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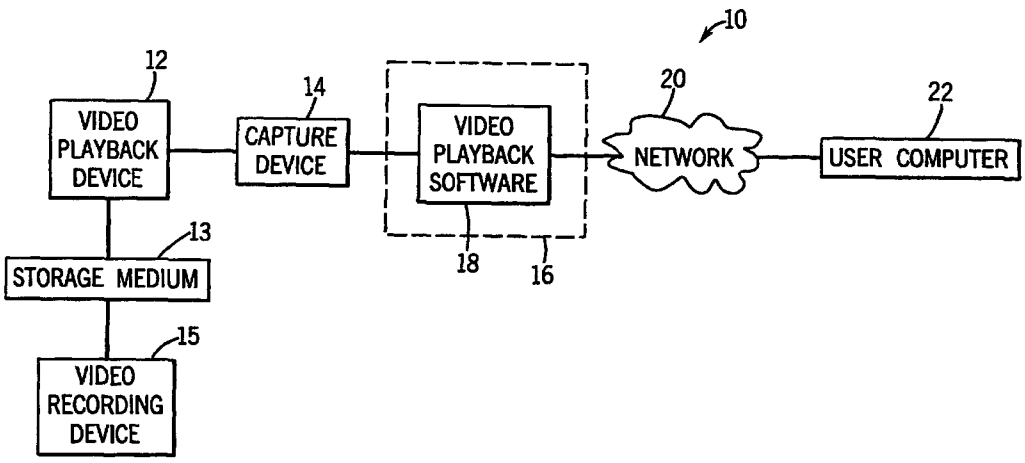
(54) Title: SYSTEM AND METHOD FOR VIDEO PLAYBACK OVER A NETWORK



(57) Abstract: A system and method for video playback over a network includes a video playback device configured to transmit a video signal from a non-volatile storage medium and a computer coupled to the video playback device configured to receive the video signal and to transmit the video signal over a network.

WO 00/76221 A1

TITLE OF THE INVENTION

SYSTEM AND METHOD FOR VIDEO PLAYBACK OVER A NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/137,921, filed June 7, 1999, and U.S. Provisional Application No. 60/141,440, filed June 29, 1999.

FIELD OF THE INVENTION

The present invention relates generally to a system and method for playing a video program over a network. The present invention also relates to a system and method for controlling a video device over a network.

BACKGROUND OF THE INVENTION

The widespread and ever-growing use of communication networks, such as the Internet and other computer-to-computer communication networks, for the dissemination of information, has fueled the need to provide for the transmission of video data over these networks. Currently, the transmission of video data over networks has been less than optimal, given current bandwidth and technology constraints. These constraints have impeded the ability to offer enhanced resolution and/or full motion video data over these networks.

The Internet marketplace is demanding enhanced resolution and high definition streaming video and precise representations of video images, objects, and events. Streaming video is a technique by which video is played in real time as it is downloaded over the Internet, as opposed to storing it in a local file

first. Video player software, operable on a user computer, decompresses and plays the data as it is transferred to the user computer over the Internet. Streaming video avoids the delay entailed in downloading an entire file and then playing it with a plug-in application. Streaming video requires a communications connection and a computer powerful enough to execute the decompression algorithm in real time.

One application for such technology is in the transmission of full screen video programs upon demand. Conventional computer network video transmission techniques for streaming video involve playing video over the network under conditions which have been dictated by and, thus, limited by the bandwidth and other technological constraints of the network, the transmission medium and equipment, as well as the computers operating in conjunction therewith. Given these constraints, video data has traditionally been compressed to varying extents in order to facilitate its transmission over a limited-bandwidth network. This compression has resulted in video having less than optimal quality characterized by grainy, blurry, and severely distorted video. Further, the ability to increase the screen size to a full screen viewing of the video information has also typically been accompanied by severe distortion and reduced resolution.

As a result, there is a need for an improved system and method for video playback over a network. There is further a need for a system and method for video playback that does not require a download at the user computer before viewing. Further still, there is a need for a system and method for controlling playback of a video via the Internet.

BRIEF SUMMARY OF THE INVENTION

According to one exemplary embodiment, a system and method for video playback over a network includes a video playback device configured to transmit a video signal from a non-volatile storage medium and a computer coupled to the video playback device configured to receive the video signal and to transmit the video signal over a network.

According to another exemplary embodiment, a method of video playback over a network includes receiving an operation command; retrieving a video signal from a non-volatile storage medium in response to the operation command; capturing the video signal; and providing the captured video signal over a network to a user computer.

According to yet another exemplary embodiment, a system for video playback over the Internet includes means for storing a video signal; means for receiving an operation command; means for transmitting the video signal in response to the operation command; means for capturing the transmitted video signal; and means for sending the captured video signal over the Internet.

According to another exemplary embodiment, a system for controlling a video device over a network includes a network computer configured to receive an operation command from a remote user over a network, and a video device coupled to the network server configured to receive the operation command from the network server and to perform a video operation based on the operation command.

According to yet another exemplary embodiment, a system for controlling a video device over a network includes a network computer configured to generate a user interface; a user

computer configured to access the user interface via a network; and a video device coupled to the network computer configured to receive an operation command from the user computer via the user interface and to perform a video operation based on the operation command.

According to still another exemplary embodiment, a system for controlling a video device over the Internet includes means for receiving a user command from a remote computer over the Internet, and means for performing a video operation based on the user command.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more fully understood from the following detailed description, taken in conjunction with the accompanying drawings, wherein like reference numerals refer to like parts, in which:

FIG. 1 is a block diagram of a system for video playback over a network according to an exemplary embodiment; and

FIG. 2 is a flowchart of a method of video playback over a network according to the exemplary embodiment of FIG. 1.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

The exemplary embodiments illustrated in FIGS. 1 and 2 provide a system and method for real-time playback of full-screen video data over a communication network. Compression and other manipulation of the video data is optional, since such manipulation typically results in decreased resolution and definition. Furthermore, saving compressed files of video data is not required to provide enhanced playback of video data to users over the network. While

the exemplary embodiments are explained with reference to video signals, it is understood that a video signal may include corresponding audio signals therein. Alternatively, the corresponding audio signals may be processed through a different method.

FIG. 1 illustrates a system 10 according to an exemplary embodiment. System 10 includes a video playback device 12, a storage medium 13, a capture device 14, a video recording device 15, and a central processing computer 16. Video playback device 12 is coupled through capture device 14 to computer 16. Computer 16 is coupled via a network 20 to a user computer 22. Computer 16, as described herein, performs various data processing functions as well as transmits video data to user computer 22. The video data may be transmitted on demand from a remote user at user computer 22, or upon initiation by or under the control of central processing computer 16.

In this exemplary embodiment, computer 16 is a local network server and user computer 22 is a network client. Computer 16 can be any suitable computer or network of computers, such as, a mainframe computer, a network server computer, a personal computer, etc. User computer 22 can be any suitable computer or communication device such as a personal computer, a personal digital assistant, a hand-held computer, a palm top computer, a video telephone, etc. Computers 16 and 22 include any necessary hardware and software, including interfacing hardware and software for interfacing with other devices, for performing any of the method steps described herein. Computer 16 includes video playback software 18 (e.g., scripts and any associated video playing software, playback software, video conferencing software, etc.) For example, video playback software 18 may include Microsoft

Netmeeting 3.01, manufactured by Microsoft Corp., Redmond, Washington. Computers 16 and 22 are configured to communicate via network 20 (e.g., the Internet, a computer-to-computer network, an internet, an intranet, a local area network (LAN), a wide area network (WAN), etc.) utilizing suitable network interface devices. According to one exemplary embodiment, a high-speed cable connection is utilized on each end of network 20. Alternative network connections include a telephone modem (e.g., at 28 kilobits per second (kbps) or 56 kpbs), an ISDN line, a T1 line, etc.

System 10 further includes a video recording device 15. Video recording device 15 can be a video camera, a Beta video recorder, an 8mm film camera/recorder, a 32mm film camera/recorder, a Beta SP recorder, a VHS (Vertical Helix Scan) recording device, or any other suitable video recording device. One suitable video recording device is a Sony DCR VX-1000 digital video camera, having 3CCD technology, manufactured by Sony Electronics, Inc., Park Ridge, N.J. Video recording device 30 is configured to record an event and store the recorded event on non-volatile storage medium 35. The term "non-volatile storage medium", as used in this application, means a storage medium whose contents are preserved after storing or recording without the use of a power source. Examples of non-volatile storage devices include magnetic disks, magnetic tape, or other forms of magnetic media, compact disk (CD-ROM), digital versatile disk (DVD), or other optical media, Electrically-Erasable Programmable Read-Only Memory (EEPROM), paper tape, punched cards, etc. In contrast, examples of volatile storage devices include static RAM and dynamic RAM (however, while RAM is normally volatile, it can be made into non-volatile storage by having a power source, such as a battery or

rechargeable battery, permanently connected), charge-coupled devices (CCDs), and an acoustic delay line.

Video playback device 12 is configured to play or transmit a video signal from non-volatile storage medium 13 to computer 16 via capture device 14. Video playback device 12 can be a digital camera, an analog camera, a tape deck, a VCR (Video Cassette Recorder), a VHS system, a Beta system, a compact disk player, a video disk player, a digital versatile disk (DVD) player, or any other suitable device for transmitting a video signal from a storage medium. For example, an analog camera has two modes: "camera" and "VCR". When used as a playback device, VCR mode is selected on the camera. Capture device 14 is any interface circuit configured to provide a digital or analog video signal to computer 16. For example, capture device 14 may include a Dazzle LAV-1000S capture device manufactured by Dazzle, Inc. of Fremont, California. Capture device 14 may be internal to computer 16 or video playback device 12 or external to both. The video signal provided to capture device 14 and the captured video signal output by capture device 14 may be in any video format or streaming video format, including television standards, such as, NTSC (National Television Standards Committee), PAL (Phase Alternative Line), SECAM (Séquentiel Couleur Avec Mémoire), digital formats, such as, AVI, MOV, MPEG, a digital format compatible with the IEEE 1394 standard, or other formats.

According to one alternative embodiment, video playback device 12 and computer 16 may be combined as one system, obviating the need for capture device 14. Further, video playback device 12 and video recording device 15 may be the same device (e.g., a VCR).

FIG. 2 illustrates a method 30 of video playback according to an exemplary embodiment. At step 32, an event is recorded by utilizing video recording device 15. At step 34, a video signal is stored on storage medium 13. Typically, recording and storing are performed substantially simultaneously, e.g., in a camcorder. At step 36, the recorded video signal on storage medium 13 is transferred to video playback device 12. For example, if the video signal has been recorded with a video camera and stored on a compact disk, video playback device 12 can be any suitable compact disk player. At step 38, video playback device 12 is initialized via computer 16. Computer 16 initializes video playback device 12 via any suitable program software or a suitable script. In this exemplary embodiment, a software driver for capture device 14 is operable on computer 16. Furthermore, video conference software utilized on computer 16 may also be used to select capture card 14 as a source of video data.

At step 40, computer 16 links to user computer 22. This link may result from an initiation by a remote user via user computer 22, or from an initiation by computer 16. The connection or link between computer 16 and user computer 22 can be accomplished by utilizing any suitable video playback software or video conferencing software operable on each of computers 14 and 22.

At step 42, computer 16 is configured to transmit an operation command to video playback device 12 to command device 12 to perform a video operation corresponding to the operation command. Operation commands may include a play command that causes device 12 to begin transmitting the video signal from storage medium 13, a stop command that causes device 12 to cease

transmitting the video signal from storage medium 13, and other similar commands, such as rewind, fast forward, etc. The operation command may be transmitted through capture device 14 to video playback device 12, or may be transmitted along a separate transmission line or cable.

One alternative system for providing the operation command to video playback device 12 is an infrared signal generator circuit. The infrared signal generator circuit is coupled to computer 16. The circuit receives the operation command from the computer in USB (Universal Serial Bus) format or another signal format. The circuit converts the USB signal to an infrared signal and transmits the infrared signal into the area surrounding computer 16. Video playback device 12 includes an infrared input circuit configured to receive the infrared signal and control one or more operations on the playback device (e.g., play, record, stop, rewind, fast-forward, etc.) based on the operation command on the infrared signal. Alternative circuits, wires, or methods are contemplated for providing the operation command to video playback device 12.

In response to the operation command, video playback device 12 is configured to perform the video operation. For example, in response to receiving a play command, device 12 begins retrieving the video signal from storage medium 13. The video signal may be played locally and/or transmitted to capture device 14. Capture device 14 digitizes the video signal, if the video signal is an analog signal, and provides the digital video signal to video playback software 18. In this exemplary embodiment, video playback software 18 is video conferencing software, such as, Microsoft Netmeeting 3.01. Video playback software 18 may perform one or more processing steps on the video signal, such as, compression,

conversion, encoding, or some other type of data manipulation, based on parameters selected by an operator. For example, an operator selects a full screen mode (e.g., 640 x 480 pixels), a Dazzle video conference driver, and the highest available image quality. User computer 22 may also run video conferencing software, such as Microsoft Netmeeting 3.01, with the same or similar parameters to those of video playback software 18. Capture device 14 may further be configured for full screen mode capture via a driver, the video conferencing software, or otherwise.

Video playback software then transmits the video signal across the network 20 (e.g., the Internet) to a user computer 22 in step 44. Finally, user computer 22 operates a software program in step 46 that enables viewing of the video signal (e.g., a video player, such as, RealPlayer, manufactured by RealNetworks, Inc., Seattle, Washington, Microsoft Netmeeting, etc.).

As a further feature, the operation command may be received via network 20 from user computer 22. According to this exemplary feature, computer 16 is configured to generate a user interface (e.g., a web page, a Microsoft Windows screen accessed via remote desktop sharing software, such as, Microsoft Netmeeting, Norton PCAnywhere, etc.) accessible by user computer 22 via network 20. One example of a suitable program operable on computer 16 is Adobe Premier 5.1, manufactured by Adobe Systems Inc., San Jose, California. A user selects "File/Capture/Movie" from user computer 22 using Microsoft Netmeeting, which presents a viewable interface having a plurality of operation commands. A user views the operation command options (e.g., play, stop, rewind, fast-forward, etc.) on the user interface and selects one or more operation command options using a mouse, keyboard, or other input

device. Thus, user computer 22 provides the operation command via a script or other software command to video playback device 12 via video playback software 18.

User computer 22 may further provide an operation command to video recording device 15 or to a simple video camera to command device 15 to perform a video operation (e.g., record, play, rewind, move camera up, move camera down, move camera left, move camera right, zoom camera in, zoom camera out, etc.). Thus, the video camera may be mounted on a motorized camera mounting, the mounting being controllable via the operation command. In this embodiment, in response to a play command or camera command, a video signal is provided in real time (i.e., live) directly from video recording device 15 through capture device 14, through video playback software 18, over network 20 to user computer 22. This feature is particularly advantageous when used with a Sony digital video camera having 3CCD technology due to the increased zooming capability allowed relative to other cameras, particularly standard video conferencing cameras.

In this manner, the exemplary embodiment provides for the transmission of real-time and enhanced resolution video data over network 20. Little or no data compression or other data manipulation is required, thereby maintaining enhanced resolution in the delivered video data. The enhanced resolution video data can be made available at user computer 22 and/or at the computer 16. In another exemplary embodiment, either or both of steps 38 and 40 (i.e., initialization steps) are eliminated.

In an alternative embodiment, the processing steps described herein for video recording device 15, central processing computer 16, and video playback device 12 can be combined into

and performed by one or more integrated devices with the operation of the integrated device being programmed for operation as described herein.

In another alternative embodiment, the video data description herein can be combined with three-dimensional video data so as to provide enhanced resolution three-dimensional video data in a network environment.

According to one application of the principles herein, a plurality of playback devices may be used, each to play back one of a plurality of videos from a cassette tape or DVD to a user accessing the system via the Internet. The videos may be home videos, movies, training sessions, seminars, etc.

According to another application of the principles herein, a video camera may be positioned in a house or other building and coupled through a computer to the Internet. A user may access the video camera remotely (e.g., from work) to monitor the house, control the camera by moving the camera left and right, zoom the camera, etc.

EXAMPLE

A first personal computer (PC) was coupled to a Dazzle LAV-1000S capture device. The Dazzle device was then coupled to a Sony TRV900 digital camera having 3CCD technology. A pre-recorded video tape was placed in the camera. The first PC was loaded with Amigo software, manufactured by Dazzle, Inc. and also Microsoft NetMeeting 3.01 software. The Amigo software was used to initialize the Dazzle device to receive a video signal from the

digital camera. The NetMeeting software was used to allow access to the first PC from the Internet.

A second PC at a location remote to that of the first PC was loaded with Microsoft NetMeeting 3.01. The second PC gained access to the first PC via the Internet using the NetMeeting software. From the second PC, a user viewed the Amigo software user interface and selected a "play" command from the user interface. The Amigo software sent the play command through the Dazzle device to the digital camera. The digital camera received the play command and, in response, began transmitting a video signal from the pre-recorded video tape through the Dazzle device to a display window in the Amigo software, which was viewed over the Internet at the second PC.

Next, a user at the second PC selected a "record" command from the user interface of the Amigo software. The Amigo software sent the record command through the Dazzle device to the digital camera. The digital camera received the record command and, in response, began transmitting a video signal representing the live, real-time video being viewed by the digital camera. This video signal was transmitted through the Dazzle device to a display window in the Amigo software, which was viewed over the Internet at the second PC. The video signal was also recorded to a tape in the digital camera.

Subsequently, the Internet connection was replaced by a local area network connection and a modem-to-modem connection, and similar results were obtained.

While the embodiments and application of the invention illustrated in the FIGS. and described above are presently preferred,

it should be understood that these embodiments are offered by way of example only. For example, alternative methods are contemplated for initializing video playback device 12 to operate with computer 16, and alternative methods are contemplated for linking computer 16 with user computer 22. Accordingly, the present invention is not limited to a particular embodiment, but extends to various modifications that nevertheless fall within the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A system for video playback over a network, comprising:

a video playback device configured to transmit a video signal from a non-volatile storage medium; and

a computer coupled to the video playback device configured to receive the video signal and to transmit the video signal over a network.

2. The system of claim 1, further comprising a capture device coupled between the video playback device and the computer, the capture device configured to receive the video signal and to generate a digital video signal based on the video signal.

3. The system of claim 2, wherein the computer utilizes video conferencing software to receive the digital video signal, to perform at least one processing step thereon, and to provide the digital video signal over the network.

4. The system of claim 3, wherein the processing step includes configuring the digital video signal for full screen display on a user computer.

5. The system of claim 4, wherein the capture device is configured to capture the video signal at a full screen size.

6. The system of claim 1, wherein the network includes the Internet.

7. The system of claim 1, wherein the video playback device is one of a video cassette recorder, a video cassette player, a digital versatile disk player, and a video camera.

8. The system of claim 1, wherein the computer is configured to transmit an operation command to the video playback device.

9. The system of claim 8, wherein the computer is configured to receive the operation command from the network.

10. The system of claim 9, wherein the operation command is a play command.

11. The system of claim 1, wherein the non-volatile storage medium is one of a magnetic tape and a read-only memory.

12. The system of claim 8, further comprising an infrared signal generator circuit configured to receive the operation command from the computer and to provide the operation command via an infrared signal to the video playback device.

13. A method of video playback over a network, comprising:

receiving an operation command;

retrieving a video signal from a non-volatile storage medium in response to the operation command;

capturing the video signal; and

providing the captured video signal over a network to a user computer.

14. The method of claim 13, wherein the operation command is generated by a local computer.

15. The method of claim 14, wherein the operation command is received from the user computer.

16. The method of claim 15, wherein the operation command is a play command.

17. The method of claim 13, wherein the non-volatile storage medium is one of a magnetic tape and a read-only memory.

18. The method of claim 13, further comprising digitizing the video signal to generate the captured video signal.

19. The method of claim 13, wherein the network includes the Internet.

20. A system for video playback over the Internet, comprising:

means for storing a video signal;

means for receiving an operation command;

means for transmitting the video signal in response to the operation command;

means for capturing the transmitted video signal; and

means for sending the captured video signal over the Internet.

21. The system of claim 20, further comprising means for generating the operation command.

22. The system of claim 21, wherein the operation command is a play command.

23. The system of claim 20, wherein the means for storing includes a magnetic tape or a read-only memory.

24. The system of claim 20, further comprising means for digitizing the video signal to generate the captured video signal.

25. The system of claim 20, wherein the means for receiving an operation command includes an infrared receiver.

26. A system for controlling a video device over a network, comprising:

a network computer configured to receive an operation command from a remote user over a network; and

a video device coupled to the network server configured to receive the operation command from the network server and to perform a video operation based on the operation command.

27. The system of claim 26, wherein the network is the Internet.

28. The system of claim 27, wherein the video device is a video playback device, wherein the operation command is a play command, and wherein the video operation is a play operation.

29. The system of claim 28, wherein the video playback device is configured to retrieve a video signal from a non-volatile storage medium in response to the play command.

30. The system of claim 29, wherein the network computer is configured to receive the video signal and to provide the video signal over the Internet to the remote user.

31. The system of claim 26, wherein the video device is a video camera, wherein the operation command is a video camera control command.

32. The system of claim 31, wherein the video camera control command is one of a video record command, a video camera move command, and a video camera zoom command.

33. The system of claim 26, further comprising an infrared signal generator circuit configured to receive the operation command from the computer and provide the operation command via an infrared signal to the video device.

34. A system for controlling a video device over a network, comprising:

a network computer configured to generate a user interface;

a user computer configured to access the user interface via a network; and

a video device coupled to the network computer configured to receive an operation command from the user computer via the user interface and to perform a video operation based on the operation command.

35. The system of claim 34, wherein the network is the Internet.

36. The system of claim 34, wherein the video device is a video playback device, wherein the operation command is a play command, and wherein the video operation is a play operation.

37. The system of claim 36, wherein the video playback device is configured to transmit a video signal from the non-volatile storage medium in response to the play command.

38. The system of claim 37, wherein the network computer is configured to play the video signal across the network to the user computer.

39. The system of claim 34, wherein the video device is a video camera, wherein the operation command is a video camera control command.

40. The system of claim 39, wherein the operation command is one of a record command, a video camera move command, and a zoom command.

41. The system of claim 34, wherein the video device includes an infrared receiver and the network computer includes an infrared transmitter, the infrared transmitter configured to provide an the operation command via an infrared signal to the infrared receiver.

42. A system for controlling a video device over the Internet, comprising:

means for receiving a user command from a remote computer over the Internet; and

means for performing a video operation based on the user command.

43. The system of claim 42, wherein the means for performing includes a video playback device, wherein the user command is a play command, and wherein the video operation is a play operation.

44. The system of claim 43, further comprising:

means for storing a video signal; and

means for playing the video signal from the means for storing in response to the play command.

45. The system of claim 44, further comprising:

means for receiving the video signal and providing the video signal over the Internet to the remote computer.

46. The system of claim 42, wherein the means for performing includes a video camera, wherein the user command is a video camera control command.

47. The system of claim 46, wherein the video camera control command is one of a video record command, a video camera move command, and a video camera zoom command.

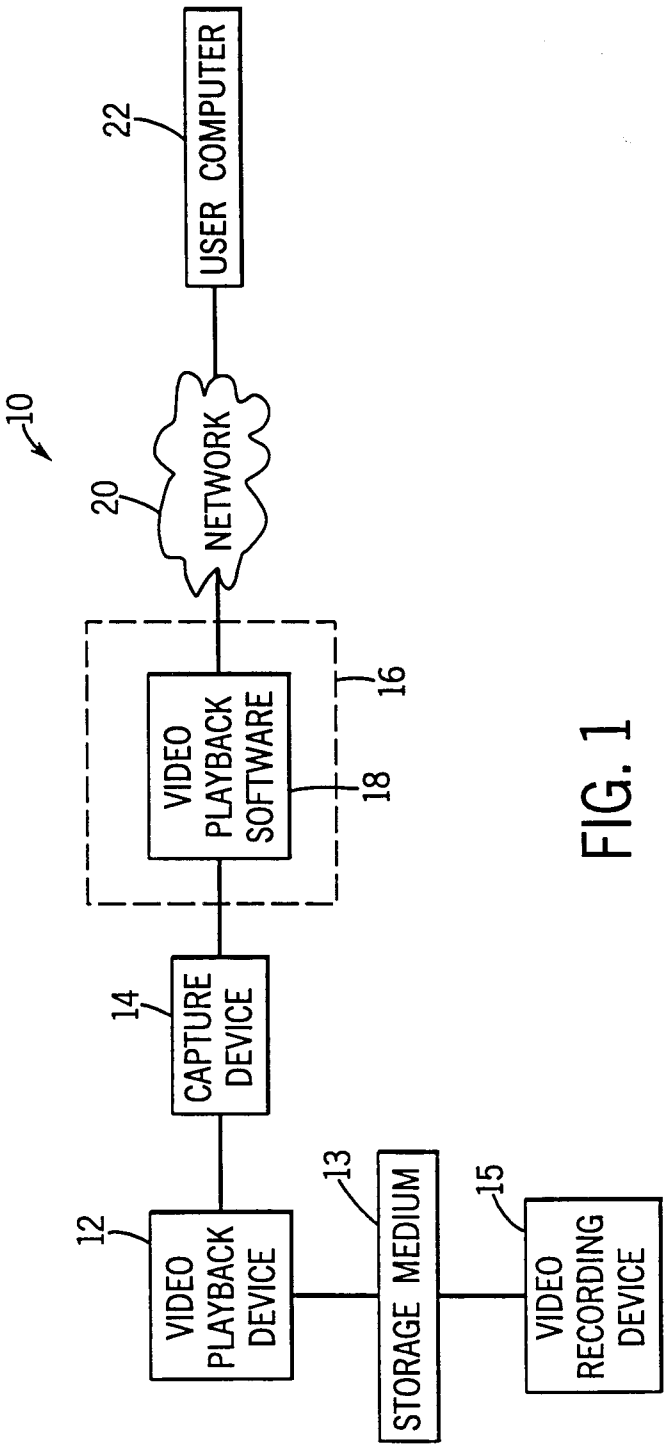
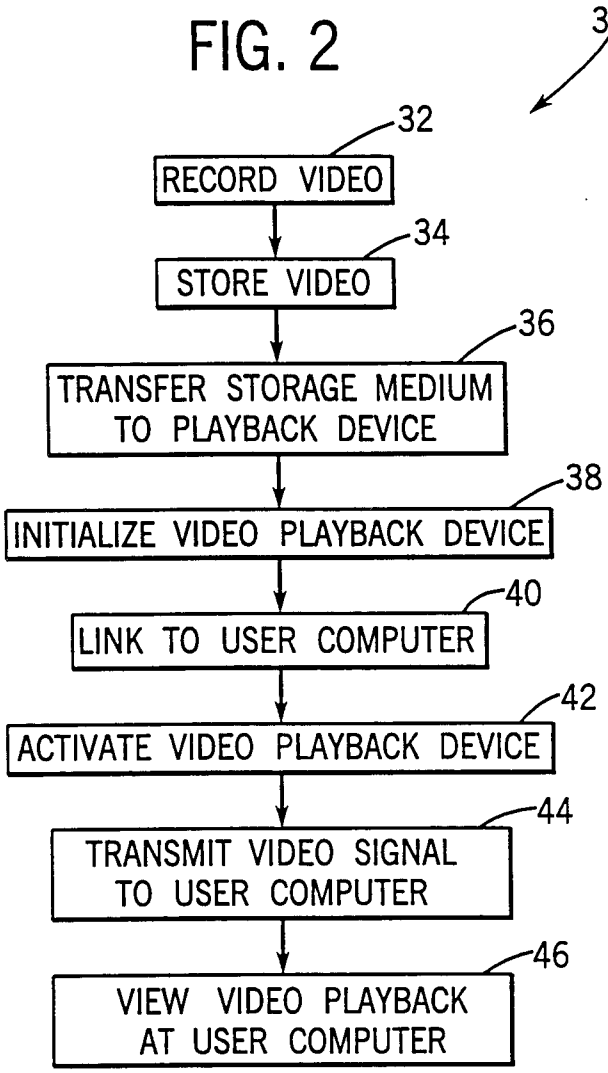

10
22
USER COMPUTER
20
NETWORK
16
VIDEO PLAYBACK SOFTWARE
18
14
CAPTURE DEVICE
12
VIDEO PLAYBACK DEVICE
13
STORAGE MEDIUM
15
VIDEO RECORDING DEVICE

FIG. 1

FIG. 2


30
32
RECORD VIDEO
34
STORE VIDEO
36
TRANSFER STORAGE MEDIUM TO PLAYBACK DEVICE
38
INITIALIZE VIDEO PLAYBACK DEVICE
40
LINK TO USER COMPUTER
42
ACTIVATE VIDEO PLAYBACK DEVICE
44
TRANSMIT VIDEO SIGNAL TO USER COMPUTER
46
VIEW VIDEO PLAYBACK AT USER COMPUTER

INTERNATIONAL SEARCH REPORT

Intern ıal Application No
PCT/US 00/15602

A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 515 099 A (CORTJENS LEO M ET AL) 7 May 1996 (1996-05-07) abstract column 1, line 51 - line 60 column 8, line 26 - line 54 column 11, line 9 - line 23 column 18, line 46 - line 61	1-47
A	WO 99 12349 A (DISCOVERY COMMUNICAT INC) 11 March 1999 (1999-03-11) the whole document	1-47
A	US 5 546 324 A (PALMER LARRY G ET AL) 13 August 1996 (1996-08-13) abstract; figures 1,2,6	1-47

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 October 2000	27/10/2000

Name and mailing address of the ISA	Authorized officer
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