Visual telephone capable of displaying synchronously quadruplex input signals and method thereof

Technical Field

The present invention relates to a visual telephone, and in particular to a visual telephone which is capable of receiving multiplex input signals and displaying four various pictures on the same screen at the same time, and the method thereof.

Background of the Invention

In FIG. 1, we have shown a structural block diagram of a visual telephone in prior art. It comprises a camera (not shown), an image decoder having a video input interface, a central processing unit (CPU), an image encoder, a modem, Memory and displaying device; wherein the video signals collected by the said camera are transmitted to the said image decoder. After decoding, the resultant images with CIF format compressed by the CPU will be transmitted to the modem. Then, they will be sent to the remote end after modulation. When displaying locally, the images will be transmitted directly by the CPU to the said image encoder, and then sent to the said display device after encoding to display.

The fixed special multimedia chip, for example, the core chip made by 8*8 corporation of the United States, is usually utilized as the central processing unit (CPU) in hardware in order to realize the functions of the visual telephone of the prior art.

However, it is impossible that a user accesses multiplex input or watches multiple pictures synchronously in the visual telephone of the prior art, because the image decoder can only receive one-way images and audio input and display on the screen, unless its structure could be changed to link multiple screens. That will result in difficulty in the structure and high costs, and it will not be acceptable by users.

Another defect in the visual telephone of the prior art is that it can be only used as a kind of communications tool having single function, so its application is also single.

Summary of the Invention

One aspect of the present invention is to provide a visual telephone capable of displaying synchronously quadruplex input signals, it can realize not only the visual function, but also the control of the remote end, comprising at least:

MultipleXer (MUX) including four video inputs, a video output, and a control input, wherein the four video inputs are used for inputting the video signals collected by various cameras respectively, the control input connects with the CPU,

and the video output, in the control of the CPU, transmits one of the four video inputs signals to the image decoder;

Image decoder, connecting with the output of the MUX, converts the video output signals of the MUX into the images with Q-CIF format, and then transmits them to the CPU;

Memory, including display buffer containing storage areas corresponding with four video input signals;

Central Processing Unit (CPU), used for controlling the MUX so that it can strobe each video input signal in a certain sequence by turns; after the gated video input signals are converted by the image decoder into the image with Q-CIF format, the image will be stored in the storage area in the display buffer corresponding with the input signal; after a gating cycle, the quadruplex images with Q-CIF format will be put together into one image with CIF format, and then transmitted to the image encoder or to the remote end through the modem;

Image encoder, used for encoding the image data output by the CPU into the image signals which can be displayed by the display device and transmitting them to the display device;

Display device, connecting with the image encoder for displaying the image signals encoded and transmitted by the image encoder;

Camera, arranged above the display device and connected with one of the video inputs of the MUX;

Modem, used for modulating or demodulating the data transmitted between the local device and the remote end and exchanging data with the CPU, including encoder/decoder having audio I/O and Modem I/O, Modem processor, and audio processor; wherein the encoder/decoder is connected with the Modem processor and the audio processor respectively, and the Modem processor and the audio processor are connected with the CPU respectively;

Control port, connecting with the CPU for exchanging data or commands between the CPU and the peripheral equipment; wherein

When transmitting the control signals to the remote end, the CPU converts the commands into data and compresses them with image and voice signals by packing, and then transmits the packet through the line to the remote end after modulation by the Modem;

When receiving the control signals from the remote end, the packet received by the Modem, after decompressing by the CPU, will be restored to image, voice signals and commands data, and then the corresponding control actions concerning the local machine or the peripheral equipment will be executed according to the commands.

Another object of the present invention is to provide a visual annunciator capable of displaying synchronously quadruplex input signals, comprising at least:

MultipleXer (MUX) including four video inputs, a video output, and a control input, wherein the four video inputs are used for inputting the video signals collected by various cameras respectively, the control input connects with the CPU, and the video output, in the control of the CPU, transmits one of the four video inputs signals to the image decoder;

Image decoder, connecting with the output of the MUX, converts the video output signals of the MUX into the images with Q-CIF format, and then transmits them to the CPU;

Memory, including display buffer containing storage areas corresponding with four video input signals;

Central Processing Unit, used for controlling the MUX so that it can strobe each video input signal in a certain sequence by turns; after the gated video input signals are converted by the image decoder into the image with Q-CIF format, the image will be stored in the storage area in the display buffer corresponding with the input signal; after a gating cycle, the quadruplex images with Q-CIF format will be put together into one image with CIF format, and then transmitted to the image encoder or to the remote end through the modem;

Image encoder, used for encoding the image data output by the CPU into the image signals which can be displayed by the display device and transmitting them to the display device;

Display device, connecting with the image encoder for displaying the image signals encoded and transmitted by the image encoder;

Camera, arranged above the display device and connected with one of the video inputs of the MUX;

Modem, used for modulating or demodulating the data transmitted between the local device and the remote end and exchanging data with the CPU, including encoder/decoder having audio I/O and Modem I/O, Modem processor, and audio processor; wherein the encoder/decoder is connected with the Modem processor and the audio processor respectively, and the Modem processor and the audio processor are connected with the CPU respectively;

Control port, connecting with the CPU for exchanging data or commands between the CPU and the peripheral equipment; wherein

When transmitting the control signals to the remote end, the CPU converts the commands into data and compresses them with image and voice signals by packing, and then transmits the packet through the line to the remote end after

modulation by the Modem;

When receiving the control signals from the remote end, the packet received by the Modem, after decompressing by the CPU, will be restored to image, voice signals and commands data, and then the corresponding control actions concerning the local machine or the peripheral equipment will be executed according to the commands.

Another object of the present invention is to provide a method capable of displaying synchronously quadruplex video input signals on the visual telephone, comprising at least the following steps: allocating four storage areas in the display buffer corresponding with the quadruplex video input signals respectively; converting the quadruplex video input signals, in one cycle of gating of the quadruplex video input signals, into the image signals with Q-CIF format respectively, and storing them in the storage areas corresponding with each video signal input; after one gating cycle, putting together the Q-CIF signals in four storage areas into one CIF image; transmitting the resultant CIF image to the image encoder for encoding and then to the display device, or transmitting the resultant CIF image, after compressing, to the Modem for modulation and then to the remote end.

The visual telephone and the visual annunciator capable of displaying synchronously quadruplex input signals according to the present invention are provided with four video inputs. The quadruplex input signals can be displayed synchronously on a single display device based on user' s option. The multiple pictures display with multiplex inputs can bring users a lot of conveniences and enhance the practicability of the entire equipment without the apparent increase of costs.

Meanwhile, the data or command exchange between the visual telephone and the peripherals can be realized through the control port comprised in the device of the present invention. The device of the present invention is capable of collecting data from exterior sensor, transmitting to the remote visual telephone, accepting the control command from the remote visual telephone, and controlling the peripheral equipment connected with the control port of the local visual telephone, including making the specific camera turn to a specific angle and making the controlled equipment operative or inoperative, etc. In this way, the visual telephone is not only a communications tool, but also an intelligent tool for remote sensing and control. The application range of the visual telephone will be expanded widely, while the costs will not increase apparently.

Brief Description of the Drawings

FIG. 1 is a structural block diagram of the visual telephone in the prior art.

FIG. 2 is a structural block diagram of the device of the first preferred embodiment according to the present invention.

FIG. 3 is a structural block diagram of the control port in the first preferred embodiment according to the present invention.

FIG. 4 is a structural block diagram of the device of the second preferred embodiment according to the present invention.

FIG. 5 is a circuit diagram of the high-speed digital-processing chip in the second preferred embodiment according to the present invention.

FIG. 6 is a circuit diagram of the image decoder in the second preferred embodiment according to the present invention.

FIG. 7 is a circuit diagram of the image control processor in the second preferred embodiment according to the present invention.

Detailed Description of the Invention

The features of the present invention will be now described in detail with reference to the attached drawings.

The basic structure and technical features of the visual annunciator of the present invention are the same as those of the visual telephone of the present invention, except for the differences in the application fields. FIG. 2 is a structural block diagram of the device of the first preferred embodiment according to the present invention, wherein it comprises camera (not shown), MultipleXer (MUX) having four inputs, image decoder, central processing unit (CPU), image encoder, Modem, Memory, display device, control port and programming port; wherein the MUX connects with the image decoder; the image decoder connects with the CPU; the CPU connects with the control input of the MUX; the CPU connects also with the image encoder; the image encoder connects with the display device; the camera connects with one of the video signal inputs of the MUX; the CPU connects also with the Memory; the CPU connects also with the Modem; the CPU connects also with the control port; and the Memory comprises display buffer, the display buffer comprises four storage areas 1, 2, 3, 4 corresponding with the quadruplex input signals respectively.

When displaying synchronously quadruplex input signals, the CPU controls the gating of the MUX, and the images with Q-CIF format converted from the quadruplex input signals are transmitted in a certain sequence by turns from the image decoder. The CPU stores the quadruplex images with Q-CIF format in the storage areas in the display buffer corresponding with the quadruplex input signals. The images with Q-

CIF format will be put together into one image with CIF format, and then transmitted to the image encoder for encoding and displaying, or to the remote end through the modem.

The programming port is also called upgrading port, used for software upgrading to the visual telephone in order to enhance the adaptability of the visual telephone to the future service of telecommunications. Different control software can be used to fulfill various purposes.

The control port is also called data port, it may be, for example, a controller with RS 232 serial interface. It can be used to carry out data communication with local peripherals, for example, exchanging data with PC. It can be also used to control external controllable equipment or receive the sensing signals from peripherals in order to expand the application fields of the visual telephone.

To make the peripheral equipment controllable by the present device, an adapter having RS 232 interface capable of communicating with the present device according to the certain protocol and controlling the operation of the equipment can be installed on the peripheral equipment.

FIG. 3 is a structural block diagram of the control port in the first preferred embodiment according to the present invention. In FIG. 3, the control port is composed of microprocessor, flash memory, static memory, encoder, keyboard interface and serial port. The keyboard codes can be converted into user' s commands through the control port and then transmitted to the CPU through the CPU interface. The control port can be linked with various adapters having RS 232 interface, so that the information can be exchanged among each other, and each other could control it. The local control can be realized and the remote control can also be carried out.

FIG.S 4 to 7 are the structural block diagrams of the second preferred embodiment according to the present invention and the circuit diagrams of corresponding parts, in which the camera is not shown.

The Modem further comprises encoder/decoder 14 having audio I/O port and Modem I/O port, Modem processor, audio processor; wherein the encoder/decoder 14 is connected with the Modem processor and the audio processor respectively, the Modem processor and the audio processor are connected with the CPU respectively.

The CPU is composed of high-speed digital-processing chip 11 and image controlling processor 12. The high-speed digital-processing chip 11 connects with the image controlling processor 12, wherein the image controlling processor 12 is a programmable logic control device.

The control port can be used to transmit data, address and control signals to the

local peripheral equipment, or transmit the data collected by the local peripheral equipment to the visual telephone and then to the remote equipment on option.

When displaying synchronously quadruplex input signals, the images with Q-CIF format converted from the quadruplex input signals will be output in a certain sequence by turns from the image decoder 10. The CPU stores the quadruplex images with Q-CIF format in the storage areas in the display buffer corresponding with the quadruplex input signals. The images with Q-CIF format will be put together into one image with CIF format, and then transmitted to the image encoder 13 for encoding and displaying. Then the next gating cycle of the quadruplex video input signals will be carried out, and the above steps will be repeated.

The high-speed digital-processing chip 11 and the image controlling processor 12 are the core of the circuit, using for processing various information of video, audio, data, control and address, and managing the Input/Output among each part. The present invention renders support to multiplex video image inputs. The camera is responsible for collecting image in general. The image signals collected by the camera will be, after decoding by the image decoder 10, transmitted to the high-speed digital-processing chip 11 and the image controlling processor 12 for processing. All of the processed image signals will be transmitted finally to the image encoder 13, and then output to monitor or TV screen after encoding.

The control software of the present invention is solidified on the programmable logic control device (FPGA) of the image controlling processor 12. When it is required to upgrade or modify the software, it is no need to take down the visual telephone for changing new chip. The only thing to do is to write new program through the upgrading port to the image controlling processor 12. Even upgrading on line could be realized, that is, upgrading at the same time when user is operating. So that it is very convenient. User can arrange three cameras in different rooms or places respectively for watching from various angles. In the addition of the image collected by the camera arranged above the screen, displaying synchronously four pictures of different scenes on the same screen can be realized.

As shown in FIG. 5, 6 and 7, FIG. 5 is a circuit diagram of the high-speed digital-processing chip (ADSP). FIG. 6 is a circuit diagram of the image decoder. FIG. 7 is a circuit diagram of the image controlling processor. Address signal port (PA), data port (PD), interrupt port (VXPIRQ), signal reading port (RD), signal writing port (WR), answer signal port (ACK), clock signal port (CLK) and reset port (SRESET) of the image controlling processor are connected with the corresponding input signal port of the high-speed digital-processing chip; in addition, DMA IRQ port (DMAREQ), MS signal port and BMS signal port of the image controlling processor are also connected with the corresponding signal port of the high-speed digital-

processing chip. Reset port (SRESET) of the image decoder is connected with the corresponding input signal port of the high-speed digital-processing chip; clock signal port (SCL) and data port (SDA) are connected with the corresponding signal port of the high-speed digital-processing chip. Clock output port (BTCLK_OUT), data valid signal port (BT_DVALID), data input port (VDIN), active signal port (BT_ACTIVE) and reset port (SRESET) of the image controlling processor are connected with the corresponding input signal port of the image decoder; its synchronous signal port (BT_VSYNC) is connected with the corresponding signal port of the image decoder.

The visual telephone of the present invention can, capable of displaying synchronously quadruplex video inputs on the same screen, having the function of controlling local and remote end, be used for various systems of monitoring, dispatching and net information, in addition to the general communications, such as transportation, post and telecommunications, public security, armed police, frontier defense, oil, prospecting, service, forest fireproofing, medical treatment, bank, entertainment and shopping etc. It can be widely used in various family applications, such as establishing digital family intelligent net control center including security, fireproofing, calling for help, visual remote control of lights and appliances; establishing digital family information center including browsing on internet, receiving and sending e-mail, shopping online, online bank, remote education online and remote medical treatment etc.

The device of the present invention can be also used as a visual annunciator. With the special feature of multiplex video input, users can arrange the cameras in different rooms and/or at different angles so that it can reflect fully what is happing in the room. The opposite person is able to understand clearly in what situation the person who has asked for help is now, so that the best and fastest succor actions could be taken. It is, therefore, convenient for rescue workers, capable of decreasing greatly the disadvantages caused by delaying rescue due to lack of necessary information about the person who has asked for help and speeding up the rescue job.

The visual annunciator of the present invention can be directly connected with some doorbells. By arranging a camera above the doorbell, when a visitor presses the doorbell, the camera will be activated, the figure of the visitor will be directly displayed on the screen of the visual annunciator. It is not only convenient to users, but also the security can be increased.

Claims

1、A visual telephone capable of displaying synchronously quadruplex input signals, comprising at least:

MultipleXer (MUX) including four video inputs, a video output, and a control input, wherein the four video inputs are used for inputting the video signals collected by various cameras respectively, the control input connects with the CPU, and the video output, in the control of the CPU, transmits one of the four video inputs signals to the image decoder;

Image decoder, connecting with the output of the MUX, converts the video output signals of the MUX into the images with Q-CIF format, and then transmits them to the CPU;

Memory, including display buffer containing storage areas corresponding with four video input signals;

Central Processing Unit (CPU), used for controlling the MUX so that it can strobe each video input signal in a certain sequence by turns; after the gated video input signals are converted by the image decoder into the image with Q-CIF format, the image will be stored in the storage area in the display buffer corresponding with the input signal; after a gating cycle, the quadruplex images with Q-CIF format will be put together into one image with CIF format, and then transmitted to the image encoder or to the remote end through the modem;

Image encoder, used for encoding the image data output by the CPU into the image signals which can be displayed by the display device and transmitting them to the display device;

Display device, connecting with the image encoder for displaying the image signals encoded and transmitted by the image encoder;

Camera, arranged above the display device and connected with one of the video inputs of the MUX;

Modem, used for modulating or demodulating the data transmitted between the local device and the remote end and exchanging data with the CPU, including encoder/decoder having audio I/O and Modem I/O, Modem processor, and audio processor; wherein the encoder/decoder is connected with the Modem processor and the audio processor respectively, and the Modem processor and the audio processor are connected with the CPU respectively;

Control port, connecting with the CPU for exchanging data or commands between the CPU and the peripheral equipment; wherein

When transmitting the control signals to the remote end, the CPU converts the commands into data and compresses them with image and voice signals by packing,

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and then transmits the packet through the line to the remote end after modulation by the Modem;

When receiving the control signals from the remote end, the packet received by the Modem, after decompressing by the CPU, will be restored to image, voice signals and commands data, and then the corresponding control actions concerning the local machine or the peripheral equipment will be executed according to the commands.

2、The visual telephone capable of displaying synchronously quadruplex input signals of claim 1, wherein the CPU is composed of high-speed digital-processing chip and image controlling processor, the high-speed digital-processing chip connects with the image controlling processor.

3、The visual telephone capable of displaying synchronously quadruplex input signals of claim 2, wherein the image controlling processor is a programmable logic control device.

4、The visual telephone capable of displaying synchronously quadruplex input signals of claim 1, wherein the control port is a RS 232 serial interface.

5、A visual annunciator capable of displaying synchronously quadruplex input signals, comprising at least:

MultipleXer (MUX) including four video inputs, a video output, and a control input, wherein the four video inputs are used for inputting the video signals collected by various cameras respectively, the control input connects with the CPU, and the video output, in the control of the CPU, transmits one of the four video inputs signals to the image decoder;

Image decoder, connecting with the output of the MUX, converts the video output signals of the MUX into the images with Q-CIF format, and then transmits them to the CPU;

Memory, including display buffer containing storage areas corresponding with four video input signals;

Central Processing Unit, used for controlling the MUX so that it can strobe each video input signal in a certain sequence by turns; after the gated video input signals are converted by the image decoder into the image with Q-CIF format, the image will be stored in the storage area in the display buffer corresponding with the input signal; after a gating cycle, the quadruplex images with Q-CIF format will be put together into one image with CIF format, and then transmitted to the image encoder or to the remote end through the modem;

Image encoder, used for encoding the image data output by the CPU into the image signals which can be displayed by the display device and transmitting them to the display device;

Display device, connecting with the image encoder for displaying the image signals encoded and transmitted by the image encoder;

Camera, arranged above the display device and connected with one of the video inputs of the MUX;

Modem, used for modulating or demodulating the data transmitted between the local device and the remote end and exchanging data with the CPU, including encoder/decoder having audio I/O and Modem I/O, Modem processor, and audio processor; wherein the encoder/decoder is connected with the Modem processor and the audio processor respectively, and the Modem processor and the audio processor are connected with the CPU respectively;

Control port, connecting with the CPU for exchanging data or commands between the CPU and the peripheral equipment; wherein

When transmitting the control signals to the remote end, the CPU converts the commands into data and compresses them with image and voice signals by packing, and then transmits the packet through the line to the remote end after modulation by the Modem;

When receiving the control signals from the remote end, the packet received by the Modem, after decompressing by the CPU, will be restored to image, voice signals and commands data, and then the corresponding control actions concerning the local machine or the peripheral equipment will be executed according to the commands.

6、The visual annunciator capable of displaying synchronously quadruplex input signals of claim 5, wherein the CPU is composed of high-speed digital-processing chip and image controlling processor, the high-speed digital-processing chip connects with the image controlling processor.

7、The visual annunciator capable of displaying synchronously quadruplex input signals of claim 6, wherein the image controlling processor is a programmable logic control device.

8、The visual annunciator capable of displaying synchronously quadruplex input signals of claim 5, wherein the control port is a RS 232 serial interface.

9、A method capable of displaying synchronously quadruplex video input signals on the visual telephone, comprising at least the following steps:

Allocating four storage areas in the display buffer corresponding with the quadruplex video input signals respectively;

Converting the quadruplex video input signals, in one cycle of gating of the quadruplex video input signals, into image signals with Q-CIF format respectively, and storing them in the storage areas corresponding with each video signal input;

Putting together the Q-CIF signals in four storage areas into one CIF image after one gating cycle;

Transmitting the resultant CIF image to the image encoder for encoding and then to the display device, or transmitting the resultant CIF image, after compressing, to the Modem for modulation and then to the remote end.

