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(54) **SYSTEM AND METHOD FOR CONTROLLING VIDEOCONFERENCE WITH TOUCH SCREEN INTERFACE**

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(52) **U.S. Cl.**
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USPC **348/14.08**; 348/14.09; 348/14.12

(58) **Field of Classification Search**
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See application file for complete search history.

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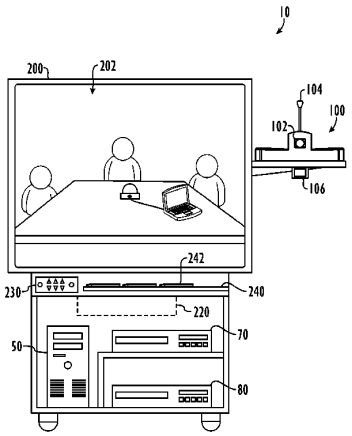
(74) *Attorney, Agent, or Firm* — Wong, Cabello, Lutsch, Rutherford & Brucculeri, LLP

(57) **ABSTRACT**

A videoconferencing system includes a touch screen display device and a videoconferencing unit. The display device displays video data for the videoconference and generates touch data based on user selections relative to the touch screen. The videoconferencing unit is operatively coupled to the touch screen device by a video connection and a data interface connection, for example. The unit establishes and conducts a videoconference with one or more endpoints via a network. The unit sends video data to the display device and receives touch data from the device. The received touch data is used to control operation of the videoconferencing system. The received touch data can be used to initiate a videoconference call, change an operating parameter, change orientation of a camera, initiate a picture-in-picture display, access a menu, access memory, change a source of video data, initiate a whiteboard display, and access a screen of a connected device.

25 Claims, 5 Drawing Sheets



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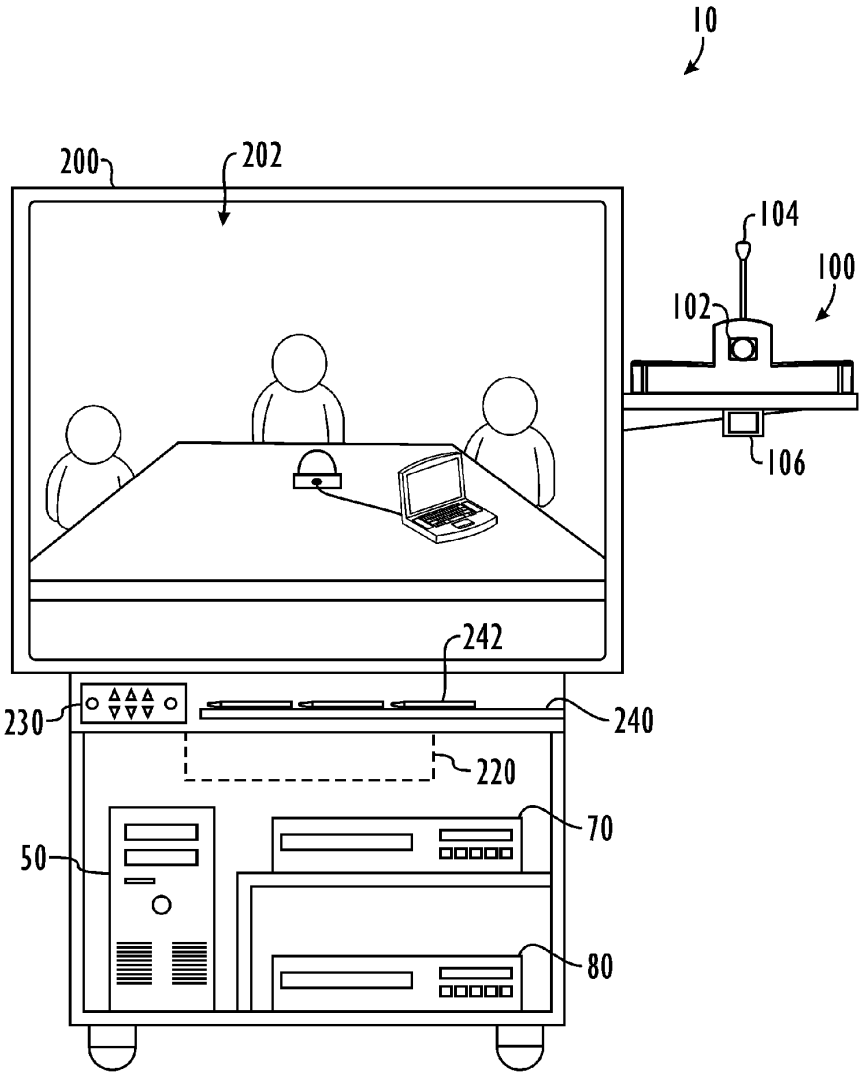

FIG. 1

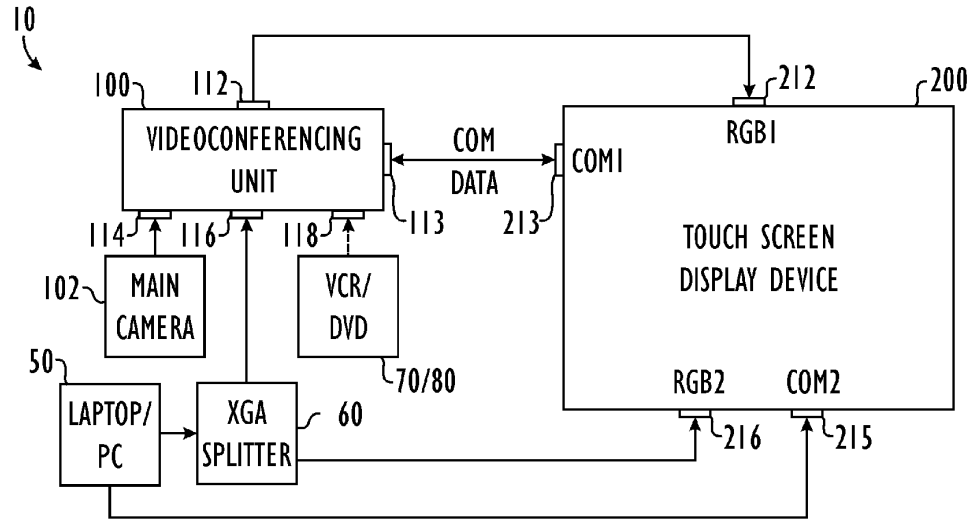
10
100
112
212
200
VIDEOCONFERENCING UNIT
COM DATA
COM1
RGB1
113
213
TOUCH SCREEN DISPLAY DEVICE
114
116
118
102
MAIN CAMERA
VCR/ DVD
70/80
50
LAPTOP/ PC
XGA SPLITTER
60
RGB2
COM2
216
215

FIG. 2A

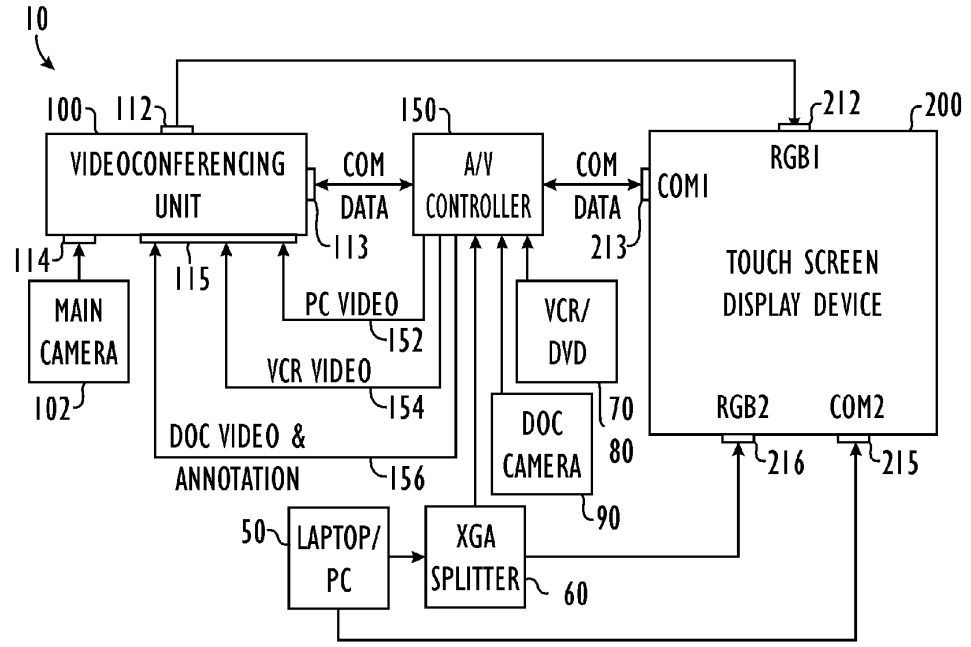
10
100
112
150
212
200
VIDEOCONFERENCING UNIT
COM DATA
A/V CONTROLLER
COM DATA
COM1
RGB1
113
213
TOUCH SCREEN DISPLAY DEVICE
114
115
MAIN CAMERA
102
PC VIDEO
152
VCR VIDEO
154
VCR/ DVD
70
DOC VIDEO & ANNOTATION
156
DOC CAMERA
80
90
RGB2
COM2
216
215
50
LAPTOP/ PC
XGA SPLITTER
60

FIG. 2B

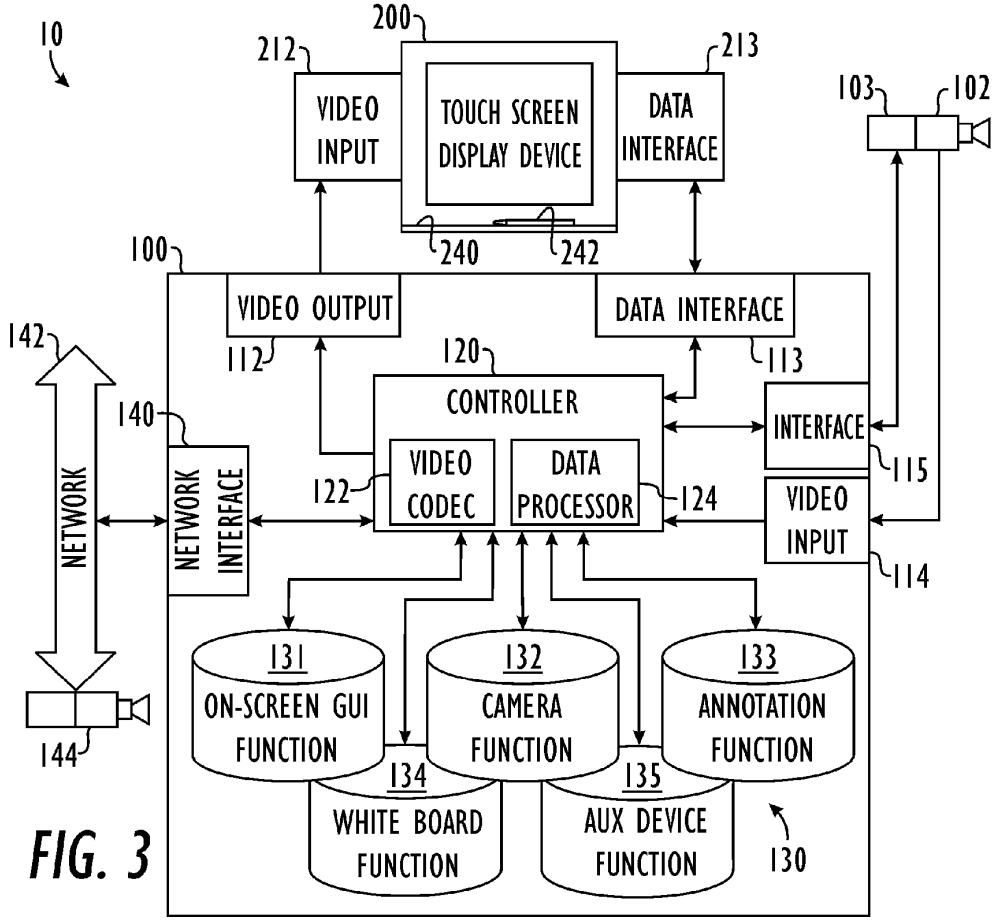
10
200
212
213
VIDEO INPUT
TOUCH SCREEN DISPLAY DEVICE
DATA INTERFACE
103
102
240
242
100
VIDEO OUTPUT
DATA INTERFACE
142
112
113
120
CONTROLLER
140
INTERFACE
115
NETWORK
NETWORK INTERFACE
122
VIDEO CODEC
DATA PROCESSOR
124
VIDEO INPUT
114
131
132
133
ON-SCREEN GUI FUNCTION
CAMERA FUNCTION
ANNOTATION FUNCTION
144
134
135
WHITE BOARD FUNCTION
AUX DEVICE FUNCTION
130

FIG. 3

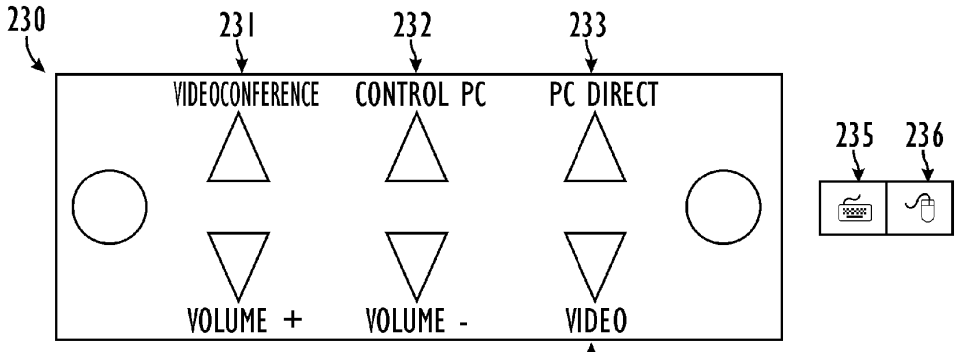
230
231
232
233
VIDEOCONFERENCE
CONTROL PC
PC DIRECT
235
236
VOLUME +
VOLUME -
VIDEO
234

FIG. 4

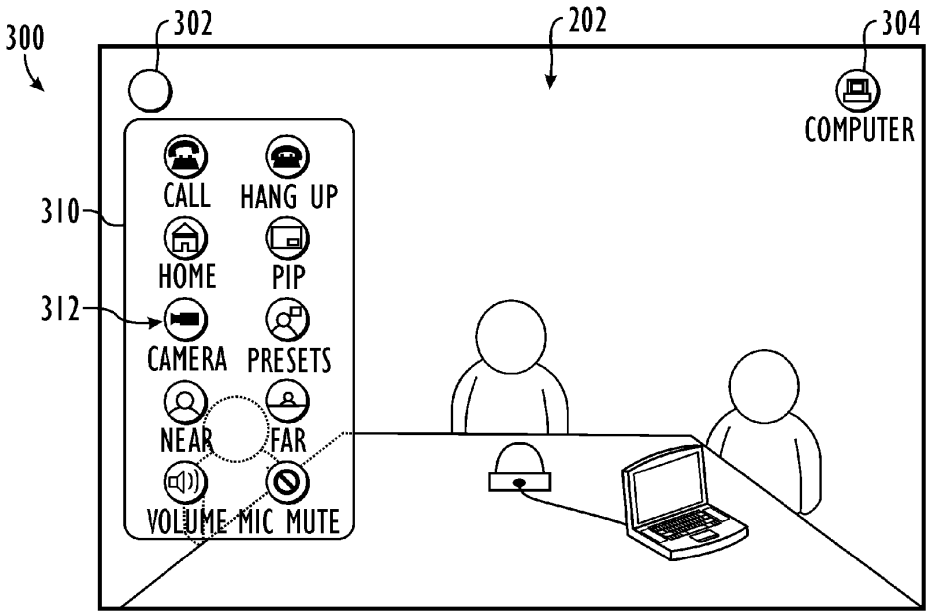
300
302
202
304
COMPUTER
310
CALL
HANG UP
HOME
PIP
312
CAMERA
PRESETS
NEAR
FAR
VOLUME
MIC MUTE

FIG. 5

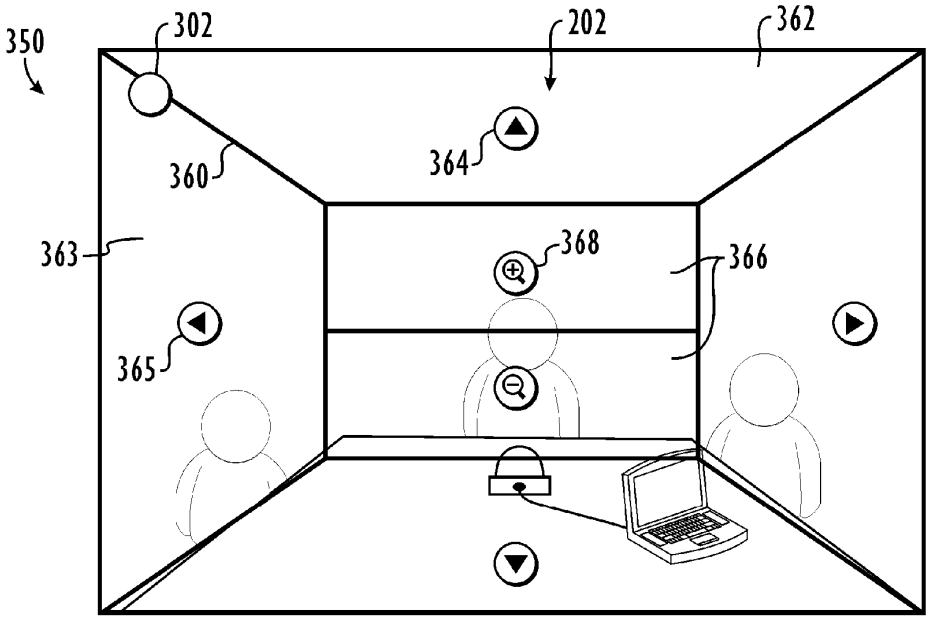
350
302
202
362
360
364
363
368
366
365

FIG. 6

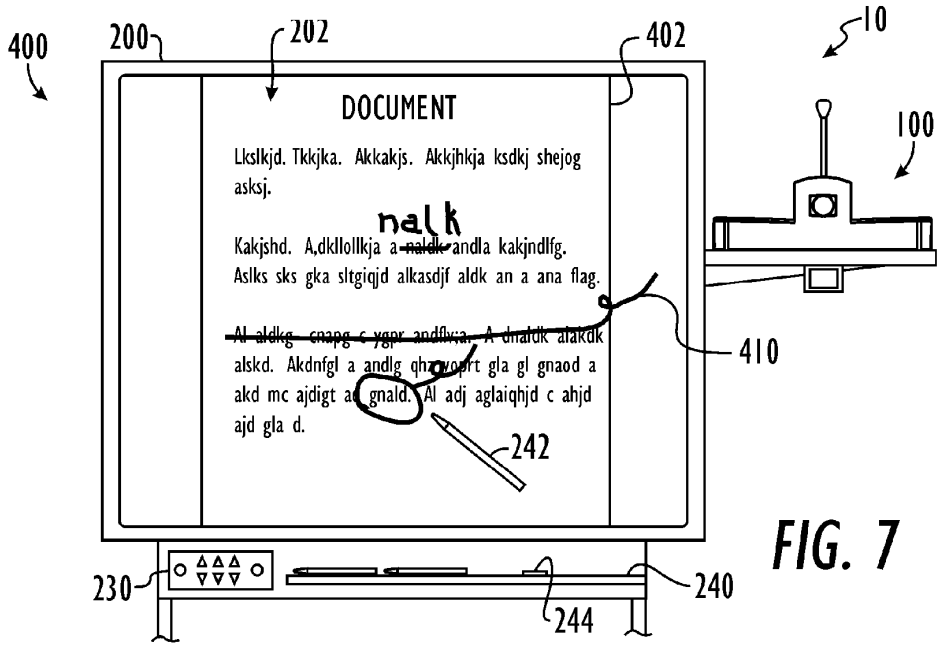
400
200
202
402
10
100
DOCUMENT
Lkslkjd. Tkkjka. Akkakjs. Akkjhkja ksdkj shejog asksj.
nalk
Kakjshd. A,dkllollkja a-naldk-andla kakjndlfg. Aslks sks gka sltgiqjd alkasdjf aldk an a ana flag.
Al aldkg cnapg c ygpr andflwra. A dnaldk alakdk alskd. Akdnfgl a andlg qhzwoprt gla gl gnaod a akd mc ajdigt ac gnald. Al adj aglaiqhjd c ahjd ajd gla d.
410
242
230
240
244

FIG. 7

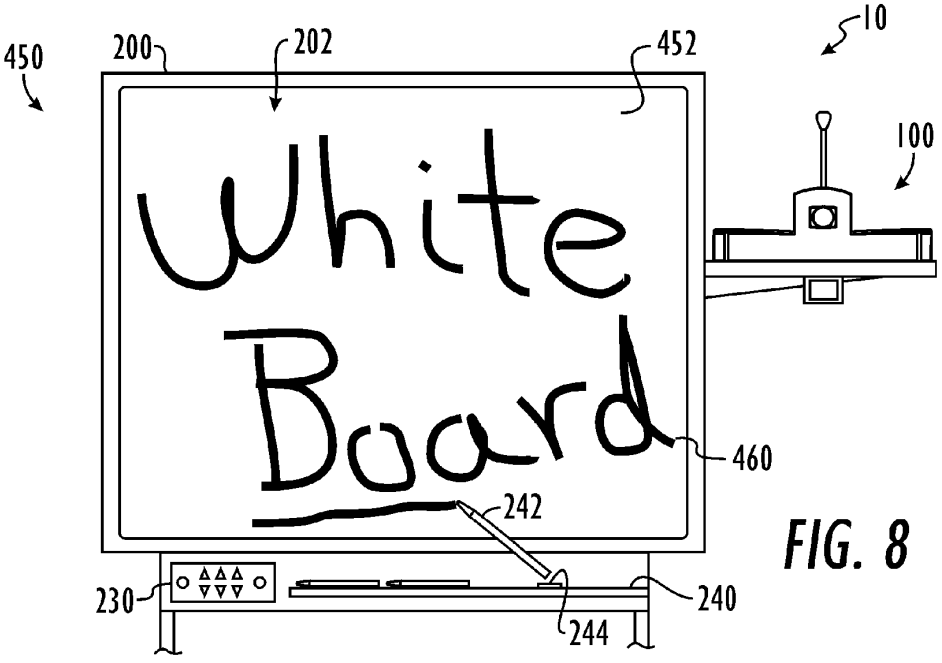
450
200
202
452
10
100
White Board
460
242
230
240
244

FIG. 8

SYSTEM AND METHOD FOR CONTROLLING VIDEOCONFERENCE WITH TOUCH SCREEN INTERFACE

FIELD OF THE DISCLOSURE

The subject matter of the present disclosure relates to a system and method for controlling a videoconference with a touch screen interface.

BACKGROUND OF THE DISCLOSURE

Typically, users of videoconferencing systems use remote controls to operate and control the systems. In addition, control panels, tablet input devices, keypads, or web interfaces can be used to operate and control the systems. When using a hand held remote, a user aims the remote at the videoconferencing system and navigates through numerous selections and menus of a user interface to operate and control the system. Tablet input devices and keyboards typically must be appropriately connected to the videoconferenceing system, and proper connection may be difficult for users. For videoconferences, users may also wish to set up a document camera or a computer with annotation tools for the user to be able to add writing and annotations to the videoconference. Unfortunately, document cameras and computers with annotation tools may be difficult to set up and use with videoconferenceing systems.

One prior art videoconferencing system known in the art is the 3000iPower available from Polycom, Inc. The 3000iPower includes a Polycom iPower 9800 and a Rear Projection SMART Board™ 3000i interactive whiteboard from SMART Technologies, Inc. The iPower 9800 has a PC-based design so that it essentially operates as a computer. The 3000iPower allows computer images to be projected and viewed within a videoconference call, and the 3000iPower offers touch screen controls that provide access to conference applications. A user can use a pen from a pen tray of the 3000iPower and make notes on a whiteboard or highlight important information.

The subject matter of the present disclosure is directed to overcoming, or at least reducing the effects of, one or more of the problems set forth above.

SUMMARY OF THE DISCLOSURE

A videoconferencing system includes a touch screen display device and a videoconferencing unit. The display device displays video data for the videoconference and generates touch data based on user selections relative to the touch screen. The videoconferencing unit is operatively coupled to the touch screen device by a video connection and a data interface connection, for example. The unit establishes and conducts a videoconference with one or more endpoints via a network. The unit sends video data to the display device and receives touch data from the device. The received touch data is used to control operation of the videoconferencing system. The received touch data can be used to initiate a videoconference call, change an operating parameter, change orientation of a camera, initiate a picture-in-picture display, access a menu, access memory, change a source of video data, initiate a whiteboard display, and access a screen of a connected device.

The foregoing summary is not intended to summarize each potential embodiment or every aspect of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing summary, preferred embodiments, and other aspects of subject matter of the present disclosure will be best understood with reference to a detailed description of specific embodiments, which follows, when read in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates an embodiment of a videoconferencing system according to certain teachings of the present disclosure.

FIG. **2**A illustrates a schematic diagram of an embodiment of the videoconferencing system.

FIG. **2**B illustrates a schematic diagram of another embodiment of the videoconferencing system.

FIG. **3** schematically illustrates components of the videoconferencing unit.

FIG. **4** illustrates an embodiment of a control panel of the touch screen display device.

FIG. **5** illustrates an embodiment of a menu function of the videoconferencing system.

FIG. **6** illustrates an embodiment of a camera function of the videoconferencing system.

FIG. **7** illustrates an embodiment of an annotation function of the videoconferencing system

FIG. **8** illustrates an embodiment of a whiteboard function of the videoconferencing system.

While the subject matter of the present disclosure is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. The figures and written description are not intended to limit the scope of the inventive concepts in any manner. Rather, the figures and written description are provided to illustrate the inventive concepts to a person skilled in the art by reference to particular embodiments, as required by 35 U.S.C. §112.

DETAILED DESCRIPTION

Referring to FIG. **1**, an embodiment of a videoconferencing system **10** according to certain teachings of the present disclosure is illustrated. The videoconferencing system **10** includes a videoconferencing unit **100** and a touch screen display device **200**. The videoconferencing system **10** can further include one or more peripheral devices, such as a computer (either laptop or desktop) **50**, a Video Cassette Recorder (VCR) **70**, and a Digital Versatile Disc (DVD) player **80**. In one embodiment, the videoconferencing unit **100** is a VSX 8000 available from Polycom, Inc., the Assignee of the present disclosure, and the touch screen display device **200** is a 3000i model SMART Board available from SMART Technologies of Canada. In an alternative embodiment, the videoconferencing unit **100** and the touch screen display device **200** can be integrated together for the videoconferencing system **10**.

The videoconferencing unit **100** is used to establish and conduct a videoconference with remote endpoints (not shown) via a network. The videoconferencing unit **100** has a camera **102** and a microphone **104**. Depending on the implementation, the unit **100** can have other common components, such as an Infrared (IR) detector **106**. The touch screen display device **200** is capable of both displaying video to the user and receiving touch and annotations from the user. In one embodiment, the touch screen display device **200** is a video monitor or the like having optical sensors surrounding the screen **202** for detecting when a user touches or writes on an area of the screen **202**. For example, the video monitor can be part of a conventional Television display, a flat panel display,

or other display known in the art. The touch screen display device **200** can also use other touch screen technologies known in the art.

As the 3000i model SMART Board, the device **200** includes a projection screen **202**, an integrated Extended Graphics Array (XGA) projector **220**, a control panel **230**, and a tray **240**. The device **200** also includes an audio system (not shown). To detect when a user touches the screen, the device **200** uses digital cameras (not shown) to detect objects and movement relative to the display screen **202**. As discussed below, the control panel **230** of the display device **200** includes buttons configured to operate in conjunction with the videoconferencing unit **100**. The tray **240** has various tools **242**, such as pens and erasers. Optical sensors (not shown) on the tray **240** are used to detect when a user picks up a certain pen or eraser tool **242** from the tray **240**.

Referring to FIGS. **2**A and **2**B, schematic diagrams of embodiments of the videoconferencing system **10** of FIG. **1** are illustrated. In the embodiment of FIG. **2**A, the videoconferencing unit **100** of the system **10** is coupled directly to the touch screen display device **200**. The discussion that follows focuses on video connections for the videoconference system **10**. However, it will be appreciated that the videoconferencing system **10** can have audio connections. For example, the videoconferencing unit **100** can have audio connections to the display device **200** and can send audio data to speakers of the display device **200**.

With respect to video connections of the system **10**, a camera **102** couples to an input **114**, such as an S-video connection, of the unit **100**. The videoconferencing unit **100** has a video output **112** that couples to a video input **212** of the display device **200**. For example, an XGA cable can be used to connect an XGA output **112** of the unit **100** to an RGB input **212** of the display device **200**. The videoconferencing unit **100** also has a serial port **113** that couples to a serial port (COM1) **213** of the display device **200**. The unit **100** and the display device **200** transfer data between one another using the serial ports **113** and **213**. This data includes touch data obtained by the display device **200** and transferred to the unit **100**, which uses the touch data for operation as discussed below. The transferred data also includes data generated by a user selecting a configured button on the control panel (not shown) of the display device **200**.

The videoconferencing system **10** can also include a number of optional components useful for some implementations or functions of the system **10**. For example, one or more optional VCRs or DVD players **70** or **80** can couple to one or more inputs **118** of the unit **100**. In addition, an optional laptop or other computer **50** can couple to the touch screen device **200** though a serial port (COM2) **215**. The coupling of the computer **50** to the serial port (COM2) **215** of the device **200** can allow the display device **200** to operate separately as an independent component from the videoconferencing unit **100**—if the computer **50** has appropriate software.

The computer **50** can also couple to an Extended Graphics Array (XGA) Splitter **60** that couples to an input **116** of the videoconferencing unit **100** and couples to an RGB input **216** of the display device **200**. The coupling of the computer **50** and splitter **60** to both the unit **100** and the device **200** allows the computer **50** to provide content, images, etc. on the computer to be displayed by the device **200** and to be manipulated and forwarded to remote endpoints (not shown) by the videoconferencing unit **100**. In one embodiment, the computer **50** can have a graphical user interface for controlling operation of the videoconferencing unit **100**—if the computer **50** has appropriate software integrating the computer **50** with the unit **100**. The GUI for controlling the unit **100** with the computer **50** can be displayed on the display device **200** when operated in a "PC direct" mode of operation discussed below.

In the embodiment of the videoconferencing system **10** in FIG. **2**B, the videoconferencing unit **100** again has its video output **112** directly coupled to the RGB input **212** of the display device **200**. However, the serial port **113** of the unit **100** couples to an A/V controller **150** that in turn couples to the serial port (COM **1**) **213** of the display device **200**. Using the A/V controller **150**, the unit **100** and the device **200** can transfer data between one another using the serial ports **113** and **213**.

In one embodiment, the A/V controller **150** is a POINTMAKER® PVI video marker, which is a programmable device that is used to control audio and visual devices and is available from Boeckeler Instruments, Inc. of Tucson, Ariz. The serial connection of the videoconferencing unit **100** to the A/V controller **150** via serial port **113** allows the unit **100** to control operation of the A/V controller **150**.

As in the previous embodiment, the camera **102** couples directly to the camera input **114** of the unit **100**. However, optional components, such as the VCR/DVD **70**/**80**, a document camera **90**, the computer **50**, and the XGA splitter **60**, are coupled to the A/V controller **150**. In turn, the A/V controller **150** provides first video data **152** from the personal computer **50**, second video data **154** from the VCR/DVD **70**/**80**, and third video data **156** from the document camera **90** to one or more inputs **115** of the videoconferencing unit **100**.

In the present embodiment, the document camera **90** can connect by an S-video cable to an S-video input of the A/V controller **150**. In turn, an S-video cable from an S-video output of the A/V controller **150** can connect to a second camera input of the unit **100**. The VCR/DVD **70**/**80** can connect by an RCA or BNC cable from a composite video output of the VCR/DVD **70**/**80** to a composite video input of the A/V controller **150**. In turn, a BNC or S-video cable from a composite video output of the A/V controller **150** can connect to a VCR/DVD video input of the videoconferencing unit **100**. The video from the A/V controller **150** can connect by a XGA/VGA cable from a VGA output of the A/V controller **150** to a VGA input of the videoconferencing unit **100**.

Referring now to FIG. **3**, additional components of the videoconferencing system **10** are schematically illustrated in more detail. The videoconferencing unit **100** has a controller **120**, which can include any conventional encoders, processors, and other electronic components known in the art and used for a videoconferencing unit. The controller **120** is coupled to the output **112** for video, the serial port **113** for data interface, and memory **130** storing functions **131**-**135**. The controller **120** is also coupled to an input **114** for video from a near camera **102** and can be coupled to an interface **115** for controlling the near camera **102**. The video output **112** is coupled to the video input **212** of the display device **200**, and the serial port **113** exchanges data with a serial port **213** of the display device **200**. For example, the serial port **113** receives touch data from the display device **200**, the port **113** can exchange control data with the display device **200**.

The controller **120** includes a video codec **122** and a data processor **124**. The video codec **122** is responsible for processing video data to be displayed by the display device **200** and to be sent to remote endpoints of the videoconference. In general, the video data can include images captured by the camera (not shown) of the unit **100**, video from remote endpoints of the videoconference, content from a peripheral device (e.g., VCR, DVD player, computer, document camera, etc.), annotations from the display device **200**, and other

visual data. Operation of such a video codec **122** in the context of videoconferencing is well known in the art is not described herein.

The data processor **124** is responsible for processing data for the videoconferencing unit **100**. This data includes touch data from the display device **200**, communication data, commands, videoconference information, etc. The controller **120** is also coupled to a network interface **140**, such as commonly used for a videoconferencing unit, and the network interface **150** couples to a videoconference network **142** known in the art.

The controller **120** controls operation of at least some features of the videoconferencing system **10** using the operational functions **131-135** stored in memory **130**. These operational functions include an on-screen graphical user interface (GUI) function **131**, a camera function **132**, an annotation function **133**, a white board function **134**, and an auxiliary device function **135**. Each of these operational functions **131-135** is discussed in more detail later, but a general overview of these functions **131-135** is provided here.

The on-screen GUI function **131** allows the videoconferencing unit **100** to display graphical user interfaces for controlling operation of the system **10** on the display device **200**. The graphical user interfaces of the videoconference unit **100** can include a number of touch controls, menus, and dialogs that can be displayed on the display device **200** for a user to operate and control the system **10**. For example, the graphical user interfaces of the unit **100** can allow the user to place a videoconference call through a directory, speed dial, or manual dial menu; answer an incoming videoconference call; hang-up a videoconference call; mute or change volume of audio; select camera and content sources, swap near and far video in picture-in-picture (PIP), and other operations disclosed herein.

The camera function **132** allows the videoconferencing unit **100** to display visual touch controls on the display device **200** for controlling operation of one or more cameras, such as near camera **102**. In one embodiment, the near camera **102** is a pan-tilt-zoom camera capable of panning, tilting, and zooming. One or more of the panning, tilting, and zooming capabilities of the near camera **102** can be accomplished by one or more mechanical actuators **103**, as are used in the art for operating pan-tilt-zoom cameras of videoconferencing units. The interface **115** is coupled to the actuator **103**, and the controller **120** controls operation of the panning, tilting, and zooming capabilities of the near camera **102** using control signals via the interface **115**. A user utilizing visual touch controls on the display device **200** can generate the control signals to control the panning, tilting, and zooming of the near camera **102**.

Alternatively, the panning, tilting, and zooming capabilities of the near camera **102** may be electronically achieved. For example, the near camera **102** may have processing capabilities for panning, tilting, and/or zooming, and the controller **120** can control that processing using control signals via the interface **115**. In another example, the controller **120** may instead having the processing capabilities for panning, tilting, and/or zooming, and the controller **120** can perform those operation based on video received from the near camera **102** via video input **114**.

In addition to controlling the near camera **102**, the camera function **132** allows the videoconferencing unit **100** to display visual touch controls on the display device **200** for controlling operation of a far-end camera **144** on the network **142**. For example, the far-end camera **144** may be associated with a remote endpoint participating in the videoconference. Using the network interface **140**, the controller can control the panning, tilting, and zooming capabilities of the far-end camera **144** using control signals. For example, the far-end camera **144** can be a pan-tilt-zoom camera having one or more mechanical actuators or having electronic processing capabilities. The controller **120** can use a far-end camera control protocol, such as H.224 that is described in Annex Q of H.323, for controlling the far-end camera **144** via the network interface **140**.

The annotation function **133** allows the user to make annotations on video displayed on the display device **200**, and the white board function **134** allows the user to make annotations on a white board displayed on the display device **200**. Finally, the auxiliary device function **135** allows the videoconferencing unit **100** to display video from other auxiliary devices, such as a computer, laptop, VCR, DVD player, etc.

As will be apparent from the general description above, the operational functions **131-135** allow the videoconferencing unit **100** to operate the touch screen display device **200** in an annotation mode and in a touch control mode. Determination of which mode can depend on whether a pen or eraser tool **242** is picked up from the tray **240** of the display device **200**. If a pen or eraser tool **242** is lifted off the tray, for example, the videoconferencing unit **100** can operate the display device **200** in the annotation mode so that the user can make annotations on video displayed on the device **200**. The video can be of the videoconference or other content and can be from the videoconferencing unit **100**, computer, laptop, VCR, DVD player, document camera, etc. When all of the tools **242** are placed in the tray **240**, the videoconferencing unit **100** can operate the display device **200** in the touch control mode so that the user can control operation of the videoconference system **10** by touching areas of the display **200** corresponding to the graphical user interfaces, touch controls, menus, dialogs, etc. of the unit **100**.

Provided the general overview of how the videoconferencing unit **100** controls operation of the videoconferencing system **10**, reference is now made to FIGS. **4** through **8** for a more detailed discussion of the operational functions of the videoconferencing unit **100**.

As noted above, the videoconferencing unit **100** controls operation of the touch screen display device **200** using the auxiliary device function **135**. One way for achieving this is accomplished by integrating controls on the control panel (**230**; FIG. **1**) of the display device **200** with the videoconferencing unit **100**. Referring to FIG. **4**, an embodiment of the control panel **230** of the touch screen display device (not shown) is illustrated. As discussed previously, the touch screen display device is preferably a 3000i model SMART Board. As such, the control panel **230** of the 3000i model SMART Board has a plurality of buttons that are configured to control volume levels, brightness levels, and contrast levels of the display device. As part of the integration between the videoconferencing unit and the display device of the disclosed videoconferencing system, however, the buttons on the control panel **230** of the display device are reconfigured as illustrated in the embodiment of FIG. **4**. (For convenience, reference is concurrently made in FIG. **4** to reference numerals for components in FIG. **1** of the present disclosure).

The control panel **230** includes a first button **231** configured to initiate a videoconference mode of operation. In this mode, the videoconferencing unit (**100**) establishes and conducts a videoconference by establishing a videoconference connection with remote endpoints via a network, by sending video of the videoconference to the RGB input of the display device (**200**), and by transferring graphical user interfaces and touch data between the display device (**200**) and the unit (**100**).

A second button **232** of the panel **230** is configured to initiate control of a personal computer (**50**) if coupled to the disclosed videoconferencing system. In this mode, content from the computer (**50**) can be shown during the videoconference. This content can include screens of the computer, video or other images stored on the computer, PowerPoint presentations, files, etc. During a videoconference, the content from the computer (**50**) is processed by the videoconferencing unit (**10**) and is sent to the display device (**200**). The content can also be sent to remote endpoints of the videoconference.

A third button **233** of the panel **230** is configured to initiate a PC direct mode of operation. In this mode, video data from the computer (**50**) is sent to the RGB input of the display device (**200**) directly from the XGA output from the splitter (**60**) rather than from the video codec of the videoconferencing unit (**100**). This could be done whether in a videoconference call or not or can be done whether computer's content is sent to other endpoints or not. A fourth button **234** of the panel **230** is configured to initiate a video mode of operation in which the display device (**200**) is operated to receive video by an S-Video connection from a connected source.

In addition to the buttons on the control panel **230**, the display device (**200**) also includes other buttons **235** and **236** on the device's tray (**240**). These buttons **235** and **236** are shown in FIG. **4** apart from the tray (**240**) for convenience. The first tray button **235** is originally configured to access an on-screen keyboard on the screen of the display device (**200**) when operated with software of a coupled computer or laptop. For the videoconferencing system (**10**) of the present disclosure, however, pressing this keyboard button **235** is reconfigured to access an on-screen keyboard of the videoconferencing unit (**100**) if all the pens (**242**) on the tray (**240**) of the display device (**200**) are down and if the unit (**100**) is generating a screen where display of the keyboard is appropriate. If a pen (**242**) is lifted from the tray (**240**), however, this button **235** is configured to access a calibration screen of the A/V controller (**150**; FIG. **2**A) if it is component of the implementation of the videoconferencing system (**10**). With the accessed calibration screen, the user can calibrate the A/V controller (**150**; FIG. **2**B) using the touch screen display device (**200**).

The second tray button **236** is originally configured to operate as a right-mouse click when the display device (**200**) is operated with software of a coupled computer or laptop (**50**). For the videoconferencing system (**10**) of the present disclosure, however, pressing this button **236** is reconfigured to start and stop VGA graphics of the videoconferencing unit (**100**) if the pens (**242**) on the tray (**240**) of the display device (**200**) are down. If a pen (**242**) is lifted from the tray (**240**), this button **236** is configured to access a menu of the A/V controller (**150**; FIG. **2**B) if it is part of the implementation. With the accessed menu screen, the user can control operation of the A/V controller (**150**; FIG. **2**B) using the touch screen display device (**200**).

Returning briefly to FIG. **3**, the videoconferencing unit **100** has an on-screen GUI function **131**, as previously discussed, for displaying user interfaces, menus, touch controls, dialogs, etc. on the display device **200** used to control operation of the system **10**. Part of the on-screen GUI function **131** involves displaying touch controls on the display device **200** and receiving touch data at the videoconferencing unit **100** from the display device **200** with respect to those touch controls to control operation of the system **10**. In other words, the display device **200** is used to detect information, selections, annotation from a user's touch, electonic pen, etc. on the touch screen display device **200**. This detected touch data is sent to the videoconferencing unit **100**. In turn, the touch data is used to operate the videoconferencing system **10**.

For example, a touch or release in an area of the touch screen of the display device **200** causes an event that corresponds to the touch and/or release of a feature configured for the user interface of the videoconferencing unit **100**. If the user's touch is on an area of the screen that is not designated as a touch control of the user interface of the unit **100**, then the touch data may be processed by a supervisory algorithm that can access camera controls or bring up a main menu or the like. Accordingly, the unit **100** determines whether a graphical user interface (GUI) and/or video is currently being displayed on the display device **200**. If the unit **100** is showing a GUI, for example, then the user will be able to use a finger or electronic pen **242** to touch the screen of the display device **200** and produce inputs to the videoconferencing unit **100**.

Referring to FIG. **5**, an embodiment of a menu **310** generated by the videoconferencing unit (**100**) is illustrated on the touch screen **202** of the display device (**200**). The menu **310** can be invoked when the user selects a button **302** displayed on the top left of the screen **202** while video is being displayed. Preferably, the button **302** is transparent or hidden and is available from all screens including those containing video of participants and content. Once invoked, the menu **310** allows the user to control the videoconferencing system by using interactive touch directly on the screen **202**. Preferably, the menu **310** is transparent and displayed over video currently displayed on the screen **202**.

The menu **310** includes a plurality of touch controls **312** similar to a buttons available on a remote control. These touch controls **312** include a Home button, a Call button, a Hang-Up button, a Volume button, a Mute button, a Cameras button, a picture-in-picture (PIP) button, a Near button, a Far button, a Preset button, and a Close button. These and other buttons may be provided in the menu **310** depending on the implementation. For example, some other possible buttons include buttons for bringing up help and buttons for an on-screen keyboard.

The touch controls **312** can operate similar to corresponding controls found on a physical remote. Here, the difference is that designated areas of the video data displayed on the screen **202** are associated with touch controls used to control and operate the videoconferencing system. For example, selecting the Call button on the menu **310** can initiate a videoconference call. To initiate the call, a Speed Dial dialog or an address book dialog may be accessed on the screen **202** to select with which remote endpoints to establish the videoconference. Selecting the Hang-up button on the menu **310** can end a videoconference call or can bring up a hang-up dialog on the screen **202** if there is more than one call currently active. Selecting the Volume button on the menu **310** can bring up a volume bar on the screen **202**, and then user can touch on the Volume bar displayed on the screen **202** to control the volume. The Mute and PIP on the menu **310** can be toggling buttons for muting the audio and producing picture-in-picture on the screen **202**.

Selecting the Preset button on the menu **310** can bring up a Preset dialog on the screen **202**, and the user can select from a plurality of stored presets or touch and hold to store a preset. Selecting the camera button on the menu **310** can bring up a dialog on the screen **202** that lists video sources (e.g., camera, computer, etc.), and the user can touch on an appropriate button on the list to select a desired video source. The near and far buttons on the menu **310** allows the user to select and control the near camera (i.e., the one coupled to the videoconferencing unit (**100**)) or one or more of the far cameras associated with the endpoints of the videoconference.

As discussed previously, the videoconferencing unit **100** of FIG. **3** also has the camera function **132** for controlling the camera. Part of the camera function **132** involves displaying camera controls on the display device **200** and receiving touch data from a user with respect to those camera controls to control operation of the camera. Referring to FIG. **6**, an embodiment of camera controls **350** generated by the videoconferencing unit is illustrated on the touch screen **202** of the display device. The camera controls **350** allow the user to control a pan-tilt-zoom camera using intuitive touch on the screen **202**. When full screen video is being displayed on the screen **202**, then touching anywhere on the screen while the pens or eraser tools (**242**; FIG. **1**) are down will bring up a watermark grid **360** displayed over the active video. Control icons **364** and **368** are positioned in areas **362** and **366** of the watermark grid **360**. By touching in a pair of upper and lower areas **362** of the grid **360** associated with the control icons **364**, the user can tilt the tilt-pan-zoom camera of the connected videoconferencing unit or of a remote endpoint participating in the videoconference. By touching in a pair of right and left areas **363** of the grid **360** associated with the control icons **365**, the user can pan the tilt-pan-zoom camera of the connected videoconferencing unit or of a remote endpoint participating in the videoconference. By touching in the pair of inside areas **366** of the grid **360** associated with the other control icons **368**, the user can zoom the camera of the connected videoconferencing unit or of a remote endpoint participating in the videoconference.

Determining which camera (e.g, near or far-end) associated with the videoconference is controlled depends on which video is currently being displayed on the screen **202**. For example, if video of a far-end camera associated with an endpoint of the videoconference is currently displayed on the screen, then touching the areas **362**, **363**, and **366** associated with the grid **360** will control the pan, tilt, and zoom of the far-end camera using the techniques disclosed herein. If video of the near camera connected to the videoconferencing unit associated with the screen **202** is currently being displayed, then touching the areas **362**, **363**, and **366** associated with the grid **360** will control the pan, tilt, and zoom of the near camera using the techniques disclosed herein

As discussed previously, the videoconferencing unit **100** of FIG. **3** has the annotation function **133** for adding annotations to displayed video. Referring to FIG. **7**, portion of the videoconferencing system **10** is shown operating in an annotation mode **400**. In the annotation mode **400**, a user can make annotations **410** over video currently displayed on the screen **202**. The annotations **410** can be made with an electronic pen **242** and can be made while either on or off an active videoconference call. If the user wants to write on a displayed object **402** (e.g., a displayed document from a connected document camera or a computer) on the screen **202**, then the videoconferencing system **10** automatically goes into the annotation mode **400** of operation as soon as the user picks up the electronic pen **242** from the tray **240**. As discussed previously, optical sensors **244** on the tray **240** of the display device **200** can be used to detect when the user picks up the pen **242** from the tray **240**. This data is sent from the display device **200** through the data interface with the videoconferencing unit **100** where the controller (**120**; FIG. **3**) of the unit **100** access the annotation function (**133**; FIG. **3**).

In the annotation mode, the user is able to make annotations **410** on various video or images displayed on the screen **202** of the display device **200**. The video and images can include videoconference video from the videoconferencing unit **100**, video from a document camera, video from a VCR or DVD player, or a computer screen image from a connected computer. The video from the document camera, VCR, and DVD player can comply with the National Television Standards Committee (NTSC) or Phase Alternating Line (PAL) standards. The computer screen image can be XGA having a resolution of 1024×768.

When annotations **410** are made on the screen **202**, the graphical elements of the annotations **410** are combined with the displayed video. By combining the annotations **410** with the displayed video, the annotations **410** can be readily sent to far endpoints of the videoconference as part of the compressed video bit stream sent from the unit **100** to remote endpoints over the videoconference network.

In one embodiment, the user can make annotations **410** to content provided by the computer. Preferably, annotating content from the computer. The content can be of a whiteboard, a computer screen, an image, or visual media from the computer. For example, the computer (**50**; FIG. **2**A-**2**B) can be designated as the source of content for display on the screen **202** of touch screen device **200**. During a videoconference, the user can pick up a user tool **242** from the tray **240** of the touch screen device **200**, and the videoconferencing system **10** automatically switches to the annotation mode of operation. Once in the annotation mode of operation, the computer (**50**) receive touch data from the touch screen device **200** and combines the received touch data as annotation to the computer's content. The computer (**50**) sends this annotated content to the touch screen device **200** for display and sends it to the videoconferencing unit **100**. In turn, the videoconferencing unit **100** receives the annotated content from the computer (**50**) and sends the received annotated content to the endpoints (not shown) of the videoconference via the unit's network interface (**140**; FIG. **3**). Thus, annotations can be made to content and sent automatically to far-end endpoints via the network.

Sending the annotated content preferably involves combining the annotation data and content data together so that the combination can be sent in the H.239 standard through the network. Furthermore, handling annotations and content for display on the touch screen device **200** with the computer (**50**) can avoid issues with delay that conventionally occur when a user makes annotations during a videoconference. Specifically, handling annotations and content with the computer (**50**) avoids the need of having the videoconferencing unit **100** handle the annotations and content and send that annotated content to the touch screen device **200** for display. Such a feedback arrangement typically results in a delay between what annotations the user is currently making on the screen **202** of the display device **200** and how much of the annotation **410** is being displayed. Any significant delay is generally undesirable.

As discussed above, the videoconferencing unit **100** of FIG. **3** also has the whiteboard function **134** for allowing the display device **200** to be used as a whiteboard. Referring to FIG. **8**, portion of the videoconferencing system **10** is shown operating in a whiteboard mode **450**. To access this mode **450**, a user picks up an electronic pen **242** from the tray **240** of the display device **200**, and the videoconferencing system **10** automatically goes into the whiteboard mode **450** of operation if another source of video (e.g., document camera, computer, VCR, DVD player, etc.) is not already selected. The user can then start writing annotations **460** on the whiteboard content **452** displayed on the screen **202**. The whiteboard content **452** is preferably an XGA image having a resolution of 1024×768. The user can make annotations **460** on the whiteboard content **452** regardless of whether the system **10** is in a videoconference call or not. When in a videoconferenc

call, however, the whiteboards content **452** with the annotations **460** can be sent to remote endpoints by the videoconferencing unit **100**.

As discussed previously with reference to FIGS. **2**A-**2**B, the system **10** may not include a computer. Lacking a computer, the videoconferencing unit **100** can generate a whiteboard on its own. When the system **10** is currently displaying video data of a graphical user interface or the camera on the display device **200**, the videoconferencing unit **100** automatically goes into the annotation mode of operation when the user picks up the pen **242** from the tray **240**. In the annotation mode, the videoconferencing unit **100** generates the whiteboard content **452**. The videoconferencing unit **100** receives touch data from the display device and combines the touch data as annotations **460** to the whiteboard content **452**. The videoconferencing unit **100** then sends the annotated whiteboard to the display device **200** and sends it to one or more remote endpoints of the videoconference as H.239 content. In an alternative embodiment, however, the system **10** can use an optional computer (**50**; FIG. **2**A-**2**B) to handle the whiteboard content **452** and the annotations **460** so that the videoconferencing unit **100** can send the annotated whiteboard to the one or more remote endpoints of the videoconference as H.239 content.

As noted previously, an optional computer (**50**; FIGS. **2**A-**2**B) can connected to the system **10**. Picking up a pen **242** from the tray **240** can cause the system **10** to pick a VGA or video source automatically for displaying full screen on the display device **200** and for sending to remote endpoints of the videoconference. For example, rather than showing the whiteboard **452** as the background of the display, a computer screen from the optionally connected computer (**50**) can be shown. The choice of which VGA or video source depends on which sources are currently selected for the system **10**. For example, behavior regarding video annotation can be controlled by the A/V controller **150** integrated with the system **10**, and the A/V controller **150** can be configured to provide the features disclosed herein for annotating video and switching between sources.

The foregoing description of preferred and other embodiments is not intended to limit or restrict the scope or applicability of the inventive concepts conceived of by the Applicants. In exchange for disclosing the inventive concepts contained herein, the Applicants desire all patent rights afforded by the appended claims. Therefore, it is intended that the appended claims include all modifications and alterations to the full extent that they come within the scope of the following claims or the equivalents thereof.

What is claimed is:

1. A videoconferencing system for a plurality of sources of video data, comprising:

a touch screen device configured to display video data and generate touch data with a touch sensor,

a tool sensor, associated with a user tool for the touch screen device and generating an indication when the user tool is moved relative to the tool sensor; and

a videoconferencing unit operatively coupled to the touch screen device and the sources of video data, the videoconferencing unit configured to:

establish a videoconference with one or more endpoints via a network,

receive video data from one or more of the sources of video data,

send received video data to the touch screen device for display and to the one or more endpoints via the network,

wherein when the user tool is moved, the videoconferencing unit receives the indication that the user tool has been moved and is configured in response to automatically:

select one of the sources of video data

switch from a current source of video data to the selected source of video data, and

send video data from the selected source to the touch screen device and to the one or more endpoints.

2. The videoconferencing system of claim **1**, wherein the system comprises at least one camera capable of at least one of panning, tilting, or zooming; and wherein the videoconferencing unit is configured to:

send video data received from the at least one camera to the touch screen device for display,

designate at least one area of sent video data as at least one touch control for user selection, the at least one touch control for controlling the pan, tilt, or zoom of the at least one camera,

receive touch data from the touch screen device,

associate received touch data with the at least one touch control, and

control operation of the at least one camera based on the associated touch control.

3. The system of claim **1**, wherein the at least one camera comprises a mechanical actuator for panning, tilting, or zooming the at least one camera, and wherein to control operation of the at least one camera based on the associated touch control, the videoconferencing unit is configured to send a control signal to the mechanical actuator.

4. The system of claim **1**, wherein the at least one camera comprises an electronic processing capability for panning, tilting, or zooming video data captured by the at least one camera, and wherein to control operation of the at least one camera based on the associated touch control, the videoconferencing unit is configured to send a control signal to the at least one camera to perform the electronic processing capability.

5. The system of claim **1**, wherein the at least one camera comprises a far-end camera coupled to one of the endpoints, and wherein to control operation of the far-end camera based on the associated touch control, the videoconferencing unit is configured to send a control signal to the far-end camera via the network.

6. The system of claim **1**, wherein the at least one camera comprises panning, tilting, or zooming capabilities that are mechanically actuated or digitally achieved.

7. The system of claim **1**, wherein the at least one camera comprises a pan-tilt-zoom camera, and wherein to designate at least one area of sent video data as at least one touch control for user selection, the videoconferencing unit is configured to generate a grid for display in conjunction with video data sent to the touch screen device, the grid having at least one area corresponding to the at least one touch control for controlling the pan, tilt, or zoom of the at least one camera.

8. The system of claim **7**, wherein the grid comprises a first pair of areas corresponding to first touch controls for panning the pan-tilt-zoom camera, a second pair of areas corresponding to second touch controls for tilting the pan-tilt-zoom camera, and a third pair of areas corresponding to third touch controls for zooming the pan-tilt-zoom camera.

9. The system of claim **1**, wherein the at least one camera comprises first and second cameras, and wherein to control operation of the first and second cameras based on the associated touch control, the videoconferencing unit is configured to:

determine which one of the first and second cameras currently has video data being sent to the touch screen device, and

control operation of the one determined camera based on the associated touch control.

10. The system of claim **1**, wherein the first camera comprises a near camera associated with the videoconferencing unit, and wherein the second camera comprises a far-end camera associated with one of the endpoints of the videoconference.

11. The system of claim **1**, wherein the sources of video data are selected from the group consisting of a network interface coupled to the one or more endpoints via the network, a camera, a video cassette recorder, a digital versatile disc player, a laptop computer, a personal computer, a programmable controller of visual sources, and an Extended Graphics Array splitter.

12. The system of claim **1**, wherein to automatically switch from the current source of video data to the selected source of video data, the videoconferencing unit is configured to:

generate a whiteboard in response to the moved user tool,

receive touch data from the touch screen device,

combine the received touch data as annotation to the whiteboard, and

send the annotated whiteboard to the touch screen device for display and to the one or more endpoints of the videoconference via the network.

13. The system of claim **1**, wherein:

the touch screen device comprises a first data interface,

the videoconferencing unit comprises a second data interface coupled to the first data interface, and

the second data interface receives touch data from the first data interface of the touch screen device.

14. The system of claim **13**, further comprising:

a computer having a video output and having a data interface coupled to another data interface of the touch screen device; and

an extended graphics array splitter having a video input coupled to the video output of the computer, the splitter having a video output coupled to a video input of the videoconferencing unit and having another video output coupled to another video input of the touch screen device.

15. The system of claim **13**, further comprising a visual controller having data interfaces coupled between the first and second data interfaces of the videoconferencing unit and the touch screen device.

16. The system of claim **15**, wherein one or more of the sources of video data are coupled to one or more video inputs of the visual controller, and wherein the visual controller comprises one or more video outputs coupled to one or more video inputs of the videoconferencing unit.

17. The system of claim **1**, wherein the tool sensor is disposed on a tray of the touch screen and generates the indication when the user tool is picked up from the tray.

18. The system of claim **17**, wherein the tool sensor senses at least one of a pen and an eraser as the user tool disposed on the tray.

19. The system of claim **17**, wherein the tool sensor comprises an optical sensor disposed on the tray.

20. A videoconferencing system, comprising:

a touch screen device configured to display video data and generate touch data, the touch screen device comprising first and second video inputs and first and second data interfaces, the touch screen device having a user tool and a sensor, the sensor generating an indication when the user tool is moved relative to the sensor;

a computer coupled to the first video input and the first data interface of the touch screen device, the computer having a video output for content; and

a videoconferencing unit coupled to the video output of the computer and coupled to the second video input and the second data interface of the touch screen device, the videoconferencing unit having a network interface establishing a videoconference with one or more endpoints via a network;

wherein in an annotation mode of operation, the computer is configured to:

receive touch data from the touch screen device, and

combine received touch data as annotation to content, and

send annotated content to the touch screen device for display and to the videoconferencing unit,

wherein the videoconferencing system is configured to automatically switch to the annotation mode of operation in response to the indication, and

wherein in the annotation mode of operation, the videoconferencing unit is configured to:

receive annotated content from the computer, and

send received annotated content to the endpoints via the network.

21. The system of claim **20**, wherein the content sent from the computer in the annotation mode of operation comprises a whiteboard, a computer screen, an image, or visual media.

22. The system of claim **20**, further comprising:

an extended graphics array splitter having a video input coupled to the video output of the computer, the splitter having a video output coupled to a video input of the videoconferencing unit and having another video output coupled to the first video input of the touch screen device.

23. The system of claim **22**, further comprising a visual controller having data interfaces coupled between a data interface of the videoconferencing unit and the second data interface of the touch screen device.

24. The system of claim **23**, wherein at least one source of video data is coupled to a video input of the visual controller, and wherein the visual controller comprises a video output coupled to a video input of the videoconferencing unit.

25. The system of claim **24**, wherein the at least one source of video data is selected from the group consisting of a camera, a video cassette recorder, and a digital versatile disc player.

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