



US006489986B1

(12) **United States Patent**
Allen

(10) **Patent No.:** **US 6,489,986 B1**
(45) **Date of Patent:** ***Dec. 3, 2002**

(54) **REMOTE CONTROL DEVICE FOR VIDEO AND AUDIO CAPTURE AND COMMUNICATION**

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/698,297**

(22) Filed: **Oct. 27, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/237,013, filed on Sep. 29, 2000.

(51) **Int. Cl.**⁷ **H04N 7/14**

(52) **U.S. Cl.** **348/14.01; 348/14.05; 348/14.02**

(58) **Field of Search** 348/14.01, 14.02, 348/14.03, 14.04, 14.05, 14.06, 14.07, 734; 379/93.17, 93.23; 725/100, 139, 141, 153

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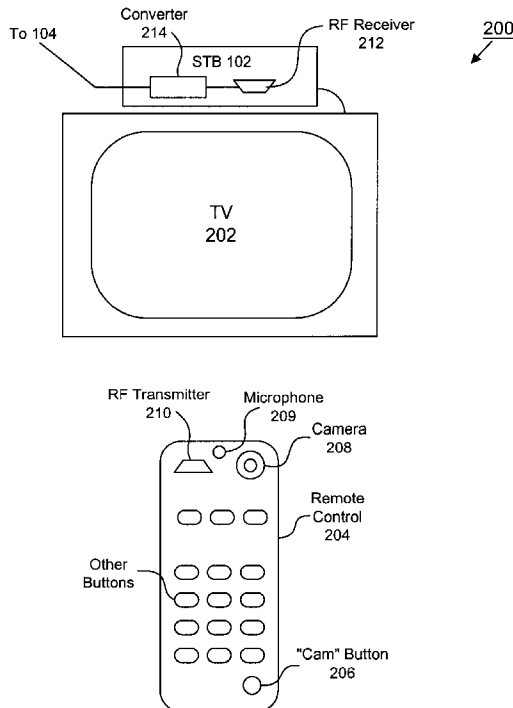
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(57) **ABSTRACT**

A remote control for an interactive television system includes an integrated camera and a wireless transmitter for transmitting video information captured by the camera to the interactive television system. A set top box for the interactive television system includes a wireless receiver for receiving the video information and a converter for transforming the video information into a network-compatible video stream for transmission to a network.

12 Claims, 8 Drawing Sheets



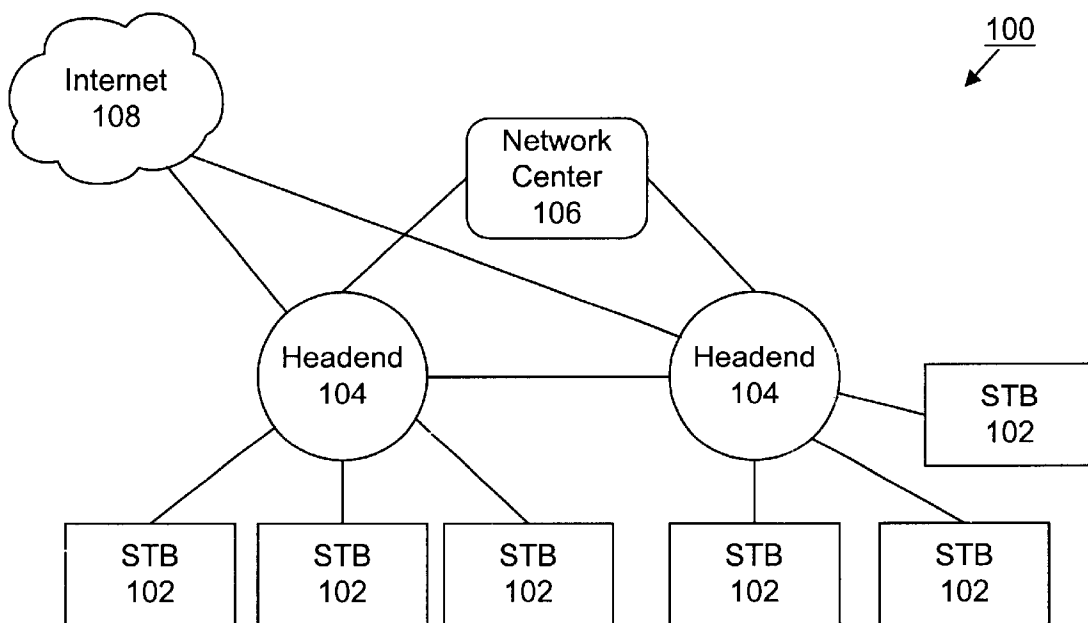


FIG. 1

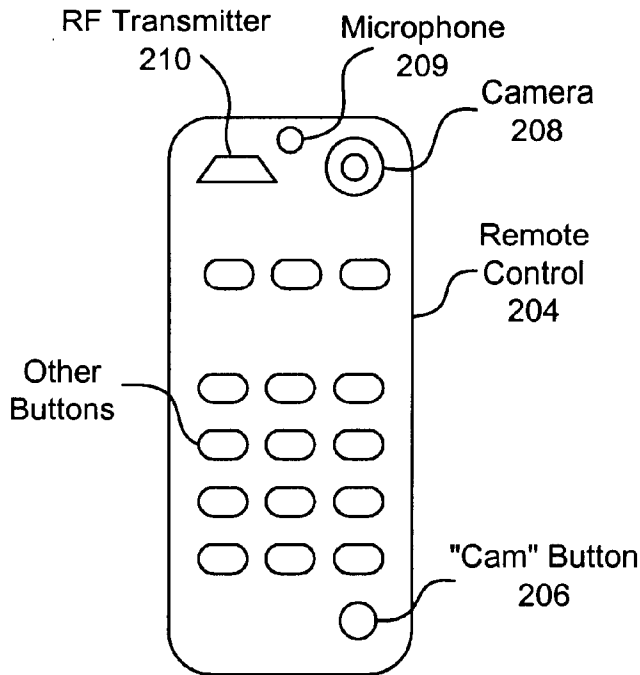
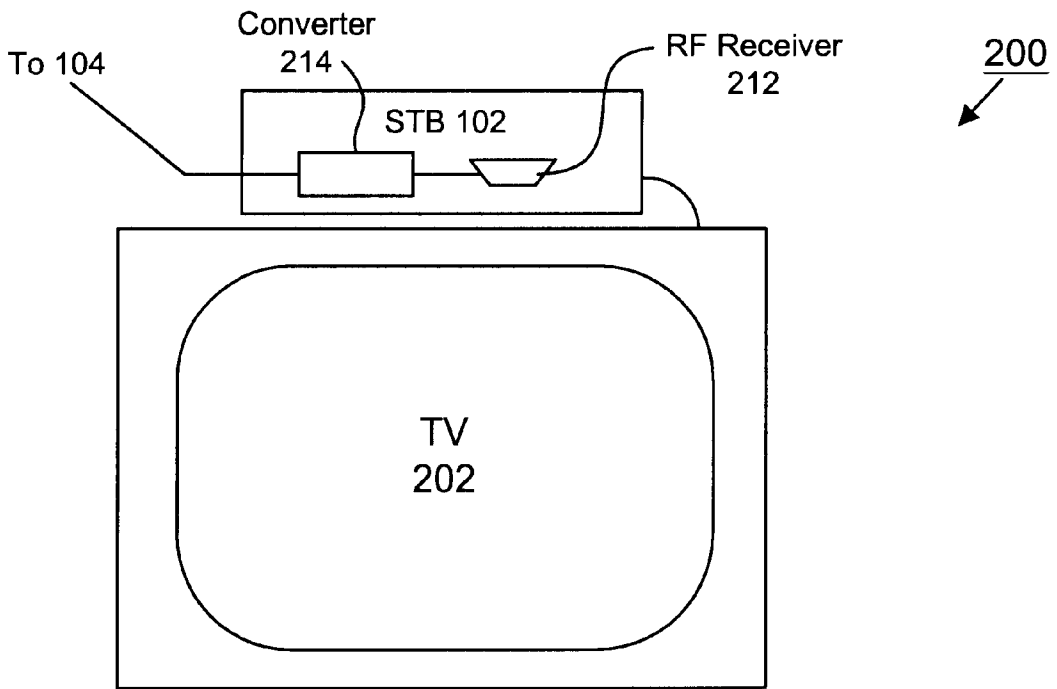


FIG. 2

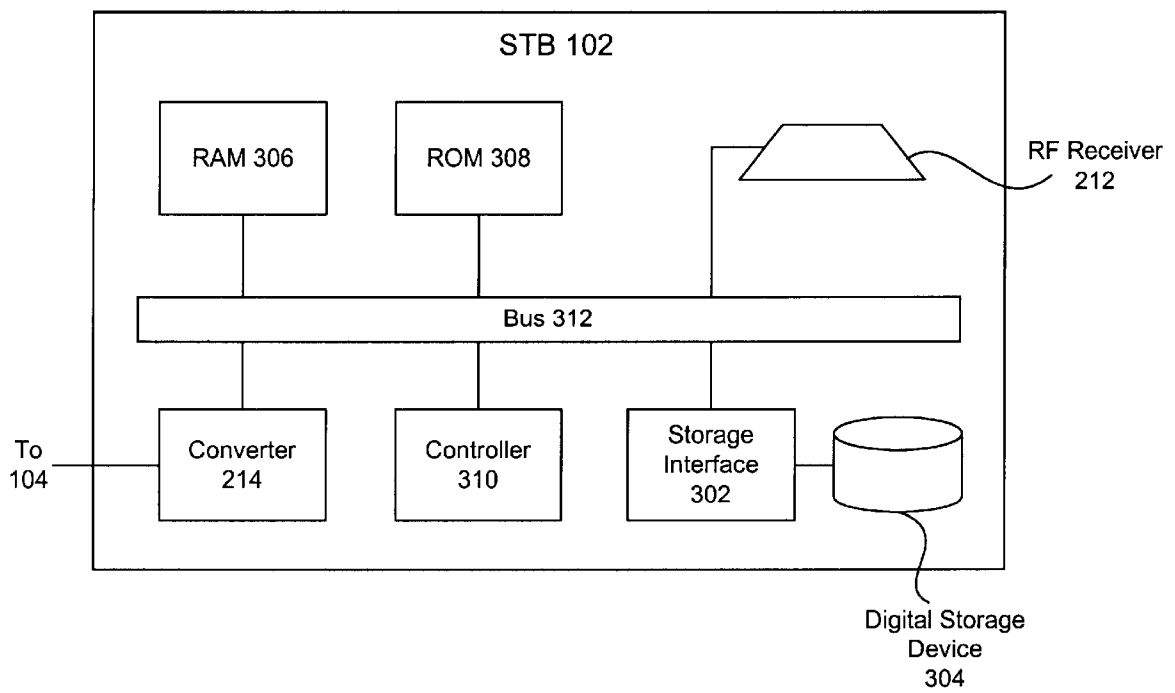


FIG. 3

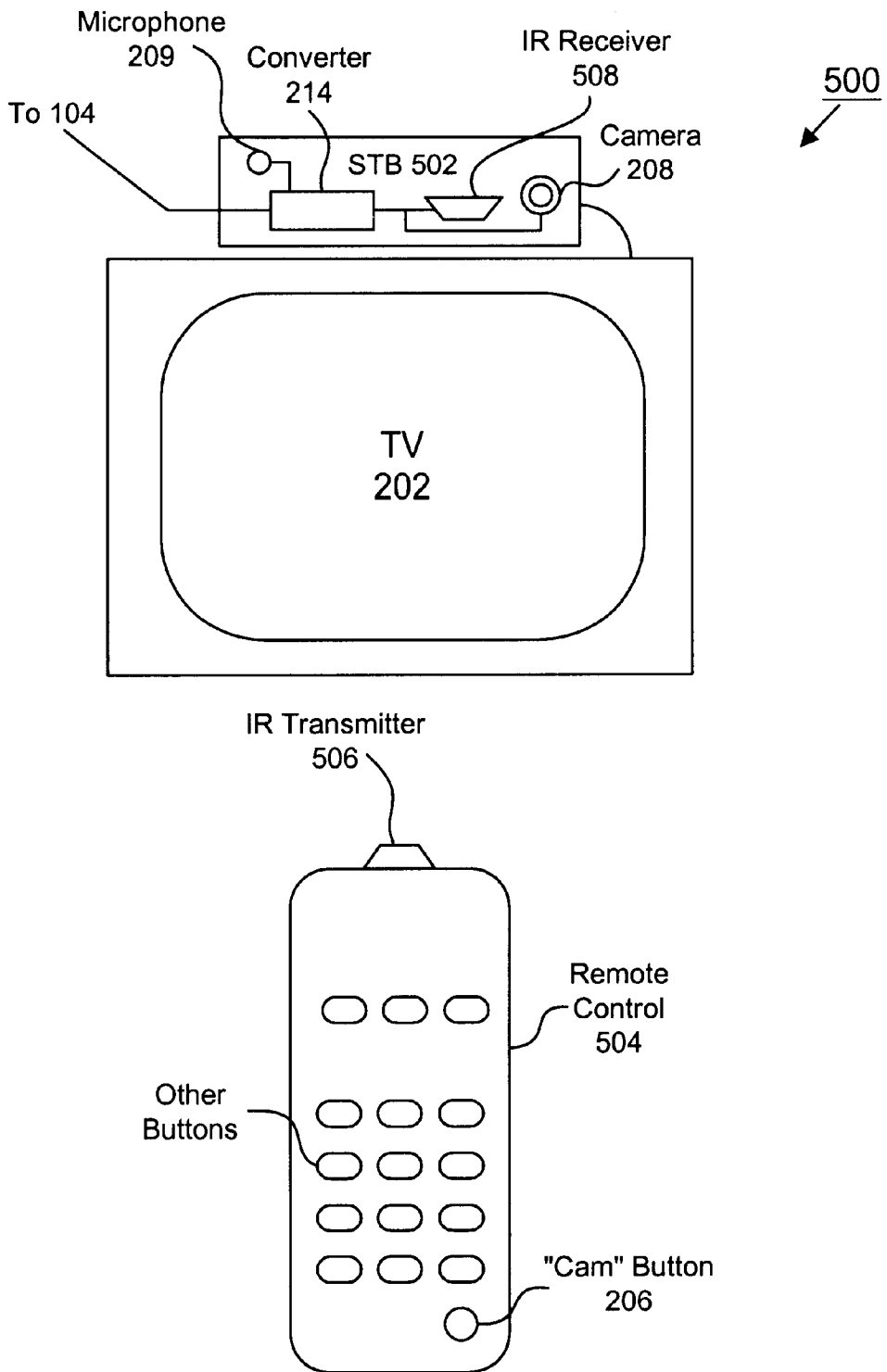


FIG. 5

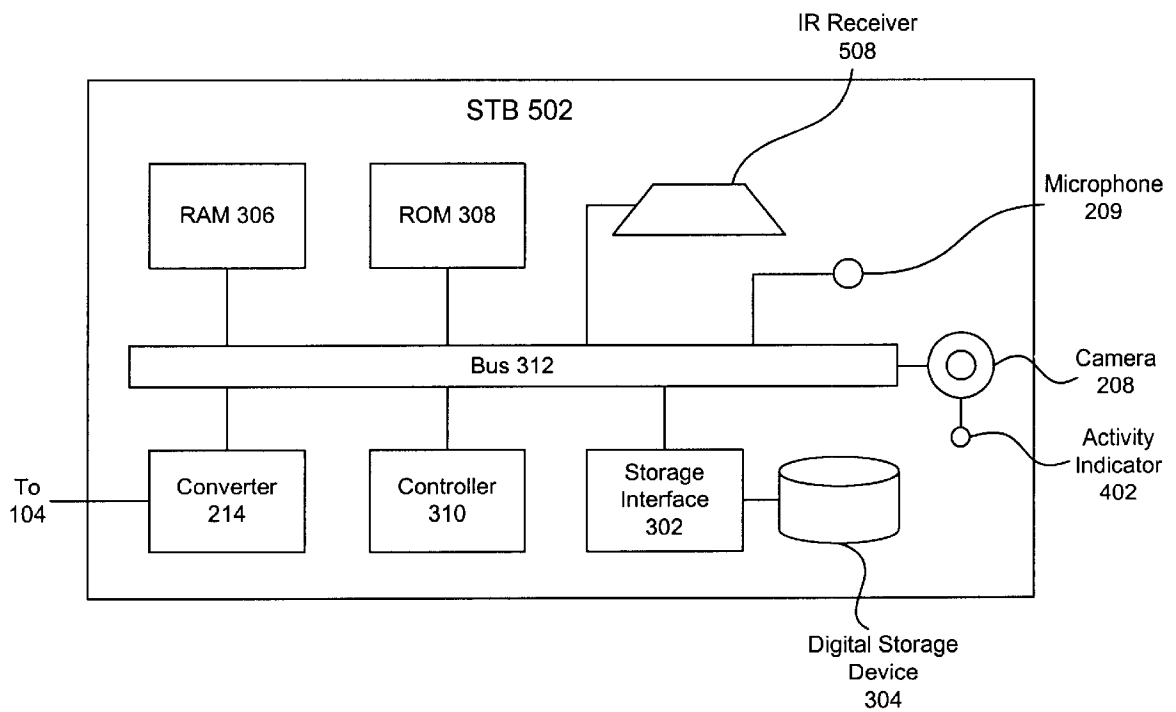


FIG. 6

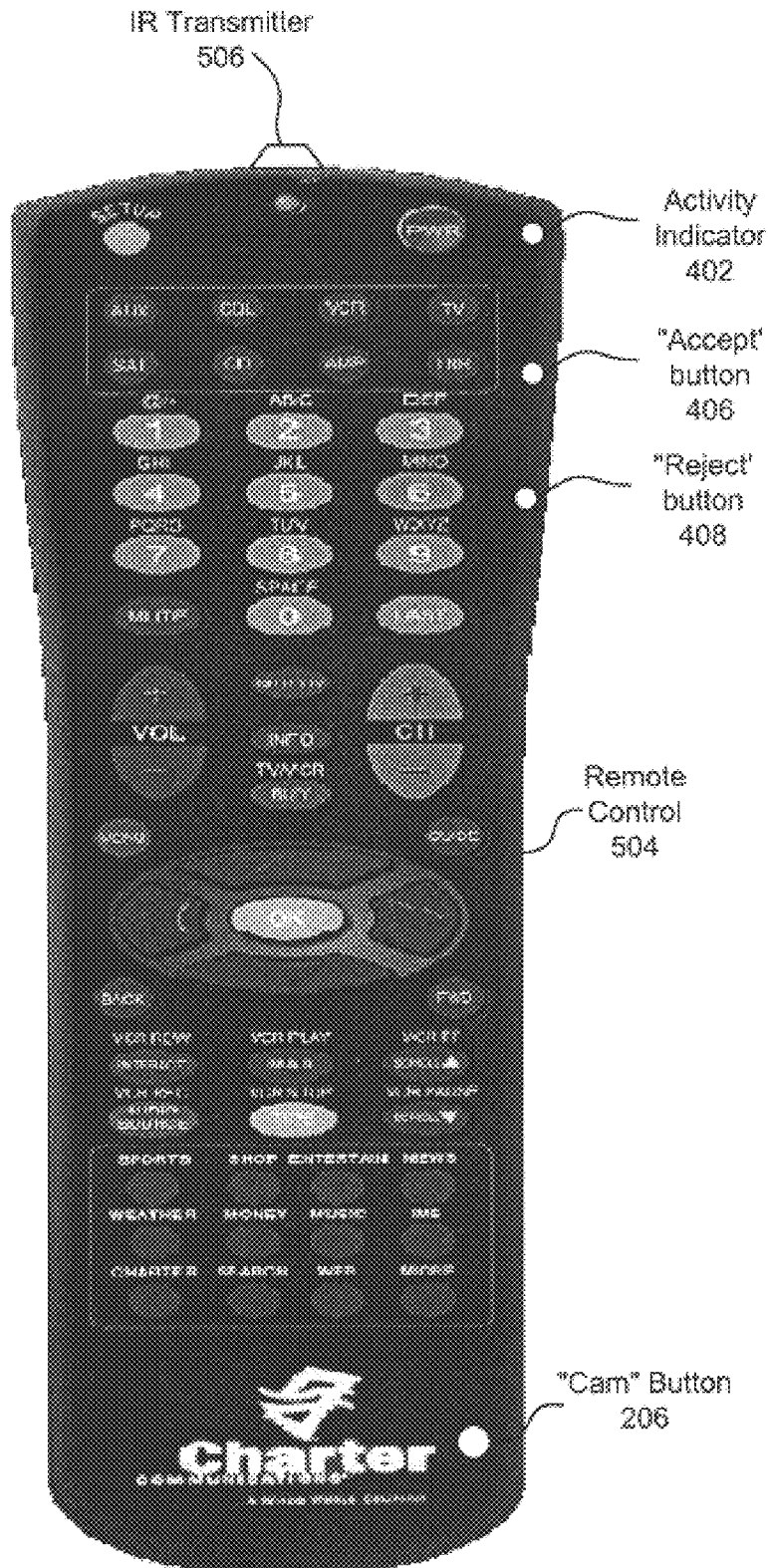


FIG. 7

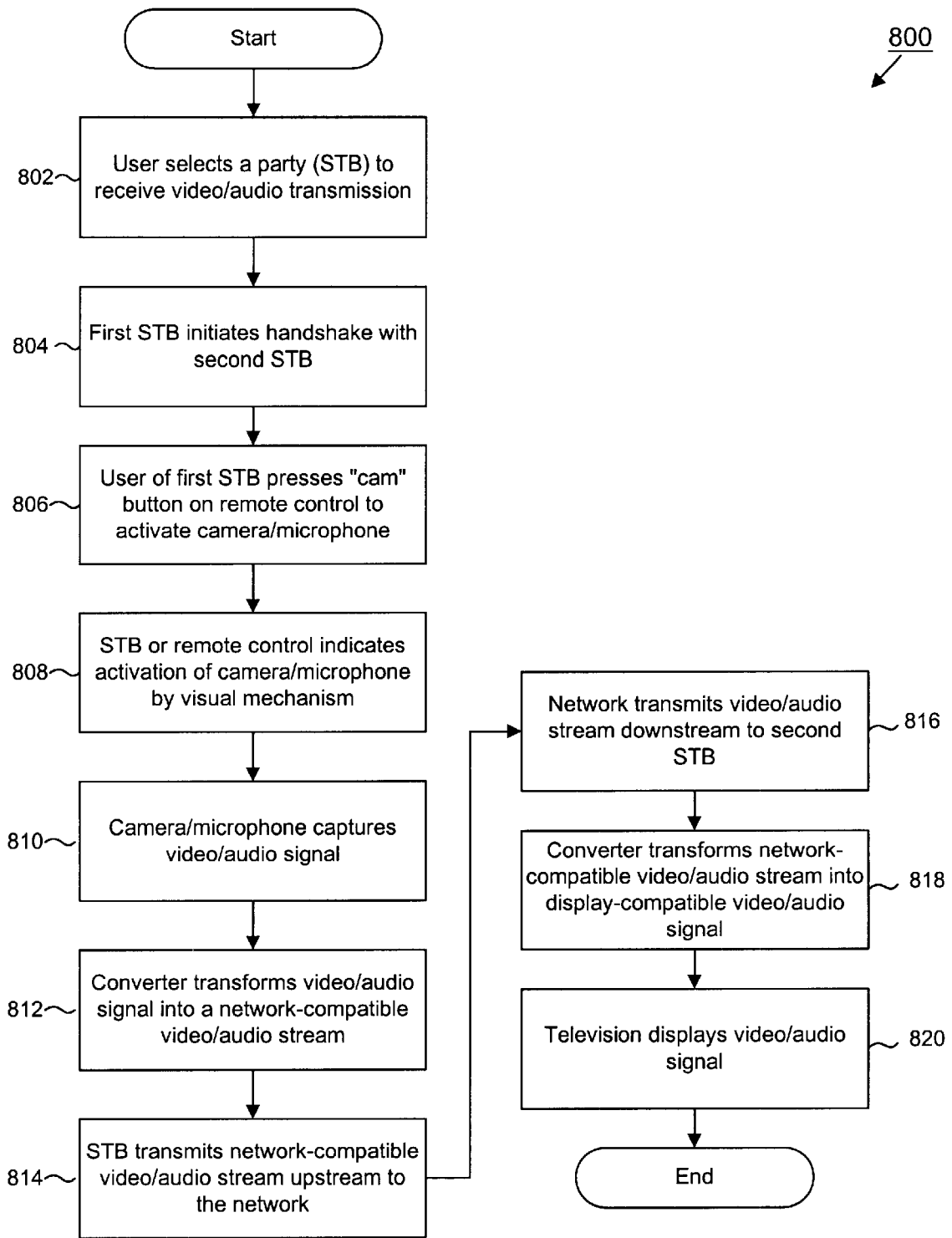


FIG. 8

REMOTE CONTROL DEVICE FOR VIDEO AND AUDIO CAPTURE AND COMMUNICATION

RELATED APPLICATIONS

The present application is related to and claims priority from U.S. Provisional Application No. 60/237,013, entitled "Systems, Methods, and Devices for Video and Audio Capture and Communications," filed Sep. 29, 2000, with inventor Paul. G. Allen, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to interactive television systems, and more particularly, to a remote control device for video and audio capture and communication.

2. Description of the Background Art

Prior systems, methods, and devices for capturing and communicating video and audio information have various problems and disadvantages.

Consider conventional "webcam" (web camera) devices available today. Such cameras are designed to be mounted on, or placed near, a computer monitor. Designs for monitor-mounted cameras are shown, for example, in U.S. Design Patent No. D0363502 to MacMurtrie et al., entitled "Monitor mounted video camera," and No. D0363730 to Flohr et al., entitled "Video camera unit for mounting on a computer monitor." Both of these design patents are hereby incorporated by reference.

A commercially-available "webcam" product that is designed to be laced near a computer monitor is the Logitech Quickcam Pro USB® from Logitech, Inc., of Fremont, Calif. Such camera devices are typically connected via a cable to a port of the computer.

In general, monitor-mounted cameras are advantageous when used to capture images of a user sitting in front of the computer. Nevertheless, they present several problems and disadvantages.

First, it is awkward and difficult for a user to point such cameras in different directions. The user would typically have to be near the camera and reach over to change the camera's orientation. Second, such cameras are typically not very mobile, since they are connected via a physical cable to the computer. Unfortunately, this means that in order to capture an image of a subject, the subject must be physically placed within view of the camera at its fixed location. Third, due to their immobility, such cameras often miss moments of primary interest to users, which are often transitory and do not occur in close proximity to a computer. For instance, a baby walking for the first time in the family room is very unlikely to be captured by such fixed or tethered devices.

Moreover, consider conventional systems and methods where such "webcam" devices are used for video communications. A conventional system would utilize a modem connection from a personal computer to an Internet service provider (ISP). Using such a connection, the captured video information would be transmitted from the personal computer of one user over the Internet to a personal computer of another user. Although this may achieve a rudimentary form of video conferencing between two users, such Internet-based video conferencing is typically unreliable and of uneven bandwidth due to limitations of the Internet.

SUMMARY OF THE INVENTION

The present invention provides a remote control device for video and audio capture and communication that overcomes the above-described problems and disadvantages.

In one aspect of the invention, a remote control for an interactive television system includes an integrated camera, such as a digital video camera, for capturing video information. The camera may include a charge-coupled device (CCD) array, and may be configured with a digital zoom feature, an automatic white balance feature, and an automatic exposure feature. In one embodiment, the camera is configured to capture an NTSC-compatible video signal.

In another aspect of the invention, the remote control includes a wireless transmitter for transmitting video information captured by the camera to the interactive television system. In one embodiment, the wireless transmitter is a high-bandwidth, radio-frequency (RF) transmitter. The wireless transmitter may be configured to utilize a radio-frequency antenna integrated with a circuit board for the remote control.

In yet another aspect of the invention, the camera is configured to capture a still image, and the wireless transmitter is further configured to transmit the still image to the interactive television system. The remote control may include a digital storage device for storing still images captured by the camera.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting and non-exhaustive embodiments of the present invention are described in the Figures, in which

FIG. 1 is a schematic block diagram of a television network according to an embodiment of the invention;

FIG. 2 is a schematic block diagram of an interactive television system according to an embodiment of the invention;

FIG. 3 is a schematic block diagram of a set top box according to an embodiment of the invention;

FIG. 4 is a plan view of a remote control according to an embodiment of the invention;

FIG. 5 is a schematic block diagram of an interactive television system according to an embodiment of the invention;

FIG. 6 is a schematic block diagram of a set top box according to an embodiment of the invention;

FIG. 7 is a plan view of a remote control according to an embodiment of the invention; and

FIG. 8 is a flowchart of a method for video capture and communication according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of a remote control device for video and audio capture and communication are described herein. In the following description, numerous specific details are provided, such as examples of programming, user selections, transactions, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the

present invention. Thus, the appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

Throughout the following description, reference is made to both video and audio information. It should be understood, however, that the devices, systems, and methods of the present invention may be used to capture and communicate either video or audio information, or both, in various embodiments.

Referring now to FIG. 1, there is shown a television network **100**, such as a cable network, according to an embodiment of the invention. In one implementation, the network **100** includes a plurality of set top boxes **102** (hereinafter STB **102**) or other client terminals located, for instance, at customer homes. Generally, an STB **102** is consumer electronics device that serves as a gateway between a customer’s television and a broadband communication network, such as a cable network. As its name implies, an STB **102** is typically located on top of, or in close proximity to, a customer’s television.

In one embodiment, an STB **102** receives encoded video/audio signals (including television signals) from the network **100** and decodes the same for display on the television. Additionally, an STB **102** receives commands from a user (typically via a remote control) and transmits such commands back to the network **100**.

In various embodiments, each STB **102** is connected to a headend **104**. In the context of cable network, a headend **104** is a centrally-located facility where cable TV (CATV) channels are received from a local CATV satellite downlink and packaged together for transmission to customer homes. In one embodiment, the headend **104** also functions as a Central Office (CO) in the telephone industry, routing video and audio streams and other data to and from the various STBs **102** serviced thereby.

Headends **104** may be coupled directly to one another or through a network center **106**. In some cases, headends **104** may be connected via a separate network, one particular example of which is Internet **108**. Of course, the illustrated network topology is provided for example purposes only, and other network topologies may be used within the scope of the invention.

As described in greater detail below, an STB **102** may transmit video and audio streams to one or more other STBs **102** connected to the network **100**. The communication path for the transmission may involve one or more headends **104**, network centers **106**, and/or the Internet **108**.

For example, a first STB **102** may send a video transmission upstream to a first headend **104**, then to a second headend **104**, and finally downstream to a second STB **102**. The transmission may use various standard protocols, such as MPEG or video over IP (Internet Protocol).

The first and second headends **104** may be one and the same if the STBs **102** are served by the same headend **104**. The transmission between headends **104** may occur (i) via a direct peer-to-peer connection between headends **104**, (ii) upstream from the first headend **104** to a network center **106** and then downstream to the second headend **104**, or (iii) via the Internet **108**.

As described in detail hereafter, each STB **102** may be identified by a unique number, code or address, such as an IP (Internet Protocol) address. Thus, a user of one STB **102** may indicate an STB **102** to receive an audio or video

transmission by specifying the corresponding address. The network **100** then routes the transmission to its destination using conventional techniques.

Referring now to FIG. 2, there is shown an interactive television system **200** according to an embodiment of the invention. The television system **200** preferably includes a television **202**, which is configured to receive and display standard analog or digital television signals or high-definition television (HDTV) signals. In one embodiment, the television system **200** also includes a STB **102**, as discussed above, for sending and receiving audio/video information (including television signals) or other data to and from the network **100**. In an alternate embodiment, the functionality of the STB **102** is integrated into an advanced version of the television **202**.

In one embodiment, a remote control **204** is provided for convenient remote operation of the STB **102** and the television **202**. As described below, the remote control **204** may communicate with the STB **102** and television **202** using conventional techniques to adjust, for example, the volume of the television, the displayed channel, and the like.

In the illustrated embodiment, the remote control **204** includes a camera **208**, such as a color (or monochromatic) digital video camera. In accordance with one embodiment, the camera includes a progressive scan CCD (charged coupled device) array to deliver digital video up to 320x240 pixels in 24 bit color. Other resolutions and levels of color are also contemplated to be within the scope of the present invention. The resolution and levels of color of the camera may also be adjustable or selectable by the viewer. Furthermore, a zoom function may be provided for the camera **208**. The zoom function may be lens based or preferably digitally based, e.g., a “digital zoom.” In addition, the camera may be provided with automatic white balance and automatic exposure features to adjust for lighting and scene content. Of course, such automatic features may be turned off by the user.

The frame rate of the video capture may be 30 frames per second (NTSC, VHS, MPEG), 25 frames per second (PAL), 24 frames per second (motion picture), or other rates. For video conferencing, a frame rate of 8 frames per second provides a somewhat jerky video. Preferably, video conferencing applications using the present invention is performed at a frame rate of at least 10 frames per second for smoother motion. In one embodiment, the MPEG-4 protocol may be used for video conferencing applications using the present invention.

The camera may be used to capture not only video, but also still-pictures. Such still-pictures may be stored in JPEG, BMP, TIFF, or other formats in a digital storage device in the STB **102**. Alternatively, the remote control **204** itself may include a digital storage device to store such still-pictures. In accordance with one embodiment, the resolution of the camera when used to capture still-pictures may be greater than the resolution when used to capture video.

The camera is preferably disposed on a surface of the remote control **204** to provide a generally unobstructed view for the camera **208**. In particular embodiments, the camera may be disposed on the same surface as the majority of the buttons, or it may be disposed on a surface perpendicular to that surface.

In one embodiment, the camera **208** is capable of capturing a series of images in real time and converting the same into analog or digital video signals. The camera **208** is in electrical communication with a specifically-designated button, such as a camera (“cam”) button **206**, which toggles

operation of the camera **208** in one implementation. The remote control **204** may further include additional buttons to control various features of the STB **102** and the television **202**. As used herein, the term "button" includes other types of controls, such as switches and the like. In addition, more than one button or control may be provided to activate and deactivate the camera **208**.

In one embodiment, the remote control **204** also includes a microphone **209** for receiving sound waves and converting the same into analog or digital audio signals. The microphone **209** may be further in communication with the "cam" button **206** to toggle the operation thereof. Alternatively, the microphone **209** may be enabled through a separate button on the remote control **204**.

In the illustrated embodiment, the remote control **204** further includes a radio frequency (RF) transmitter **210**. In alternative embodiments, the transmitter **210** may be configured to transmit using infrared (IR), microwave, VHF, UHF, or other frequencies along the electromagnetic spectrum.

In one implementation, the transmitter **210** is in electrical communication with the camera **208** to receive video information captured by the camera **208**. The transmitter **210** may further be in electrical communication with the microphone **209** to receive audio information.

The transmitter **210** preferably modulates the video and/or audio information with a carrier frequency to enable transmission of the information to the STB **102** using techniques well known in the art. For example, the transmitter **210** may operate according to the IEEE 802.11a or 802.11b Wireless Networking standards, the "Bluetooth" standard, or according to other standard or proprietary wireless techniques. Modulation techniques may include spread spectrum, frequency shift keying, multiple carrier, or other techniques known in the art. To achieve modulation and transmission, the transmitter **210** may include various additional components not specifically illustrated but well known in the art. For example, the transmitter **210** may include a source encoder to reduce the amount of bandwidth required, a channel encoder to modulate the video and/or audio information with a carrier wave, and a directional or non-directional transmission antenna. The transmitter **210** may further include an amplifier to increase the transmission signal strength to an appropriate power level.

In accordance with one embodiment, the transmitter **210** comprises an integrated RF antenna (linear or otherwise configured) etched onto the main printed circuit board of the remote control **204**. Integration of the antenna with the remote control's circuit board provides for compactness and efficiency in manufacture.

Preferably, the transmitter **210** is a high-bandwidth transmitter capable of sending the video/audio information to the STB **102** in real time. In one embodiment, the transmitter **210** may use wideband frequency modulation over a frequency band to provide a one-way video/audio link from the remote control **204** to the STB **102**. For example, frequency band may be within the 890–960 MHz range (GSM), 1990–2110 MHz range or 2400–2500 MHz range or other frequency ranges as approved by FCC regulations. The one-way video/audio link between remote control **204** and STB **102** also provides for efficiency in manufacture, as a two-way video/audio link is not required in accordance with this embodiment. In another embodiment, the transmitter **210** utilizes a frequency division multiplexing (FDM) technique in order to transmit several streams of data simultaneously. These streams may be reassembled at the STB **102**

to derive the encoded video/audio information. Various other techniques for providing a high bandwidth in multimedia transmissions may also be used within the scope of the invention.

In one embodiment, the transmitter **210** is configured to broadcast digital signals. As such, the transmitter **210** may include an analog-to-digital converter (ADC) to convert analog video/audio signals from an analog camera system into digital information. The present invention contemplates the use of analog or digital or both types of transmissions from the remote control **204**.

In various embodiments, the remote control **204** is also in electrical communication with a processor (not shown) that senses a user's operation of the buttons of the remote control **204** and generates appropriate command signals for transmission to the STB **102** and television **202** in order to control the operation of the same.

In the illustrated embodiment, the STB **102** includes an RF receiver **212** for receiving transmissions from the transmitter **210** in the remote control **204**. Such a receiver **212** may include an antenna integrated into a printed circuit board (either a main board or a card coupled to a main board) within the STB **102**. The receiver **212** may also demodulate video/audio information from the modulated band transmitted by the remote control **204**. In various embodiments, the receiver **212** may be configured to receive IR, microwave, VHF, UHF, or other frequencies. In one embodiment, the receiver **212** demodulates the video/audio information contained within a carrier frequency of the transmission.

The receiver **212** may further include components not specifically illustrated but well known in the art. For example, the receiver **212** may include an antenna for receiving the transmission, an amplifier for increasing the strength of the received signal, and a decoder for separating and demodulating the video and/or audio information from the carrier signal.

In one implementation, the receiver **212** is in electrical communication with a converter **214**, which converts the video and/or audio information into a digital video and/or audio stream compatible for transmission over the network **100**. The conversion process may include compressing the information to improve transmission speed.

As noted above, the converter **214** is in electrical communication with a headend **104** in order to transmit the network-compatible video/audio stream to one or more other STBs **102** in the network **100**. The converter **214** is further configured to receive network-compatible video/audio streams from the network **100** and transform the same into display-compatible video/audio signals for display/playback on the television **202**. In particular, the transmission from the STB **102** to the network **100** must be made to be compatible with upstream transmission in the network **100**. For example, in a cable distribution network **100**, one or more frequency bands (for example from 5 to 30 MHz) may be reserved for upstream transmission. Digital modulation (for example, quadrature amplitude modulation or vestigial sideband modulation) may be used to send digital signals in the upstream transmission. Various protocols, such as MPEG or video over IP, may be used to embed the video/audio stream in the digital signals. Upstream transmission will be accomplished differently for different networks **100**. Alternative ways to accomplish upstream transmission include an analog telephone line, ISDN, DSL, or other techniques.

Referring to FIG. 3, there is shown an expanded block diagram of an STB **102** according to an embodiment of the invention. The STB **102** may include a storage interface **302**,

which provides access to a digital storage device **304**, such as a hard disk drive or the like. In one embodiment, the storage interface **302** receives video/audio information from the receiver **212** and delivers the same to the digital storage device **304** for storage. The video/audio information may be stored in an MPEG format or other encoded file formats. Alternatively, the video/audio information may be converted by the converter **214** into a network-compatible video/audio stream before being stored in the storage device **304**.

In one embodiment, the converter **214** includes conventional interface circuitry for communicating with the network **100**. In an alternative embodiment, a separate network interface (not shown) may be provided, such as a cable modem or the like. Such a cable modem may operate in accordance with the DOCSIS or DAVIC standards.

The STB **102** may further include a random access memory (RAM) **306** configured to store data for temporary use. Similarly, a read-only memory (ROM) **308** may be provided for storing more permanent data, such as fixed code and configuration information. In one embodiment, the ROM **308** may be used to store an operating system for the STB **102**, such as Windows CE® or Linux®.

The STB **102** preferably includes a controller **310** that is in communication with the receiver **212**, the converter **214**, the storage interface **302**, the RAM **306**, the ROM **308**, and the converter **214**. The controller **310** may be coupled to the other components of the STB **102** via a bus **312**.

In various embodiments, the controller **310** may be embodied as a microcontroller, a microprocessor, a digital signal processor (DSP) or other device known in the art. The controller **310** manages the operation of the STB **102**, including, for example, the conversion of the encoded video/audio information, the storage of the video/audio information, the transmission and reception of video/audio information from the network **100**, and the like. As noted above, the controller **310** may perform these and other operations based on control signals generated by the remote control **204** and transmitted to the receiver **212**.

In operation, the video/audio information received from the remote control **204** may be displayed directly on the television **202** coupled to the STB **102**. As described in greater detail below, the video/audio information may also be converted, compressed and transmitted across the network **100** to one or more other STBs **102** where it is displayed on corresponding televisions **202**.

In one embodiment, a user may select which STB(s) **102** will receive a video/audio transmission by entering one or more addresses of the receiving STB(s) **102** using the remote control **204**. As noted above, the address of an STB **102** uniquely identifies the STB **102** within the network **100** and is used by the headends **104**, network centers **106**, and/or the Internet **108** to route a network-compatible video/audio stream to the appropriate STB **102** using conventional techniques.

In various embodiments, an STB **102** may simultaneously send and receive multiple video/audio streams. In this manner, video conferencing of networked interactive television systems **200** is enabled.

FIG. 4 provides an expanded view of the remote control **204**, including the camera **208**, the microphone **209**, the transmitter **210**, and the “cam” button **206**. In addition, FIG. 4 illustrates an activity indicator **402**, which illuminates or otherwise signals the user when the camera **208** and/or microphone **209** is active. The activity indicator **402** may be embodied as an LED (light-emitting diode) or other suitable indicator. As illustrated, the remote control **204** may include

a number of other buttons or controls, such as an “accept” button **406**, a “reject” button **408**, and a “switch” button **410**, the functions of which are described below.

Those skilled in the art will recognize that the various components of the remote control **204** may be positioned in different locations for ergonomics and ease-of-use. For example, the camera **208**, “cam” button **206**, and activity indicator **402** may be disposed at any convenient and ergonomic location within the remote control **204**.

Referring now to FIG. 5, there is shown an alternative interactive television system **500** according to an embodiment of the invention. The television system **500** differs primarily from the television system **200** of FIG. 2 in that the camera **208** and microphone **209** are disposed within a STB **502** rather than a remote control **504**.

In the illustrated embodiment, the remote control **504** includes an infrared (IR) transmitter **506** for sending control signals to an IR receiver **508** within the STB **502** and/or the television **202**. In alternative embodiments, however, the transmitter may use RF, VHF, UHF, microwave, or other frequencies. In one embodiment, the remote control **504** also includes a “cam” button **206** for enabling remote operation of the camera **208** and/or the microphone **209** disposed within the STB **502**.

Referring to FIG. 6, there is shown an expanded block diagram of the STB **502**. The converter **214**, the storage interface **302**, the digital storage device **304**, the RAM **306**, the ROM **308**, and the controller **310** function as previously described with reference to FIG. 3. However, the STB **502** includes a camera **208** and a microphone **209**, which are depicted as being in communication with the bus **312**. In addition, the STB **502** is depicted as including an activity indicator **402** for visually indicating to a user when the camera **208** is active.

FIG. 7 provides an expanded view of the remote control **504**, including the IR transmitter **506**, the “cam” button **206**, the “accept” button **406** and the “reject” button **408**. The remote control **504** may also include a separate activity indicator **402** in addition to the indicator **504** in the STB **502**. Those skilled in the art will recognize that the various components of the remote control **504** may be positioned in different locations for convenience and ergonomics.

In yet another alternative embodiment, the remote control **504** and the STB **502** may both be configured with a camera **208** and/or a microphone **209**. This would allow a user to select between a camera **208** disposed locally on the remote control **504** and a camera **208** disposed remotely on the STB **102**. Thus, a user may conveniently switch between a stationary camera **208** at a fixed distance or a remote-mounted camera **208** that is highly mobile, depending on the subject to be viewed. In one embodiment, the “switch” button **410** of FIG. 4 may be used for this purpose.

FIG. 8 is a flowchart of a method **800** for video and audio capture and communication according to an embodiment of the invention. The method **800** begins when a user of a first STB **102** selects **802** a second STB **102** (or set of STBs **102**) in the network **100** to receive a video/audio transmission. The selection may be performed by entering an identification of the second STB **102** or a user thereof by means the remote control **204**. If a user’s name is specified, for example, the first STB **102** may access a name server or directory (not shown) to retrieve a corresponding address of the second STB **102**. In one embodiment, the first STB **102** may contain a local directory of addresses to which the user frequently sends video/audio transmissions.

Once the first STB **102** has a valid address, it sends a request across the network **100** to the second STB **102**. The

precise format of the request is not crucial to the invention, but the request should indicate to the second STB **102** that the user of the first STB **102** desires to send a video/audio transmission.

In response to the request, the second STB **102** generates a notification, such as a text message or icon, for display on the corresponding television **202** to notify the user of the second STB **102** of the video/audio transmission. Alternatively, the notification may take the form of an audio signal that is played on a speaker (not shown) in the STB **102** or the television **202**.

If the second STB **102** is off-line or otherwise not available, the first STB **102** may wait until a timeout period has expired, after which it notifies the user that the audio/video transmission cannot be sent. Likewise, if the user of the second STB **102** does not respond, or refuses to receive the transmission (by means of the "reject" button **408** of FIG. 4, for example) a not-available signal may be returned to the first STB **102**.

If the user of the second STB **102** wishes to receive the video/audio transmission, she may press a suitable button the remote control **204**, such as the "accept" button **406** of FIG. 4, which results in an acceptance signal being returned to the first STB **102**. In one embodiment, the first STB **102** generates, in response to receiving the acceptance signal, a video or audio acceptance message to notify the user that permission for the video/audio transmission has been granted.

The first and second STBs **102** may then initiate **804** a handshake procedure to establish a communication protocol. Such a handshake procedure may have some similarity with handshake procedures performed between facsimile (fax) machines. In this case, the STBs **102** may negotiate a new protocol or reaffirm an existing protocol for video/audio communication. The appropriate protocol may need to be determined because the two STBs have different video/audio conferencing capabilities. For example, the second STB may be capable of video conferencing at a lower resolution (or frame rate), so the communication protocol would be established as is suitable to this lower resolution (or frame rate). The communication protocol used may also depend on the bandwidth and/or reliability of the connection between the two set top boxes. At this point, an active communication link is established between the first and second STBs **102** across the network **100**.

In one embodiment, the first user then activates **806** the camera **208** and/or microphone **209** by pressing, for example, the "cam" button **206**. In one implementation, the remote control **204** and/or STB **102** indicates **808** activation of the camera **208** by a visual mechanism, such as an activity indicator **402** (e.g., LED). Thereafter, the camera **208** and/or microphone **209** captures **810** a video and/or audio signal (which is transmitted to the STB **102** in the case of the remote control **204** of FIG. 2).

The converter **214** within the STB **102** then transforms **812** the captured video/audio signal into a network-compatible video/audio stream for transmission over the network **100**. Thereafter, the network-compatible video/audio stream is transmitted **814** upstream to the network **100**. As noted with reference to FIG. 1, the communication path for the transmission may involve one or more headends **104**, network centers **106**, and/or the Internet **108**, using conventional routing techniques.

In one embodiment, the network-compatible video/audio stream is then transmitted **816** downstream from the network **100** to the second STB **102**. Thereafter, the network-

compatible video/audio stream is transformed **818** into a display-compatible video/audio signal for display **820** on the television **202**.

In a like manner, the second STB **102** may transmit video/audio information to the first STB **102**. Indeed, in one embodiment, multiple video/audio streams may be received and transmitted simultaneously by a STB **102**. Multiple video streams received by a STB **102** may be displayed on a television **202** at the same time using picture-in-picture (PIP) techniques. Likewise, multiple audio streams may be mixed for playback on the television **202**. Thus, video conferencing between two or more users of networked interactive television systems **200** is enabled.

Of course, the above-described method **800** is only one possible technique for video and audio capture and communication within the scope of the invention. In alternative embodiments, the first STB **102** may transmit a video/audio stream to the second STB **102** without waiting for an acceptance signal. The second STB **102** may record all incoming transmissions in the digital storage device **304**. Thereafter, a user of the second STB **102** may review the stored video/audio streams and select which stream, if any, to display at a convenient time.

In yet another alternative embodiment, the first STB **102** may be preconfigured to transmit video/audio information to a second STB **102**, which has previously granted permission to receive the transmission. Accordingly, a user of the first STB **102** may simply press the "cam" button **206** to immediately capture video/audio information and transmit the same to the second STB **102** for immediate display.

Alternatively, the video/audio conferencing may occur between the first STB **102** and a client terminal more generically (not just a second STB **102**). The client terminal may comprise a personal computer or other device with a connection to the Internet **108**. Such other devices may include Internet appliances, personal digital assistants, Internet-enabled cell phones, and the like. These devices are likely to have varying videoconferencing capabilities, so a handshaking procedure as described above is likely to be quite useful in determining a proper communication protocol.

In view of the forgoing, the present invention offers numerous advantages not available in the prior art. By integrating, in a compact manner, a camera **208** and/or microphone **209** with a remote control **204** for an interactive television system **200**, a user may easily capture video images of events that would be difficult or impossible to capture with conventional "webcam" devices. Because the remote control **204** is not limited by a physical cable, a user has the flexibility of carrying the remote control **204** to any desired location. Even in an embodiment in which the camera **208** is integrated with the STB **102**, it is likely that a user will be able to capture events of primary interest, since televisions **202** their associated STBs **102** are normally located in areas of high use, such as family rooms and the like.

The above description of illustrated embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise forms disclosed. While specific embodiments of, and examples for, the invention are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize.

These modifications can be made to the invention in light of the above detailed description. The terms used in the following claims should not be construed to limit the inven-

11

tion to the specific embodiments disclosed in the specification and the claims. Rather, the scope of the invention is to be determined by the following claims, which are to be construed in accordance with established doctrines of claim interpretation.

What is claimed is:

1. A remote control for interactive television system, the remote control comprising: user control means for receiving user input for operating the interactive television system;

processing means, coupled to the user control means, for generating control signals for interactive television system in response to user interaction with user control means;

video and still picture capture means, coupled to the processing means, for capturing video information and a still picture;

activity indication means, coupled to the processing means, for visually indicating when the camera is actively capturing video information;

audio capture means, coupled to the processing means, for capturing audio information; and

wireless transmission means, coupled to the processing means, for transmitting the control signals and captured audio and video information and the still picture information to the interactive television system while interactive television system simultaneously displays a received video stream.

2. The remote control of claim 1, wherein the wireless transmission means comprises a high-bandwidth, radio-frequency transmitter.

12

3. The remote control of claim 2, wherein the radio-frequency transmitter is configured to utilize a radio-frequency antenna integrated with a circuit board for the device.

4. The remote control of claim 1, wherein the video and still picture capture means comprises a digital video camera.

5. The remote control of claim 4, wherein the digital video camera comprises a charged-coupled device array.

6. The remote control of claim 4, wherein the digital video camera further comprises a digital zoom feature.

7. The remote control of claim 4, wherein the digital video camera further comprises an automatic white balance feature.

8. The remote control of claim 4, wherein the digital video camera further comprises an automatic exposure feature.

9. The remote control of claim 4, wherein the digital video camera is configured to capture an NTSC-compatible video signal.

10. The remote control of claim 1, wherein the still picture is stored in a compressed format.

11. The remote control of claim 1, wherein the still picture has a relatively higher resolution than a resolution of the captured video information.

12. The remote control of claim 1, further comprising: a specifically-designated button for activating the video and still picture capture means and the audio capture means to initiate capture of the audio and video information.

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