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(54) **METHOD AND SYSTEM FOR VIEWING IMAGES FROM AN IMAGE CAPTURE DEVICE ON A HOST COMPUTER**

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(51) **Int. Cl.**
G06F 15/00 (2006.01)

(52) **U.S. Cl.** **715/501.1**; 715/500.1

(58) **Field of Classification Search** 707/501, 707/500.1; 709/201, 205, 247; 345/302; 715/501.1, 715/500.1, 530
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,335,072	A		8/1994	Tanaka et al.	348/232
5,633,678	A		5/1997	Parulski et al.	348/232
5,640,193	A		6/1997	Wellner	348/7
5,640,204	A	*	6/1997	Tsutsui	348/231
5,649,186	A		7/1997	Ferguson	395/610
5,659,729	A		8/1997	Nielsen	395/603
5,721,908	A		2/1998	Lagarde et al.	395/610
5,805,829	A	*	9/1998	Cohen et al.	395/200.32
5,818,977	A	*	10/1998	Tansley	382/294
5,848,420	A		12/1998	Xu	707/104
5,861,918	A	*	1/1999	Anderson et al.	348/233
5,898,779	A	*	4/1999	Squilla et al.	380/23
5,898,833	A		4/1999	Kidder	395/200.64
5,943,050	A	*	8/1999	Bullock et al.	715/783
6,005,613	A	*	12/1999	Endsley et al.	348/231
6,035,323	A	*	3/2000	Narayen et al.	709/201
6,058,428	A	*	5/2000	Wang et al.	709/232
6,078,756	A	*	6/2000	Squilla et al.	396/300
6,094,221	A	*	7/2000	Andersion	348/231
6,122,409	A	*	9/2000	Boggs et al.	382/276
6,161,131	A	*	12/2000	Garfinkle	709/206
6,334,025	B1		12/2001	Yamagami	386/96

(Continued)

FOREIGN PATENT DOCUMENTS

EP	0650125	A1	4/1995
EP	664475	A1 *	5/1995
EP	0890919	A	1/1999
JP	2000-287110		10/2000
WO	WO98/14887		4/1998

OTHER PUBLICATIONS

fMann, Headmounted Wireless Video: Computer–Supported Collaboration for Photojournalism and Everyday Use, IEEE Jun. 1998, pp. 144–151.*

(Continued)

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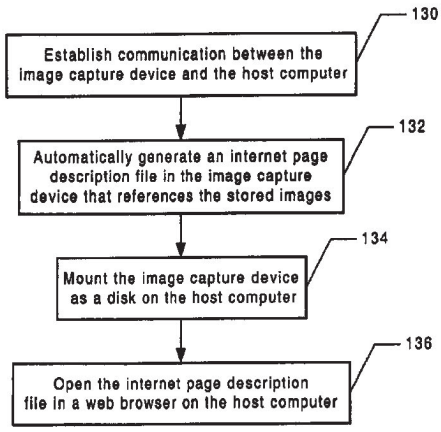
(57) **ABSTRACT**

A method and system for viewing images from an image capture device on a host computer. The method and system include establishing communication between the image capture device and the host computer, and mounting the image capture device as a disk on the host computer. The method and system further include automatically generating an Internet page description file in the image capture device that references the images stored therein, and accessing the Internet page description file through a standard web browser on the host computer. The user may then view the images stored in image capture device on the host computer through the web browser.

20 Claims, 8 Drawing Sheets



U.S. PATENT DOCUMENTS

6,437,829	B1 *	8/2002	Webb et al.	348/476
6,571,271	B1 *	5/2003	Savitzky et al.	709/200
6,779,153	B1 *	8/2004	Kagle	715/522
6,803,945	B1 *	10/2004	Needham	348/207.1
6,897,891	B1 *	5/2005	Itsukaichi	348/14.1
6,965,400	B1 *	11/2005	Haba et al.	348/222.1

OTHER PUBLICATIONS

"Phaser 740L Color–Capable Laser Printer," Tektronix, Inc., webmaster@tek.com; Apr. 15, 1999, 2 pages.

"What is Phaserlink Software?", Tektronix, Inc., webmaster@tek.com, Apr. 15, 1999, 2 pages.

Peter Corcoran et al., "A Portable Java API Interface to Simplify User Access to Digital Cameras," IEEE Transactions on Consumer Electronics, vol. 44, No. 3, Aug. 1998, pp. 686–691.

Bill Peisel, "Designing the Next Step in Internet Appliances," Electronic Design, Mar. 23, 2998, pp. 50, 52, and 56.

"Disk Drive with Embedded Hyper–Text Markup Language Server," IBM Technical Disclosure Bulletin, vol. 38, No. 12, Dec. 1995, page 479.

Edward Steinfield, "Leveraging Browsers as Universal GUIs," EE Times, Issue 932, Dec. 16, 1996, 4 pages.

* cited by examiner

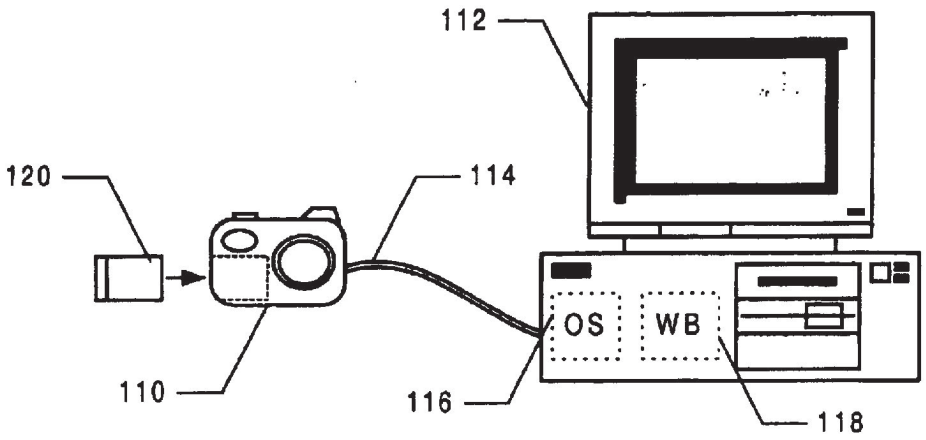

112
120
114
OS
WB
110
116
118

FIG. 1

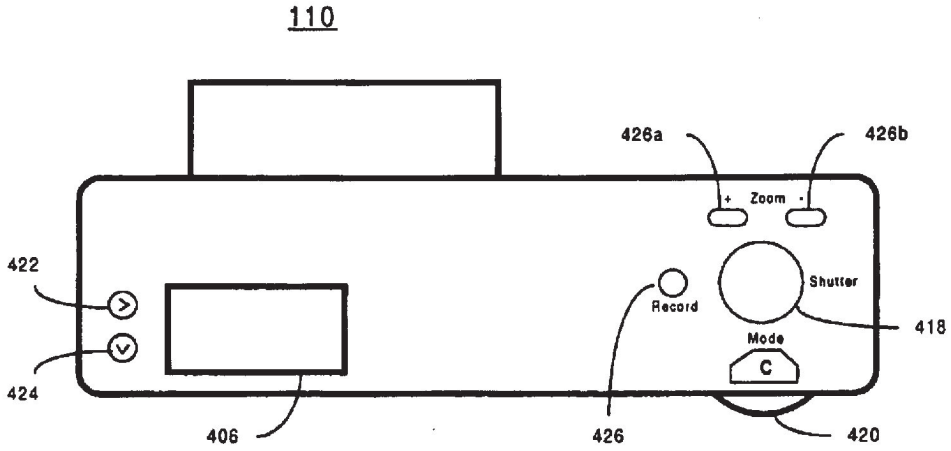

110
426a
426b
+
Zoom
-
422
Record
Shutter
418
Mode
C
424
406
426
420

FIG. 2

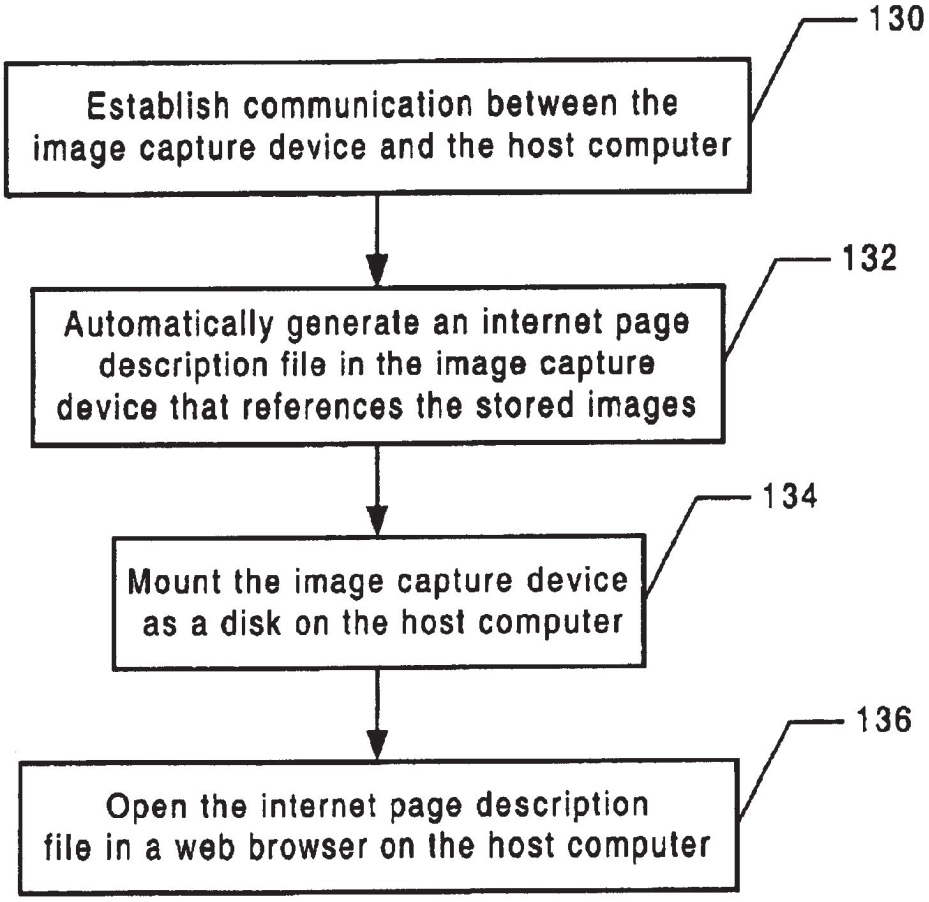

130
Establish communication between the image capture device and the host computer
132
Automatically generate an internet page description file in the image capture device that references the stored images
134
Mount the image capture device as a disk on the host computer
136
Open the internet page description file in a web browser on the host computer

FIG. 3

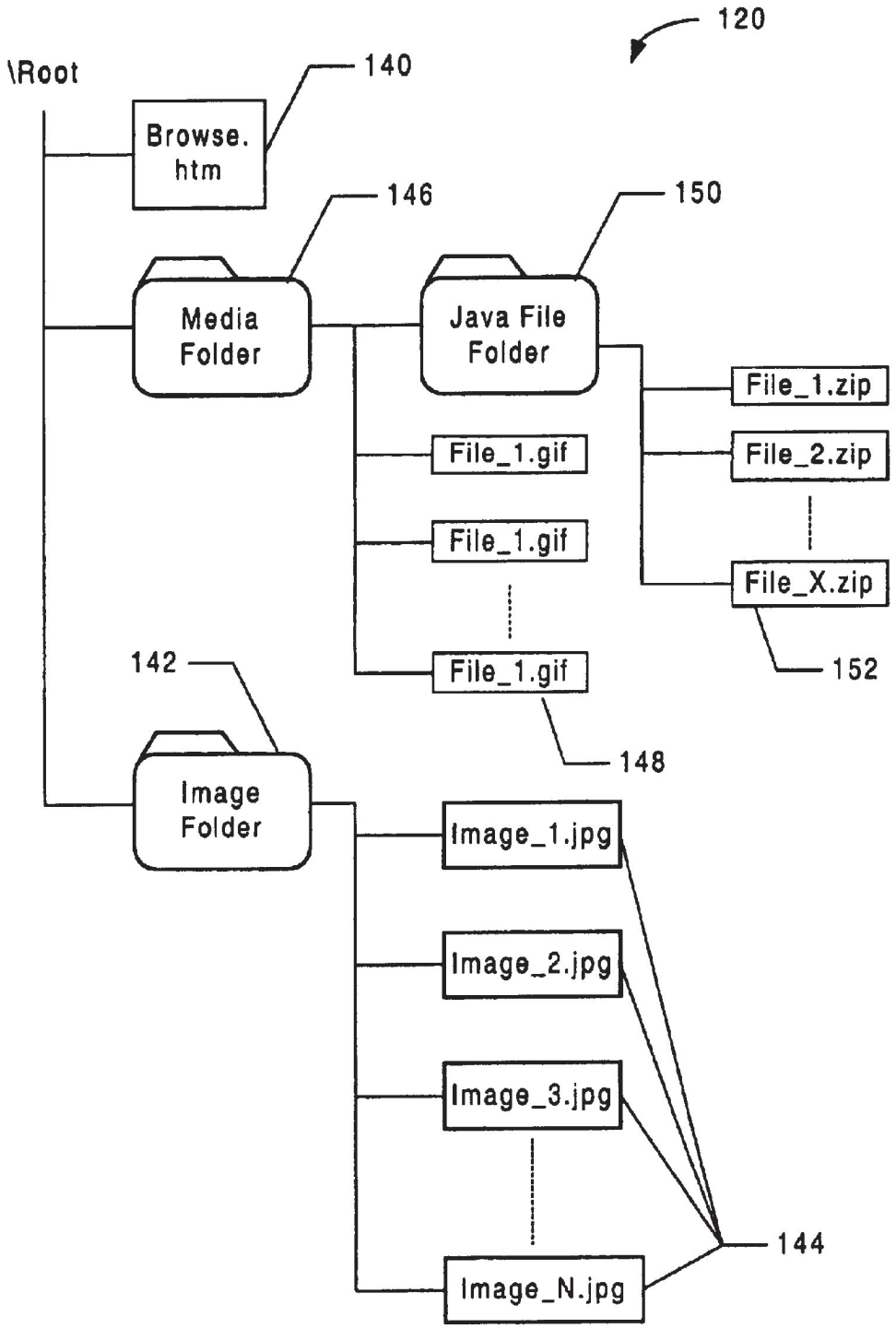

120
\Root
140
Browse.
htm
146
150
Media
Folder
Java File
Folder
File_1.zip
File_2.zip
File_1.gif
File_1.gif
File_X.zip
152
142
File_1.gif
148
Image
Folder
Image_1.jpg
Image_2.jpg
Image_3.jpg
144
Image_N.jpg

FIG. 4

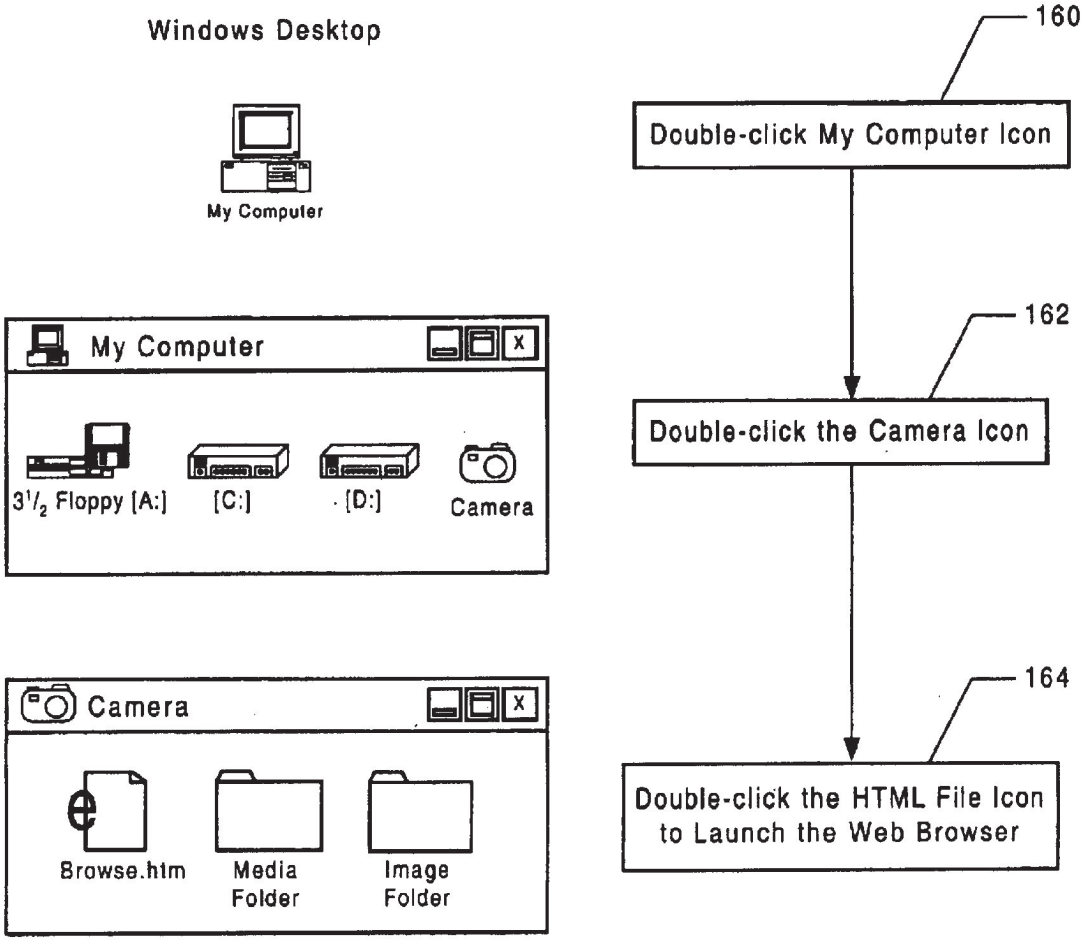

Windows Desktop
My Computer
My Computer
3 1/2 Floppy [A:]
[C:]
[D:]
Camera
Camera
Browse.htm
Media Folder
Image Folder
160
Double-click My Computer Icon
162
Double-click the Camera Icon
164
Double-click the HTML File Icon to Launch the Web Browser

FIG. 5

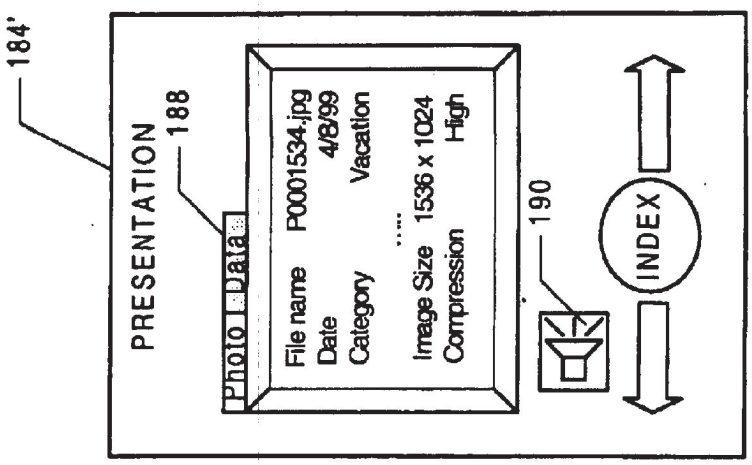


FIG. 6C

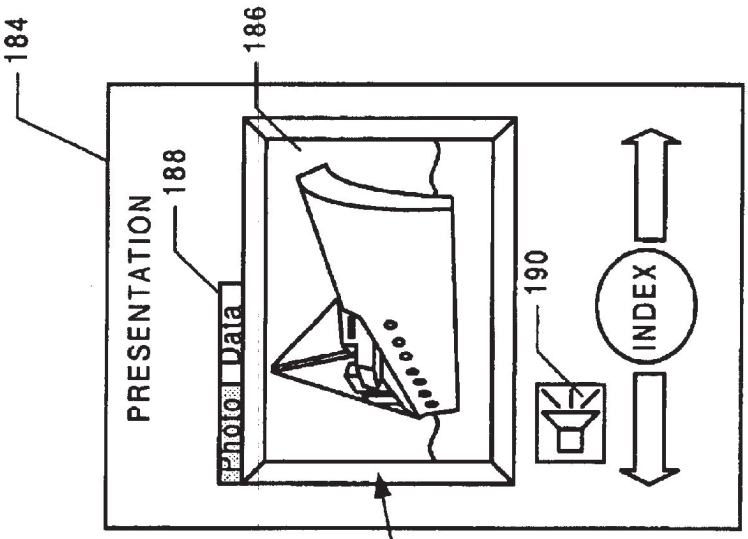


FIG. 6B

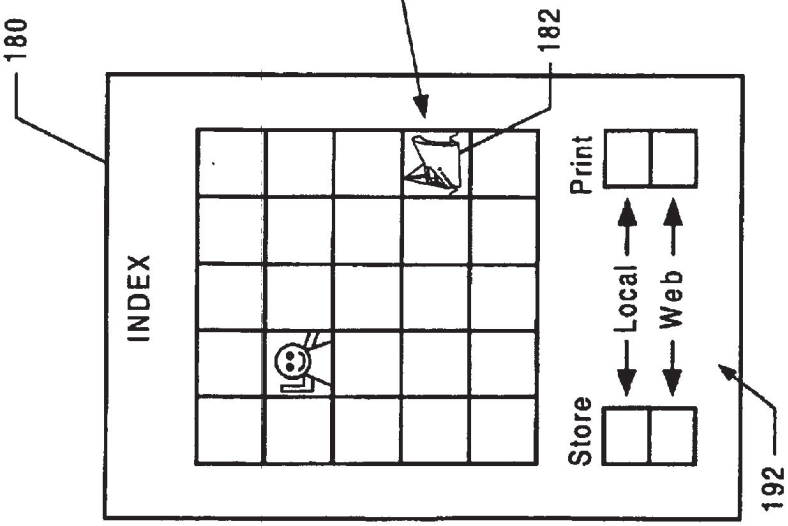


FIG. 6A

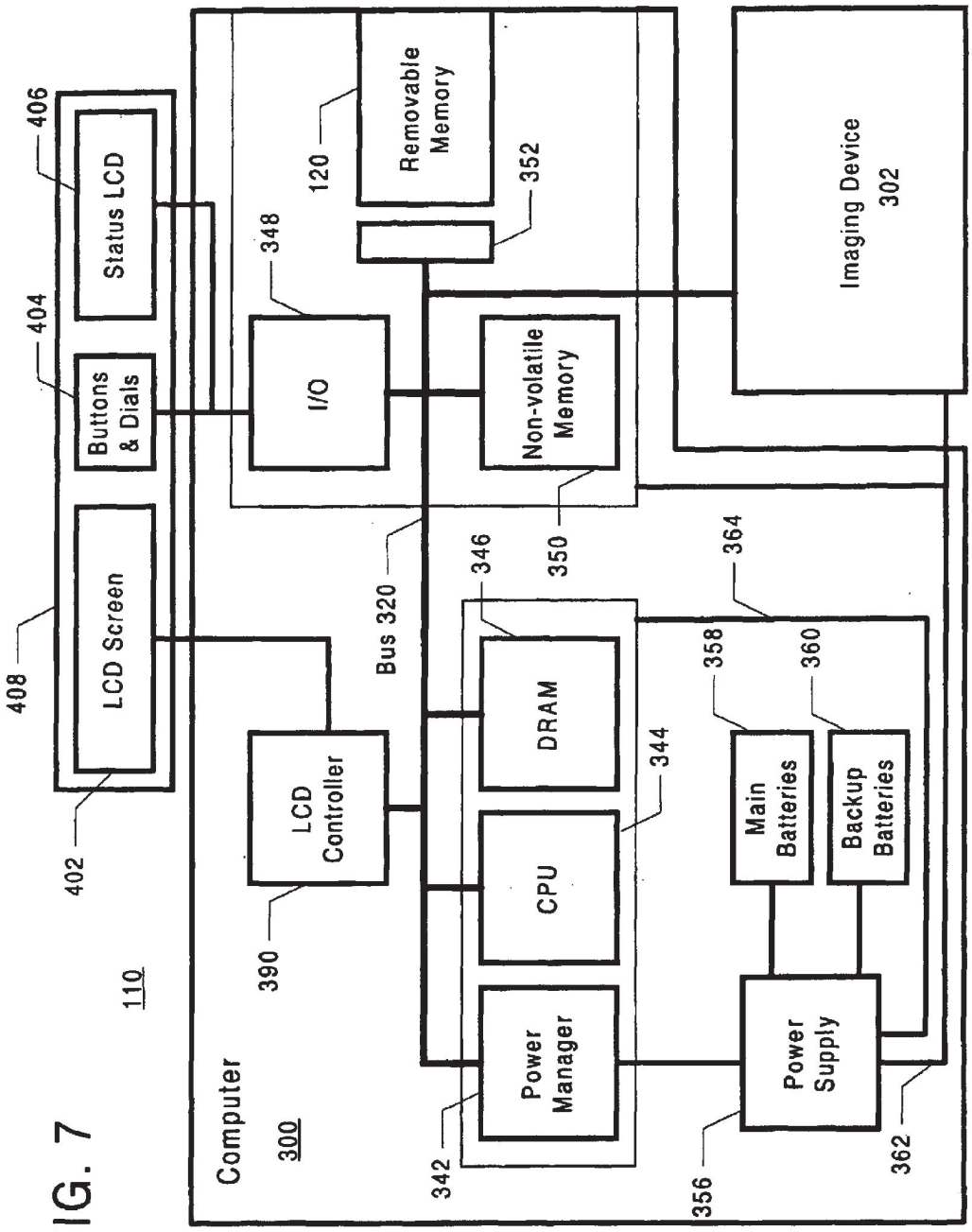

406
Status LCD
404
Buttons & Dials
408
LCD Screen
402
110
Computer
300
LCD Controller
390
Bus 320
120
Removable Memory
348
I/O
352
Non-volatile Memory
350
346
DRAM
CPU
344
Power Manager
342
364
358
Main Batteries
360
Backup Batteries
Power Supply
356
362
Imaging Device
302

FIG. 7

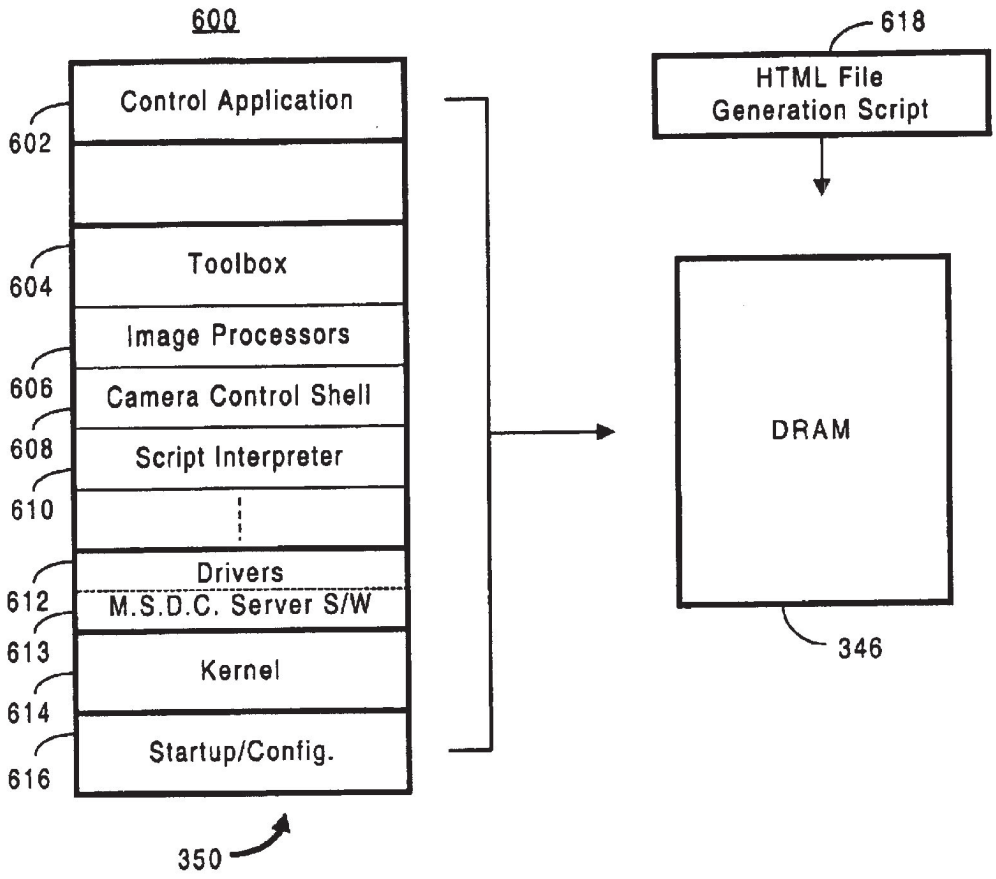

600
Control Application
602
Toolbox
604
Image Processors
606
Camera Control Shell
608
Script Interpreter
610
Drivers
612
M.S.D.C. Server S/W
613
Kernel
614
Startup/Config.
616
350
618
HTML File
Generation Script
DRAM
346

FIG. 8

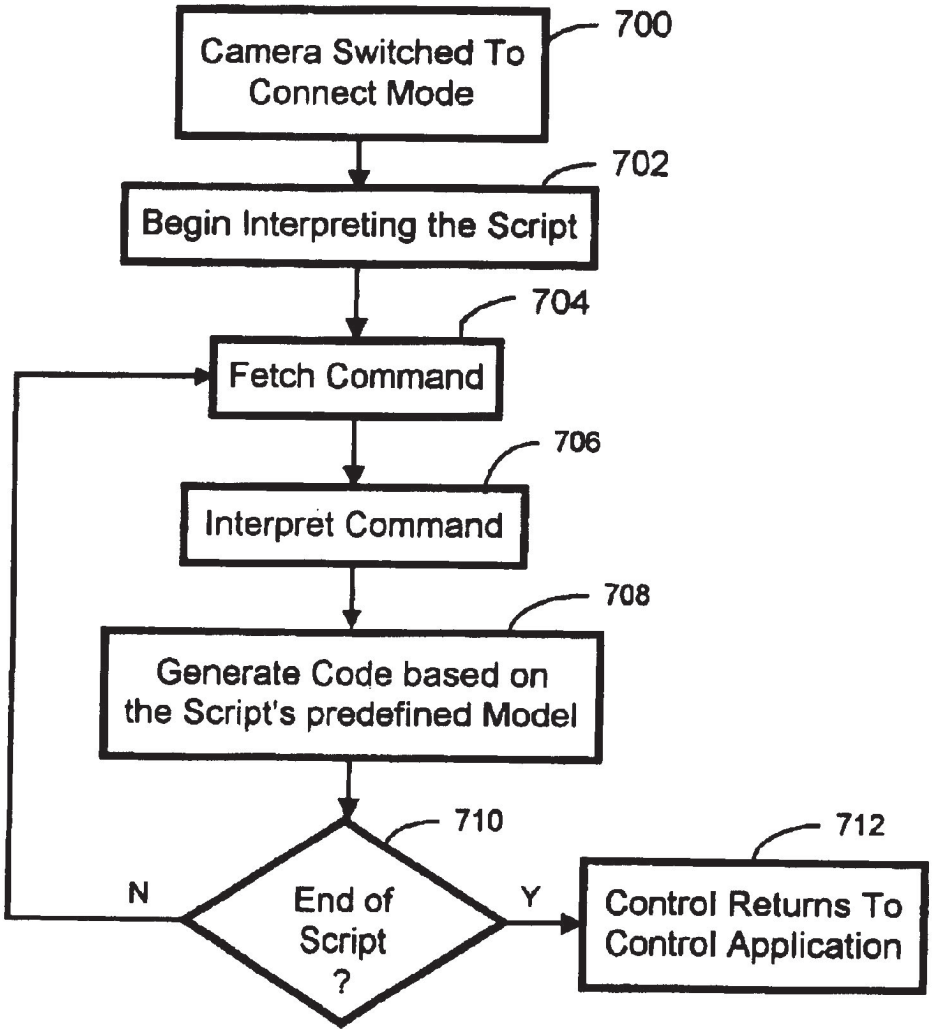

Camera Switched To Connect Mode
700
Begin Interpreting the Script
702
Fetch Command
704
Interpret Command
706
Generate Code based on the Script's predefined Model
708
End of Script ?
710
N
Y
Control Returns To Control Application
712

FIG. 9

METHOD AND SYSTEM FOR VIEWING IMAGES FROM AN IMAGE CAPTURE DEVICE ON A HOST COMPUTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation-In-Part of U.S. Pat. No. 6,223,190, entitled "A Method And System For Producing An Internet Page Description File On A Digital Imaging Device," filed on Apr. 13, 1998.

FIELD OF THE INVENTION

The present invention relates to a method and system for viewing images from an image capture device on a host computer, and more particularly to a method and system for viewing images from an image capture device on the host computer without having to load device-specific software onto the host.

BACKGROUND OF THE INVENTION

Today's digital cameras look and function similar to analog 35 mm SLR's cameras, except that digital cameras store images digitally in a memory card and include an LCD display that allows the user to instantly view the images directly on the camera. The stored images may then be transferred to a host computer system for viewing, printing, editing and otherwise manipulating the images. In instances where the host computer includes a drive that is compatible with a memory card, such as a notebook computer, the images may be transferred by inserting the digital camera's memory card into the host computer.(e.g., via a PCMCIA slot). instances where the host computer lacks a drive that is compatible with a memory card, the digital camera images may be uploaded to the host computer through some type of communication channel, such as a universal serial bus (USB) or IrDA. To enable the uploading of images and the viewing of the images once on the host, most, if not all, digital cameras are shipped with one or more software applications that provide such functionality once loaded on the host.

One type, of software application shipped with today's digital cameras is a graphics application, such as Adobe PhotoDeluxe or Microsoft Picture It!, that allows a user to edit and manipulate images.

Another type of software application provided with digital cameras is a communication application that enables the graphics application to communicate with the digital camera. The technology underlying most communication applications include Windows OLE Control EXtension (OCX) modules and Twain (Technology Without An Interesting Name) data source modules. In operation, some communication applications insert a "digital camera" option into the graphics application's Import menu that allow the user to select, upload, and manage digital camera images.

Although the present method for allowing the user to upload and view digital camera images on a host computer function adequately, the method has several disadvantages. One disadvantage is that the digital camera must be shipped with a communication application that has been specifically written to communicate with that particular type of digital camera. Consequently, if images from a different type of digital camera are to be uploaded to-the host computer, a completely new camera-specific communication application must be loaded onto the host, typically from a CD ROM or floppy disk that has been included with the digital camera

packaging. After loading the appropriate communication application, the user must then learn how to operate it, which depending on the user, may not be a trivial exercise.

Today's digital camera users perceive the notion of having to load camera-specific software onto the host, learn how to use the camera-specific software, tether the digital camera to the host, and then upload the images too burdensome a task just to view images from the camera.

Another disadvantage with the conventional method for uploading digital camera images to the host computer is that the graphics application on the host typically receives the images from the camera in compressed form. The graphics application must then open and decompress each image for display and manipulation. For permanently storing images on the host, the images are then compressed a second time to save space, which degrades image quality if a well-known lossy compression scheme, such as JPEG compression, is used.

Due to such disadvantages the current method for viewing digital camera images on a host computer may be inhibiting the widespread adoption of digital cameras.

Accordingly, what is needed is an improved method and system for viewing images from an image capture device on a host computer without the need for first loading camera-specific software onto the host computer. The present invention addresses such a need.

SUMMARY OF THE INVENTION

The present invention provides a method and system for viewing images from an image capture device on a host computer. The method and system comprise establishing communication between the image capture device and the host computer, and mounting the image capture device as a disk on the host computer. The method and system further comprise automatically generating an Internet page description file in the image capture device that references the images stored therein, and accessing the Internet page description file through a standard web browser on the host computer. The user may then view the images stored in image capture device on the host computer through the web browser.

According to the system and method disclosed herein, the present invention eliminates the need for first loading camera-specific communication software onto the host computer before being able to view the images. And because the image capture device generates the Internet page description file automatically, the user need not have any knowledge of HTML programming to create a web page of the camera images.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating the system environment for the present invention.

FIG. **2** is a diagram illustrating a top view of the camera.

FIG. **3** is a flow chart illustrating the process for viewing images from a digital camera on a PC in accordance with the present invention.

FIG. **4** is a diagram illustrating the contents of the digital camera's removable memory after the HTML file has been generated in accordance with the present invention.

FIG. **5** is a flow chart illustrating the process of accessing and opening the -camera HTML file on a Windows-based PC.

FIGS. **6**A–**6**C are diagrams illustrating the content of the web pages generated by the opened HTML file.

FIG. **7** is a block diagram of one preferred embodiment of a digital camera for use in accordance with the present invention

FIG. **8** is a block diagram illustrating the contents of the camera's ROM where the software is stored, and DRAM where the software is executed.

FIG. **9** is a flow chart illustrating an exemplary process of running a script for producing the HTML file in accordance with the dynamic HTML file generation process of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a method and system for viewing images from an image capture device on a host computer using a standard web browser. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Although the present invention will be described in the context of a still digital camera, various modifications to the preferred embodiment will be readily apparent to those skilled in the art and the generic principles herein may be applied to other embodiments. That is, any digital image capture device which captures, stores, or displays digital images, could incorporate the features described hereinbelow and that device would be within the spirit and scope of the present invention. Thus, the present invention is not intended to be limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features described herein.

Referring now to FIG. **1**, a diagram illustrating a system environment for the present invention is shown. The system includes a digital camera **110** for capturing and storing digital images that is connected to a host computer **112** via a cable **114** or other communication channel. Images are stored in the digital camera **110** on a removable memory card **120** or on internal memory (not shown), and are transferred to the host computer **112** for viewing, storing, printing, and editing the images.

The host computer **112** may represent any well-known microprocessor-based computer system, such as a desktop, notebook, or workstation that is capable of running an operating system **116** including Windows, Macintosh, Unix and Linux, for example. In addition, nearly all such computers include a web browser application **118**, such as Netscape Navigator or Microsoft's Internet Explorer, for surfing the Internet. For simplicity, the host computer **112** will hereinafter be referred to as a "PC" **112**.

FIG. **2** is a top view of a typical camera **110** showing a shutter button **418** a mode dial **420**, an optional status LCD **406**, status LCD scroll and select buttons **422** and **424**, a sound record button **426**, and zoom-in, zoom-out buttons **426***a* and **426***b*. Turning the mode dial **420** places the camera **110** into different operating modes, including capture mode for capturing images, play mode for playing back the captured images on the LCD screen **402**, and connect mode for connecting to the PC **112** and transferring images.

As stated previously, conventional methods for transferring images from a digital camera to a PC **112** require that the user first load camera-specific communication software onto the PC **112** that communicates with that particular type of digital camera **110**. Not only is this burdensome to the user, but the camera-specific software may not be compatible with any other type of digital camera **110**.

This requires that new communication software be loaded onto the PC **112** every time the user wishes to upload images from a different type of digital camera **110**.

The present invention overcomes the shortcomings of these conventional methods by providing a method and system for viewing images from a digital camera **110** on a PC **112** without having to first load camera-specific software onto the PC. More particularly, the images stored on the digital camera **110** may be viewed from the PC **112** using a standard web browser and operating system functionality, which leverages the software already included on most computers. This is accomplished by automatically generating an HTML file in the camera **110** that references the images stored in the camera **110**, and by connecting the digital camera **110** to the PC **112** as a mass storage device to make the HTML file easily accessible by the computer's web browser, whereby the user may view the camera **110** images through the web browser. Accordingly, the present invention eliminates the requirement that the camera **110** user load camera-specific software onto the host before being able to view the camera **110** images.

Referring now to FIG. **3**, a flow chart illustrating the process for viewing images from a digital camera **110** on a PC **112** in accordance with a preferred embodiment of the present invention is shown. The process begins by establishing communication between the digital camera **110** and a PC **112** in step **130**. As used herein, communication is established when the digital camera **110** is physically interfaced with the PC **112** (e.g., by a cable or infrared link), and the digital camera **110** is either placed into connect mode via the mode dial, or the camera **110** automatically enters connect mode upon detection of the physical interface. In a preferred embodiment of the present invention, the physical interface between the digital camera **110** on the PC **112** is established with a universal serial bus (USB) connection.

After communication is established, an Internet page description file is automatically generated within the digital camera **110** that references the digital camera **110**'s images in step **132**. In a preferred embodiment of the present invention, the Internet page description file is implemented as an HTML (hypertext markup language) file, and is hereinafter referred to as such. However, the HTML file may also be, implemented in other formats, such as XML (extensible markup language) format, Acrobat format, and the like. Generating formatted HTML files, however, provides the advantage of being a relatively widespread standard for contemporary web browsers.

In one preferred embodiment, the HTML file is created on the digital camera **110** by a program running on the camera **110**, as explained below with reference to FIGS. **8** and **9**. After the HTML file has been generated, it is stored in the camera **110**'s removable memory **120** along with the images.

Referring now to FIG. **4**, a diagram illustrating the contents of the digital camera **110**'s removable memory **120** is shown after the HTML file **140** has been generated in accordance with the present invention. The removable memory **120** is preferably configured as a DOS-based file directory, which inherently includes a directory list and a File Allocation Table, or FAT (not shown). The directory list includes all basic file information such as file name, date of creation, and the location of the FAT. The FAT is part of the file system that keeps track of where data is stored-on the disk.

As shown, the directory list typically begins at a root directory. In a preferred embodiment of the present invention, the HTML file **140**, shown here with the file name "Browse.htm", is stored in the root directory so as to be readily visible and accessible to the user. Also stored in the

root directory is an image folder **142** for storing the images **144** captured by the digital camera **110**, and a media folder **146** for storing files referenced by the HTML file **140**. The media folder **146** includes several GIF (Graphics Interchange Format) files **148** for displaying any bitmapped graphics referenced in the HTML file **140**, and a Java file folder **150**. The Java folder **150** contains one or more Java applets **152** for opening and extracting information from the image files **144** referenced in the HTML file **140**. Note, the image folder **142** may also contain folders of images, rather than images, such as for-the DCF-98 standard. In this case, the image folder may be named DCIM (digital camera images).

Referring again to FIG. **3**, after generating the Internet page description file **140**, the digital camera **110** is mounted as a disk drive on the PC **112** in step **134**. When communication between the camera **110** in the PC **112** takes place via USB, this is accomplished by specifying to the PC **112** that the digital camera **110** is a USB mass storage device. As will be appreciated by those with ordinary skill in the art, operating systems (OS), such as Windows and Macintosh, support the USB Mass Storage Device Class.

To identify itself as a mass storage device class to the PC's **112** operating system **116**, the digital camera **110** includes USB Mass Storage Device Class server-software that operates in accordance with USB protocols to identify to the OS **118** that the device is a mass storage device. In response, the OS **118** loads the appropriate USB drivers that are File Allocation Table (FAT) compatible, and mounts the digital camera **110** as a disk volume. Thereafter the digital camera **110** appears to the PC **112** as a true disk drive (block device).

Although the present invention is described as using a USB standard, any, communication standard utilizing a mass storage device class that is supported by the host-computer operating system **116** may also be used, such as IrDA (infrared) and IEEE 1394 (Firewire), for example.

When a digital camera **110** is typically connected to PC **112**, the camera **110** is usually in "command mode" whereby the PC **112** sends commands to the camera **110** to retrieve the images. Therefore, and a preferred embodiment of the present invention, the user is given a choice of manually placing the camera **110** into either command mode or mass storage device mode when connecting camera **110** to the PC **112**. Of course, this choice may be programmed as a preference in the digital camera **110**, to make the step automatic.

Referring still to FIG. **3**, after the HTML file **140** has been generated in the camera **110** and mounted as a disk, the HTML file **140** may be opened in a standard web browser **118** on the PC **112** in step **136**. According to the present invention, the images stored on the camera **110** are then accessed and displayed by the web browser **118**, without the need to first load camera-specific software on the PC.

It should be understood that the steps involved in the process described in FIG. **3** are order independent. For example, the HTML file **140** may be generated before communication with the host has been established, or portions of the HTML file **140** may even be generated dynamically after the HTML file is opened on the PC **112**, as explained further below.

Referring now to FIG. **5**, a flow chart illustrating the process of accessing and opening the camera **110** HTML file **140** on a Windows-based PC **112** is shown. After connecting the camera **110** to the PC **112** and placing the camera **110** in connect mode, as explained above, the camera **110** will appear to the PC **112** as a disk. The user may then access the camera **110** by double-clicking the "My computer" icon on the Windows desktop in step **160**. This causes the "My computer" window to open, which shows all the drives available to the PC **112**, including the digital camera **110**.

In a one embodiment of the present invention, the user manually opens the HTML file **140** by first double-clicking the camera **110** icon in step **162** to cause a "Camera **110**" window to open showing folder icons, files, and images on the camera **110**'s removable memory **120**. To then open the HTML file **140** and to view the camera **110** images, the user double clicks the icon (Browse.htm) for the HTML file **140** in step **164**. In response, the PC's **112** default web browser **118** launches and opens the HTML file **140**.

In an alternative embodiment, the process of opening the HTML file **140** and launching the web browser may be made automatic by providing a pre-stored autoplay.inf file on the removable memory **120**. The autoplay.inf is a standard Windows OS file for automatically executing a specified file when the directory where the autoplay.inf file is located and accessed. Thus, by specifying the HTML file **140** in the autoplay.inf file, the HTML file **140** will automatically open in the web browser **118** without user intervention.

As will be appreciated by those with ordinary skill in the art, the HTML file **140** is interpreted by the web browser **118**, which in turn, displays resulting web pages. The commands included in the HTML file **140** describe the logical structure of the web page. The HTML file **140** includes ASCII text with embedded HTML tags that instruct the web browser as to the appropriate font, position, etc., for the text. The images are also associated with HTML tags describing their attributes with respect to the web page (e.g., position, relative size, etc.). The web browser **118** interprets the HTML file **140** and displays the web page, or pages, described by the file. Thus, the process of generating an HTML file **140** is often referred to as generating a web page and the process of a web browser accessing and interpreting the. HTML file **140** is-often referred to as displaying a web page.

Referring now to FIGS. **6**A–**6**C, diagrams illustrating the content of the web pages generated by the opened HTML file **140** are shown., FIG. **6**A shows that in a preferred embodiment of the present invention, the first page of the HTML file **140** is an index page **180** which displays thumbnail images **182** so the user can readily see the contents of camera **110**. Clicking one of the thumbnail images **182** on index page **180** causes a presentation page **184** to appear displaying a larger, window-sized view of the corresponding JPEG image **186**, as shown in FIG. **6**B. Optionally, a control may be added that allows the user to access a full-sized view of the image, which is typically much larger than the screen, whereby the user pans around the image using arrow keys.

As stated above, HTML file **140** includes references to the Java applets **156** that are generated along with HTML file **140** and are stored on removable memory **120**. As the web browser interprets the HTML file **140** and encounters the references to the Java applets **156**, the Java applets **156** are loaded by the browser and executed by a Java subsystem. When executed, the Java applets **156** locate the image files **144** on the removable memory **120** and extract and display the specific type of image data requested by the HTML file **140**. Depending on the particular image file formats involved, the different types of image data that may be stored in an image file include any combination of compressed image data (typically in JPEG format), a thumbnail image, a screennail image, sound, and image tags that

include information about the image (e.g., category, time, date, name, size, etc.). In the case of the compressed image data, the Java applets **156** are designed to decompress the data for display.

Using the Java applets **156**, various buttons may also be displayed on web pages that allow the user to control the display, storage, and printing of the images. Referring to FIG. **6**A for example, clicking on one of the control buttons **192** enables the user to upload and/or print the images locally on the PC **112** or on a destination on the World Wide Web. Clicking the "store" or "print" buttons causes a Java applet **156** to be executed that fetches the selected image(s) from the camera **110** and transfers it to the indicated destination.

The Java applets **156** may be provided with other types of functionality as well, such as determining which images, if any, have previously been uploaded, and then uploading only those images that have not. Another function could include automatically storing the images in a database. One primary advantage of saving images from the web browser **118** is that unlike in prior art systems, the images are stored directly to the destination without opening and recompressing the images, thereby maintaining image quality.

The HTML file generation process of the present invention may be implemented using several embodiments. In the first embodiment, the HTML file generation is a static process, while in the second and third embodiments, the HTML file generation, is a dynamic process.

The first embodiment is referred to as a static process because in this embodiment, the format of HTML file **140** is preset in the camera **110** and is designed to display a fixed number of web pages regardless of the number of images stored in the camera.

The second and third embodiments are referred to as dynamic processes because the HTML file **140** is automatically generated by the camera **110** to generate dynamic content. In the second embodiment, the HTML file **140** is dynamically generated each time the camera **110** is placed into connect mode. Dynamically generating the HTML file **140** means that the HTML file **140** will be customized to display the current contents of the camera **110** in the correct format. In this second embodiment, the HTML file **140** is generated by a script running in the camera **110**. In the third embodiment, the dynamic content of the HTML file **140** is generated by a Java Generation Applet running on the host **112**, rather than a script running on the camera **112**. In this embodiment, the "Browser.HTM" file **140** is provided on the removable memory as an introduction page that references the index page **180** (FIG. **6**A). When this introduction page is opened after the camera is properly connected to the PC **112**, the "Browser.HTM" file **140** invokes the Java Generation Applet. The Java Generation Applet then scans the removable memory **120** for images **144** and generates the index page **180** accordingly.

In another aspect of the present invention, the user may also browse the images stored in the PC **112** even when the camera **110** is not connected by copying the HTML file **140** and accompanying media folder **146** to the directory on the PC **112** where the images are stored. By opening the window for the image directory and double clicking the HTML file **140**, the user launches the web browser and may view the formatted web pages of the images stored on the PC's **112** hard drive. If the Java Generation Applet is used to build the index page, then the user will see both the images downloaded from the camera **110** as well as the images previously stored on the PC's **112** hard drive. In a preferred embodiment, the copying of the HTML file **140** and the media folder **146** to the PC is accomplished by providing a "Save to PC" option on the web pages.

In a further aspect of the present invention, the web browser **118** may not only be used to upload images from the camera to the PC **112** and the web, but also download images from the PC **112** or the web to the camera **110**. Thus, the user is provided with the means for transferring images seamlessly between the camera **110**, the PC **112**, and the Internet.

Referring to FIG. **6**B, other control buttons may also be provided on the web pages, such as the data tab **188** in the presentation page **184**. Clicking the data tab **188** causes a Java applet **156** to be executed that extracts the tag information from the image file and displays the information to the user, as shown in FIG. **6**C. Pressing the photo tab will return the user to the presentation page **184** of FIG. **6**B. If the file format of the images supports sound, then a sound button **190** for playing any sound associated with the image may also be provided. Ideally, a button for recording sound for the images is also provided.

A preferred embodiment for automatically generating the HTML file **140** in the digital camera **110** using scripts will now be explained. Before describing the present invention in more detail, however, it is necessary to provide a brief overview of the internal environment of the digital camera **110**.

Referring now to FIG. **7**, a block diagram of one preferred embodiment of a digital camera **110** is shown for use in accordance with the present invention. Camera **110** preferably comprises an imaging device **302**, a system bus **320** and a computer **300**. Imaging device **302** includes an image sensor, such as a charged coupled device (CCD) or a CMOS sensor, for generating a set of raw image data representing a captured image. In a preferred embodiment, system bus **320** provides connection paths between imaging device **302**, an optional power manager **342**, central processing unit (CPU) **344**, dynamic random-access memory (DRAM) **346**, input/output interface (I/O) **348**, non-volatile memory **350**, and buffers/connector **352** that connect an removable memory **120** to system bus **302**.

CPU **344** may include a conventional microprocessor device for controlling the operation of camera **110**. In the preferred embodiment, CPU **344** is capable of concurrently running multiple software routines to control the various processes of camera **110** within a multithreaded environment. For example, images may be captured at the same time that previously captured images are processed in the background to effectively increase the capture rate of the camera **110**. In a preferred embodiment, CPU **244** runs an operating system that includes a menu-driven GUI and provides image processing through software, rather than hardware. An example of such software is the Digita™ Operating Environment by FlashPoint Technology of San Jose, Calif. Although CPU **344** is preferably a microprocessor, one or more DSP's (digital signal processor) or ASIC's (Application Specific Integrated Circuit) could also be used.

I/O **348** is an interface device allowing communications to and from computer **118**. For example, I/O **348** permits the digital camera **110** the digital camera **110** to connect to and communicate with the PC. I/O **348** also interfaces with a plurality of buttons and/or dials **404**, and an optional status LCD **406**, which in addition to the LCD screen **402**, are the hardware elements of the camera **110**'s user interface **408**.

Non-volatile memory **350**, which may typically comprise a conventional read-only memory or flash memory, stores a set of computer-readable program instructions to control the

operation of camera **110**. Removable memory **120** serves as an additional image data storage area and is preferably a non-volatile device, such a flash disk, readily removable and replaceable by a camera **110** user via buffers/connector **352**.

Power supply **356** supplies operating power to the various components of camera **110**. Power manager **342** communicates via line **366** with power supply **356** and coordinates power management operations for camera **110**. In the preferred embodiment, power supply **356** provides operating power to a main power bus **362** and also to a secondary power bus **364**. Power supply **356** is connected to main batteries **358** and also to backup batteries **360**.

Dynamic Random-Access-Memory (DRAM) **346** is a contiguous block of dynamic memory that may be selectively allocated for various storage functions. DRAM **346** stores both raw and compressed image data and is also used by CPU **344** while executing the software routines used within computer **118**. The raw image data received from imaging device **114** is temporarily stored in several input buffers (not shown) within DRAM **346**. Once the raw image data is processed by CPU **344**, it is stored in removable memory **120**. After the image data has been processed and stored, it may also be displayed on the LCD screen **402** via LCD controller **390**.

As stated above, the HTML file **140** is preferably created through the use of a script running on the digital camera **110**. As used herein, a script is an interpreted program written with text-based commands. A script may also be written using other interpreted languages, such as BASIC, for example. A script in accordance with the present invention also includes a predefined set of commands which determine the formatted appearance of a web page. The script is interpreted by camera **110**, which performs the actions, steps, functions, and the like, as dictated by the script. The predefined set of commands which determine the formatted appearance of a web page are referred to as a model. The model is designed (e.g., by the user, a third party developer, or the like) to give the resulting web page its distinctive appearance. The model functions as a "blue print" that defines the formatting and positioning information which determine the overall appearance of the resulting web page described by the HTML file **140**. In executing a script in accordance with the present invention, the camera **110** generates the HTML file **140** referencing the stored images, wherein the HTML file. **140** is formatted in accordance with the script's predefined model.

In another embodiment, the script may also be programmed to prompt the user to select pictures from a set stored in the camera **110** before generating the HTML file **140**. As the particular pictures are selected, the script may prompt the user for any descriptive information, annotations, and the like.

In both embodiments, the camera **110** produces a completed, formatted, HTML file (e.g., one or more web pages) which references the resulting images from the digital camera **110**, without requiring the user to have any knowledge of HTML or HTML formatting.

In one embodiment of the present invention, one or more scripts (each providing a different look and feel) may be built-in into the camera **110** as preexisting functions. However, the camera **110** may be made more flexible by implemented the scripts as a set of program instructions that may be externally loaded into the camera **110**. Once loaded in the camera **110**, the instructions comprising the scripts are then preferably interpreted by the system software running on CPU **344**. A selector script or a user preference selects which look and feel script to run.

FIG. **8** is a block diagram illustrating the contents of ROM **350** where the software is stored, and DRAM **346** where the software is executed. In one embodiment, the software **600** may include a control application **602**, a toolbox **604**, drivers **612**, a kernel **614**, and a startup/configuration module **616**. The control application **602** is the main program that controls high-level functions of the digital camera **110** and is responsible for interfacing with functions in the toolbox **604**.

Toolbox **604** comprises selected function modules that control how the digital camera **110** captures and manipulates images. The modules may include image processors **606**, a camera **110** control shell **608**, and a script interpreter **610**. Image processors **606** are programs for enhancing (e.g., adjusting the contrast, sharpening, converting the image to gray-scale, etc.) the digital image received from imaging device **114**. Camera **110** control shell **608** receives and processes data structures for controlling camera **110** functions. Script interpreter **610** translates and executes the script statements.

Drivers **612** comprise program instructions for controlling various camera **110** hardware components, such as motor **234** (FIG. **2**) and a flash (not shown). The drivers also include mass storage devices server-software **613** that identifies the camera **110** as a mass storage device class to the PC's operating system **116**.

Kernel **614** comprises program instructions providing basic underlying camera **110** operating system services including synchronization routines, task creation, activation and deactivation routines, resource management routines, etc. Startup/configuration **616** comprises program instructions for providing initial camera **110** start-up routines such as the system boot routine and system diagnostics.

When the camera **110** is first turned on and booted up, the startup/configuration **616** module begins to execute and loads the drivers **612**, the kernel **614**, the control application **602**, and system files containing configuration information into DRAM **346**. Thereafter, operation of the camera **110** is passed to the control application **602**. In an alternative embodiment, the software **600** may execute out of ROM **350** in order to reduce the size of DRAM **346**.

The script for HTML file generation **618** may be loaded into the digital camera **110** from the removable memory **120** (FIG. **7**), a PC **112**, or a network, and stored in ROM **350**. Once loaded into the camera **110**, the script may be automatically executed when the camera **110** is switched to connect mode by passing the script to the script interpreter **610**. The script interpreter **610** then translates and executes the instructions comprising the HTML file generation script **618** one-by-one to generate the resulting HTML file **140**.

FIG. **9** is a flow chart illustrating an exemplary process of running a script for producing the HTML file **140** in accordance with the dynamic HTML file generation, process of the present invention. The dynamic generation process is begun once the user places the camera **110** into connect mode in step **700**. In response to the camera **110** being placed into connect mode, the script interpreter **610** begins interpreting the HTML file generation script **618** in step **702**, and control is passed from the control application **602** to the script. In step **704**, the script interpreter **610** fetches a script command comprising the HTML file generation script **618**. Next, the script interpreter **610** interprets the script command in step **706**.

The script may include many different types of script commands for performing different functions. For example, interpreting an open file command will cause the script interpreter **610** to open an HTML file **140** in which HTML

commands, image references, and the like are to be stored. Interpreting a write command will cause a specified HTML command to be written to the file. And interpreting a close file command will cause the script interpreter **610** to close and save the HTML file **140**, and so on. Thus, the interpretation of these different types of script commands generates HTML code in accordance with the script's predefined model in step **708**.

If a particular script command represents the end of the script in step **710**, then control is returned to the control application **602** in step **712**, and one or more formatted HTML files **140** are available to the user for browsing the camera contents in accordance with the present invention. If the script command does not represent the end of the script in step **710**, then the script interpreter **610** continues to fetch and interpret script commands in steps **704**, **706** and **708** until the end of the script is reached in step **710**.

An exemplary portion of the resulting HTML file for viewing camera contents in accordance with one embodiment of the present invention is shown below:

```
<html>
    <head>
        <title>Digita - Digital Camera Browser</title>
        <!--STYLE SHEETS-->
        <!------------------------------------------------------------------------------->
        <!--specific layer styles-->
        <style type="text/css">
            <!--
            -->
        </style>
        <!--EXTERNAL JAVASCRIPT-->
        <!------------------------------------------------------------------------------->
        <!--for scrollbar-->
        <SCRIPT LANGUAGE="JavaScript"
SRC="dynlayer.js"></SCRIPT>
        <SCRIPT LANGUAGE="JavaScript"
SRC="scroll.js"></SCRIPT>
        <!--INTERNAL JAVASCRIPT-->
        <!------------------------------------------------------------------------------->
        <script language=javascript>
            //<!--
                imageList = new Array( "P0000102.JPG",
"P0000107.JPG", "P0000130.JPG", "P0000134.JPG", "P0000141.JPG",
"P0000177.jpg", "P0000179.JPG", "P0000272.jpg", "P0000286.jpg",
"P0000295.JPG", "P0000308.JPG", "P0000311.JPG", "P0000321.jpg",
"P0000326.jpg", "P0000327.JPG", "P0000335.jpg", "P0000384.jpg",
"P0000635.JPG", "P0000637.JPG", "P0000662.JPG");
                imageListSelected = new Array( 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 );
            //-->
        </script>
        <!--javascript to deal with different browser implementations of
layers/css-->
        <script language=javascript>
            //<!--
            //layers will work on both browsers using this function in
onload( )
                //-----------------------------------------------------------------------
                var layerRef=" ", styleSwitch=" ";
                function pageInit( ){
            if (navigator.appName == "Netscape") {
                layerRef="document.layers";
        styleSwitch=" ";
            }
            else{
                layerRef="document.all";
                styleSwitch=".style";
            }
        }
                //-->
    </script>
    <!--initializes scroll object-->
    <SCRIPT LANGUAGE="JavaScript">
    //<!--
                function init( ) {
                        myscroll.activate( )
                }
                // Initialize Scroll Object
                // change for position of images layer -
scroll(left, top, width, height)
                myscroll = new Scroll(35, 106, 290, 355)
                myscroll.build( )
                writeCSS (
                myscroll.css
                )
```

-continued

```
//-->
</SCRIPT>
<!--preloading images-->
<script language=javascript>
        <!--
        if (document.images){
            //--------------------------------
            // PRELOAD IMAGES
            //--------------------------------
            presentOn = new Image( );
            presentOn.src = "graphics/nav/presentOn.gif";
            presentOff = new Image( );
            presentOff.src = "graphics/nav/presentOff.gif";
            presentOver = new Image( );
            presentOver.src = "graphics/nav/presentOver.gif";
            printOn = new Image( );
            printOn.src = "graphics/nav/printOn.gif";
            printOff = new Image( );
            printOff.src = "graphics/nav/printOff.gif";
            printOver = new Image( );
            printOver.src = "graphics/nav/printOver.gif";
            sendOn = new Image( );
            sendOn.src = "graphics/nav/sendOn.gif";
            sendOff = new Image( );
            sendOff.src = "graphics/nav/sendOff.gif";
            sendOver = new Image( );
            sendOver.src = "graphics/nav/sendOver.gif";
            saveOn = new Image( );
            saveOn.src = "graphics/nav/saveOn.gif";
            saveOff = new Image( );
            saveOff.src = "graphics/nav/saveOff.gif";
            saveOver = new Image( );
            saveOver.src = "graphics/nav/saveOver.gif";
            previewOff = new Image( );
            previewOff.src = "graphics/nav/previewOff.gif";
            previewOver = new Image( );
            previewOver.src =
"graphics/nav/previewOver.gif";
        }
    //-->
    </script>
    <script language=javascript>
        //changes a navigation image
        function changeImage(layerName, imgName, state) {
            if (document.images){
    eval(layerRef+'[layerName].document[layerName+"__"+imgName].src=eval(i
mgName + state+".src")');
            }
        }
        //changes current screen
        currentScreen = "preview";
        function changeScreen(newScreen) {
            //hide old screen
            hideScreen(currentScreen);
            //show new screen
            showScreen(newScreen);
            //update current Screen variable
            currentScreen = newScreen;
        }
        //hides a screen
        function hideScreen (screenToHide) {
            if (screenToHide == "preview") {
                //hideLayer("previewLayer");
                //hideLayer("previewImageLayer");
                //hideLayer("previewImageBorderHLayer");
                //hideLayer("previewImageBorderVLayer");
                //hideLayer("imageInfoLayer");
                //hideLayer("navPreviewLayer");
            }
            else if (screenToHide == "present") {
                hideLayer("presentLayer");
                hideLayer("navPresentLayer");
                hideLayer("whiteLayer");
            }
            else if (screenToHide == "print") {
                hideLayer("printLayer");
                hideLayer("navPrintLayer");
                hideLayer("whiteLayer");
            }
```

-continued

```
                    else if (screenToHide == "send") {
                        hideLayer("sendLayer");
                        hideLayer("navSendLayer");
                        hideLayer("whiteLayer");
                    }
                    else if (screenToHide == "save") {
                        hideLayer("saveLayer");
                        hideLayer("navSaveLayer");
                        hideLayer("whiteLayer");
                    }
                }
                //shows a screen
                function showScreen (screenToShow) {
                    if (screenToShow == "preview") {
                        showLayer("previewLayer");
                        showLayer("previewImageLayer");
                        if (document
["previewImage"].width>document ["previewImage"].height) {
    showLayer("previewImageBorderHLayer");
                        }
                        else if (document
["previewImage"].height>document ["previewImage"].width) {
    showLayer("previewImageBorderVLayer");
                        }
                        showLayer("imageInfoLayer");
                        showLayer("navPreviewLayer");
                    }
                    else if (screenToShow == "present") {
                        showLayer("whiteLayer");
                        showLayer("presentLayer");
                        showLayer("navPresentLayer");
                    }
                    else if (screenToShow == "print") {
                        showLayer("whiteLayer");
                        showLayer("printLayer");
                        showLayer("navPrintLayer");
                    }
                    else if (screenToShow == "send") {
                        showLayer("whiteLayer");
                        showLayer("sendLayer");
                        showLayer("navSendLayer");
                    }
                    else if (screenToShow == "save") {
                        showLayer("whiteLayer");
                        showLayer("saveLayer");
                        showLayer("navSaveLayer");
                    }
                }
```

In summary, a method and system for viewing images from a digital camera **110** on a host computer has been disclosed whereby a formatted HTML file referencing the images stored on the camera **110** is automatically generated that is accessible by the computer's web browser when the camera **110** is connected to the host computer as a mass storage device. According to the present invention, the user is able to view the contents of the camera **110** on the computer using a standard web browser interface, eliminating the need for the user to insert a CD-ROM into the PC **112** and install specialized communication and viewing software for that particular make of camera **110**.

Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. For example, the present invention may be implemented in other types of image capture devices, such as an electronic device for archiving images that displays stored images on a television, for instance. In addition, software written according to the present invention may be stored on a computer-readable medium, such as a removable memory, or transmitted over a network, and loaded into the digital camera for execution. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A method for viewing images from an image capture device on a host computer, comprising steps of:

a) establishing communication between the image capture device and the host computer;

b) automatically generating an Internet page description file in the image capture device that references the images stored therein;

c) mounting the image capture device as a disk on the host computer; and

d) opening the Internet page description file in a web browser on the host computer, wherein the images stored in the image capture device are displayed on the host computer through the web browser without the need for loading camera-specific communication software onto the host computer.

2. A method as in claim **1** wherein step b) further includes the step of:

i) providing Java files along with the Internet page description file in the image capture device.

3. A method as in claim 2 wherein a portion of the images in the image capture device are stored as compressed image files, step d) further including the step of:

i) executing the Java files on the host computer for decompressing the compressed image files and for extracting information from the image files for display by the web browser.

4. A method as in claim 3 wherein step b) further includes the step of:

ii) automatically generating the Internet page description file when communication with the host computer is indicated.

5. A method as in claim 4 further including to step of:

e) storing the images displayed in the web browser on the host computer by copying the compressed image files from the image capture device directly to the host computer.

6. A method as in claim 5 wherein step e) further includes the steps of:

i) determining if any of the compressed image files have previously been copied to the host computer, and

ii) copying only the compressed image files to the host computer that have not been previously copied.

7. A method as in claim 6 further including the steps of:

f) uploading the Java files and the Internet page description file to the host computer, and

g) opening the Internet page description file in the web browser on the host computer to display the images stored in host computer.

8. A system for viewing images from an image capture device on a host computer, comprising:

a host computer having an operating system and a web browser; and

a digital camera having a plurality of images stored therein in communication with the host computer such that the digital camera appears to the host computer as a disk, the digital camera including means for generating an Internet page description file that references the stored images, wherein the Internet page description is accessible by the web browser on the host computer to enable a user to view the images on the digital camera from the host computer without the need for loading camera-specific communication software onto the host computer.

9. A system as in claim 8 wherein each image in the digital camera is stored in a compressed image file, the Internet page description file further having associated Java files that are invoked by the web browser for decompressing the compressed image files and for extracting information from the image files for display by the web browser.

10. A system as in claim 9 wherein the means for generating the Internet page description file generates the Internet page description file in response to an indication that the digital camera is in communication with the host computer.

11. A system as in claim 10 wherein the Internet page description file is a HTML file.

12. A system as in claim 11 wherein the HTML file creates web pages that allow the user to transfer the images between the digital camera, the host computer, and the Internet.

13. A computer-readable medium containing program instructions for viewing images from a digital camera on a host computer, the program instructions for:

a) automatically generating in the digital camera an HTML file that references the images stored in the digital camera;

b) establishing a Universal Serial Bus (USB) connection between the digital camera and the host computer; and

c) identifying the digital camera to the host computer as a mass storage device class whereby the digital camera appears to the host computer as a disk, thereby allowing a user to open the HTML file in a web browser on the host computer, wherein the images stored in the digital camera are displayed on the host computer through the web browser without the need for loading camera-specific communication software onto the host computer.

14. A computer-readable medium an in claim 13 wherein instruction a) further includes the instruction of:

i) automatically generating an HTML file in response to the digital camera being placed into connect mode.

15. A computer-readable medium as in claim 14 wherein instruction a) further includes the instruction of:

ii) providing Java files along with the HTML file in the digital camera.

16. A computer-readable medium as in claim 15 wherein the HTML file includes an introduction page referencing an index page, further including the instruction of:

d) executing a Java Generation Applet on the host computer that scans the digital. camera for images and generates the index page accordingly.

17. A computer-readable medium as in claim 15 wherein a portion of the images in the digital camera are stored as a compressed image files, further including the instruction of:

d) executing the Java files on the host computer for decompressing the compressed image files and for extracting information from the image files for display by the web browser.

18. A computer-readable medium as in claim 17 further including the instruction of:

e) storing the images displayed in web browser on the host computer by copying the compressed image files from the digital camera directly to the host computer.

19. A computer-readable medium as in claim 18 wherein instruction e) further includes the instructions of:

i) determining if any of the compressed image files have previously been copied to the host computer, and

ii) copying only the compressed image files images to the host computer that have not been previously copied.

20. A computer-readable medium as in claim 19 further including the instructions of:

uploading the Java files and the HTML file to the host computer, and

g) opening the HTML, file in the web browser on the host computer to display the images stored in host computer.

* * * * *