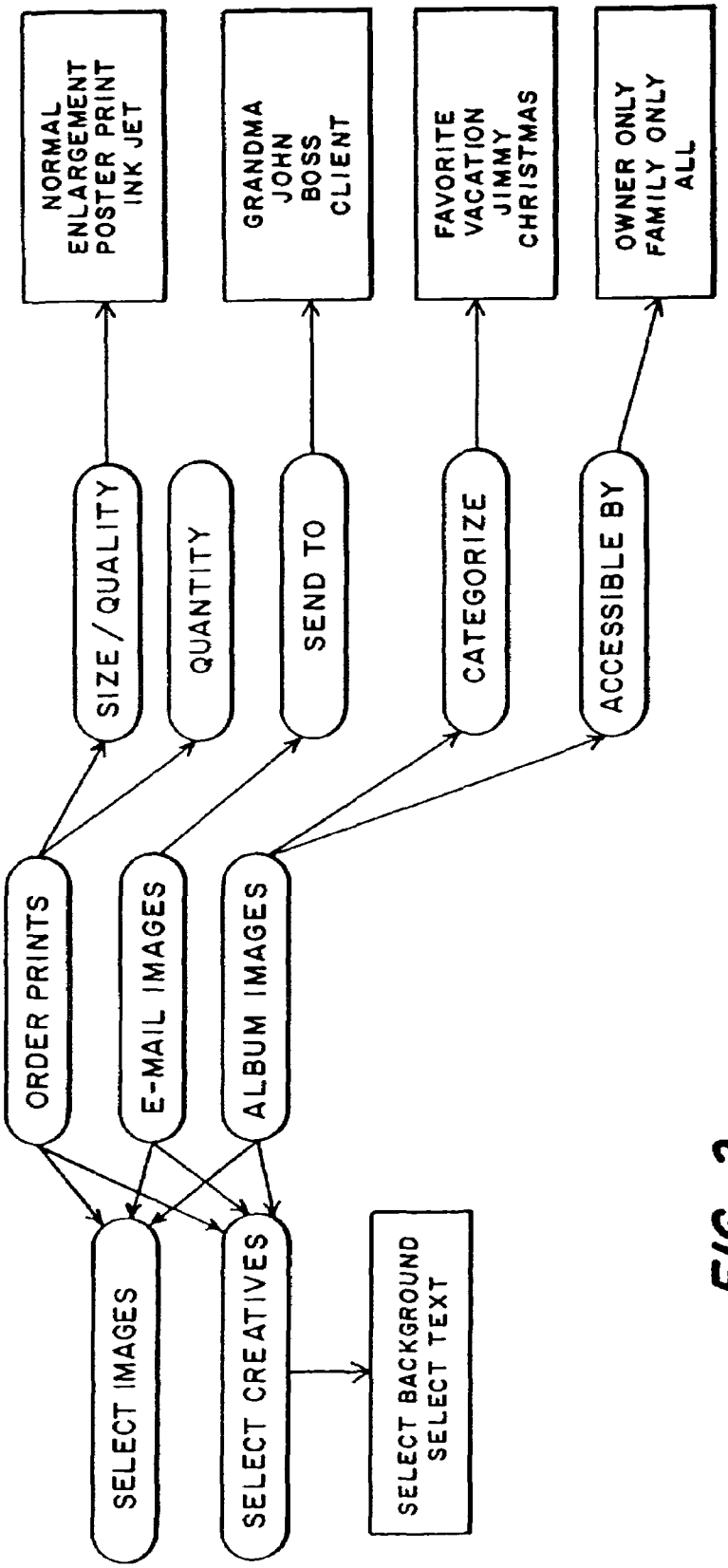
ORDER PRINTS
E-MAIL IMAGES
ALBUM IMAGES
SIZE / QUALITY
QUANTITY
SEND TO
CATEGORIZE
ACCESSIBLE BY
NORMAL
ENLARGEMENT
POSTER PRINT
INK JET
GRANDMA
JOHN
BOSS
CLIENT
FAVORITE
VACATION
JIMMY
CHRISTMAS
OWNER ONLY
FAMILY ONLY
ALL
SELECT IMAGES
SELECT CREATIVES
SELECT BACKGROUND
SELECT TEXT

FIG. 2

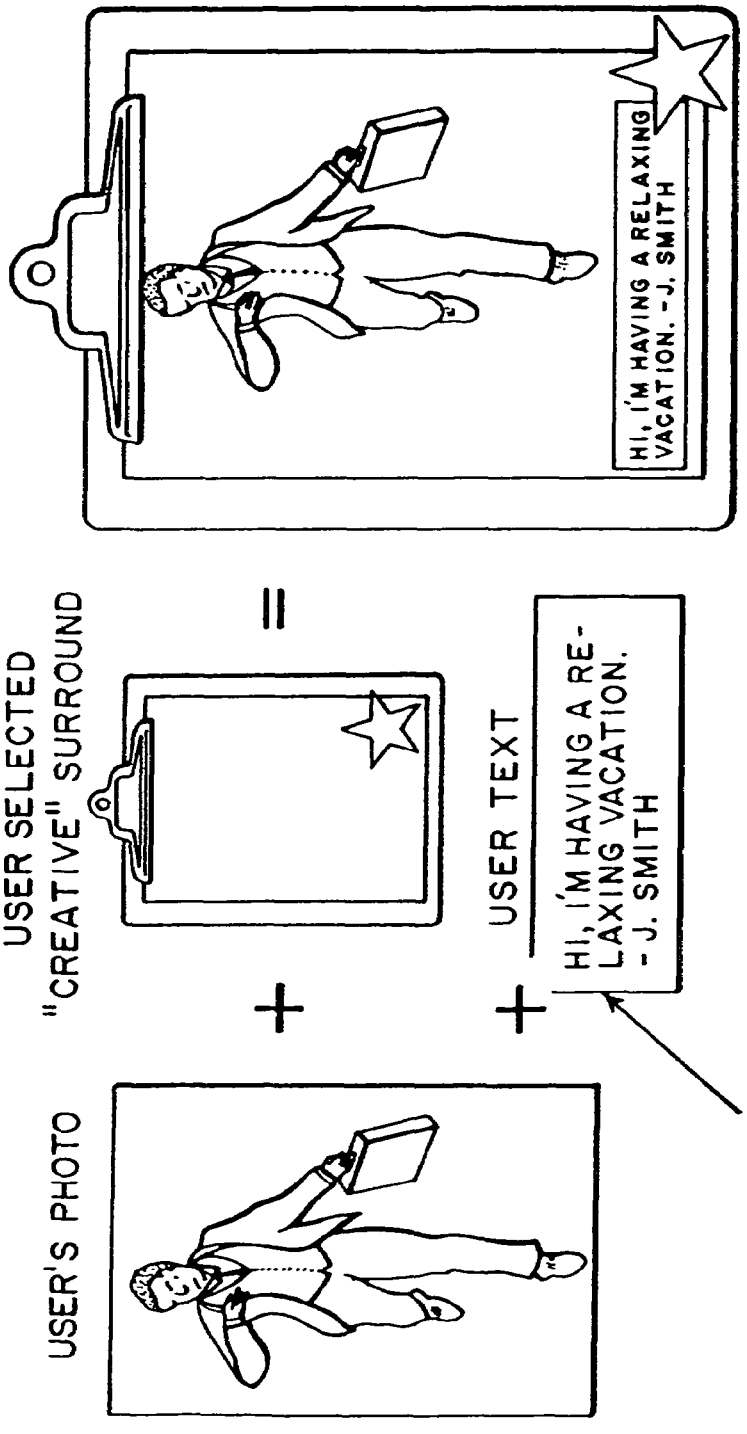
USER'S PHOTO
+
USER SELECTED "CREATIVE" SURROUND
=
USER TEXT
HI, I'M HAVING A RE-LAXING VACATION. - J. SMITH
+
INPUT VIA HOST PC, SELECT VIA CAMERA UI
HI, I'M HAVING A RELAXING VACATION. - J. SMITH

FIG. 3

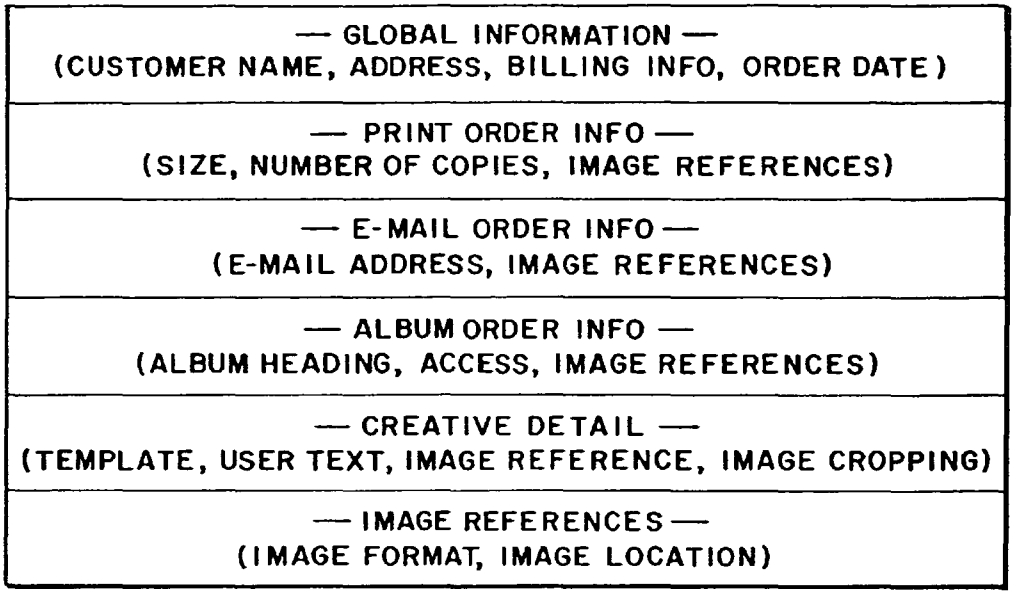
— GLOBAL INFORMATION —
(CUSTOMER NAME, ADDRESS, BILLING INFO, ORDER DATE)
— PRINT ORDER INFO —
(SIZE, NUMBER OF COPIES, IMAGE REFERENCES)
— E-MAIL ORDER INFO —
(E-MAIL ADDRESS, IMAGE REFERENCES)
— ALBUM ORDER INFO —
(ALBUM HEADING, ACCESS, IMAGE REFERENCES)
— CREATIVE DETAIL —
(TEMPLATE, USER TEXT, IMAGE REFERENCE, IMAGE CROPPING)
— IMAGE REFERENCES —
(IMAGE FORMAT, IMAGE LOCATION)

FIG. 4

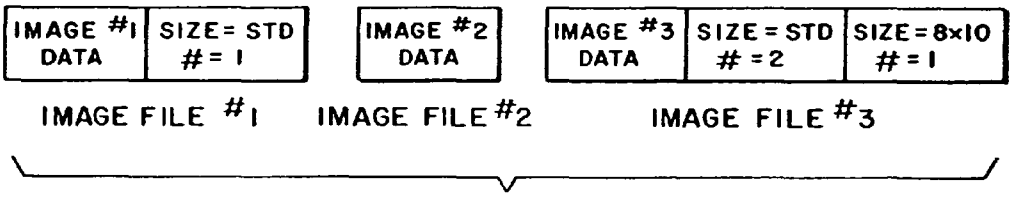
IMAGE #1 DATA
SIZE = STD # = 1
IMAGE #2 DATA
IMAGE #3 DATA
SIZE = STD # = 2
SIZE = 8×10 # = 1
IMAGE FILE #1
IMAGE FILE #2
IMAGE FILE #3

FIG. 5

CAPTURING DIGITAL IMAGES TO BE TRANSFERRED TO AN E-MAIL ADDRESS

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application is a Continuation Application of U.S. Ser. No. 09/821,152, filed Mar. 29, 2001 now U.S. Pat. No. 7,034,871, by Kenneth A. Parulski et al., entitled Electronic Still Camera for Capturing Digital Images to be Transferred to an E-Mail Address, which is a Continuation of U.S. Ser. No. 08/977,382, filed Nov. 24, 1997 now issued as U.S. Pat. No. 6,573,927 on Jun. 3, 2003.

FIELD OF THE INVENTION

The invention relates generally to the field of photography, and in particular to electronic photography. More specifically, the invention relates to an electronic camera that can be interfaced with a host computer.

BACKGROUND OF THE INVENTION

Digital cameras, such as the Kodak Digital Science DC25™ camera, allow images to be utilized on a home computer (PC) and to be incorporated into e-mail documents and personal home pages on the World Wide Web. Presently, if a print is desired, each image must first be copied to the PC and then individually printed. The user is required to manually select each image to be printed, and manually decide how big each print should be and how many prints to make of each image.

In addition, it is possible for users to electronically send images to others using software, such as the Kodak Digital Science Picture Postcard Software™. However, this again requires the user to manually download each image to the host computer, select each image to be transmitted, and create a new "Postcard" for each image to be sent. Users can also create "albums" of photos on their computers using software such as the Family Album Creator™ by Creative Wonders, Inc. Again, however, this is a manual process that requires each image to be downloaded to the computer, individually selected, and added to the album.

In U.S. Pat. No. 5,241,659, reprint information can be generated at the time a PhotoCD disc is played back. This patent describes an EEPROM card that can be inserted into a PhotoCD player. As shown in FIGS. **3**, **5**, and **6** of this patent, the EEPROM card can contain reprint order information and "album disc" information input by the player operator. However, this information is not generated at the time of picture taking, and is not stored on the same media as the images. Moreover, the reprint information does not include information useful to the service provider, such as user account, charge card, and mailing address.

What is needed is a way for camera users to quickly and easily compose "print orders" and "transmission orders" and/or "electronic albuming" orders, at the time they capture their images.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an electronic still camera for capturing images to be transferred to at least one e-mail address, the electronic still camera comprising:

(a) an image sensor for capturing a plurality of images of scenes and for producing image signals representative of the corresponding scenes;

(b) an analog-to-digital converter for digitizing the image signals to produce digital images;

(c) a removable memory card for storing a plurality of digital image files corresponding to the digital images;

(d) an internal memory for storing at least one digital image to be displayed and a plurality of e-mail addresses;

(e) a processor for controlling the transfer of the digital images from the removable memory card to the internal memory and for producing a utilization file;

(f) a display coupled to the internal memory for displaying at least one digital image; and

(g) a user interface for selecting at least one e-mail address and for scrolling through the plurality of digital images stored on the removable memory card in order to display and select particular digital images to be transferred to the selected at least one e-mail address, wherein the utilization file includes the at least one selected e-mail address and the name of at least one digital image file to be transferred to the at least one selected e-mail address and the processor stores the utilization file on the removable memory card separate from the digital image files.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of the system according to the invention;

FIG. **2** is a diagram of downstream services available in the system shown in FIG. **1**;

FIG. **3** is an illustration of one example of a creative background added to an image;

FIG. **4** is a diagram of the organization of a utilization file; and

FIG. **5** is a diagram of another organization of a utilization file together with each image file.

DETAILED DESCRIPTION OF THE INVENTION

Because imaging systems and devices are well known, the present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. Elements not specifically shown or described herein may be selected from those known in the art. Some aspects of the present description may be implemented in software. Unless otherwise specified, all software implementation is conventional and within the ordinary skill in the programming arts.

A system block diagram of the invention is shown in FIG. **1**, and includes a user's host computer (PC) **10**, a digital camera **12**, equipment located at a "downstream" service provider **14**, and equipment at a walk-up kiosk **16**. The camera **12** includes an optical section **18** for imaging a scene upon an image sensor **20** and generating an image signal, an A/D converter **22** for digitizing the image signal, a liquid crystal display (LCD screen) **24** for displaying images and other information, a number of user input buttons **26**, and both internal memory **32** and a removable memory card **36** for storing captured images. The camera **12** may optionally include an internal communications interface **28** (e.g., modem). A microprocessor **29** generally controls the operation of the camera **12**, and interchanges data through a memory card interface **34** with the memory card **36**, through a PC interface **38** with the host computer **10**, through a host interface **30** directly with the kiosk **16**, and through the communications interface **28** and a communications network **31** with the service provider **14**.

When the camera **12** is purchased, it is provided with a software application (located on a disc **40**) for running on the

user's host PC **10** that enables the user to specify the name(s) of downstream service providers, network addresses (friends, family or business associates) and related account information such as billing information (e.g., charge card number, mailing addresses). The user can also select, through the software application, one or more "creative backgrounds" offered by the service provider (such as a postcard border) and enter one or more text messages, (such as "Hi, I'm having a relaxing vacation, John Smith"), as will be described in connection with FIG. **3**. All of this information can then be downloaded, via a memory card reader **42** on the host PC **10**, to the removable memory card **36**, which can be subsequently inserted into the camera **12**. Alternatively, the information can be downloaded to the camera **12** via the host PC interface **38** and written to the camera's internal memory **32** or the removable memory card **36** in the camera. Typically, keyword descriptors accompany the information to enable easy access by the camera user.

After placing the memory card **36** in the camera **12** (or disconnecting the camera **12** from the host PC **10**), the user can operate the camera **12** to take numerous pictures, which are stored either in the internal memory **32** or in the memory card **36** (or in both). After taking pictures, the user reviews the images on the LCD screen **24**, using the buttons **26** to scroll through the images. The user can then select the desired "downstream services" (printing, e-mailing, and/or albuming) and compose the order using the options listed in FIG. **2**. These services and options are accessed from the memory card **36** and, for example, the keyword descriptors are assembled in a menu and displayed on the LCD screen **24**. Selections among these services and options are made, for example, by reference to the keyword descriptors and actuation of the user buttons **26**. The details of the order information is written into a "utilization" file generated by the camera **12** that identifies the order and includes pointers to the image files that store the images required to "fulfill" the order. The "utilization" file is stored in the internal memory **32** or the memory card **36**.

For printing, order composition involves selecting the quantity, print size, and quality level (e.g., thermal or ink jet) of the images to be printed. For example, the user might choose one "standard" (4"×6" size) image of 2 different images, and 2 standard size images plus one "enlargement" (8"×10" size) image of their "favorite" vacation image. The print order information is provided in the utilization file that identifies the order and includes pointers to the image files that store the images required to "fulfill" the print order. In addition to "normal" type prints, the prints can be "creative" prints, using one of the creative backgrounds selected on the host computer and downloaded to the camera along with text. In this case, the "favorite" image might be surrounded with one of the border and captions provided via the host PC **10**, as shown in FIG. **3**.

The user can then take or mail the image memory card **36** containing the image files and order information (utilization file) to the print service provider **14**. The provider reads the information, fills the print order, and returns the print order either for pick-up by the user or by mail. The service provider **14** charges the user's credit card account (which can be stored in the print order information file) for the prints provided. Alternatively, the user can place the card **36** in a slot **50** of a "walk-up kiosk" **16** along with a credit card. The kiosk can then automatically produce the prints required while minimizing the amount of user interaction required. Finally, the user could place the card in a home printer **48**, and the printer could automatically produce the quantity of prints of each image required. In the last two cases, the size and quality of print types available might be limited to those available by the kiosk **16** or the home printer **48**.

Alternatively, the camera **12** could incorporate or be connected to a wired or wireless modem, such as the communications interface **28**. In this case, the print order information, and the image information needed to fulfill the print order, would be transmitted to the service provider **14** along with the account information through the communication network **31** (which could be a wired or wireless network). The service provider **14** would print the order and mail the prints back to the user.

Instead of, or in addition to, composing a print order, the user may choose to transmit one or more images to others. These images can include the "creative" images and/or text described above. The user selects the images and the person(s) who will receive them, from the group of addresses loaded into the camera **12** via the process described earlier (the software application running on the home PC **10**). The e-mail order information is provided in the utilization file that gives the e-mail address and includes pointers to the image files that store the images required to "fulfill" the e-mail order.

If the camera **12** includes a transmitter, e.g., a cellular connection in the communications interface **28**, the camera **12** could include and initiate a "send" command that the user would enable after completing the e-mail order. This command would automatically send the appropriate images to the appropriate user's e-mail accounts through the network **31** using the appropriate communications protocol (i.e., FTP, mailto). Alternatively, the camera **12** can be placed in a docking unit (not shown) containing the modem. The images can then be automatically transmitted to the service provider **14**, when the camera **12** is inserted into the dock. Alternatively, the memory card **36** could be removed from the camera **12** and placed in a kiosk, which would then transmit the images and bill the user's charge card.

Instead of, or in addition to, composing a print order and/or an e-mail order, the user may choose to transmit one or more images to their "electronic photo album" account, which could be maintained by the service provider **14** (or alternatively could be maintained on the user's home computer **10**) in an image "album" storage **52**. In this case, the user selects the images to be transferred to their photo album, and optionally selects what group of users might be allowed to view the images. The groups may include "Self only", "Self plus immediate family only", and "All" (i.e., family, friends) The information may include text, which may be input and selected as described in U.S. Pat. No. 5,633,678, "An Electronic Still Camera for Capturing and Categorizing Images", filed Dec. 20, 1995, and assigned to the assignee of the present application, the disclosure of which is herein incorporated by reference.

Instead of having the camera **12** communicate directly to the "downstream" service provider **14** over the communications network **31**, the communications network **31** from the camera **12** could alternatively be connected to an internet service provider (ISP) (not shown) such as AOL (America On Line), Earthlink, and Eznet. The "downstream" service provider **14** would then be connected to all ISPs via the internet, eliminating the need to maintain a separate communications network. The ISP would transfer the utilization file data and images needed to order prints and album images to the downstream service provider. The ISP could itself handle e-mailing of images to other users, using the data and images in the utilization file.

The utilization order information is provided in the utilization file. The general file organization is shown in FIG. **4**, and a detailed example of the file contents of an elaborate

utilization file is given in Appendix I. This file may be encrypted to prevent unauthorized use of the sensitive information, such as the user's credit card number. Referring to Appendix I, a Global information section (lines **2-26**) provides the customer information (name, address, credit card), as well as the time the order was placed, and whether it has been processed or not.

The file may contain one or more Print Order sections. For example, lines **28-37** describe a print order of "standard" size (4"×6") prints of the images made on a silver halide based CRT printer. Line **34** indicates that two copies of the image referenced in line **33** will be printed, while only one copy of the images referenced in lines **35-36** is printed. A second print order section (lines **39-55**) indicates a large size print (24"× 36") should be made on a silver halide printer and mounted in particular in a walnut frame. This printer should be sent via UPS to the address shown in lines **47-52**. The image is the composite shown in FIG. **3**, which is described in the CreativeDetail section (lines **76-90**).

An e-mail order section (lines **57-65**) provides the e-mail address and a list of images that should be sent to this address. An album order section (lines **67-72**) provides a means for adding images to the users on-line photo album. The user can classify the images under a particular heading (e.g., "vacation" images) and indicate who is allowed to access the images via the internet.

A Creative Detail section (lines **74-90**) defines each creative image, such as the image in FIG. **3**. It also describes user defined text (line **81**). Multiple templates and user text options may be downloaded from the host computer to a memory card **36** that is then inserted into the camera **12**, prior to taking pictures. The template (background) may be an identification code that is only added, for example, during printing. In this case, the template is not viewed when the image is displayed on the camera **12**. Alternatively, a low resolution version of the templates desired by the user can be stored in the camera **12**, so that the user can preview the final composite image. A high resolution version of the template can be used by the service provider to print the final composite image. The user may decide to crop and rotate the image (lines **86-87**) prior to inserting it into the creative background.

Finally, an image detail section (**92-102**) describes the file type (e.g., FlashPix, JPEG, TIFF) and location of each image. In this example, the three images are all FlashPix images located on the memory card "Local Card" in the "vacation" folder.

Most of the information in GlobalInfo and CreativeDetail sections of the digital camera utilization file, for example the addresses and creative text, is downloaded from the host computer to the camera prior to picture taking. After reviewing the images, the user uses the image LCD and user interface to select which images to print, e-mail, and album. The print size, e-mail, albuming, and creative options are offered by pull-down menus that match the options provided by the service providers they have selected on the computer and downloaded to the camera **12** (via the memory card **36**). The full utilization file (i.e., Print order, e-mail order) is then created by the camera based on the user selections.

A much simpler print utilization file is shown in Appendix II. In this case, the camera **12** simply allows a print order to be created. The memory card **36** containing the images and the simple utilization file is then inserted into the home PC **10**, the home printer, or the walk-up kiosk **16** or sent to a service provider via a communications interface. The proper number of each selected image is then automatically printed, without further user intervention.

Instead of providing the utilization information for multiple images in a single utilization file, other embodiments are possible. For example, the camera may create three utilization files, one containing the information needed to produce a print order, a second containing information needed to provide electronic albuming, and a third containing e-mail order information. Alternatively, the utilization information may be provided with each image file, as shown in FIG. **5**. In this embodiment, the print order information describing the number and size of each image to be printed is included in tags provided within each image file. For example, image file #1 contains the image data and a tag indicating that the user has requested one standard size print. Image file #2 does not contain a print tag (or alternatively could include a tag with the number of prints set equal to zero) so no prints will be made of image #2. Image file #3 includes a first print tag indicating that the user has requested two standard size prints, and a second tag indicating that the user has also requested a single 8"×10" size enlargement.

The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

APPENDIX I: DIGITAL CAMERA UTILIZATION FILE

```
1   00000000 UTILIZATION ORDER SPECIFICATION
    (Non-zero initial number identifies encryption key)
2   %Section: GlobalInfo
3       %Section: ConsumerInfo (Provides info on camera owner and
        default mailing address)
4           %Name: ~Smith~~John~~W~
5           %Consumer ID: Njj1007
6           %Address: ~1 Picture Avenue~
7               ~Apartment 8b~
8               ~PO Box 123~
9               ~Anytown~
10              ~State~
11          %PostalCode: ~14650~
12          %CountryCode: USA
13          %Email: ~jdoe@kodak.com~
14          %PhoneDay: ~(716) 555-1111~
15          %PhoneNight: ~(716) 555-2222~
16          %CreditCardExpDate: 1996 03 24
```

-continued

```
            %CreditCardNumber: 3030445643345
            %CreditCardType: AmericanExpress
        %EndSection: ConsumerInfo

        %Section: OrderInfo (Provides infornation on when utilization file was created)
            %Date: 1996 2 28
            %Time: 14 22 29
            %Processed: 0 (1 Indicates that this utilization order was processed)
        %EndSection: OrderInfo
%EndSection: GlobalInfo

%Section: PrintOrder (Lists the images in a print order)
        %Section: FinishInfo
            %ImageOutputSize: 4 6 Inches (This example is for standard size prints)
            %MediaClass: AgX 20 EN34 Glossy
        %EndSeccion: FinishInfo
            %ImageRef: ImageDetail1 (Points to images defined below)
            %Quantity:2 (Optionally indicates number of copies, default = 1)
            %ImageRef: ImageDetail2
            %ImageRef: ImageDetail3
%EndSection: PrintOrder

%Section: PrintOrder
        %Section: FinishInfo
            %ImageOutputSize: 24 36 Inches (This example is for a large creative print)
            %MediaClass: AgX 20 EN34 Glossy
            %FrameType: F134 Walnut
        %EndSection: FinishInfo
        %Section: ShippingInfo (Instructions to ship to an address other than the one in
        GlobalInfo)
            %ShippingCarrier: UPS
            %Name: ~Good~~Johnny~~B~
            %Address: ~1 Song Street~
                ~Mytown~
                ~State~
            %PostalCode: ~00111~
            %CountryCode: USA
        %EndSection: ShippingInfo
        %ImageRef: CreativeDetail1 (Points to creative defined below)
%EndSection: PrintOrder

%Section: EmailOrder (Sends images via e-mail)
        %Section: AddressInfo (Instructions to ship to an address other than the one in
        GlobalInfo)
            %Name: ~Good~~Johnny~~B~
            %Email: ~jgood@localnet.net~
        %EndSection: AddressInfo
        %ImageRef: Creative Detail1 (Points to creative defined below)
        %ImageRef: ImageDetail2
        %ImageRef: Imagefletail3
%EndSection: EmailOrder

%Section: AlbumOrder (Add these images to on-line photo album)
        %AlbumHeading: ~Vacation images~ (Place images under "vacation"
        album heading)
        %AlbumViewing: All (gives access to all authorized album viewers)
        %ImageRef: CreativeDetail1 (Points to creative defined below)
        %ImageRef: ImageDetail2
%EndSection: AlbumOrder

%Section: CreativeDetail 1 (Describes each composite image)

        %LayoutRef: T12345 (Indicates template ID or template image file)
        %Section: PageInfo
            %PageRef: 0
            %Section: TextInfo (Indicates what text appears in the template)
                %TextNodeRef: 1
                %ConsumerText: ~Hi, I'm having a relaxing time on vacation. John Smith
            %EndSection: TextInfo
            %Section:ImageInfo (Indicates which images(s) appear in template)
                %ImageNodeRef: 2
                %ImageDetailRef: 1
                %CropRect: 256 0 768 1280 (Cropped image top, left, width, height)
                %Rotate: 90 (Indicates rotation in degrees clockwise)
            %EndSection: ImageInfo
        %EndSection: PageInfo
%EndSection: CreativeDetail

%Section: ImageData (Describes each image, may be referenced multiple times)
```

-continued

```
93        %Section: ImageDetail 1
94            %FileType: FlashPix Version 2.0
95            %ImageLocation: LocalCard~Vacation/Image4.FPX~
96        %Section: ImageDetail 2
97            %FileType: FlashPix Version 2.0
98            %ImageLocation: LocalCard~Vacation/Image7.FPX~
99        %Section: ImageDetail 3
100           %FileType: FlashPix Version 2.0
101           %ImageLocation: LocalCard~Vacation/Image10.FPX~
102   %EndSection: ImageData
```

APPENDIX II: SIMPLE PRINT ORDER UTILIZATION FILE

```
1     %Section:PrintOrder (Lists the images in a print order)
2         Image4.FPX 1 (One copy of image 4)
3         Image7.FPX 2 (Two copies of image 7)
4         Image10.FPX 1
5         Image12.FPX 4
6         Image13.FPX 1
7     %EndSection:PrintOrder
```

What is claimed is:

1. An electronic camera for capturing images to be transferred to at least one e-mail address, the electronic camera comprising:

(a) an image sensor for capturing a plurality of images;

(b) a first memory for storing the plurality of images;

(c) a second memory for storing a plurality of e-mail addresses;

(d) a processor for producing a utilization file;

(e) a display coupled to the first memory for displaying at least one of the plurality of stored images; and

(f) a user interface for selecting at least one e-mail address stored in the second memory and for scrolling through the plurality of images stored in the first memory in order to display and select at least one image to be transferred to the selected at least one e-mail address, wherein the utilization file identifies the at least one selected e-mail address and the at least one image to be transferred to the at least one selected e-mail address.

2. The electronic camera as claimed in claim **1** wherein the first memory is a removable memory card.

3. The electronic camera as claimed in claim **1** further including a communications interface which interfaces to a communications network for transferring the at least one selected image to the at least one selected e-mail address.

4. The electronic camera as claimed in claim **3** wherein the communications interface includes a transmitter.

5. The electronic camera as claimed in claim **4** wherein the transmitter provides a cellular connection.

6. The electronic camera as claimed in claim **4** wherein the electronic camera provides a send command to initiate transfer of the at least one selected image to the at least one selected e-mail address using the transmitter.

7. The electronic camera as claimed in claim **1** further including a separate docking unit having a modem for transferring the at least one selected image to the at least one selected e-mail address.

8. The electronic camera as claimed in claim **7** wherein the at least one selected image is transmitted to a service provider, and the service provider then transfers the at least one selected image to the at least one selected e-mail address.

9. The electronic camera as claimed in claim **1** wherein the plurality of images are stored in a corresponding plurality of digital image files.

10. The electronic camera as claimed in claim **9** wherein the digital image files are JPEG files.

11. The electronic camera as claimed in claim **1** wherein the utilization file identifies at least two digital images.

12. The electronic camera as claimed in claim **1** wherein the utilization file identifies the camera owner.

13. A method for capturing images to be transferred to at least one e-mail address, comprising:

(a) storing a plurality of e-mail addresses in a memory of an electronic camera;

(b) capturing a plurality of images of scenes with the electronic camera;

(c) storing the plurality of images in a memory of the electronic camera;

(d) providing a user interface in the electronic camera for selecting at least one e-mail address from the stored plurality of e-mail addresses and for scrolling through the plurality of stored images in order to display and select particular images to be transferred from the electronic camera to the selected at least one e-mail address;

(e) transferring the selected images to the selected at least one e-mail address.

14. The method as claimed in claim **13** wherein the plurality of e-mail addresses are transferred from a separate device to the electronic camera.

15. The method as claimed in claim **14** wherein the separate device is a PC.

16. The method as claimed in claim **13** further including interfacing to a communications network and transferring the selected images to the at least one selected e-mail address.

17. The method as claimed in claim **16** wherein the communications network includes a cellular transmitter.

18. The method as claimed in claim **13** wherein the selected images are transmitted to a service provider, and the service provider then transfers the selected images to the at least one selected e-mail address.

19. The method as claimed in claim **13** further including producing a utilization file that identifies the at least one selected e-mail address and the selected images.

20. The method as claimed in claim **13** wherein the plurality of images is stored in a corresponding plurality of JPEG image files.

* * * * *

EXHIBIT E

US007936391B2

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

(10) **Patent No.: US 7,936,391 B2**
(45) **Date of Patent: *May 3, 2011**

(54) **DIGITAL CAMERA WITH COMMUNICATIONS INTERFACE FOR SELECTIVELY TRANSMITTING IMAGES OVER A CELLULAR PHONE NETWORK AND A WIRELESS LAN NETWORK TO A DESTINATION**

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(73) Assignee: **Eastman Kodak Company**, Rochester, NY (US)

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/625,692**

(22) Filed: **Nov. 25, 2009**

(65) **Prior Publication Data**

US 2010/0073489 A1 Mar. 25, 2010

Related U.S. Application Data

(60) Continuation of application No. 11/692,224, filed on Mar. 28, 2007, now Pat. No. 7,742,084, which is a continuation of application No. 09/783,437, filed on Feb. 14, 2001, now Pat. No. 7,256,823, which is a division of application No. 09/004,046, filed on Jan. 7, 1998, now Pat. No. 6,784,924.

(60) Provisional application No. 60/037,962, filed on Feb. 20, 1997.

(51) **Int. Cl.**
H04N 5/222 (2006.01)

(52) **U.S. Cl.** **348/333.02**

(58) **Field of Classification Search** 348/231.2–231.3, 348/211.2–211.4, 333.01–333.02
See application file for complete search history.

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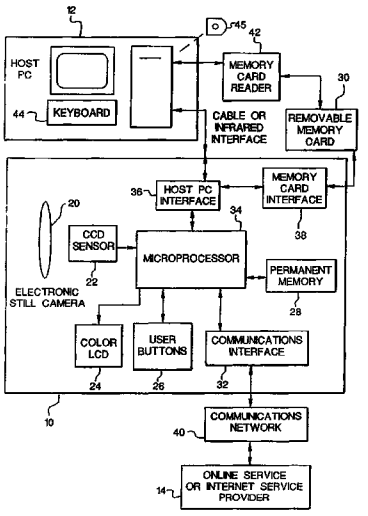
Primary Examiner — Tuan Ho
(74) *Attorney, Agent, or Firm* — Peyton C. Watkins

(57) **ABSTRACT**

Digital camera includes an image sensor receiving incident light of a scene, the digital camera captures an image corresponding to the incident light; display displays the plurality of captured images and displays a menu of destinations; at least one user input for selection of at least one image from the plurality of captured images and a destination from the menu of destinations displayed on the display; communications interface transmits the at least one selected image to the selected destination over one of a plurality of networks, the plurality of networks including at least two different types of wireless networks; memory; and processor coupled to the image sensor, the display, the at least one user input, the communications interface, and the memory, the processor controlling the transmission of the at least one selected image to the selected destination using either one of the at least two different types of wireless networks.

18 Claims, 4 Drawing Sheets



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Sharp MI-10 Zaurus Camera Document, 3 pages (English translation included).

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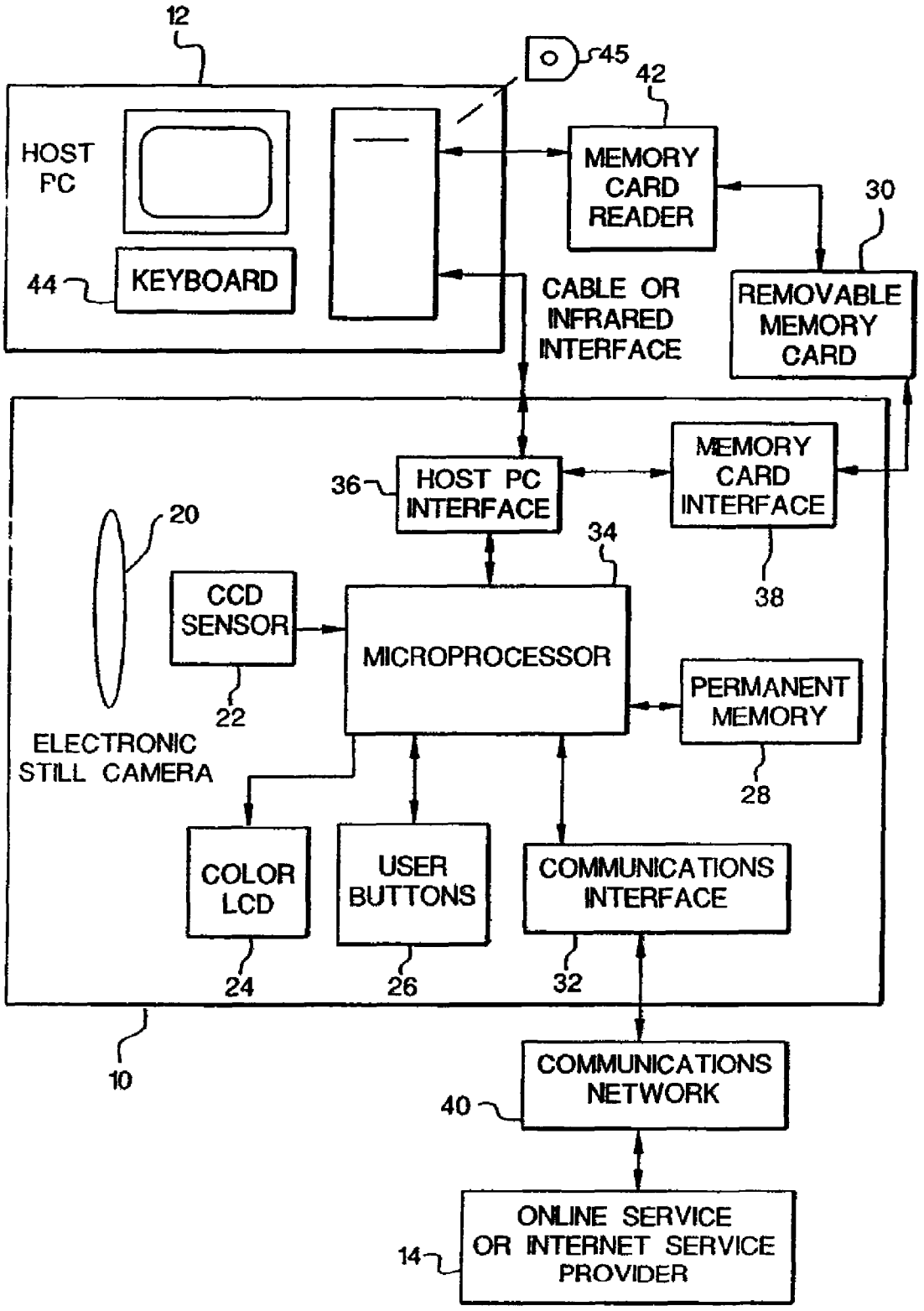

12
45
42
HOST PC
MEMORY CARD READER
30
44
KEYBOARD
CABLE OR INFRARED INTERFACE
REMOVABLE MEMORY CARD
36
HOST PC INTERFACE
MEMORY CARD INTERFACE
20
34
CCD SENSOR
MICROPROCESSOR
38
PERMANENT MEMORY
22
ELECTRONIC STILL CAMERA
28
COLOR LCD
USER BUTTONS
COMMUNICATIONS INTERFACE
24
26
32
10
COMMUNICATIONS NETWORK
40
ONLINE SERVICE OR INTERNET SERVICE PROVIDER
14

FIG. 1

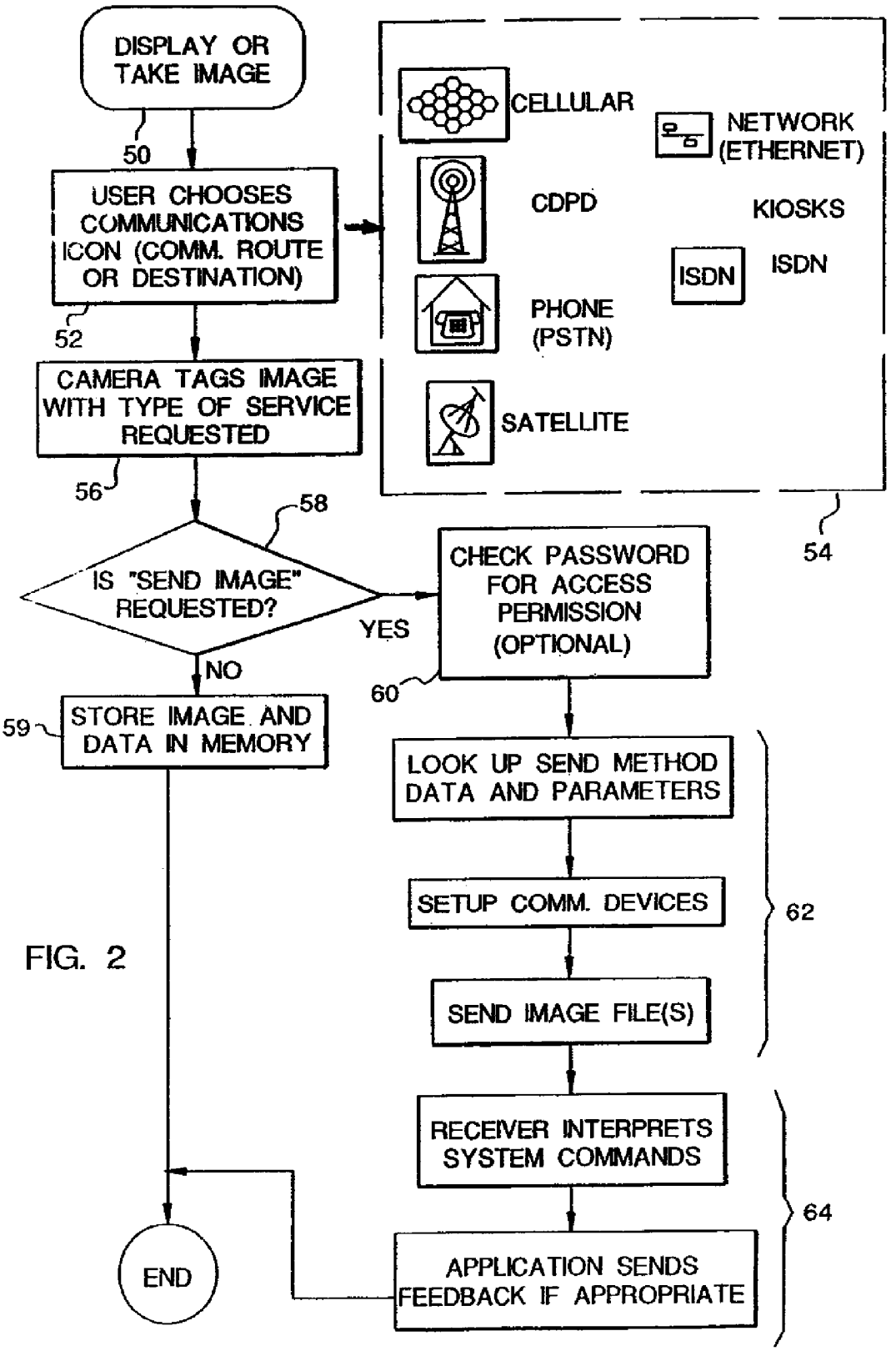

DISPLAY OR TAKE IMAGE
50
USER CHOOSES COMMUNICATIONS ICON (COMM. ROUTE OR DESTINATION)
52
CAMERA TAGS IMAGE WITH TYPE OF SERVICE REQUESTED
56
58
IS "SEND IMAGE" REQUESTED?
YES
NO
CHECK PASSWORD FOR ACCESS PERMISSION (OPTIONAL)
60
59
STORE IMAGE AND DATA IN MEMORY
LOOK UP SEND METHOD DATA AND PARAMETERS
SETUP COMM. DEVICES
SEND IMAGE FILE(S)
62
RECEIVER INTERPRETS SYSTEM COMMANDS
APPLICATION SENDS FEEDBACK IF APPROPRIATE
64
END
CELLULAR
NETWORK (ETHERNET)
CDPD
KIOSKS
ISDN
ISDN
PHONE (PSTN)
SATELLITE
54

FIG. 2

FIG. 3

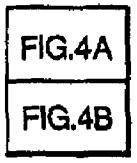


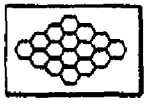
FIG. 4

FIG. 4A

PHONE (PUBLIC SWITCHED TELEPHONE NETWORK)

PROTOCOL TYPE	PHONE NUMBER	DEFAULT SETTINGS	MODERN CONTROL STRING	ACCOUNT DATA	PASSWORD	SYSTEM COMMANDS

CELLULAR OR PCS



PROTOCOL TYPE	PHONE NUMBER	DEFAULT SETTINGS	MODERN CONTROL STRING	ACCOUNT DATA	PASSWORD	SYSTEM COMMANDS	ERROR PROTOCOL	RADIO TYPE

WIRELESS LAN

PROTOCOL TYPE	PHONE NUMBER	DEFAULT SETTINGS	PARA-METER FILE	ACCOUNT DATA	PASSWORD	SYSTEM COMMANDS

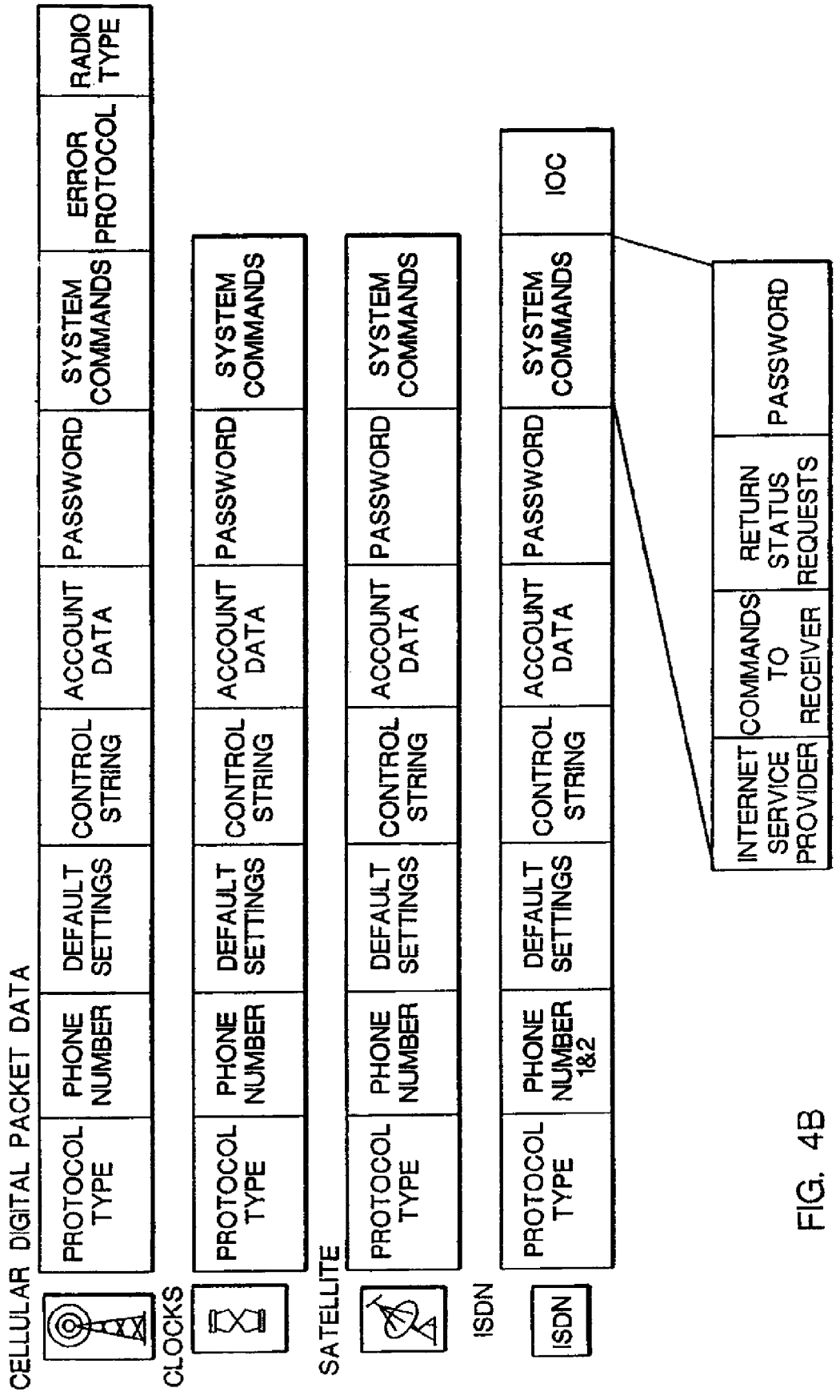

CELLULAR DIGITAL PACKET DATA
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
ERROR PROTOCOL
RADIO TYPE
CLOCKS
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
SATELLITE
PROTOCOL TYPE
PHONE NUMBER
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
ISDN
PROTOCOL TYPE
PHONE NUMBER 1&2
DEFAULT SETTINGS
CONTROL STRING
ACCOUNT DATA
PASSWORD
SYSTEM COMMANDS
IOC
INTERNET SERVICE PROVIDER
COMMANDS TO RECEIVER
RETURN STATUS REQUESTS
PASSWORD

FIG. 4B

DIGITAL CAMERA WITH COMMUNICATIONS INTERFACE FOR SELECTIVELY TRANSMITTING IMAGES OVER A CELLULAR PHONE NETWORK AND A WIRELESS LAN NETWORK TO A DESTINATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation of U.S. Ser. No. 11/692,224 filed Mar. 28, 2007, now U.S. Pat. No. 7,742,084, which is a continuation of U.S. Ser. No. 09/783,437 filed Feb. 14, 2001 (which issued as U.S. Pat. No. 7,256,823 on Aug. 14, 2007, which is now Reissue application Ser. No. 12/540,610) which is a divisional of U.S. Ser. No. 09/004,046 filed Jan. 7, 1998 (now U.S. Pat. No. 6,784,924 which issued on Aug. 31, 2004) which claims the benefit of U.S. Provisional Application No. 60/037,962 filed Feb. 20, 1997

FIELD OF THE INVENTION

The invention relates generally to the filed of photography, and in particular to electronic photography. More specifically, the invention relates to a digital camera that interfaces with a host computer.

BACKGROUND OF THE INVENTION

Digital cameras, such as the Kodak Digital Science DC25™ camera, allow images to be utilized on a home computer (PC) and to be incorporated into e-mail documents and personal home pages on the World Wide Web. Presently, images must be copied to the PC and transmitted as e-mail, for example using an online service or an Internet Service Provider (ISP), via a modem from the user's PC. It would be desirable to be able to transmit pictures directly from the digital camera instead of first transferring the pictures to a PC. For instance, on a vacation trip, it is desirable to immediately share pictures with friends or relatives via e-mail or Internet access. It is also desirable to transmit pictures from a location without PC access in order to free up camera storage to take additional pictures. There are a wide variety of connection means to online services such as America On Line, ISPs, and bulletin board services. Each of these services typically requires an account name and password, as well as local telephone access numbers, and specific communications settings. It would be difficult to provide an easy-to use means with buttons or menus on a small digital camera to input and/or modify all of these required settings.

SUMMARY OF THE INVENTION

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 invention resides in a digital camera for capturing a plurality of images comprising an image sensor for receiving incident light of a scene, the digital camera capturing an image corresponding to the incident light of the scene; a display for displaying the plurality of captured images and for displaying a menu of destinations; at least one user input for selection of at least one image from the plurality of captured images and a destination from the menu of destinations displayed on the display; a communications interface for transmitting the at least one selected image to the selected destination over one of a plurality of networks, the plurality of networks including at least two different types of wireless networks; a memory; and a processor coupled to the image sensor, the display, the at least one user input, the communications interface, and the memory, the processor controlling the transmission of the at least one selected image to the selected destination using either one of the at least two different types of wireless networks.

These and other aspects, objects, features and advantages of the present invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiment and appended claims, and by reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a system block diagram of the invention.

FIG. **2** is a diagram showing the steps used to automatically transmit images using the network configuration file.

FIG. **3** is a diagram of an image file.

FIG. **4** is a diagram showing several versions of the network configuration file.

DETAILED DESCRIPTION OF THE INVENTION

Because imaging systems and devices are well known, the present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. Elements not specifically shown or described herein may be selected from those known in the art. Some aspects of the present description may be implemented in software. Unless otherwise specified, all software implementation is conventional and within the ordinary skill I the programming arts.

A system block diagram of the invention is shown in FIG. **1** including an electronic still camera **10**, a host computer (PC) **12** and a service provider **14**. The camera includes an optical section **20** for imaging a scene upon a CCD sensor **22** and generating an image signal, a liquid crystal display (LCD) **24** for displaying images and other information, a number of user input buttons **26**, both permanent memory **28** and removable memory **30**, and an internal communications interface (**32**) (e.g., modem). This interface may connect to a variety of known networks, such as a public switched telephone network (PSTN), ISDN, an RF cellular phone network, or Ethernet. The camera **10** also includes a microprocessor **34** for generally controlling the camera functions, as well as the interchange of data with the host PC **12** and the memory card **30** through a host PC interface **36** and a memory card interface **38**, respectively. Besides the host PC **12**, the system includes a network connection **40** to the online service or ISP (Internet Service Provider) **14**. Alternately, the network **40** can connect to the user's home PC **12**.

When the camera **10** is first purchased (or at any time thereafter), it is connected to the PC **12** via the host PC **36** interface and a software application (stored on a disc **45**) running on the host PC **12** will enable the user to specify the name of a destination ISP or online service and to input from the host PC keyboard **44** the appropriate communication settings and account information. This information generates a network configuration file, which then can then be downloaded to the camera **10** through the host PC interface **36**, which may be a wired or infrared (e.g., IrDA) interface, and written to the camera's internal memory **28** and/or the removable memory card **30**. Alternatively, a host PC equipped with a memory card reader/writer **42** can write the information directly to the card **30** without connecting the camera through its host PC interface **36**. Also, this information could be

predetermined by the user and stored in a "preferences" file on the host PC **12** and then transferred to the camera **10** from this file without further intervention by the user. Multiple sets of destination services can be stored on the memory card **30**. Typically, keyword or graphic descriptors (e.g., icons) accompany the information in the network configuration file about destination services to enable easy access by the camera user.

The steps used to automatically transmit images using the network configuration file are shown in FIG. **2**. After disconnecting the camera from the host PC, the user operates the camera to take pictures (step **50**). This is typically done at a remote location, for example while traveling to another city. As the user takes or reviews images on the image LCD display, the decision can be made to transmit one or more images (step **52**). This is done by choosing one of the keywords or icons in a menu **54** shown in FIG. **2**, which are displayed on the LCD **24** and selected, e.g., through the user buttons **26**. (Note that a camera will typically only include a subset (only those desired by the user) of all the different services shown.) The selected image files may be tagged with a code (step **56**) indicating which service is requested, as shown in FIG. **3**. (Alternately, an "image utilization" file can be created in the camera storing a list of images to be transmitted by a particular method, as described in the cross-referenced copending patent application (U.S. Ser. No. 60/037,963). As described in that patent application, the details of an order, e.g., number of print copies to be made from an image and the size of the prints and/or a list of images to be e-mailed to various recipients, is written into the "utilization" file, which identifies the order and includes pointers to the image files that store the images required to "fulfill" the order. The "utilization" file is stored in the internal memory **28** or the memory card **30**.)

Next, the system determines whether a request exists to send an image (step **58**). If no request is present, the image and associated data is stored in either permanent memory **28** or the memory card **30** (step **59**). (Typically, all images are initially saved in memory whether eventually sent or not.) Otherwise, if there is a request to send an image, the user ensures that the camera is connected to the appropriate service (wired telephone line, cellular phone, kiosk, etc.) and pushes a "send" button in the user button section **26**, or selects a "send" menu option on the LCD **24**. The camera then utilizes the appropriate network configuration file, shown in FIG. **4**. Each network configuration file contains items such as the protocol type, phone number, etc., as described in Appendix I. The user password may be checked against the password in the network configuration file to ensure that the user is authorized to connect the camera to the desired service (step **60**). Alternately, the stored password in the appropriate configuration file can be used. Next, the camera uses the parameters in the configuration file to establish communications with the service and send one or more image files as selected by the user (steps **62**). The service receiver interprets the system commands issued by the camera from the network configuration file list and sends appropriate feedback (such as "transfer in progress" and "transfer complete") which are interpreted by the camera and displayed on the LCD **24** (steps **64**).

For example, when the camera uses a normal wired telephone (Public Switched Telephone Network) connection (i.e., network **40**) to the camera's internal modem **32**, after the user selects the images to be sent and presses the "send" button, the camera performs the following steps without user intervention:

1) Read the appropriate connection parameters from the network configuration file (on the memory card **30** or internal camera memory **28**), dial the phone and establish the connection to the destination service **14**.
2) Read the user's account name and password and transmit these to "log-on" to the service **14**.
3) Using the appropriate communications protocol (FTP, mailto, etc.), transmit the selected image or images to the destination service **14**.

The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variation and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

APPENDIX I

These are descriptions of the tags listed in the previous drawing:

Protocol Type

Each communication method has its own protocol, or rules to communicate. This tag identifies that protocol and where to find it. For example, the Network may use TCP/IP and a modem may use XModem.

Phone Number

This is the number of the receiving service. If internet access is requested, this could be the number of the Internet Service Provider. For ISDN, some systems require two phone numbers, dialed and connected to in sequence.

Default Settings

Standard settings that make the communications device compatible with the imaging device.

Modem Control String

Modem and communications devices have a command language that can set them up before they are used. For example, modems have many options controlled by command strings including volume level, the amount of time the carrier is allowed to fail before the system hangs up, and so on.

Account Data

This can be internet account data, charge number data, phone card data, billing address, and data related to the commerce part of the transmission.

Password

Any password needed to get into the communications system. Other passwords to get into the remote application or destination are located in the System Commands section.

System Commands

These are commands that control the end destination.

Error Protocol

In cellular and some other wireless communications, error protocols are used to increase the robustness of the link. For example, MNP10 or ETC may be used for cellular links.

Radio Type

The type of radio used for this communications feature may be identified here. Some cell phones have modems built in, others will have protocols for many communications functions built in. The radio type will make the imaging device adapt to the correct interface.

IOC

ISDN Ordering Code identifies what features are available on the ISDN line provided by the teleco. It is used to establish the feature set for that communications link.

Internet Service Provider

This identifies the actual service provider and any specific information or sequence of information that the service wants to see during connection and logoff. It also tells the device how to handle the return messages, like "time used" that are returned by the server.

Commands to Receiver

This may be a list of commands to control the receiving application. For example, a command to print one of the images and save the data to a particular file on a PC may be embedded here.

Return Status Requests

This tag can set up the ability of the application to tell if an error has occurred, or what the status of the application might be. The data here will help the device decide if it should continue communicating and a set user interface response can be developed around this feedback.

The invention claimed is:

1. A digital camera for capturing a plurality of images comprising:

an image sensor for receiving incident light of a scene, the digital camera capturing an image corresponding to the incident light of the scene;

a display for displaying the plurality of captured images and for displaying a menu of destinations;

at least one user input for selection of at least one image from the plurality of captured images and a destination from the menu of destinations displayed on the display;

a communications interface for transmitting the at least one selected image to the selected destination over one of a plurality of networks, the plurality of networks including at least two different types of wireless networks;

a memory; and

a processor coupled to the image sensor, the display, the at least one user input, the communications interface, and the memory, the processor controlling the transmission of the at least one selected image to the selected destination using either one of the at least two different types of wireless networks.

2. The digital camera of claim **1**, wherein the at least two different types of wireless networks include a cellular phone network and a wireless LAN.

3. The digital camera of claim **2**, wherein the image sensor, the display, the at least one user input, and the communications interface are directly coupled to the processor, and the memory is coupled to the processor via a memory interface, and wherein the memory stores first information used by the processor to control the communications interface to enable transmission over the cellular phone network, and stores second information used by the processor to control the communications interface to enable transmission over the wireless LAN.

4. The digital camera of claim **3**, wherein the first information is stored in a first configuration file and the second information is stored in a second configuration file.

5. The digital camera of claim **4**, wherein the first and second configuration files are generated by a separate device, and transferred from the separate device to the memory of the digital camera.

6. The digital camera of claim **5**, wherein the separate device is a computer.

7. The digital camera of claim **1**, wherein the memory is an internal memory.

8. The digital camera of claim **1**, wherein the memory is a removable memory card.

9. The digital camera of claim **3**, wherein the first information includes a phone number associated with the selected destination.

10. The digital camera of claim **3**, wherein the first and second information include account data.

11. A digital camera for capturing a plurality of images comprising:

an image sensor for receiving incident light of a scene, the digital camera capturing an image corresponding to the incident light of the scene;

a display for displaying the plurality of captured images;

at least one user input for selection of at least one image from the plurality of captured images;

a communications interface for transmitting the at least one selected image over one of a plurality of networks, the plurality of networks including a cellular phone network and a wireless LAN;

a processor coupled to the image sensor, the display, the at least one user input, and the communications interface, the processor controlling the transmission of the at least one selected image to a destination;

a memory coupled to the processor for storing first information used by the processor to control the communications interface to transmit to the destination over the cellular phone network when the camera is connected to the cellular phone network, and for storing second information used by the processor to control the communications interface to transmit to the destination over the wireless LAN when the camera is connected to the wireless LAN.

12. The digital camera of claim **11**, wherein the first information is stored in a first configuration file and the second information is stored in a second configuration file.

13. The digital camera of claim **12**, wherein the first and second configuration files are generated by a separate device, and transferred from the separate device to said memory of said digital camera.

14. The digital camera of claim **13**, wherein the separate device is a computer.

15. The digital camera of claim **11**, wherein the memory is an internal memory.

16. The digital camera of claim **11**, wherein the memory is a removable memory card coupled to the processor via a memory card interface, and wherein the image sensor, the display, the at least one user input, and the communications interface are directly coupled to the processor.

17. The digital camera of claim **11**, wherein the first information includes a phone number associated with the destination.

18. The digital camera of claim **11**, wherein the first and second information include account data.

* * * * *