S3.10 Host discussion mode;

S3.11 Whether the host announces the end, if not S3.12, if so, end;

S3.12 Whether the host designated the use, if not S3.13, if so S3.15;

S3.13 Speaker application;

S3.14 The host confirms whether to approve, if not S3.13, if so S3.15;

S3.15 Speakers use cloud conferences to send high-definition conference TV streams to the display cloud;

Whether S3.16 is completed or someone requested interruption; if not, S3.15; if so, S3.11;

(3)HD

Correspondence of each conference to display high-definition conference TV streams of 720p or higher quality, including the following 2 steps:

Build an IP network: The full-duplex bandwidth of the network formed by wired and / or wireless transmission channels is not less than 33Mbps; display conference display equipment including high-definition projectors and displays support high-definition conference televisions of 720p or higher quality; Step S3.5 priority rules include the following 6 categories:

First, determine the priority queue according to the submission topics and contents of the registration of participants, from large to small;

Second, in accordance with the application time sequence of the registration of participants, the Markov property of the discrete-time random process {Xi} in queuing theory is used to determine the priority queue;

Third, determine the priority queue according to the sequence of units registered by the participants;

Fourth, determine the priority queue according to the department's professional sequence in which the participants are registered;

Fifth, according to the registered job title and name sequence of the participants, the duties are from large to small, and the same job is determined according to the alphabetical order of the names;

Sixth, when people join the conference one after another during the power dispatch cloud conference, the random service queuing theory mathematical method is used to determine the priority queue rule: the first-come-first-served service (LCFS) is M / M / c / LCFS Model, important issues and content with priority service rights (PR) namely M / M / c / PR model, secondary important issues and content random service (SIRO) namely M / M / c / SIRO model, remaining general issues and content The first-come-first-served (FCFS) or M / M / c / PR model is used in the collection;

Among them, the (2) non-blocking is based on the random service characteristics of intelligent cloud consultation in power dispatching, and uses the queuing theory mathematical method to establish a mathematical model, including:

Suppose there are c consultation cloud slides, and the average service rate of each cloud slide that requires consultation is u. Under normal circumstances, the average arrival rate of the power dispatch message flow event is λ, then there is a power dispatch in Δt time. The probability of a message flow event arriving is P1 = λΔt, and the probability of a power dispatch message flow event leaving within Δt time is q1 = λΔt;

There are three cases:

(4)When no power dispatches message flow events, the probabilities of three mutually incompatible events are:

(a) There is no queue of power dispatch message flow events within time t, and the probability of no power dispatch message flow event arrival at time Δt is P0 (1-λΔt);

(b) There is a power dispatch message flow event within time t, no power dispatch message flow event arrives within Δt, but the probability of a power dispatch message flow event leaving after accepting cloud consultation is P1 (1-λΔt) uΔt ;

(c) There is no queue of power dispatch message flow events at time t, but there is a probability of a power dispatch message flow event arriving at time Δt, and a probability of leaving a power dispatch message flow event after cloud consultation is P0λΔtuΔt;

Then P0 = P0 (1-λΔt) + P1 (1-λΔt) uΔt + P0λu (Δt)2

Ignore the second-order small amount, finishing P1 = λP0 / u;

(5)When there are n power dispatch message flow events and 1≤n c, it can be divided into the following four cases:

(a) There are n-1 power dispatch message flow events in queue at time t, and a power dispatch message flow event arrives at time Δt, but the probability that no power dispatch message flow event is negotiated by the cloud is Pn-1λΔt (1-nuΔt);

(b) There are n + 1 power dispatch message flow events in queue at time t. No power dispatch message flow event arrives at time Δt, but the probability of a power dispatch message flow event leaving after accepting cloud consultation is Pn + 1 (1-λΔt) [(n + 1) uΔt];

(c) There are n power dispatching message flow events in queue at time t, and no power dispatching message flow event arrives at time Δt, nor is the probability of any power dispatching message flow event being negotiated by the cloud Pn (1-λΔt) (1-nuΔt);

(d) There are n power dispatch message flow events in the queue at time t, one power dispatch message flow event arrives at time Δt, and one power dispatch message flow event has the probability of leaving after accepting cloud consultations as PnλΔtnuΔt;

(6)When the number of power dispatch message flow events n ≥ c, it is similar to case (2), but the corresponding probabilities are:

(a) Pn-1 (λΔt) (1-cμΔt)

(b) Pn + 1 (1-λΔt) (cμΔt)

(c) Pn (1-λΔt) (1-cμΔt)

(d) Pn (λΔt) cμΔt

From the above formula:

The steady-state probability of the solution is:

Only when λ / cμ □1, can the consultation cloud slideshow service system reach a steady state without lining up in an infinite queue. The service intensity of the consultation cloud slideshow system is

, which means the utilization rate of the consultation cloud slideshow system;

The service rate of the conference cloud slideshow system is:

That is, when there are n (n □c) power dispatch message flow events in the system, the service rate of the system is nμ; when there are c power dispatch message flow events in the system, the service rate of the system reaches the maximum value cμ; When the number of power dispatching message flow events in C exceeds c, because c service desks are busy, the remaining power dispatching message flow events must be queued, and the service rate at this time is still cμ; therefore,

The queue length of the power dispatch message flow events in the system is

The average waiting time for power dispatch message flow events in the system is

Average time of power dispatch message flow events in the system

Average number of power dispatch message flow events in the system

Among them, the defined parameters are:

Lq: average queue length in the system;

Wq: the average waiting time of power dispatch message flow events in the system, each power dispatch message flow event hopes that this period is as short as possible;

WS: average stay time of the power dispatch message flow event in the system;

LS: the average number of power dispatch message flow events in the system;

λ: average arrival rate;

μ: average service rate;

c: the number of parallel consultation cloud slides in the system;

ρ: service intensity, that is, the average service time of each consultation cloud slide unit time interval;

P0: steady state probability of the system.

The present invention also proposes a device using the above method, which includes the following eight features:

First, the steps to ensure security and non-blocking implementation are implemented in the security management server;

Second, the wireless server supports IEEE 802.11b / g and 100M LAN interfaces, with a signal interface connected to a projector / display with a quality of 720p or higher, and a built-in H.264 soft decompression software that supports the DHCP server function. Automatically assign IP addresses to client computers;

Third, install the cloud consultation client software on the computers participating in the power dispatch cloud consultation. The software includes the steps of claims 1-2 and H.264 soft coding software;

Fourth, in the wired LAN application scenario, the computer cloud conference group is aggregated through an ordinary Ethernet switch, connected to a wireless server via an Ethernet cable, connected to a security management server and a projector / display with a quality of 720p or higher to complete power dispatch. The

display and display of conferences are "clouded" to realize the sharing of display and display resources and ensure its security;

Fifth, in the wireless LAN application scenario, the computer cloud conference group connects to the wireless server through the wireless IEEE 802.11b / g protocol through its built-in or external wireless LAN card, and the wireless server is connected to the security management server and a 720p or higher quality server. The projector / display screen completes the “cloud” display and presentation of power dispatch conferences, realizes the sharing of display and display resources, and guarantees its security;

Sixth, in a mixed network application scenario consisting of wireless LAN and wired LAN, the computer cloud conference group uses wired or wireless LAN cards, and the wired scenario is aggregated through a common Ethernet switch to connect to the wireless server. The wireless server is connected to the security management server and 720p. The projectors / display screens of the above quality can complete the "cloud" display and display of power dispatch conferences, realize the sharing of display and display resources, and ensure its security;

Seventh, the computers participating in the power dispatch cloud conference can be laptops, desktop computers, or server clusters;

Eighth, multiple co-frequency jammers are used to establish a protective isolation boundary. The specific method is to make the radio coverage radius of the co-frequency jammer smaller than the radio server's radio coverage radius, and to make a co-frequency interference outside the perimeter of the power dispatch cloud conference venue Around the boundary of the wireless coverage radius of the device, a plurality of co-frequency interferers are used to establish a protective isolation boundary. The distance between adjacent co-frequency interferers is the radio coverage radius of a co-frequency interferer.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to make the content of the present invention more clearly understood and to facilitate the description of specific embodiments, the accompanying drawings related to the present invention are described as follows:

FIG. 1 is a schematic structural diagram of a device of the present invention;

FIG. 2 is a diagram for describing a cloud consultation process of the present invention; FIG.

FIG. 3 is a probabilistic characteristic diagram of a power dispatch message flow event of the cloud consultation process of the present invention;

4 is a classification diagram of video resolution according to the present invention;

FIG. 5 is a video resolution comparison chart of the present invention;

6 is a schematic structural diagram of a device according to a first embodiment of the present invention;

7 is a schematic structural diagram of a device according to a second embodiment of the present invention;

8 is a schematic structural diagram of a device according to a third embodiment of the present invention;

9 is a schematic structural diagram of a device according to a fourth embodiment of the present invention;

10 is a schematic flowchart of a non-blocking step in a method according to the present invention;

FIG. 11 is a diagram of an embodiment of constructing a protective isolation boundary using multiple co-frequency interferers according to the present invention.

detailed description

The device implementation diagram of the present invention is shown in Fig. 1 and described in detail below.

The wireless LAN is constructed through IEEE802.11b / g wireless communication equipment, and the wired LAN can also be constructed through network cables or optical cables. The central node of the star topology is used to display and display the cloud (specific cloud devices include projectors and various display screens, etc.), Other nodes are connected to various terminals (such as notebook computers, desktop computers, server clusters) participating in the dynamic cloud consultation of power dispatching. At the same time, the security management server embeds the method of the present invention, and manages the security, non-blocking, and high-definition of the video stream of the entire power dispatching dynamic cloud consultation system through the topology center node to ensure resource sharing of cloud devices. Among them, the computer and server cluster can be connected to the central node through the built-in wireless communication network card or external wireless communication equipment, or can be connected to the central node through the wired local area network to send power dispatch message flow events to the projector and various displays Cloud devices composed of screens, etc., for dynamic display and presentation.

Examples of specific technical problems that can be solved by the present invention are as follows.

When there is only one projector, there are often many people in the conference room to participate in the power dispatch conference. It is necessary to connect your laptop to the projector in turn, and it is very troublesome to plug and unplug the projector cable. This problem can be solved very conveniently by the present invention. FIG. 7 is a first specific embodiment of the present invention. The wireless cloud consultation is as follows. Install the security management server software on an ordinary computer and connect the Ethernet cable to the wireless server. The wireless server is connected to a 1080p-quality projector / display. Each computer participating in the cloud conference installs the cloud conference client software and connects to the wireless server through its wireless LAN card to complete the wireless cloud conference.

When there is only one display screen available and the switch matrix is not used, the power dispatch conference meeting that many people attend will need to connect their laptops to the display screen in turn, and it is very troublesome to plug in the display cable. This problem can be solved very conveniently by the present invention. FIG. 8 is a second specific embodiment of the present invention.

When there is only one projector, the conference room has the conditions of a wired local area network, and the invention can easily realize the sharing of the projectors. FIG. 9 is a third specific embodiment of the present invention. The wired cloud consultation is as follows. Install the security management server software on an ordinary computer and connect the Ethernet cable to the wireless server. The wireless server is connected to a 1080p-quality projector / display. Each computer participating in the cloud conference installs the cloud conference client software, and converges through a wired Ethernet card through a common Ethernet switch, and connects to the wireless server to complete the wired cloud conference. Business.

When there is only one projector, the conference room has the conditions of wired LAN, and some computer conference groups have the function of supporting IEEE802.11b / g wireless local area network. Wired and wireless can be used in combination. Through the invention, projector sharing can be implemented very conveniently. . FIG. 10 is a fourth specific embodiment of the present invention. The wired and wireless hybrid network cloud consultation is as follows. Install the security management server software on an ordinary computer and connect the Ethernet cable to the wireless server. The wireless server is connected to a 1080p-quality projector / display, and each computer participating in the cloud conference installs the cloud conference client software. In wired mode, the wired LAN card is used to converge through an ordinary Ethernet switch and connected to a wireless server to complete wired cloud consultation. Connect wirelessly to the wireless server through its wireless LAN card to complete wireless cloud consultation.

The invention has been described above by means of specific embodiments, but those skilled in the art will also recognize the many possibilities of variations and alternative embodiments, for example, by combining and / or changing features of a single embodiment. Therefore, it can be understood that these modifications and alternative embodiments are considered to be included in the present invention, and the scope of the present invention is limited only by the attached patent claims and their equivalents.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventorship:	BEEL	Examiner:	BARTELS, CHRISTOPHER
Serial No.:	16/852790	Group Art Unit:	2184
Filed:	April 20, 2020	Docket No.:	21044.0006USC1
Title:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS		

CERTIFICATE OF TRANSMISSION.
I hereby certify that this paper is being transmitted by EFS Web to the United States Patent & Trademark Office on July 13, 2021.

By: /Thomas Lee/
Name: Thomas Lee

AMENDMENT AND RESPONSE

Mail Stop: AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Commissioner:

In response to the Non-Final Office Action issued January 14, 2021, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims that begins on page 2 of this paper.

Remarks begin on page 7 of this paper.

AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1-81. (Cancelled)

82. (Currently Amended) A method for connecting a processing device to a communications network, the processing device having a memory, a display, an operating system and communication between processing device and a class of peripheral devices, the method comprising:

a) coupling an external peripheral device physically to a port of the processing device, the external peripheral device having a transceiver and a connector configured to couple to the port of the processing device, and presenting the external peripheral device to the processing device as a human interface device;

b) communicating at least one of audio data and display data from the processing device to the external peripheral device via the human interface device;

c) reading the audio data from the port ~~using an audio device on the external peripheral device~~,

d) connecting the processing device to a communications network via the transceiver, and

e) display data and audio data being routed between the processing device and the communication network via the transceiver and further to a base node.

83. (Previously Presented) The method of claim 82, wherein the audio device comprises an audio output adapter device which is configured as a virtual audio device to transfer the audio data from the processing device to the base node via the communications network.

84. (Currently Amended) The method of claim 82, further comprising presenting the external peripheral device to the processing device as any of the following:

~~a human interface device;~~

a mass storage device; and

a composite device.

85. (Previously Presented) The method of claim 82, wherein a client application is stored on the external peripheral device which when run on the processing device obtains screen scraped data.

86. (Previously Presented) The method of claim 85, wherein the client application is a portable application.

87. (Currently Amended) The method of claim 82, wherein the external peripheral device analyzes an incoming audio signal from the processing device and if no audio data is received, the incoming audio signal is discarded and if audio data is received, the external peripheral device initiates a TCP/IP socket connection to the base unit through the communications network.

88. (Previously Presented) The method of claim 82, further comprising time-stamping synchronously a stream of the audio data with a stream of the display data.

89. (Previously Presented) The method of claim 88, further comprising encoding, optionally encrypting the audio data.

90. (Currently Amended) A system for connecting a processing device to a communications network, the processing device having a memory, a display and an operating system and communication between processing device and a class of peripheral devices, the system comprising:

a) means for coupling an external peripheral device physically to a port of the processing device, the external peripheral device having a transceiver and a connector configured to couple to the port of the processing device;

b) means for presenting the external peripheral device to the processing device as a human interface device;

[[b)]] c) means for at least one of display data communication and audio communication between the external peripheral device and the processing device via the human interface device;

wherein the external peripheral device is configured ~~in a way~~ to connect the processing device to a communications network via the transceiver; and

d) means for routing display data and audio data between the processing device and the communication network via the means for display data and audio data communication and the transceiver to a base node.

91. (Previously Presented) The system of claim 90, wherein the external peripheral device comprises an audio device which is configured in a way to be implemented as a virtual audio device to transfer the audio data from the processing device to the base node via the communications network.

92. (Currently Amended) The system of claim 91, further comprising any of the following:

~~means for presenting the external peripheral device to the processing device as a human interface device,~~

means for presenting the peripheral device to the processing device as a mass storage; and

means for presenting the external peripheral device to the processing device as a composite device.

93. (Previously Presented) The system of claim 92, wherein a client application is stored on the external peripheral device which when run on the processing device obtains screen scraped data.

94. (Previously Presented) The system of claim 93, wherein the client application is a portable application.

95. (Currently Amended) The system of claim 92, wherein the external peripheral device is adapted to analyse an incoming audio signal from the processing device and if no audio is received, the incoming audio signal is discarded.

96. (Previously Presented) The system of claim 95, wherein if audio is received, the external peripheral device is adapted to initiate an additional connection to the base unit through the communications network.

97. (Previously Presented) The system of claim 90, further comprising time-stamping synchronously the audio data with the display data.

98. (Previously Presented) The system of claim 90, further comprising means for encoding, optionally encrypting the audio data.

99. (Currently Amended) A peripheral device for providing communication connectivity to a processing device which is provided with memory, a display and an operating system and for communication between the processing device and a class of peripheral devices, the peripheral device comprising a connection configured to be physically coupled to a port of the processing device and the peripheral device being adapted to work with executable software code, said executable software code comprising:

a fourth software code for presenting the external peripheral device to the processing device as a human interface device;

a first software code portion for setting up, a means for at least one of display data communication and audio data communication between the peripheral device and the processing device via the human interface device;

a second software code portion for connecting the processing device to a communications network via a transceiver of the external peripheral device; [[and]]

a third software code portion for routing the display data and the audio data between the processing device and the communication network via the transceiver to a base node.

100. (Currently Amended) A method for connecting a processing device to a communications network, the processing device having a memory, a display and an operating system, the method comprising:

a) coupling an external peripheral device physically to a port of the processing device,

wherein the peripheral device comprises a wireless transceiver and a connector, said connector configured to couple to the port of the processing device;

b) presenting the external peripheral device to the processing device as a human interface device;

[[b)]] c) setting up one of an audio communication between the peripheral device and the processing device and ~~setting up~~ a display data communication between the peripheral device and the processing device via the human interface device;

[[c)]] d) the peripheral device being configured to connect the processing device to a communications network via the wireless transceiver;

[[d)]] e) routing audio data from the processing device to the wireless transceiver via the connector of the peripheral device and the audio communication and routing display data from the processing device to the wireless transceiver via the connector of the peripheral device and the display data communication;

f) routing the display data and the audio data from the wireless transceiver of the peripheral device to a base node over the communications network via at least one channel created between the external peripheral device to the base node.

101. (Previously Presented) The method of claim 100, wherein the external peripheral device is configured to analyze an incoming signal from the processing device and if no audio data is received, the incoming signal is discarded and if audio data is received, the external peripheral device initiates a TCP/IP socket connection to the base unit through the communications network.

REMARKS

Applicant respectfully requests favorable reconsideration of this application in view of the above amendments and the following remarks.

Claim 82 is amended to include certain features from claim 84, where support for the amendment may be found, for example, at least on page 10, lines 11-25 of the specification as originally filed.

Claims 90, 99, and 100 are amended to recite similar features as now recited in mended claim 82.

Claims 84, 87, 92, and 95 are amended to remove any inconsistencies introduced by the amendments to claims 82 and 90.

No new matter has been added.

Claims 82-101 are pending.

Applicant respectfully requests that the specification be amended as requested in the Preliminary Amendment filed April 20, 2020 to add the Cross-Reference of the Applications, which was not included in the publication of the present application in U.S. publication 20200250110.

Claim Rejections - 35 U.S.C. § 103

Claims 82-84 and 87-101 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nuyttens et al. (U.S. Patent Application Publication No. 2007/0033289) ("Nuyttens") in view of Thompson (U.S. Patent Application Publication No. 2009/0247006) ("Thompson"). Applicant respectfully traverses the rejection.

Applicant initially notes that claims 82-101 are currently pending in this application, and does not include claim 102 as indicate on page 8 of the Office Action.

With respect to independent claim 82, Applicant submits that the claim has been amended to recite, at least in part, coupling an external peripheral device physically to a port of the processing device, the external peripheral device having a transceiver and a connector configured to couple to the port of the processing device, presenting the external peripheral device to the processing device as a human interface device, communicating at least one of audio data and display data from the processing device to the external peripheral device via the human interface device, and at least reading the audio data from the port.

Applicant submits that neither Nuyttens nor Thompson, taken alone or in combination, result in the features now recited in amended claim 82.

Rather, Nuyttens discloses in paragraph [0116]:

> The following functional blocks can be used in this DGU 14: the drawing unit 40, the decoding units 41 and the CPU unit 47. These building blocks are connected together via a switching means 46, e.g. via a PClexpress switch. The decoding units 41 execute the same function as in the first embodiment. The single board computer (SBC) of the Hydra in the first embodiment is replaced by the drawing unit 40 and CPU unit 47 in the second embodiment. This separation allows to provide better performance on both the CPU and drawing functionality. The CPU unit 47 is in control of the setup and operation of the DGU unit and can receive commands across a separated control network (out-of-band control) or across the video network (in-band control). The decoding unit 41 receives the encoded information across the gigabit interface, decodes the information and forwards it to the drawing unit 40. The drawing unit 40 renders the information requested in the graphics configuration file, e.g. tagged mark-up language configuration document 61.

Nuyttens also discloses in paragraph [0112]:

> The DGU unit receives a number of encoded signals--unicasted or multicasted on the network 13--through the redundant 1 Gb/s network interface in a number of input buffers 30 (RJ45 Magnetics--PHY). The buffered signals are processed in a processor 31 (Network processing--SDRAM--Flash). The received signals are then decoded in a decoder 32 (Codec logic--SDRAM--ADV202) and transferred across the baseboard-mezzanine interface of the multi-viewer driver 2, e.g. Hydra, to the baseboard of the multi-viewer driver 2, e.g. Hydra. This baseboard takes care of inserting the decoded image on the internal bus of the multi-viewer driver 2, e.g. Hydra. A controller block 33 (SDRAM+flash+processor) with an own redundant fast Ethernet network interface 33- to separate streaming and control channels--(RJ45-Mac Phy) is used to control the display generator unit 14. The Hydra Single Board Computer (SBC) is used to render metadata and embedded information.

Thus, Nuyttens only discloses a display generator equipped with a drawing unit, but fails to disclose each and every feature recited in amended claim 82.

As the Examiner suggested on page 5 of the Office Action, since he needed to show "only one element of the group to be shown by the reference to teach the claim," the Examiner suggested that Nuyttens teaches a storage device in paragraph [0252]. One having ordinary skill in the art, however, would not have observed any evidence in Nuyttens that the external peripheral device is presented to the processing device as a human interface device, where at least one of audio data and display data is communicated from the processing device to the external peripheral device via the human interface device, and the audio data is read from the

port, as recited in amended claim 82. In so doing, one having ordinary skill in the art would have appreciated that claim 82, as now amended, now refers to connecting the processing device to a communications network. If one having ordinary skill is confronted with connecting a processing device like a laptop to a LAN, one having ordinary skill would have selected the appropriate driver to package the data for transmission, e.g., will use a modem. HID drivers are designed to work with a modem. For example, as discussed in the pending application, an HID (human interface device) is used for capturing user input (e.g. following a user action such as pressing or activating a button) and providing user feedback, e.g. by an optical indicator such as a light ring around the button e.g. an LED ring, for streaming the screen scraped video content to the network and hence to a base unit and a display (page 10, lines 18-22). In so doing, one having ordinary skill would not have observed any evidence in the prior art to select a driver that is not suitable for this job. Rather, only in the present application is one having ordinary skill taught of the peripheral device where it is particularly advantageous and non-obvious to select the HID driver. By doing so it is possible to avoid the network interfaces of the processing device. That is, the processing device does not associate data being transferred by the HID driver with the network interfaces, routing tables, and administrator privileges of the processing device. Thus, such features increase the scalability of the system allowing rapid connection independent of the type of processing device being used, e.g. independent of whether it is a Microsoft Windows or an Apple device using iOS. The claimed system is therefore agnostic by design. On the other hand, as discussed above, while Nuyttens discloses using a storage device, Nuyttens is silent with respect to presenting the external peripheral device to the processing device as the human interface device. In fact, Applicant submits that one having ordinary skill in the art would have appreciated that drivers for a USB connection are device specific and, hence, there is no relationship between the driver for a storage device and for a human interface device. Thus, Nuyttens fails to disclose or suggest the features now recited in amended claim 82.

Thompson fails to cure the deficiencies of the teachings of Nuyttens with respect to amended claim 82, at least because Thompson is only directed providing an in-wall access point enclosure, that will securely accept the insertion of a access point electronics units node consisting of a network communications module (motherboard) and any one of a plurality of application interface cartridge daughter boards that is retained within the module and arranged in a ‘piggy back’ manner (para. [0015]). Thompson also teaches providing a free-standing (e.g., set-

top box) docking station network communications module that will securely accept the insertion of one or more application interface cartridges (para. [0016]). That is, Thompson only teaches a multimedia system, but fails to disclose each and every feature recited in amended claim 82.

Therefore, since neither Nuyttens nor Thompson discloses or suggests each and every feature now recited in amended claim 82, any proposed modification of the invention of Nuyttens with the teachings of Thompson fails to result in the same combination of features as now recited in amended claim 82. In fact, Applicant submits that one having ordinary skill in the art would not have been prompted by the prior art to modify the teachings of Nuyttens or Thompson, taken alone or in combination, to result in the specific combination of features as recited in amended claim 82, at least because both Nuyttens and Thompson are directed to different methods and structures for networking.

Claims 90, 99, and 100 are allowable over the cited prior art at least for reciting similar features as recited in the method of amended claim 82, as well as their individually recited features.

The remaining claims are allowable over the cited prior art at least based on their dependencies of claims 82, 90, and 100 as well as their individually recited features. Applicant does not concede the correctness of the rejection for claim features not discussed.

Applicant respectfully requests favorable reconsideration of the claim and withdrawal of the rejection.

Claims 85 and 86 are rejected under U.S.C. 103(a) as being unpatentable over Nuyttens in view of Thompson, and further in view of Carlson et al. (U.S. Patent Application Publication No. 2013/0060662) ("Carlson"). Applicant respectfully traverses the rejection.

Claims 85 and 86 depend from claim 82. Accordingly, claims 85 and 86 are also patentable over the combination of the invention of Nuyttens in view of Thompson for at least the same reasons as amended claim 82, where Carlson does not remedy the deficiencies of Nuyttens and Thompson with respect to amended claim 82. Applicant does not concede the correctness of the rejection for claim features not discussed. Applicant respectfully requests favorable reconsideration of the claim and withdrawal of the rejection.

In view of the above, Applicant respectfully requests favorable reconsideration in the form of a Notice of Allowance. If any questions arise regarding this communication, the

Examiner is invited to contact Applicant's representative listed below. Please charge any underpayment of fees or credit any overpayment to Deposit Account No. 50-3478.

Respectfully submitted,

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Dated: July 13, 2021

By: /Thomas Lee/
Thomas Lee
Reg. No.: 66,396
TL/ajs

PTO/AIA/22 (10-20)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) 21044.0006USC1
Application Number 16/852790	Filed April 2, 2020
For ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS	
Art Unit 2184	Examiner BARTELS, CHRISTOPHER

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$220	$110	$55	$
☐	Two months (37 CFR 1.17(a)(2))	$640	$320	$160	$
☑	Three months (37 CFR 1.17(a)(3))	$1,480	$740	$370	$ 1480
☐	Four months (37 CFR 1.17(a)(4))	$2,320	$1,160	$580	$
☐	Five months (37 CFR 1.17(a)(5))	$3,160	$1,580	$790	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☑ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 503478.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 66396.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Thomas Lee/ — Signature

July 13, 2021 — Date

THOMAS LEE — Typed or printed name

6124553844 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ * Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	16852790
Filing Date:	20-Apr-2020
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Filer:	Thomas Lee
Attorney Docket Number:	21044.0006USC1

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	1253	1	1480	1480
Miscellaneous:				
		Total in USD ($)		**1480**

Electronic Acknowledgement Receipt	
EFS ID:	43240359
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	52835
Filer:	Thomas Lee
Filer Authorized By:	
Attorney Docket Number:	21044.0006USC1
Receipt Date:	13-JUL-2021
Filing Date:	20-APR-2020
Time Stamp:	18:06:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1480
RAM confirmation Number	E20217CI06581712
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response_0006.pdf	194763 7ee8d438ed99cc1c3a0e1c6e12e3b12748793cde	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	6	
	Applicant Arguments/Remarks Made in an Amendment		7	11	
Warnings:					
Information:					
2	Extension of Time	EOT.pdf	165666 f066972bf06a49ff45873c947fc7a7b1515461b4	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30903 4c079b091415ab7929c35f2987575fbe18a6a9ae	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	391332		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/852,790	04/20/2020	Koen Simon Herman Beel	21044.0006USC1

CONFIRMATION NO. 5321

52835
HAMRE, SCHUMANN, MUELLER & LARSON, P.C.
45 South Seventh Street
Suite 2700
Minneapolis, MN 55402-1683

POA ACCEPTANCE LETTER

OC000000126288459

Date Mailed: 06/15/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/11/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/cnguyen/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/852,790	04/20/2020	Koen Simon Herman Beel	BEEL3004C/TJM

CONFIRMATION NO. 5321

23364
BACON & THOMAS, PLLC
625 SLATERS LANE
FOURTH FLOOR
ALEXANDRIA, VA 22314-1176

POWER OF ATTORNEY NOTICE

OC000000126288445

Date Mailed: 06/15/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/11/2021.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/cnguyen/

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/852,790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman Beel
Title	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
Art Unit	2184
Examiner Name	BARTELS, CHRISTOPHER A.
Attorney Docket Number	21044.0006USC1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Thomas Lee/	Date (Optional)	2021-06-11
Name	Thomas Lee	Registration Number	66,396
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 52835

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

BARCO N.V.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	26/05/2014
Name	Jimmy Dirickx		
Title	IPT Services Manager		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	42960982
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas Lee/Yanling Cottle
Filer Authorized By:	Thomas Lee
Attorney Docket Number:	BEEL3004C/TJM
Receipt Date:	11-JUN-2021
Filing Date:	20-APR-2020
Time Stamp:	09:43:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	POA_0006USC1.pdf	509713 1536290582c0455a2914f0efa0f795cabd53a4ee	no	2

Warnings:

Information:	
Total Files Size (in bytes):	509713

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Christopher A. Bartels
Attorney Docket Number	BEEL3004C/TJM

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TJM

	1	Summons To Attend Oral Proceedings in corresponding European Application No. 12762258.7, dated May 20, 2021.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TJM

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas J. Moore/	Date (YYYY-MM-DD)	2021-05-28
Name/Print	THOMAS J. MOORE	Registration Number	28974

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	42834632
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas J. Moore/Shelly Darrenkamp
Filer Authorized By:	Thomas J. Moore
Attorney Docket Number:	BEEL3004C/TL
Receipt Date:	28-MAY-2021
Filing Date:	20-APR-2020
Time Stamp:	08:13:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	BEEL3004C_IDS.pdf	1034441 71ebaf233acc46b8d216eb03c8b3c3a80c49b2a8	no	4

Warnings:

Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Non Patent Literature	Summonsattendoralproceedings_20May2021.pdf	3806026 a4cbac9591e7978bff2b1b60596e82dd2ad2d236	no	72
Warnings:					
Information:					
			Total Files Size (in bytes):	4840467	

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Christopher A. Bartels
Attorney Docket Number	BEEL3004C/TL

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20110222556	A1	2011-09-15	Shefler et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

	1	European Office Action in corresponding European Application No. 12775162.6, dated April 19, 2021.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2021-04-21
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	16852790
Filing Date:	20-Apr-2020
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Filer:	Thomas Lee/Shelly Darrenkamp
Attorney Docket Number:	BEEL3004C/TL

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt	
EFS ID:	42507812
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas Lee/Shelly Darrenkamp
Filer Authorized By:	Thomas Lee
Attorney Docket Number:	BEEL3004C/TL
Receipt Date:	21-APR-2021
Filing Date:	20-APR-2020
Time Stamp:	13:34:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E20214KD34511712
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	EP_OA4_19Apr2021.pdf	638990 a90f485694db254ccb175b811deb1022df013cb3	no	15
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	BEEL3004C_IDS.pdf	1034406 bbd4d75e0b9dcb8134684730 9b5f63e8c57ef11f	no	4
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30586 ada70a88771e703457a2ee676653d6fe7b106954	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1703982		

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<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (02-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Christopher A. Bartels
Attorney Docket Number	BEEL3004C/TL

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100079783	A1	2010-04-01	Naganuma et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1462998	EP	A2	2005-12-07	Microsoft Corporation		

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

	1	European Search Search in corresponding European Application No. 20212054.9, dated April 7, 2021.	

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Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
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	Attorney Docket Number	BEEL3004C/TL

CERTIFICATION STATEMENT

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OR

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2021-04-07
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 462 998 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.09.2004 Bulletin 2004/40

(51) Int Cl.[7]: **G06T 11/00**

(21) Application number: **03010289.1**

(22) Date of filing: **07.05.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(30) Priority: **27.03.2003 US 401717**

(71) Applicant: **MICROSOFT CORPORATION**
Redmond, WA 98052 (US)

(72) Inventors:
- **Beda, Joseph S.**
  Seattle, Washington 98103 (US)
- **Gallo, Kevin T.**
  Woodinville, Washington 98072 (US)
- **Wong, Gilman K.**
  Redmond, Washington 98052 (US)
- **Smith, Adam. M.**
  Kirkland, Washington 98033 (US)
- **Subramanian, Sriram**
  Kirkland, Washington 98033 (US)

(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) Markup language and object model for vector graphics

(57) An element object model and a vector graphics markup language for using that element object model in a manner that allows program code developers to consistently interface with a scene graph data structure to produce graphics. The vector graphics element object model generally corresponds to shape elements and other elements including image and video elements that correlate with a scene graph object model of the scene graph. Markup may be parsed into data including elements in an element tree that is translated into the objects of a scene graph data structure. Other markup may be translated directly into data and calls that create the scene graph objects. The markup language provides distinct ways to describe an element, including a simple string format or complex property syntax, which may be named, enabling reuse in other locations in the markup.

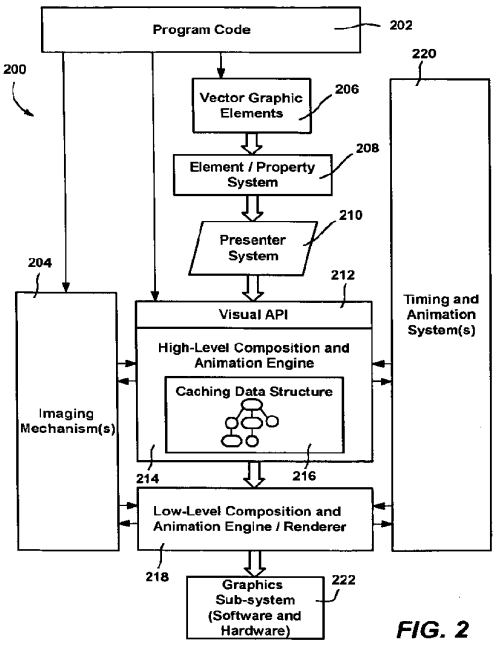


FIG. 2

EP 1 462 998 A2

Printed by Jouve, 75001 PARIS (FR)

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present invention is related to the following copending United States Patent Applications: Serial No. 10/184,795 entitled Multiple-Level Graphics Processing System and Method; Serial No. 10/184,796, entitled Generic Parameterization for a Scene Graph; Serial No. 10/185,775 entitled "Intelligent Caching Data Structure for Immediate Mode Graphics;" each filed on June 27, 2002; and United States Patent Application entitled "Visual and Scene Graph Interfaces" (Attorney Docket No. 3470), filed concurrently herewith. Each related application is assigned to the assignee of the present patent application and hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The invention relates generally to computer systems, and more particularly to the processing of graphical and other video information for display on computer systems.

BACKGROUND OF THE INVENTION

[0003] The limits of the traditional immediate mode model of accessing graphics on computer systems are being reached, in part because memory and bus speeds have not kept up with the advancements in main processors and/or graphics processors. In general, the current (e.g., WM_PAINT) model for preparing a frame requires too much data processing to keep up with the hardware refresh rate when complex graphics effects are desired. As a result, when complex graphics effects are attempted with conventional graphics models, instead of completing the changes that result in the perceived visual effects in time for the next frame, the changes may be added over different frames, causing results that are visually and noticeably undesirable.

[0004] A new model for controlling graphics output is described in the aforementioned United States Patent Application Serial Nos. 10/184,795, 10/184,796, and 10/185,775. This new model provides a number of significant improvements in graphics processing technology. For example, U.S. Serial No. 10/184,795 is generally directed towards a multiple-level graphics processing system and method, in which a higher-level component (e.g., of an operating system) performs computationally intensive aspects of building a scene graph, updating animation parameters and traversing the scene graph's data structures, at a relatively low operating rate, in order to pass simplified data structures and/or graphics commands to a low-level component. Because the high-level processing greatly simplifies the data, the low-level component can operate at a faster rate, (relative to the high-level component), such as a rate that corresponds to the frame refresh rate of the graphics subsystem, to process the data into constant output data for the graphics subsystem. When animation is used, instead of having to redraw an entire scene with changes, the low-level processing may interpolate parameter intervals as necessary to obtain instantaneous values that when rendered provide a slightly changed scene for each frame, providing smooth animation.

[0005] U.S. Serial No. 10/184,796 describes a parameterized scene graph that provides mutable (animated) values and parameterized graph containers such that program code that wants to draw graphics (e.g., an application program or operating system component) can selectively change certain aspects of the scene graph description, while leaving other aspects intact. The program code can also reuse already-built portions of the scene graph, with possibly different parameters. As can be appreciated, the ability to easily change the appearance of displayed items via parameterization and/or the reuse of existing parts of a scene graph provide substantial gains in overall graphics processing efficiency.

[0006] U.S. Serial No. 10/185,775 generally describes a caching data structure and related mechanisms for storing visual information via objects and data in a scene graph. The data structure is generally associated with mechanisms that intelligently control how the visual information therein is populated and used. For example, unless specifically requested by the application program, most of the information stored in the data structure has no external reference to it, which enables this information to be optimized or otherwise processed. As can be appreciated, this provides efficiency and conservation of resources, e.g., the data in the cache data structure can be processed into a different format that is more compact and/or reduces the need for subsequent, repeated processing, such as a bitmap or other post-processing result.

[0007] While the above improvements provide substantial benefits in graphics processing technology, there still needs to be a way for programs to effectively use this improved graphics model and its other related improvements in a straightforward manner. What is needed is a comprehensive yet straightforward way for programs to take advantage of the many features and graphics processing capabilities provided by the improved graphics model and thereby output complex graphics in an efficient manner.

SUMMARY OF THE INVENTION

[0008] Briefly, the present invention provides an element object model and a vector graphics markup language for accessing that element object model in a manner that allows program code developers to consistently interface with a scene graph data structure to produce graphics. The vector graphics markup language comprises an interchange format for expressing vector graphics via the element object model. When interpreted, the markup is parsed into data including elements in an element tree that is translated into the objects of a scene graph data structure. At the element tree level, a property system and presenter system are provided to provide rich programmability features, including inheritance characteristics and eventing, making it straightforward for scene designers to design possibly complex scenes. In general, the vector graphics elements correspond to shape elements and other elements including image and video elements that correlate with scene graph objects of the scene graph object model. The properties and other resources of the vector graphics elements also correlate with similar properties and resources the scene graph object model.

[0009] The vector graphics system can thus program to an element level, in which each of the drawing shapes is represented as an element at the same level as the rest of the programmable elements in a page/screen, allowing interaction with the presenter system, events and properties. The vector graphics system also provides a mechanism for programming to a resource level, by which scene designers can essentially shortcut the element tree and presenter system and program directly to the visual API layer that interfaces with the scene graph data structure. This provides a more efficient and lightweight way to output the appropriate object, although losing of some of the programmability of the element level. In one implementation, when a fill of type "visual brush" is programmed, the parser can directly call the API layer with resource level data to create a corresponding visual paint object (which is also a correlation between the element object model and the scene graph object model). In this two-tiered system, element level vector graphics get parsed into created elements, which need later translation to the objects, while resource level vector graphics get parsed and directly stored in an efficient manner. At the same time, the resource level data or the objects created thereby can be referenced by elements and part of the element tree. To this end, elements including visual paint elements may be named. The scene designer thus has the ability to balance efficiency against programmability as needed.

[0010] The element class hierarchy includes a shape class, an image class, a video class and a canvas class. Elements of the shape class include rectangle, polyline, polygon, path, line and ellipse. Each element may include or be associated with fill (property) data, stroke data, clipping data, transform data, filter effect data and mask data. Shapes correspond to geometry (of the scene graph object model) that is drawn with inherited and cascaded presentation properties that are used to construct the pen and the brush needed to draw the shapes. The image class is more specific than a shape and can include more raster graphical data, while the video class allows video (or similar multimedia) to be played within a displayed element. The canvas class may act as a container for shapes, to keep shapes lightweight.

[0011] In one implementation the markup code is interpreted by a parser / translator which generally adds element-level elements to an element tree / property system and attaches presenters to those elements. The presenter system then takes the element tree with the attached presenters and translates the data to objects (via a builder) and calls to a visual API layer that interfaces with the scene graph and creates the scene graph objects.

[0012] The markup language provides distinct ways to describe an element, including a simple string format or a complex object notation (a complex property syntax). For a simple string format, the parser / translator and/or presenter system uses a type converter for converting a string to an appropriate visual API object. When the fill attribute is too complex to fit into a single string, complex property syntax, which may be inline in the markup, is used to describe the property set. Because the same rendering model is shared between the element level and the API level, many of the objects are the same, which makes parsing / translation highly efficient and provides other benefits. A resource instance also may be located elsewhere (e.g., in the markup or a file), and referenced by a name. In this manner, a scene designer can reuse an element in the element tree throughout a scene, including elements described by the complex property syntax.

[0013] Other benefits and advantages will become apparent from the following detailed description when taken in conjunction with the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIGURE 1 is a block diagram representing an exemplary computer system into which the present invention may be incorporated;

FIG. 2 is a block diagram generally representing a graphics layer architecture into which the present invention may

be incorporated;
FIG. 3 is a representation of a scene graph of visuals and associated components for processing the scene graph such as by traversing the scene graph to provide graphics commands and other data in accordance with an aspect of the present invention;
FIG. 4 is a representation of a scene graph of validation visuals, drawing visuals and associated drawing primitives constructed in accordance with an aspect of the present invention;
FIG. 5 is a representation of a visual class, of an object model, in accordance with an aspect of the present invention;
FIG. 6 is a representation of various other objects of the object model, in accordance with an aspect of the present invention;
FIG. 7 is a diagram representing transformation of a visual's data in accordance with an aspect of the present invention;
FIGS. 8A and 8B are representations of transformations of a visual's data in a geometry scale and a non-uniform scale, respectively, in accordance with an aspect of the present invention;
FIGS. 9A-9C are block diagrams of surface visual objects and other visuals and components in accordance with an aspect of the present invention;
FIGS. 10A and 10B are diagrams representing HWnd visual objects in accordance with an aspect of the present invention;
FIG. 11 is a diagram representing a layered visual object in accordance with an aspect of the present invention;
FIG. 12 is a representation of geometry classes of the object model, in accordance with an aspect of the present invention;
FIG. 13 is a representation of a PathGeometry structure, in accordance with an aspect of the present invention;
FIG. 14 is a representation of a scene graph of visuals and drawing primitives showing example graphics produced by the primitives, in accordance with an aspect of the present invention;
FIG. 15 is a representation of brush classes of the object model, in accordance with an aspect of the present invention;
FIG. 16 is a representation of rendered graphics resulting from data in a linear gradient brush object, in accordance with an aspect of the present invention;
FIG. 17 is a representation of rendered graphics resulting from data in a radial gradient brush object, in accordance with an aspect of the present invention;
FIG. 18 is a representation of rendered graphics resulting from having various stretch values, in accordance with an aspect of the present invention;
FIG. 19 is a representation of rendered graphics resulting from having various tile values, in accordance with an aspect of the present invention;
FIG. 20 is a flow diagram generally representing logic for interpreting a visual, including a brush object, to generate graphics in accordance with an aspect of the present invention;
FIG. 21 is a representation of a grid and transformed grid, resulting from data in a visual brush object, in accordance with an aspect of the present invention;
FIG. 22 is a representation of the grid and transformed grid, with rendered graphics therein drawn from a visual, in accordance with an aspect of the present invention;
FIG. 23 is a representation of a rendered nine grid brush object in accordance with an aspect of the present invention;
FIG. 24 is a representation of transform classes of the object model, in accordance with an aspect of the present invention;
FIG. 25 is a representation of element classes of the element object model, in accordance with an aspect of the present invention;
FIG. 26 is a representation of components for interpreting markup language code to interface with the visual API layer, in accordance with an aspect of the present invention; and
FIG. 27 is a representation of clipping via a geometry path in accordance with an aspect of the present invention.

DETAILED DESCRIPTION

EXEMPLARY OPERATING ENVIRONMENT

[0015] FIGURE 1 illustrates an example of a suitable computing system environment 100 on which the invention may be implemented. The computing system environment 100 is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the invention. Neither should the computing environment 100 be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment 100.

[0016] The invention is operational with numerous other general purpose or special purpose computing system environments or configurations. Examples of well known computing systems, environments, and/or configurations that may be suitable for use with the invention include, but are not limited to, personal computers, server computers, hand-held or laptop devices, tablet devices, multiprocessor systems, microprocessor-based systems, set top boxes, programmable consumer electronics, network PCs, minicomputers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

[0017] The invention may be described in the general context of computer-executable instructions, such as program modules, being executed by a computer. Generally, program modules include routines, programs, objects, components, data structures, and so forth, which perform particular tasks or implement particular abstract data types. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote computer storage media including memory storage devices.

[0018] With reference to FIG. 1, an exemplary system for implementing the invention includes a general purpose computing device in the form of a computer 110. Components of the computer 110 may include, but are not limited to, a processing unit 120, a system memory 130, and a system bus 121 that couples various system components including the system memory to the processing unit 120. The system bus 121 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, Accelerated Graphics Port (AGP) bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus.

[0019] The computer 110 typically includes a variety of computer-readable media. Computer-readable media can be any available media that can be accessed by the computer 110 and includes both volatile and nonvolatile media, and removable and non-removable media. By way of example, and not limitation, computer-readable media may comprise computer storage media and communication media. Computer storage media includes both volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information such as computer-readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can accessed by the computer 110. Communication media typically embodies computer-readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of the any of the above should also be included within the scope of computer-readable media.

[0020] The system memory 130 includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) 131 and random access memory (RAM) 132. A basic input/output system 133 (BIOS), containing the basic routines that help to transfer information between elements within computer 110, such as during start-up, is typically stored in ROM 131. RAM 132 typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit 120. By way of example, and not limitation, FIG. 1 illustrates operating system 134, application programs 135, other program modules 136 and program data 137.

[0021] The computer 110 may also include other removable/non-removable, volatile/nonvolatile computer storage media. By way of example only, FIG. 1 illustrates a hard disk drive 141 that reads from or writes to non-removable, nonvolatile magnetic media, a magnetic disk drive 151 that reads from or writes to a removable, nonvolatile magnetic disk 152, and an optical disk drive 155 that reads from or writes to a removable, nonvolatile optical disk 156 such as a CD ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard disk drive 141 is typically connected to the system bus 121 through a non-removable memory interface such as interface 140, and magnetic disk drive 151 and optical disk drive 155 are typically connected to the system bus 121 by a removable memory interface, such as interface 150.

[0022] The drives and their associated computer storage media, discussed above and illustrated in FIG. 1, provide storage of computer-readable instructions, data structures, program modules and other data for the computer 110. In FIG. 1, for example, hard disk drive 141 is illustrated as storing operating system 144, application programs 145, other program modules 146 and program data 147. Note that these components can either be the same as or different from

operating system 134, application programs 135, other program modules 136, and program data 137. Operating system 144, application programs 145, other program modules 146, and program data 147 are given different numbers herein to illustrate that, at a minimum, they are different copies. A user may enter commands and information into the computer 110 through input devices such as a tablet (electronic digitizer) 164, a microphone 163, a keyboard 162 and pointing device 161, commonly referred to as mouse, trackball or touch pad. Other input devices (not shown) may include a joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit 120 through a user input interface 160 that is coupled to the system bus, but may be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). A monitor 191 or other type of display device is also connected to the system bus 121 via an interface, such as a video interface 190. The monitor 191 may also be integrated with a touch-screen panel 193 or the like that can input digitized input such as handwriting into the computer system 110 via an interface, such as a touch-screen interface 192. Note that the monitor and/or touch screen panel can be physically coupled to a housing in which the computing device 110 is incorporated, such as in a tablet-type personal computer, wherein the touch screen panel 193 essentially serves as the tablet 164. In addition, computers such as the computing device 110 may also include other peripheral output devices such as speakers 195 and printer 196, which may be connected through an output peripheral interface 194 or the like.

[0023] The computer 110 may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer 180. The remote computer 180 may be a personal computer, a server, a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements described above relative to the computer 110, although only a memory storage device 181 has been illustrated in FIG. 1. The logical connections depicted in FIG. 1 include a local area network (LAN) 171 and a wide area network (WAN) 173, but may also include other networks. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

[0024] When used in a LAN networking environment, the computer 110 is connected to the LAN 171 through a network interface or adapter 170. When used in a WAN networking environment, the computer 110 typically includes a modem 172 or other means for establishing communications over the WAN 173, such as the Internet. The modem 172, which may be internal or external, may be connected to the system bus 121 via the user input interface 160 or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer 110, or portions thereof, may be stored in the remote memory storage device. By way of example, and not limitation, FIG. 1 illustrates remote application programs 185 as residing on memory device 181. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

GRAPHICS ARCHITECTURE

[0025] One aspect of the present invention is generally directed to allowing program code, such as an application or operating system component, to communicate drawing instructions and other information (e.g., image bitmaps) to graphics components in order to render graphical output on the system display. To this end, the present invention provides a markup language along with a set of shape elements and other elements, a grouping and compositing system, and integration with a general property system in an object model to enable programs to populate a scene graph with data structures, drawing primitives (commands), and other graphics-related data. When processed, the scene graph results in graphics being displayed on the screen.

[0026] FIG. 2 represents a general, layered architecture 200 into which the present invention may be implemented. As represented in FIG. 2, program code 202 (e.g., an application program or operating system component or the like) may be developed to output graphics data in one or more various ways, including via imaging 204, via vector graphic elements 206, and/or via function / method calls placed directly to a visual application programming interface (API) layer 212. Direct interaction with the API layer is further described in the aforementioned copending patent application entitled "Visual and Scene Graph Interfaces."

[0027] In general, imaging 204 provides the program code 202 with a mechanism for loading, editing and saving images, e.g., bitmaps. These images may be used by other parts of the system, and there is also a way to use the primitive drawing code to draw to an image directly.

[0028] In accordance with an aspect of the present invention, vector graphics elements 206 provide another way to draw graphics, consistent with the rest of the object model (as described below). Vector graphic elements 206 may be created via a markup language, which an element / property system 208 and presenter system 210 processes to make appropriate calls to the visual API layer 212. As described below with reference to FIG. 26, in general the vector graphic elements 206 are parsed into objects of the object model from which a scene graph is drawn, which may be provided to the scene graph via an element level via the element / property system 208 and presenter system 210, or may be provided in a more efficient manner at a resource level, as also described below.

[0029] In one implementation, the graphics layer architecture 200 includes a high-level composition and animation

engine 214, which includes or is otherwise associated with a caching data structure 216. The caching data structure 216 contains a scene graph comprising hierarchically-arranged objects that are managed according to a defined object model, as described below. In general, the visual API layer 212 provides the program code 202 (and the presenter system 210) with an interface to the caching data structure 216, including the ability to create objects, open and close objects to provide data to them, and so forth. In other words, the high-level composition and animation engine 214 exposes a unified media API layer 212 by which developers may express intentions about graphics and media to display graphics information, and provide an underlying platform with enough information such that the platform can optimize the use of the hardware for the program code. For example, the underlying platform will be responsible for caching, resource negotiation and media integration.

[0030] In one implementation, the high-level composition and animation engine 214 passes an instruction stream and possibly other data (e.g., pointers to bitmaps) to a fast, low-level compositing and animation engine 218. As used herein, the terms "high-level" and "low-level" are similar to those used in other computing scenarios, wherein in general, the lower a software component is relative to higher components, the closer that component is to the hardware. Thus, for example, graphics information sent from the high-level composition and animation engine 214 may be received at the low-level compositing and animation engine 218, where the information is used to send graphics data to the graphics subsystem including the hardware 222.

[0031] The high-level composition and animation engine 214 in conjunction with the program code 202 builds a scene graph to represent a graphics scene provided by the program code 202. For example, each item to be drawn may be loaded with drawing instructions, which the system can cache in the scene graph data structure 216. As will be described below, there are a number of various ways to specify this data structure 216, and what is drawn. Further, the high-level composition and animation engine 214 integrates with timing and animation systems 220 to provide declarative (or other) animation control (e.g., animation intervals) and timing control. Note that the animation system allows animate values to be passed essentially anywhere in the system, including, for example, at the element property level 208, inside of the visual API layer 212, and in any of the other resources. The timing system is exposed at the element and visual levels.

[0032] The low-level compositing and animation engine 218 manages the composing, animating and rendering of the scene, which is then provided to the graphics subsystem 222. The low-level engine 218 composes the renderings for the scenes of multiple applications, and with rendering components, implements the actual rendering of graphics to the screen. Note, however, that at times it may be necessary and/or advantageous for some of the rendering to happen at higher levels. For example, while the lower layers service requests from multiple applications, the higher layers are instantiated on a per-application basis, whereby is possible via the imaging mechanisms 204 to perform time-consuming or application-specific rendering at higher levels, and pass references to a bitmap to the lower layers.

SCENE GRAPH OBJECT MODEL

[0033] As described below, the rendering model is shared by the higher-level, control-based vector graphics elements 206, and the lower-level objects created by the visual API layer 212 used in the scene graph data structure 216. This provides a significant amount of correlation between the higher-level elements of the present invention, and the lower-level objects. The following describes one implementation of the scene graph object model.

[0034] FIGS. 3 and 4 show example scene graphs 300 and 400, respectively, including a base object referred to as a visual. In general, a visual comprises an object that represents a virtual surface to the user and has a visual representation on the display. As represented in FIG. 5, a base class visual provides the base functionality for other visual types, that is, the visual class 500 is an abstract base class from which visual types (e.g., 501-506) derive.

[0035] As represented in FIG. 3, a top-level (or root) visual 302 is connected to a visual manager object 304, which also has a relationship (e.g., via a handle) with a window (HWnd) 306 or similar unit in which graphic data is output for the program code. The VisualManager 304 manages the drawing of the top-level visual (and any children of that visual) to that window 306. FIG. 6 shows the VisualManager as one of a set of other objects 620 in the object model of the graphics system described herein.

[0036] To draw, the visual manager 304 processes (e.g., traverses or transmits) the scene graph as scheduled by a dispatcher 308, and provides graphics instructions and other data to the low level component 218 (FIG. 2) for its corresponding window 306, such as generally described in U.S. Patent Application Serial Nos. 10/184,795, 10/184,796, and 10/185,775. The scene graph processing will ordinarily be scheduled by the dispatcher 308 at a rate that is relatively slower than the refresh rate of the lower-level component 218 and/or graphics subsystem 222. FIG. 3 shows a number of child visuals 310-315 arranged hierarchically below the top-level (root) visual 302, some of which are represented as having been populated via drawing contexts 316, 317 (shown as dashed boxes to represent their temporary nature) with associated instruction lists 318 and 319, respectively, e.g., containing drawing primitives and other visuals. The visuals may also contain other property information, as shown in the following example visual class:

```
public abstract class Visual : VisualComponent
 {
     public Transform Transform { get; set; }
     public float Opacity { get; set; }
     public BlendMode BlendMode { get; set; }
     public Geometry Clip { get; set; }
     public bool Show { get; set; }
     public HitTestResult HitTest(Point point);
     public bool IsDescendant(Visual visual);
     public static Point TransformToDescendant(
         Visual reference,
         Visual descendant,
         Point point);
     public static Point TransformFromDescendant(
         Visual reference,
         Visual descendant,
         Point point);
     public Rect CalculateBounds(); // Loose bounds
     public Rect CalculateTightBounds(); //
     public bool HitTestable { get; set; }
     public bool HitTestIgnoreChildren { get; set; }
     public bool HitTestFinal { get; set; }
 }
```

[0037] A transformation, set by the transform property, defines the coordinate system for the sub-graph of a visual. The coordinate system before the transformation is called pre-transform coordinate system, the one after the transform is called post-transform coordinate system, that is, a visual with a transformation is equivalent to a visual with a transformation node as a parent. FIG. 7 generally provides an example of transformation, identifying the pre-transformation and post-transformation coordinate systems relative to a visual. To get or set the transformation of a visual, the Transform property may be used.

[0038] Note that the coordinate transforms may be applied in a uniform way to everything, as if it were in a bitmap. Note that this does not mean that transformations always apply to bitmaps, but that what gets rendered is affected by transforms equally. By way of example, if the user draws a circle with a round pen that is one inch wide and then applies a scale in the X direction of two to that circle, the pen will be two inches wide at the left and right and only one inch wide at the top and bottom. This is sometimes referred to as a compositing or bitmap transform (as opposed to a skeleton or geometry scale that affects the geometry only). FIG. 8A is a representation of scaling transformation, with a non-transformed image 800 appearing on the left and a transformed image 802 with a non-uniform scale appearing on the right. FIG. 8B is a representation of scaling transformation, with the non-transformed image 800 appearing on the left and a transformed image 804 with geometry scaling appearing on the right.

[0039] With respect to coordinate transformation of a visual, TransformToDescendant transforms a point from the reference visual to a descendant visual. The point is transformed from the post-transformation coordinate space of the reference visual to the post-transformation coordinate space of the descendant visual. TransformFromDescendant transforms a point from the descendant visual up the parent chain to the reference visual. The point is transformed from post-transformation coordinate space of the descendant visual to post-transformation coordinate space of the reference visual. The CalculateBounds method returns the bounding box of the content of the Visual in Post-Transformation coordinate space. Note that there may be an alternative version of the API where more specific specifications are allowed as to how the transform on a visual is interpreted during a coordinate transformation. For example, the transform on the reference and descendant visual may or may not be taken into account. In this alternative, there are thus four options, e.g., coordinates can be transformed from pre-transformation to pre-transformation space, pre-transformation to post-transformation space, post-transformation to pre-transformation space, and post-transformation to post-transformation space. The same concept applies to hit-testing, e.g., hit-testing may be started in pre-transformation or post-transformation transform coordinate space, and the hit-test results might be in pre-transformation or post-transformation coordinate space.

[0040] The clip property sets (and gets) the clipping region of a visual. Any Geometry (the geometry class is described below with reference to FIG. 12) can be used as a clipping region, and the clipping region is applied in Post-Transfor-

mation coordinate space. In one implementation, a default setting for the clipping region is null, i.e., no clipping, which can be thought of as an infinite big clipping rectangle from (-∞, -∞) to (+∞, +∞) .

[0041] The Opacity property gets/sets the opacity value of the visual, such that the content of the visual is blended on the drawing surface based on the opacity value and the selected blending mode. The BlendMode property can be used to set (or get) the blending mode that is used. For example, an opacity (alpha) value may be set between 0.0 and 1.0, with linear alpha blending set as the mode, e.g., Color = alpha * foreground color + (1.0-alpha) * background color). Other services, such as special effects properties, may be included in a visual, e.g., blur, monochrome, and so on.

[0042] The various services (including transform, opacity, clip) can be pushed and popped on a drawing context, and push/ pop operations can be nested, as long as a pop call matches a push call. For example PushTransform(...); PushOpacity (...) ; PopTransform(...); is illegal, because before the PopTransform call, PopOpacity needs to be called.

[0043] The PushTransform method pushes a transformation. Subsequent drawing operations are executed with respect to the pushed transformation. The PopTransform pops the transformation pushed by the matching PushTransform call:

```
void PushTransform(Transform transform);
void PushTransform(Matrix matrix);
void PopTransform();.
```

[0044] Similarly, the PushOpacity method pushes an opacity value. Subsequent drawing operations are rendered on a temporary surface with the specified opacity value and then composite into the scene. PopOpacity pops the opacity pushed by the matching PushOpacity call:

```
void PushOpacity(float opacity);
void PushOpacity(NumberAnimationBase opacity);
void PopOpacity();.
```

[0045] The PushClip method pushes a clipping geometry. Subsequent drawing operations are clipped to the geometry. The clipping is applied in post transformation space. PopClip pops the clipping region pushed by the matching PushClip call:

```
void PushClip(Geometry clip);
void PopClip();.
```

[0046] Note that push operations can be arbitrarily nested as long as the pop operations are matched with a push. For example, the following is valid:

```
PushTransform(...);
DrawLine(...);
PushClip(...);
DrawLine(...);
PopClip();
PushTransform(...);
DrawRect(...);
PopTransform();
PopTransform();
```

[0047] Hit-testing is performed in the Post-Transformation coordinate space, and returns an identity of each hit-testable visual that is hit, e.g., when a pen or mouse click is detected. An alternate version of the interface may allow for hit-testing to start at a Pre-Transformation coordinate space relative to the visual where the hit test is started. Visuals that are hit are returned in right-to-left, depth-first order. Hit-testing may be controlled with various flags, including HitTestable, which determines if the visual is hit-testable (the default is true), and HitTestFinal, which determines if hit-testing stops when the visual is hit, i.e. if a Visual is hit and the HitTestFinal property of the visual is true, hit-testing aborts and returns the results collected up to this point (the default is false). Another flag is HitTestIgnoreChildren, which determines if the children of a visual should be considered when hit-testing is performed on a visual (the default is false).

[0048] A ProxyVisual is a visual that may be added more than once into the scene graph. Since any visual referred

to by a ProxyVisual may be reached by multiple paths from the root, read services (TransformToDescendent, TransformFromDescendent and HitTest) do not work through a ProxyVisual. In essence, there is one canonical path from any visual to the root of the visual tree and that path does not include any ProxyVisuals.

[0049] As represented in FIG. 5, various types of visuals are defined in the object model, including ContainerVisuals 501, DrawingVisuals 502, ValidationVisuals 503, SurfaceVisuals 504 and HwndVisuals 505. The table below sets forth example methods of a DrawingVisual:

```
public class DrawingVisual : Visual
{
    public DrawingVisual();
    public IDrawingContext Open();
    public IDrawingContext Append();
}
```

[0050] A DrawingVisual is a container for graphical content (e.g. lines, text, images, and so forth). Note that it is possible to add a Visual into a DrawingVisual, but in some implementations this is not allowed. The DrawingVisual 502 includes an Open method, which returns an IDrawingContext that can be used to populate the DrawingVisual, e.g., with other visuals and drawing primitives, as described below. In one implementation, for various reasons also described below, a DrawingVisual may be only opened once to populate its drawing context; in other words, such a DrawingVisual is immutable. After the DrawingVisual has been populated, the DrawingVisual is closed using a Close method, e.g., on the drawing context. Note that an Open call may clear any contents (children) of a visual, however in one alternative implementation, there is provided an Append method, to open a current visual in a manner that appends to that visual. In other words, an OpenForAppend call works like Open, except the current content of the DrawingVisual is not cleared out on the open.

[0051] The following is an example of how a drawing context is used to populate a visual:

```
ContainerVisual cv1 = new ContainerVisual();
DrawingVisual dv1 = new DrawingVisual();
```

```
// Open a drawing context.  The context
// will automatically be closed when
// exiting the using block.  This will also
// replace any contents that might already
// be in dv1.
using (IDrawingContext dc = dv1.Open())
{
    dc.DrawLine(new Pen(Brushes.Blue), new Point(...), new Point(...));
}

// Add dv1 to the child collection of cv1
cv1.Children.Add(dv1);

// Add another arbitrary visual to cv1
cv1.Children.Add(someOtherVisual);

// Create another DrawingVisual
DrawingVisual dv2 = new DrawingVisual();

using (IDrawingContext dc = dv2.Open())
{
    // This sets up a new coordinate system
    // where everything is twice as big
    dv.PushTransform(new Scale(2.0, 2.0));

    // This line is drawn in the new scaled
    // coordinate system.
    dc.DrawLine(new Pen(Brushes.Red), new Point(...), new Point(...));

    // This reverts to the original coordinate system.
    dv.PopTransform();

    dc.DrawLine(new Pen(Brushes.Green), new Point(...), new Point(...));
}

// Add dv2 to the child collection of cv1;
cv1.Children.Add(dv2);
```

[0052] In general, a ValidationVisual 503 is conceptually similar to a DrawingVisual, except that a ValidationVisual is populated when the system requests that it be filled, instead of when the program code wants to populate it. For example, as described in U.S. Serial No. 10/185,775, the high-level composition and animation engine 214 (FIG. 2) may invalidate scene graph data as resources are needed, such as when part of a scene graph is not visible. For example if some parts are scrolled off the display, clipped, and so on. If the invalidated scene graph data is later needed, the program code 202 called will be called back to redraw (validate) the invalidated portion of the scene graph. To this end, one typical usage scenario is for a program code to subclass the ValidationVisual and override the OnValidate method. When the system calls the OnValidate method, a drawing context is passed in, and the program the uses the drawing context repopulate the ValidationVisual.

[0053] The example below shows one way to implement a simple ValidationVisual, e.g., one that draws a line with a certain color. The color of the line can be changed by calling SetColor. To force the update of the ValidationVisual, SetColor calls Invalidate to force the graphics sub-system to revalidate the ValidationVisual:

```
public class MyValidationVisual : ValidationVisual
{
    public override void OnValidate(IDrawingContext dc)
    {
        dc.DrawLine(m_color, ...);
    }

    public void SetColor(Color newColor)
    {
        m_color = color;
        Invalidate(); // Force a redraw of the ValidationVisual to
                      // reflect the color change.
    }
    private Color m_color
}
```

[0054] This example shows how to use the ValidationVisual:

```
MyValidationVisual myVV = new MyValidationVisual();

container.Children.Add(myVV);

myVV.SetColor(new Color(...));
```

[0055] FIG. 4 shows an example scene graph 400 in which ContainerVisuals and DrawingVisuals are related in a scene graph, and have associated data in the form of drawing primitives, (e.g., in corresponding drawing contexts). The ContainerVisual is a container for Visuals, and ContainerVisuals can be nested into each other. The children of a ContainerVisual can be manipulated with a VisualCollection returned from a Children property of the VisualContainer. The order of the Visuals in the VisualCollection determines in which order the Visuals are rendered, i.e. Visuals are rendered from the lowest index to the highest index from back to front (painting order). For example, with proper parameters with three drawing visuals representing red, green, and blue rectangles hierarchically under a container visual, the following code would result in three rectangles being drawn (translating to the right and down), a red rectangle in back, a green rectangle in the middle and a blue rectangle in front:

```
VisualCollection vc = m_cv.Children;
vc.Add(new DrawingVisual());
vc.Add(new DrawingVisual());
vc.Add(new DrawingVisual());

for (int i = 0; i < vc.Count; i++)
```

```
{
      DrawingVisual v = (DrawingVisual)(vc[i]);
      if (v != null)
      {
            v.Transform = Transform.CreateTranslation(i * 20.0f, i*20f);
            IDrawingContext dc = v.Open();
            dc.DrawRectangle(
                  new Brush(colors[i]),
                  null,
                  new Point2D(0, 0),
                  new Point2D(100.0f, 100.0f));
            v.Close(dc);
      }
}
```

[0056] As represented in FIG. 5, another type of visual object is a SurfaceVisual 504. In general, as represented in FIG. 3, a SurfaceVisual object 315 references an in-memory surface (bitmap) 322 that the program code 202 (FIG. 2) can access. The client program code 202 can supply its own surface memory, or it can request that the memory be allocated by the surface object.

[0057] The program code 202 has the option to open a SurfaceVisual and get a drawing context 323, into which the program code 202 can write pixel data 324 or the like and directly put those pixels onto the surface. This is represented in FIG. 3 by the dashed line between the surface object 322, the drawing context 323 (shown as a dashed box to represent its temporary nature) and the pixel data 324.

[0058] The program code 202 also has an option to create a surface visual manager 330 and associate a visual subgraph 332 with the SurfaceVisual 315. This option is represented in FIG. 3 by the dashed line between the surface object 322 and the surface visual manager 330. Note that the visual subgraph 332 can also nest other surface visuals, as also shown in FIG 3. The surface visual manager 330 (also shown as a type of other object in the set 620 of FIG. 6) walks the visual subgraph 332 to update the SurfaceVisual bitmap 322. Further, note that this traversal is scheduled by the dispatcher 308, and for efficiency may be throttled to control how often this bitmap 322 is updated. The surface visual manager 330 does not have to traverse the visual subgraph 322 each time and/or at the same rate that the top level visual manager 302 walks the rest of the scene graph.

[0059] With respect to surfaces, as further described with reference to FIGS. 9A-9C, in general, the present graphics model thus allows compositing a set of visuals to a surface, immediate-mode rendering of vector and bitmap primitives into a surface, compositing a surface onto the desktop or onto another surface, and controlling which surface in a surface list is used to composite into or to draw into. A surface list is defined as a collection of one or more surfaces (i.e. frames/buffers) of physical (system or video) memory used to store compositions of visuals or graphical drawings, or both. One of the surfaces of the surface list may be set as a current back buffer where drawing and/or compositing is done, and one of the surfaces of the surface list is set as a current primary, or front buffer, which is used to composite onto another render target.

[0060] Surfaces may be used in a number of ways. By way of example, FIG. 9A shows compositing to a surface. In FIG. 9A, a surface visual manager object 900 connects a surface list 902 as a render target for a visual tree 904. During each compositing cycle, the visuals are composited into the surface of the surface list that is currently serving as the active back buffer for the surface list. The surface being composited to can include a surface owned by the client/high level compositing engine 214 (FIG. 2) for in-process compositing scenarios, a surface owned by the low-level compositing engine 218 for scenarios where the client does not need the bits but the low-level compositing engine 218 needs them to composite the surface onto another render target, or a cross-process surface, for scenarios where the client needs access to the surface bits, but the low-level compositing engine 218 also needs the surface for other compositing work.

[0061] The compositing is controlled by a timing service that is attached to the Visual Manager. One example of a timing service, is a manual mode that might be used as in the example below:

```
// create a manual timing service and attach a visual manager
TimingService timingService = new ManualTimingService(visualManager);

// composite the visual tree to the current back buffer of the surface
visualManager.Render();

foreach (Tick tick in timingService)
```

```
{
      // advance the back buffer to the next frame of the surface
      surfaceList.NextFrame();

      // advance the time of the visual tree
      timingService.Tick(tick);

      // composite the visual tree to the current back buffer of surface
      visualManager.Render();
}
```

[0062] Another way to use a surface is with immediate-mode rendering to a surface, via a context. Attaching a surface list to a visual (a surface visual) enables immediate-mode rendering to the surface of the surface list that is currently serving as the active back buffer for the surface list. This rendering is done by obtaining a drawing context from the surface visual and executing drawing commands on that context, as described above. Note that obtaining a drawing context locks the surface so that other compositing operations cannot be done to it. Each drawing command is executed immediately, and vectors and other surfaces can be drawn (blended) onto the surface. However, other visuals cannot be drawn onto the surface, but instead can be composited into the surface by associating it with a visual manager, as previously described (e.g., in FIG. 9A).

```
// attach a surface list to a visual
SurfaceVisual surfaceVisual = new SurfaceVisual(surfaceList);

// enable immediate-mode rendering to (and lock) back buffer
surface
BaseDrawingContext dc = surfaceVisual.Open();

// draw a line (immediately) to the current back buffer of the
surface
dc.DrawLine (pen, startPoint, endPoint);
```

```
// unlock the surface - we're done with immediate-mode rendering
surfaceVisual.Close(dc);
```

[0063] Another use for surfaces is when compositing a surface onto another render target. To this end, once a surface list is attached to a surface visual, the surface can then be attached as a node in a visual tree, and the surface of the surface list that is currently serving as the primary or front buffer can be composited to another surface or to the desktop. This is illustrated in FIG. 9B and in the example below:

```
// attach a surface list to a visual
SurfaceVisual surfaceVisual = new SurfaceVisual(surfaceList);

// Add the surfaceVisual to a visual tree for compositing onto another
// render target
rootVisual.Add(surfaceVisual);
```

[0064] Live composition to/from a surface is represented in FIG. 9C, where the above-described capabilities are combined so that compositing to the back buffer surface of a surface list and compositing from the front buffer surface of a surface list (e.g. to the desktop) happen simultaneously. Note that to eliminate the undesirable video effect known as tearing, the surface list should have at least two surfaces, a front and a back buffer surface. A surface used as in FIG. 9C is likely owned by the low-level engine 218, or is a cross-process surface to make the composition in the low level engine 218 perform better.

[0065] Surfaces are constructed as independent objects, as set forth in the examples of constructors below:

```
public class Surface
{
      // create and allocate a blank surface without initial data
      public Surface(int width,
            int height,
            int dpi,
            PixelFormat pixelFormat,
            SurfaceFlags flags)

      // create a surface using the supplied memory
      public Surface(int width,
            int height,
            int dpi,
            PixelFormat pixelFormat,
            IntPtr pixels,  // managed memory for the surface
            Int stride)

      // create from a source (i.e. Clone)
      public Surface(Surface sourceSurface,
            SurfaceFlags flags)

      // Create from File or URL
      public Surface (String filename,
            SurfaceFlags flags)

      // Create from Stream
      public Surface (System.IO.Stream stream,
            SurfaceFlags flags)

      // Create from HBITMAP (which can't be selected into an HDC)
      public Surface (HBITMAP hbitmap, HPALETTE hPalette)

      // Create from HICON
      public Surface (HICON hicon)

      // read-only properties
      public Int Width {get; }

      public Int Height {get; }

      public Int Dpi {get;}

      public PixelFormat Format{get; }

      public int Stride{get; }

      public IntPtr Buffer {get;}

}
```

```
public class SurfaceList
{
      // Create a list of blank surfaces (without initial data).
      public SurfaceList (int width,
            int height,
            int dpi,
            PixelFormat pixelFormat,
            int numSurfaces,
            SurfaceFlags flags)

      // Create a SurfaceList that uses the specified surfaces
      // All the surfaces must have identical properties (w, h,
      // dpi, etc).
      public SurfaceList (Surface []surfaces)

      // change the front buffer to the first-in-line back buffer
      public Flip()

      // advance the back buffer to the next surface
      public Next()

      public int FrontBufferIndex {get; set;}

      public int BackBufferIndex {get; set;}

      public Surface GetFrontBuffer()
      public Surface GetBackBuffer()
      public Surface GetSurface(int surfaceIndex)
}
```

[0066] Once constructed, a surface and/or a surface list can be attached to a surface visual object or to a visual manager object.

```
// Create a surface visual
public SurfaceDrawingVisual(Surface surface)
public SurfaceDrawingVisual(SurfaceList surfaceList)

// Create a visual manager with a surface render target
public VisualManager(Surface surface)
public VisualManager(SurfaceList surfaceList)
```

[0067] Further, a surface can get data from a decoder, and/or send its data to an encoder for writing to a specific file format. Surfaces can also receive/send data from/to effect interfaces. A surface can be constructed for any pixel format from the full set of supported surface format types. However, some adjustments may be made to the specified pixel format, e.g., if the specified pixel format is less than 32 bits per pixel, then the format will be promoted to 32 bits per pixel. Whenever bits are requested from a surface in the original format, the surface will be copied to a buffer of the requested pixel format using a format conversion filter.

[0068] Returning to FIG. 5, yet another visual is an HwndVisual 505, which positions a Win32 child HWnd in the scene graph. More particularly, legacy programs will still operate via the WM_PAINT method (or the like) that draws to a child HWnd (or the like) based on prior graphics technology. To support such programs in the new graphics processing model, the HwndVisual allows the Hwnd to be contained in a scene graph and moved as the parent visual is repositioned, as represented in FIG. 10A. As a result of limitations with existing Hwnds, however, when rendered, a child Hwnd can only be on top of other windows, and cannot be rotated or scaled like other visuals described above. Some clipping is possible, as represented in FIG. 10B, where the dashed lines indicate the HWnd's displayed rectangle being clipped during relative movement with respect to its parent visual.

[0069] Other types of visuals 506 are also feasible, and the present object model is extensible to allow others to be developed. For example, as represented in FIG. 11, a layered visual 1100 enables an application developer to separately control the information in a visual via multiple data streams, providing a finer granularity of control relative to visuals having a single data stream. Note that similar granularity of control can be accomplished by having (e.g., three) separate child visuals under a single parent visual, however this requires that the program code work with multiple visuals, which is more complicated than working with a single layered visual having indexes to multiple layers.

[0070] By way of example, in FIG. 11, background data, content data and border data are contained in a single layered visual, but are separated from one another as indexed by a layer value, e.g., 0, 1 or 2, respectively. Layers can be inserted, including tacked onto either end, and/or deleted, with the layering order (e.g., left-to-right as shown) defining an implied Z-order for display. Note that for security, child content and other data in a layered visual cannot be enumerated.

[0071] Other types of visuals include container visuals, and redirected child HWnd visuals, in which content is drawn to a bitmap, and incorporated into a surface visual. Three-dimensional visuals enable a connection between two-dimensional and three dimensional worlds, e.g., a camera-like view is possible via a two-dimensional visual having a view into a three-dimensional world.

[0072] Many of the resource objects are immutable once created, that is, once they are created they cannot be changed for various reasons, including simplifying threading issues, preventing corruption by others, and simplifying the interaction with elements and APIs. Note that this generally simplifies the system. It should be noted, however, that it is feasible to have a system where such objects are mutable, but for example would require managing a dependency graph. For example, while it is possible to have a system where such objects are mutable, if program code changed the clip set on a Visual, the visual would need to be re-rendered, thus requiring a notification / registration mechanism, e.g., if a new clip is assigned to a visual, the visual registers itself with the clip for notifications (e.g., a clip changed notification). Thus, in one implementation, for simplification purposes, resource objects are immutable.

[0073] These resource objects can be defined with a constructor, which is a straightforward, generic way to create an object, or by using a companion builder object, as described below. For instance, to create a SolidColorBrush, (brush objects are described below), a constructor may be used:

```
Brush MyBrush = new SolidColorBrush(Colors.Red);
```

[0074] The user can also use the static members on the Brushes class to get a set of predefined colors.

[0075] Because immutable objects cannot be changed, to effectively change an object, the user needs to create a new object and replace the old one with it. To this end, many of the resource objects in the system may utilize the builder pattern, in which immutable objects are created with a builder class, which is a companion class that is mutable. The user creates an immutable object to mirror the parameters set on the builder, creates a new builder for that object, and initializes it from the immutable object. The user then changes the builder as necessary. Once done, the user can build a new object, by changing the builder and reusing it to create another immutable object. Note that having immutable objects with set properties is desirable, and that immutable objects cannot be changed, but only replaced by firing a property change event.

[0076] Thus, instead of using a constructor to create a SolidColorBrush as described above, a SolidColorBrushBuilder may be used:

```
SolidColorBrushBuilder MyBuilder = new
SolidColorBrushBuilder();
MyBuilder.Color = Colors.Red;
Brush MyBrush = MyBuilder.ToBrush();
```

[0077] Most objects that take static values can also take animation objects. For instance, on the DrawingContext there is an override on DrawCircle that takes a PointAnimationBase for the center of the circle. In this way, the user can specify rich animation information at the primitive level. For resource objects there exists an animation collection in addition to the base value. These are composited, whereby if the user wanted to animate the above example, the user could specify the following example line before the brush is built:

```
MyBuilder.ColorAnimations.Add(new ColorAnimation (...));
```

[0078] Note that an object with animation parameters is still immutable, because its animation parameters are static. However, when the scene graph is processed (e.g., traversed), the meaning of animation parameters changes over time, giving the appearance of animated, not static, data.

[0079] As described above, visuals can be drawn on by populating their drawing contexts with various drawing prim-

itives, including Geometry, ImageData and VideoData. Furthermore, there are a set of resources and classes that are shared through this entire stack. This includes Pens, Brushes, Geometry, Transforms and Effects. The IDrawingContext exposes a set of drawing operations that can be used to populate a DrawingVisual, ValidationVisual. ISurfaceDrawingContext, a base interface to IDrawing context, can be used to populate a SurfaceVisual. In other words, the drawing context exposes a set of drawing operations; for each drawing operation there are two methods, one that takes constants as arguments, and one that takes animators as arguments.

[0080] The DrawLine method draws a line with the specified pen from the start point to the end point.

```
public void DrawLine(Pen pen, Point start, Point end);
public void DrawLine(
      Pen pen,
      PointAnimationBase start,
      PointAnimationBase end);
```

[0081] The DrawRoundedRectangle method draws a rounded rectangle with the specified brush and pen; brush and pen can be null.

```
public void DrawRoundedRectangle(
      Brush brush,
      Pen pen,
      Point topLeft,
      Size size,
      float radius);
public void DrawRoundedRectangle(
      Brush brush,
      Pen pen,
      PointAnimationBase topLeft,
      SizeAnimationBase size,
      NumberAnimationBase radius);
public void DrawRoundedRectangle(
      Brush brush,
      Pen pen,
      Point topLeft,
      Point bottomRight,
      float rx,
      float ry);
public void DrawRoundedRectangle(
      Brush brush,
      Pen pen,
      PointAnimationBase topLeft,
      PointAnimationBase bottomRight,
      NumberAnimationBase radiusX,
      NumberAnimationBase radiusY);
```

[0082] The DrawGeometry method draws a path with the specified brush and pen; brush and pen can be null.

```
public void DrawGeometry(
      Brush brush,
```

```
        Pen pen,
        Geometry geometry);
```

[0083] The DrawRectangle method draws a rectangle with the specified brush and pen; brush and pen can be null.

```
public void DrawRectangle(
    Brush brush,
    Pen pen,
    Point topLeft,
    Size size);
public void DrawRectangle(
    Brush brush,
    Pen pen,
    PointAnimationBase topLeft,
    SizeAnimationBase size);
```

[0084] The DrawSurface method draws a surface.

```
public void DrawSurface(
    Surface surface,
    Point topLeft,
    Size size,
    float opacity);
public void DrawSurface(
    Surface image,
    PointAnimationBase topLeft,
    SizeAnimationBase size,
    NumberAnimationBase opacity);
```

[0085] Geometry is a type of class (FIG. 12) that defines a vector graphics skeleton, without stroke or fill. Each geometry object is a simple shape (LineGeometry, EllipseGeometry, RectangleGeometry), a complex single shape (PathGeometry) or a list of such shapes GeometryList with a combine operation (e.g., union, intersection, and so forth) specified. These objects form a class hierarchy as represented in FIG. 12.

[0086] As represented in FIG. 13, the PathGeometry is a collection of Figure objects. In turn, each of the Figure objects is composed of one or more Segment objects which actually define the figure's shape. A Figure is a sub-section of a Geometry that defines a segment collection. This segment collection is a single connected series of two-dimensional Segment objects. The Figure can be either a closed shape with a defined area, or just a connected series of Segments that define a curve, but no enclosed area.

[0087] The filled area of the PathGeometry is defined by taking the contained Figures that have their Filled property set to true, and applying a FillMode to determine the enclosed area. Note that the FillMode enumeration specifies how the intersecting areas of Figure objects contained in a Geometry are combined to form the resulting area of the Geometry. An "Alternate" rule determines whether a point is inside the canvas, by conceptually drawing a ray from that point to infinity in any direction, and then examining the places where a segment of the shape crosses the ray. By starting with a count of zero and adding one each time a Segment crosses the ray from left to right and subtracting one each time a path segment crosses the ray from right to left, after counting the crossings, if the result is zero then the point is outside the path. Otherwise, it is inside. A "winding" rule determines whether a point on the canvas is inside, and works by conceptually drawing a ray from that point to infinity in any direction and counting the number of path Segments from the given shape that the ray crosses. If this number is odd, the point is inside; if even, the point is outside.

[0088] As represented in FIG. 14, when geometry (e.g., a rectangle) is drawn, a brush or pen can be specified, as described below. Furthermore, the pen object also has a brush object. A brush object defines how to graphically fill a plane, and there is a class hierarchy of brush objects. This is represented in FIG. 14 by the filled rectangle 1402 that

results when the visual including the rectangle and brush instructions and parameters is processed.

[0089] As described below, some types of Brushes (such as gradients and nine grids) size themselves. When used, the size for these brushes is obtained from the bounding box, e.g., when the GradientUnits/DestinationUnits for the Brush is set to ObjectBoundingBox, the bounding box of the primitive that is being drawn is used. If those properties are set to UserSpaceOnUse, then the coordinate space is used.

[0090] A Pen object holds onto a Brush along with properties for Width, LineJoin, LineCap, MiterLimit, DashArray and DashOffset, as represented in the example below:

```
public enum System.Windows.Media.PenLineCap
{
    Butt, Round, Square
}
```

```
public enum System.Windows.Media.PenLineJoin
{
    Miter, Round, Bevel
}

public class System.Windows.Media.Pen
{
    // Constructors
    public Pen(Color color, float width);
    public Pen(Brush brush, float width);

    // Properties
    public float[] DashArray { get; }

    public float DashOffset { get; }
    public FloatAnimationCollection DashOffsetAnimations { get; }

    public PenLineCap LineCap { get; }
    public PenLineJoin LineJoin { get; }

    public float MiterLimit { get; }
    public FloatAnimationCollection MiterLimitAnimations { get; }

    public float Opacity { get; }
    public FloatAnimationCollection OpacityAnimations { get; }

    public Brush Brush { get; }

    public float Width { get; }
    public FloatAnimationCollection WidthAnimations { get; }
}

public sealed class System.Windows.Media.PenBuilder : Builder
{

    // Fields

    // Constructors
    public PenBuilder();
    public PenBuilder(Color color);
    public PenBuilder(Brush brush);
    public PenBuilder(Pen pen);

    // Properties
    public float[] DashArray { get; set; }

    public float DashOffset { get; set; }
    public FloatAnimationCollectionBuilder DashOffsetAnimations {
      get; }

    public PenLineCap LineCap { get; set; }
    public PenLineJoin LineJoin { get; set; }

    public float MiterLimit { get; set; }
```

```
    public FloatAnimationCollectionBuilder MiterLimitAnimations {
      get; }

    public float Opacity { get; set; }
    public FloatAnimationCollectionBuilder OpacityAnimations { get;
      }

    public Brush Brush { get; set; }

    public float Width { get; set; }
    public FloatAnimationCollectionBuilder WidthAnimations { get; }

    // Methods
    public Pen ToPen();
}
```

[0091] As mentioned above, the graphics object model of the present invention includes a Brush object model, which is generally directed towards the concept of covering a plane with pixels. Examples of types of brushes are represented in the hierarchy of FIG. 15, and, under a Brush base class, include SolidColorBrush, GradientBrush, ImageBrush, VisualBrush (which can reference a Visual) and NineGridBrush. GradientBrush includes LinearGradient and RadialGradient objects. As described above, Brush objects are immutable.

```
public abstract class System.Windows.Media.Brush
{
    float Opacity { get; }
    FloatAnimationCollection OpacityAnimations { get; }
}
```

[0092] The following sets forth an example BrushBuilder class:

```
public abstract class System.Windows.Media.BrushBuilder : Builder
{
```

```
    public virtual Brush ToBrush();
    public override sealed object CreateInstance();
    {
        return ToBrush();
    }
    float Opacity { get; set; }
    FloatAnimationCollectionBuilder OpacityAnimations { get; }
}
```

[0093] Note that Brush objects may recognize how they relate to the coordinate system when they are used, and/or how they relate to the bounding box of the shape on which they are used. In general, information such as size may be inferred from the object on which the brush is drawn. More particularly, many of the brush types use a coordinate system for specifying some of their parameters. This coordinate system can either be defined as relative to the simple bounding box of the shape to which the brush is applied, or it can be relative to the coordinate space that is active at the time that the brush is used. These are known, respectively, as ObjectBoundingBox mode and UserSpaceOnUse mode.

```
public enum System.Windows.Media.BrushMappingMode
{
    ObjectBoundingBox,
    UserSpaceOnUse,
}
```

[0094] A SolidColorBrush object fills the identified plane with a solid color. If there is an alpha component of the color, it is combined in a multiplicative way with the corresponding opacity attribute in the Brush base class. The following sets forth an example SolidColorBrush object:

```
public sealed class System.Windows.Media.SolidColorBrush : Brush
{

    // Constructors
    public SolidColorBrush(); // initialize to black
    public SolidColorBrush(Color color);
    public SolidColorBrush(System.Windows.Media.Animation.ColorComposer
      colorComposer);

    // Properties
    public Color Color { get; }
    public IEnumerator ColorAnimations { get; }
}

public class System.Windows.Media.SolidColorBrushBuilder : BrushBuilder
{
    // Constructors
    public SolidColorBrushBuilder();
    public SolidColorBrushBuilder(Color color);
    public SolidColorBrushBuilder(SolidColorBrush scp);

    // Properties
    public Color Color { get; set; }
    public AnimationList ColorAnimations { get; }

    // Methods
    public virtual Brush ToBrush();
}
```

[0095] The GradientBrush objects, or simply gradients, provide a gradient fill, and are drawn by specifying a set of gradient stops, which specify the colors along some sort of progression. The gradient is by drawn by performing linear interpolations between the gradient stops in a gamma 2.2 RGB color space; interpolation through other gammas or other color spaces (HSB, CMYK and so forth, is also a feasible alternative. Two types of gradient objects include linear and radial gradients.

[0096] In general, gradients are composed of a list of gradient stops. Each of these gradient stops contains a color (with the included alpha value) and an offset. If there are no gradient stops specified, the brush is drawn as a solid transparent black, as if there were no brush specified at all. If there is only one gradient stop specified, the brush is drawn as a solid color with the one color specified. Like other resource classes, the gradient stop class (example in the table below) is immutable.

```
public class System.Windows.Media.GradientStop
{
    public GradientStop(Color color, float offset);

    public Color Color { get; }
    public AnimationEnumerator ColorAnimations { get; }
    public float Offset { get; }
    public AnimationEnumerator OffsetAnimations { get; }
}

public class System.Windows.Media.GradientStopBuilder : Builder
{
    public GradientStopBuilder();
    public GradientStopBuilder(Color color, float offset);

    public Color Color { get; set; }
    public AnimationList ColorAnimations { get; }
    public float Offset { get; set; }
    public AnimationList OffsetAnimations { get; }
    public GradientStop ToGradientStop();
}
```

[0097] There is also a collection class, as set forth in the following example:

```
public class System.Windows.Media.GradientStopCollection : ICollection
{
    public GradientStopCollection(); // empty list
    public GradientStopCollection(GradientStop[] GradientStops);
    public GradientStopCollection(ICollection c);

    // IEnumerable
    public IEnumerator GetEnumerator();

    // ICollection
    public void CopyTo(Array array, int index);
    public bool ICollection.IsSynchronized { get { return false; } }
```

```
    public int Count { get; }
    public object ICollection.SyncRoot { get; }

    // Extra functions
    public GradientStop this[int index] { get; }
    public bool Contains(GradientStop value);
    public int IndexOf(GradientStop value); // returns first one
    public int IndexOf(GradientStop value, int startIndex);
    public int IndexOf(GradientStop value, int startIndex, int count);
    public int LastIndexOf(GradientStop value);
    public int LastIndexOf(GradientStop value, int startIndex);
    public int LastIndexOf(GradientStop value, int startIndex, int count);
    public GradientStopCollection GetRange(int index, int count);
}

public class System.Windows.Media.GradientStopCollectionBuilder : Builder,
      IList
{
    public GradientStopCollectionBuilder();
    public GradientStopCollectionBuilder(GradientStop [] GradientStops);
    public GradientStopCollectionBuilder(ICollection c);
    public GradientStopCollectionBuilder(GradientStopCollection
      GradientStops);

    // IEnumerable
    public IEnumerator GetEnumerator();

    // ICollection
    public void CopyTo(Array array, int index);
    public bool ICollection.IsSynchronized { get { return false; } }
    public int Count { get; }
    public object ICollection.SyncRoot { get; }

    // IList
    public bool IsFixedSize { get { return false; } }
    public bool IsReadOnly { get { return false; } }
    public object IList.this [int index] { get; set; }
    public int IList.Add(object value);
    public void Clear();
    public bool IList.Contains(object value);
    public int IList.IndexOf(object value); // returns first one
    public void IList.Insert(int index, object value);
    public void IList.Remove(object value); // removes first one
    public void RemoveAt(int index);

    // Extra functions
    public GradientStop this [int index] { get; set; }
    public int Add(GradientStop value);
    public bool Contains(GradientStop value);
    public int IndexOf(GradientStop value); // returns first one
    public int IndexOf(GradientStop value, int startIndex);
    public int IndexOf(GradientStop value, int startIndex, int count);
    public int LastIndexOf(GradientStop value);
    public int LastIndexOf(GradientStop value, int startIndex);
    public int LastIndexOf(GradientStop value, int startIndex, int count);
    public void Insert(int index, GradientStop value);
    public void Remove(GradientStop value); // removes first one
    public void AddRange(ICollection c);
```

```
    public void InsertRange(int index, ICollection c);
    public void RemoveRange(int index, int count);
    public void SetRange(int index, ICollection c);
    public GradientStopCollectionBuilder GetRange(int index, int count);

    // Capacity is a hint.  It will throw an exception if it is set less
      than Count.
    public int Capacity { get; set; }

    // Builder overloads
    public override object Build();
    public override void ResetBuilder();
    public override void SetBuilder(Object example);

    public GradientStopCollection ToGradientStopCollection();
}
```

[0098] As represented in the table below, the GradientSpreadMethod specifies how the gradient should be drawn outside of the specified vector or space. There are three values, including pad, in which the edge colors (first and last) are used to fill the remaining space, reflect, in which the stops are replayed in reverse order repeatedly to fill the space, and repeat, in which the stops are repeated in order until the space is filled:

```
public enum System.Windows.Media.GradientSpreadMethod
{
    Pad,
    Reflect,
    Repeat
}
```

[0099] FIG. 16 shows examples of the GradientSpreadMethod. Each shape has a linear gradient going from white to grey. The solid line represents the gradient vector.

[0100] The LinearGradient specifies a linear gradient brush along a vector. The individual stops specify colors stops along that vector. An example is shown in the table below:

```
public class System.Windows.Media.LinearGradient : GradientBrush
{
    // Sets up a gradient with two colors and a gradient vector
    // specified to fill the object the gradient is applied to.
    // This implies ObjectBoundingBox for the GradientUnits
    // property
    public LinearGradient(Color color1, Color color2, float
      angle);

    public BrushMappingMode GradientUnits { get; }
    public Transform GradientTransform { get; }
    public GradientSpreadMethod SpreadMethod { get; }

    // Gradient Vector
    public Point VectorStart { get; }
    public PointAnimationCollection VectorStartAnimations { get; }
    public Point VectorEnd { get; }
    public PointAnimationCollection VectorEndAnimations { get; }

    // Gradient Stops
    public GradientStopCollection GradientStops { get; }
}


public class System.Window.Media.LinearGradientBuilder :
     GradientBrushBuilder
{
    public LinearGradientBuilder();
    public LinearGradientBuilder(Color color1, Color color2, float
      angle);
    public LinearGradientBuilder(LinearGradient lg);

    // GradientUnits: Default is ObjectBoundingBox
    public BrushMappingMode GradientUnits { get; set; }
    // GradientTransform: Default is identity
    public Transform GradientTransform { get; set; }
    // SpreadMethod: Default is Pad
    public GradientSpreadMethod SpreadMethod { get; set; }

    // Gradient Vector
    // Default vector is (0,0) - (1,0)
    public Point VectorStart { get; set; }
    public PointAnimationCollectionBuilder VectorStartAnimations {
      get; set; }
    public Point VectorEnd { get; set; }
    public PointAnimationCollectionBuilder VectorEndAnimations { get; set;
      }
```

```
      // Gradient Stops
      public void AddStop(Color color, float offset};
      public GradientStopCollectionBuilder GradientStops { get;
set; }
```

```
}
```

[0101] The RadialGradient is similar in programming model to the linear gradient. However, whereas the linear gradient has a start and end point to define the gradient vector, the radial gradient has a circle along with a focal point to define the gradient behavior. The circle defines the end point of the gradient, that is, a gradient stop at 1.0 defines the color at the circle. The focal point defines center of the gradient. A gradient stop at 0.0 defines the color at the focal point.

[0102] FIG. 17 shows a radial gradient that from white to grey. The outside circle represents the gradient circle while the dot denotes the focal point. This example gradient has its SpreadMethod set to Pad:

```
public class System.Windows.Media.RadialGradient : GradientBrush
{
    // Sets up a gradient with two colors.
    // This implies ObjectBoundingBox for the GradientUnits
    // property along with a center at (0.5,0.5)
    // a radius of 0.5 and a focal point at (0.5,0.5)
    public RadialGradient(Color color1, Color color2);

    public BrushMappingMode GradientUnits { get; }
    public Transform GradientTransform { get; }
    public GradientSpreadMethod SpreadMethod { get; }

    // Gradient definition
    public Point CircleCenter { get; }
    public PointAnimationCollection CircleCenterAnimations { get; }
    public float CircleRadius { get; }
    public FloatAnimationCollection CircleRadiusAnimations { get; }
    public Point Focus { get; }
    public PointAnimationCollection FocusAnimations { get; }

    // Gradient Stops
    public GradientStopCollection GradientStops { get; }
}
```

```
public class System.Windows.Media.RadialGradientBuilder :
      GradientBrushBuilder
{
    public RadialGradientBuilder();
    public RadialGradient(Color color1, Color color2);
    public RadialGradientBuilder(RadialGradient rg);

    // GradientUnits: Default is ObjectBoundingBox
    public BrushMappingMode GradientUnits { get; set; }
    // GradientTransform: Default is identity
    public Transform GradientTransform { get; set; }
    // SpreadMethod: Default is Pad
    public GradientSpreadMethod SpreadMethod { get; set; }

    // Gradient definition
    public Point CircleCenter { get; set;}//Default: (0.5, 0.5)
    public PointAnimationCollectionBuilder CircleCenterAnimations { get;
      set;}
    public float CircleRadius { get;set; } // Default: 0.5
    public FloatAnimationCollectionBuilder CircleRadiusAnimations {
      get;set; }
    public Point Focus { get;set; } // Default: (0.5, 0.5)
    public PointAnimationCollectionBuilder FocusAnimations { get;set; }

    // Gradient Stops
    public void AddStop(Color color, float offset);
    public GradientStopCollectionBuilder GradientStops { get; set; }
}
```

[0103] Another brush object represented in FIG. 15 is a VisualBrush object. Conceptually, the VisualBrush provides a way to have a visual drawn in a repeated, tiled fashion as a fill. Visual paint objects also provide a mechanism for markup language to directly work with the API layer at a resource level, as described below. An example of such a fill is represented in FIG. 14 by the visual brush referencing a visual (and any child visuals) that specifies a single circular shape 1420, with that circular shape filling a rectangle 1422. Thus, the VisualBrush object may reference a visual to define how that brush is to be drawn, which introduces a type of multiple use for visuals. In this manner, a program may use an arbitrary graphics "metafile" to fill an area via a brush or pen. Since this is a compressed form for storing and using arbitrary graphics, it serves a graphics resource. The following sets forth an example VisualBrush object:

```
public class System.Windows.Media.VisualBrush : Brush
{
    public VisualBrush(Visual v);

    public BrushMappingMode DestinationUnits { get; }
    public BrushMappingMode ContentUnits { get; }
    public Transform Transform { get; }

    public Rect ViewBox { get; }
    public Stretch Stretch { get; }
    public HorizontalAlign HorizontalAlign { get; }
    public VerticalAlign VerticalAlign { get; }

    public Point Origin { get; }
    public PointAnimationCollection OriginAnimations { get; }
    public Size Size { get; }
    public SizeAnimationCollection SizeAnimations { get; }

    // Visual
    public Visual Visual { get; }
}

public class System.Windows.Media.VisualBrushBuilder : BrushBuilder
{
    public VisualBrushBuilder();
    public VisualBrushBuilder(Visual v);
    public VisualBrushBuilder(VisualBrush vb);

    // DestinationUnits: Default is ObjectBoundingBox
    public BrushMappingMode DestinationUnits { get; set; }
    // ContentUnits: Default is ObjectBoundingBox
    public BrushMappingMode ContentUnits { get; set; }
    // Transform: Default is Identity
    public Transform Transform { get; set; }
    // ViewBox: Default is (0,0,0,0) -- unset and ignored
    public Rect ViewBox { get; set; }
    // Stretch: Default is None -- and ignored
    //          because the ViewBox is not set
    public Stretch Stretch { get; set; }
    // HorizontalAlign: Default is Center and ignored
    public HorizontalAlign HorizontalAlign { get; set; }
    // VerticalAlign: Default is Center and ignored
    public VerticalAlign VerticalAlign { get; set; }

    // Origin: Default is (0,0)
    public Point Origin { get; set; }
    public PointAnimationCollectionBuilder OriginAnimations { get; set; }
    // Size: Default is (1,1)
    public Size Size { get; set; }
    public SizeAnimationCollectionBuilder SizeAnimations { get; set; }

    // Visual: Default is null -- nothing drawn
    public Visual Visual { get; set; }
}
```

[0104] A VisualBrush's contents have no intrinsic bounds, and effectively describe an infinite plane. These contents exist in their own coordinate space, and the space which is being filled by the VisualBrush is the local coordinate space at the time of application. The content space is mapped into the local space based on the ViewBox, ViewPort, Alignments and Stretch properties. The ViewBox is specified in content space, and this rectangle is mapped into the ViewPort (as specified via the Origin and Size properties) rectangle.

[0105] The ViewPort defines the location where the contents will eventually be drawn, creating the base tile for this Brush. If the value of DestinationUnits is UserSpaceOnUse, the Origin and Size properties are considered to be in local space at the time of application. If instead the value of DestinationUnits is ObjectBoundingBox, then an Origin and Size are considered to be in the coordinate space, where 0,0 is the top/left corner of the bounding box of the object being brushed, and 1,1 is the bottom/right corner of the same box. For example, consider a RectangleGeometry being filled which is drawn from 100,100 to 200,200. In such an example, if the DestinationUnits is UserSpaceOnUse, an Origin of 100,100 and a Size of 100,100 would describe the entire content area. If the DestinationUnits is ObjectBoundingBox, an Origin of 0,0 and a Size of 1,1 would describe the entire content area. If the Size is empty, this Brush renders nothing.

[0106] The ViewBox is specified in content space. This rectangle is transformed to fit within the ViewPort as determined by the Alignment properties and the Stretch property. If the Stretch is none, then no scaling is applied to the contents. If the Stretch is Fill, then the ViewBox is scaled independently in both X and Y to be the same size as the ViewPort. If the Stretch is Uniform or UniformToFill, the logic is similar but the X and Y dimensions are scaled uniformly, preserving the aspect ratio of the contents. If the Stretch is Uniform, the ViewBox is scaled to have the more constrained dimension equal to the ViewPort's size. If the Stretch is UniformToFill, the ViewBox is scaled to have the less constrained dimension equal to the ViewPort's size. In other words, both Uniform and UniformToFill preserve aspect ratio, but Uniform ensures that the entire ViewBox is within the ViewPort (potentially leaving portions of the ViewPort uncovered by the ViewBox), and UniformToFill ensures that the entire ViewPort is filled by the ViewBox (potentially causing portions of the ViewBox to be outside the ViewPort). If the ViewBox is empty, then no Stretch will apply. Note that alignment will still occur, and it will position the "point" ViewBox.

[0107] FIG. 18 provides representations of a single tile 1800 of graphics rendered with various stretch settings, including a tile 800 when stretch is set to "none." The tile 1802 is a representation of when the stretch is set to "Uniform," the tile 1804 when stretch is set to "UniformToFill," and the tile 1806 when stretch is set to "Fill."

[0108] Once the ViewPort is determined (based on DestinationUnits) and the ViewBox's size is determined (based on Stretch), the ViewBox needs to be positioned within the ViewPort. If the ViewBox is the same size as the ViewPort (if Stretch is Fill, or if it just happens to occur with one of the other three Stretch values), then the ViewBox is positioned at the Origin so as to be identical to the ViewPort. Otherwise, HorizontalAlignment and VerticalAlignment are considered. Based on these properties, the ViewBox is aligned in both X and Y dimensions. If the HorizontalAlignment is Left, then the left edge of the ViewBox will be positioned at the Left edge of the ViewPort. If it is Center, then the center of the ViewBox will be positioned at the center of the ViewPort, and if Right, then the right edges will meet. The process is repeated for the Y dimension.

[0109] If the ViewBox is (0,0,0,0), it is considered unset, whereby ContentUnits are considered. If the ContentUnits are UserSpaceOnUse, no scaling or offset occurs, and the contents are drawn into the ViewPort with no transform. If the ContentUnits are ObjectBoundingBox, then the content origin is aligned with the ViewPort Origin, and the contents are scale by the object's bounding box's width and height.

[0110] When filling a space with a VisualBrush, the contents are mapped into the ViewPort as above, and clipped to the ViewPort. This forms the base tile for the fill, and the remainder of the space is filled based on the Brush's TileMode. Finally, if set, the Brush's transform is applied - it occurs after all the other mapping, scaling, offsetting, etc.

[0111] The TileMode enumeration is used to describe if and how a space is filled by its Brush. A Brush which can be tiled has a tile rectangle defined, and this tile has a base location within the space being filled. The rest of the space is filled based on the TileMode value. FIG. 19 provides a representation of example graphics with various TileMode settings, including "None" 1900, "Tile" 1092, "FlipX" 1904, "FlipY" 1906 and "FlipXY" 1908. The top left-most tile in the various example graphics comprises the base tile.

[0112] FIG. 20 represents a process for generating the pixels for this brush. Note that the logic described in FIG. 20 is only one possible way to implement of the logic, and it should be understood that other ways, including more efficient ways, are feasible. For example, there are likely more efficient ways processing the data, e.g., such that the content is not drawn for each repetition, with the tile drawn and cached. However, FIG. 20 provides a straightforward description.

[0113] In general, each time the contents of the pattern are drawn, a new coordinate system is created. The origin and offset of each repetition is specified by the Origin and Size properties, as filtered through the DestinationUnits and Transform properties.

[0114] A coordinate frame is set up based on the DestinationUnits property. To this end, if at step 2000, the DestinationUnits property is UserSpaceOnUse, the current coordinate frame at the time the brush was used is the starting coordinate frame, via step 2002. If instead at step 2004 the property is ObjectBoundingBox, the bounding box of the geometry to which this brush is applied is used, as represented by step 2004, to set a new coordinate frame such that the upper left corner of the bounding box maps to (0,0) and the lower left corner of the bounding box maps to (1,1). In either case, at step 2006 the Transform property is applied to this coordinate frame, which essentially defines a grid.

[0115] FIG. 21 represents a VisualBrush Grid that is defined for the tiles in a VisualBrush. The first circle is a simple grid, and the second has a Transform with a Skew in the x direction of 47.

[0116] At step 2008, the visual is drawn into each cell of the grid, as represented in FIG. 22, where the visual draws the appropriate data. If at step 2010 there is a ViewBox specified, the Visual is fitted into the grid cell as specified by the ViewBox, Stretch, HorizontalAlign and VerticalAlign attributes, via step 2012. The DestinationUnits and Transform properties are used to apply the correct transform such that the visual lines up in the grid box.

[0117] If there is no ViewBox specified, then a new coordinate system is established for drawing the content at step 2014.

[0118] The coordinate frame is set such that its origin is at the Origin point for that particular grid cell being drawn.

[0119] A clip is applied at step 2018 based on the Size property such that this tile will not draw outside of the bounds of the cell. The Origin and Size are modified appropriately based on the DestinationUnits property.

[0120] The coordinate system is then modified, based on the SourceUnits property. To this end, if at step 2020 the SourceUnits property is ObjectBoundingBox, the appropriate scaling transform is applied at step 2026, otherwise it is UserSpaceOnUse, and no new transform is applied. The Transform property is applied at step 2024, and the content is drawn at step 2026.

[0121] Note that if any part of size is zero, nothing is drawn, and if Stretch is "None," the transform for the viewbox is set up such that one unit in the new coordinate frame is equal to one unit in the old coordinate frame. The transform essentially becomes an offset based on the align attributes and the size of the ViewBox. As described above at steps 2010 and 2012, Stretch and the alignment properties only apply when there is a ViewBox specified. The ViewBox specifies a new coordinate system for the contents, and Stretch helps to specify how those contents map into the ViewBox. The alignment options align the ViewBox, not the contents. Thus, for example, if the viewbox is set to "0 0 10 10" and something is drawn at -10,-10 and aligned to the upper left corner, that thing will be clipped out.

[0122] Returning to FIG. 15, image brush can be thought of as a special case of VisualBrush. Although a program can create a visual, put an image into it and attach it to VisualBrush, the API for doing so would be cumbersome. Since there is no necessary content coordinate frame, the ViewBox and ContentUnits property members no longer apply.

```
public class System.Windows.Media.ImageBrush : Brush
{
    public ImageBrush(ImageData image);

    public BrushMappingMode DestinationUnits { get; }
    public Transform Transform { get; }

    public Stretch Stretch { get; }
    public HorizontalAlign HorizontalAlign { get; }
    public VerticalAlign VerticalAlign { get; }

    public Point Origin { get; }
    public PointAnimationCollection OriginAnimations { get; }
    public Size Size { get; }
    public SizeAnimationCollection SizeAnimations { get; }

    public ImageData ImageData { get; }
}

public class System.Windows.Media.ImageBrushBuilder : BrushBuilder
{
    public ImageBrushBuilder();
    public ImageBrushBuilder(ImageData image);
    public ImageBrushBuilder(ImageBrush ib);
```

```
    // DestinationUnits: Default is ObjectBoundingBox
    public BrushMappingMode DestinationUnits { get; set; }
    // Transform: Default is identity
    public Transform Transform { get; set; }

    // Stretch: Default is None
    public Stretch Stretch { get; set; }
    // HorizontalAlign: Default is Center
    public HorizontalAlign HorizontalAlign { get; set; }
    // VerticalAlign: Default is Center
    public VerticalAlign VerticalAlign { get; set; }

    // Origin: Default is (0,0)
    public Point Origin { get; set; }
    public PointAnimationCollectionBuilder OriginAnimations { get; set; }

    // Size: Default is (1,1)
    public Size Size { get; set; }
    public SizeAnimationCollectionBuilder SizeAnimations { get; set; }

    // ImageData: Default is null -- nothing drawn
    public ImageData ImageData { get; set; }
}
```

[0123] NineGridBrush is very similar to ImageBrush except the image is warped based on the size. In essence, NineGridBrush may be thought of a custom type of Stretch, in which certain parts of the image stretch, while others (e.g., borders) do not. Thus, while the Size of the image in the ImageBrush will cause a simple scale, the NineGridBrush will produce a non-uniform scale up to the desired size. The units for the non-scaled areas are the user units when the brush is applied, which means that ContentUnits (if it existed for NineGridBrush) would be set to UserUnitsOnUse. The Transform property of the Brush can be used effectively. Note that the border members count in from the edge of the image.

[0124] By way of example, FIG. 23 represents a nine-grid image being enlarged from a first instance 2302 to a second instance 2304, with four types of areas. As represented in FIG. 23, to keep the border the same, the areas marked "a" expand horizontally, the areas marked "b" expand vertically, the areas marked "c" expand horizontally and vertically, and the areas marked "d" do not change in size.

```
public class System.Windows.Media.NineGridBrush : Brush
{
    public NineGridBrush(ImageData image,
            int LeftBorder, int RightBorder,
            int TopBorder, int BottomBorder);

    public BrushMappingMode DestinationUnits { get; }
    public Transform Transform { get; }

    public Point Origin { get; }
    public PointAnimationCollection OriginAnimations { get; }
    public Size Size { get; }
    public SizeAnimationCollection SizeAnimations { get; }

    public int LeftBorder { get; }
    public int RightBorder { get; }
    public int TopBorder { get; }
    public int BottomBorder { get; }

    public ImageData ImageData { get; }
}

public class System.Window.Media.NineGridBrushBuilder : BrushBuilder
{
    public NineGridBrushBuilder();
    public NineGridBrushBuilder (ImageData image,
            int LeftBorder, int RightBorder,
            int TopBorder, int BottomBorder);
    public NineGridBrushBuilder (NineGridBrush ngb);

    // DestinationUnits: Default is ObjectBoundingBox
    public BrushMappingMode DestinationUnits { get; set; }
    // Transform: Default is identity
    public Transform Transform { get; set; }

    // Origin: Default is (0,0)
    public Point Origin { get; set; }
    public PointAnimationCollectionBuilder OriginAnimations { get;
      set; }

    // Size: Default is (1,1)
    public Size Size { get; set; }
    public SizeAnimationCollectionBuilder SizeAnimations { get; set; }

    // *Border: default to 0
    public int LeftBorder { get; set; }
    public int RightBorder { get; set; }
    public int TopBorder { get; set; }
    public int BottomBorder { get; set; }

    // ImageData: Default is null -- nothing drawn
    public ImageData ImageData { get; set; }
}
```

[0125] As generally described above, the graphics object model of the present invention includes a Transform object

model, which includes the types of transforms represented in the hierarchy of FIG. 24, under a Transform base class. These different types of components that make up a transform may include TransformList, TranslateTransform, RotateTransform, ScaleTransform, SkewTransform, and MatrixTransform. Individual properties can be animated, e.g., a program developer can animate the Angle property of a RotateTransform.

[0126] Matrices for 2D computations are represented as a 3x3 matrix. For the needed transforms, only six values are needed instead of a full 3x3 matrix. These are named and defined as follows.

$$\begin{bmatrix} m00 & m01 & 0 \\ m10 & m11 & 0 \\ m20 & m21 & 1 \end{bmatrix}$$

[0127] When a matrix is multiplied with a point, it transforms that point from the new coordinate system to the previous coordinate system:

$$\begin{bmatrix} x_{newCoordSys} & y_{newCoordSys} & 1 \end{bmatrix} \bullet \begin{bmatrix} m00 & m01 & 0 \\ m10 & m11 & 0 \\ m20 & m21 & 1 \end{bmatrix} = \begin{bmatrix} x_{oldCoordSys} & y_{oldCoordSys} & 1 \end{bmatrix}$$

[0128] Transforms can be nested to any level. Whenever a new transform is applied it is the same as post-multiplying it onto the current transform matrix:

$$\begin{bmatrix} x_{newCoordSys} & y_{newCoordSys} & 1 \end{bmatrix} \bullet \begin{bmatrix} m00_2 & m01_2 & 0 \\ m10_2 & m11_2 & 0 \\ m20_2 & m21_2 & 1 \end{bmatrix} \bullet \begin{bmatrix} m00_1 & m01_1 & 0 \\ m10_1 & m11_1 & 0 \\ m20_1 & m21_1 & 1 \end{bmatrix} = \begin{bmatrix} x_{oldCoordSys} & y_{oldCoordSys} & 1 \end{bmatrix}$$

[0129] Most places in the API do not take a Matrix directly, but instead use the Transform class, which supports animation.

```
public struct System.Windows.Media.Matrix
{
    // Construction and setting
    public Matrix(); // defaults to identity

    public Matrix(
                double m00, double m01,
                double m10, double m11,
                double m20, double m21);

    // Identity
    public static readonly Matrix Identity;
    public void SetIdentity();
    public bool IsIdentity { get; }

    public static Matrix operator *(Matrix matrix1, Matrix
     matrix2);
    public static Point operator *(Matrix matrix, Point point);

    // These function reinitialize the current matrix with
    // the specified transform matrix.
    public void SetTranslation(double dx, double dy);
    public void SetTranslation(Size offset);
    public void SetRotation(double angle); // degrees
    public void SetRotation(double angle, Point center); // degrees
    public void SetRotationRadians(double angle);
    public void SetRotationRadians(double angle, Point center);
    public void SetScaling(double sx, double sy);
```

```
    public void SetScaling(double sx, double sy, Point center);
    public void SetSkewX(double angle); // degrees
    public void SetSkewY(double angle); // degrees
    public void SetSkewXRadians(double angle);
    public void SetSkewYRadians(double angle);

    // These function post-multiply the current matrix
    // with the specified transform
    public void ApplyTranslation(double dx, double dy);
    public void ApplyTranslation(Size offApply);
    public void ApplyRotation(double angle); // degrees
    public void ApplyRotation(double angle, Point center); //
      degrees
    public void ApplyRotationRadian(double angle);
    public void ApplyRotationRadian(double angle, Point center);
    public void ApplyScaling(double sx, double sy);
    public void ApplyScaling(double sx, double sy, Point center);
    public void ApplySkewX(double angle); // degrees
    public void ApplySkewY(double angle); // degrees
    public void ApplySkewXRadians(double angle);
    public void ApplySkewYRadians(double angle);
    public void ApplyMatrix(Matrix matrix);

    // Inversion stuff
    public double Determinant { get; }
    public bool IsInvertible { get; }
    public void Invert();  // Throws ArgumentException if
      !IsInvertable
    public static Matrix Invert(Matrix matrix);

    // Individual members
    public double M00 { get; set; }
    public double M01 { get; set; }
    public double M10 { get; set; }
    public double M11 { get; set; }
    public double M20 { get; set; }
    public double M21 { get; set; }
};
```

MARKUP LANGUAGE AND OBJECT MODEL FOR VECTOR GRAPHICS

[0130] In accordance with an aspect of the present invention, a markup language and element object model are provided to enable user programs and tools to interact with the scene graph data structure 216 without requiring a specific knowledge of the details of the API layer 212 (FIG. 2). In general, a vector graphics markup language is provided, which comprises an interchange format, along with a simple markup based authoring format for expressing vector graphics via the element object model. Via this language, markup (e.g., HTML or XML-type content) may be programmed. Then, to build the scene graph, the markup is parsed and translated into the appropriate visual API layer objects that were as described above. At this higher operating level, an element tree, the property system and the presenter system are provided to handle much of the complexity, making it straightforward for scene designers to design possibly complex scenes.

[0131] In general, the vector graphics system generally provides a set of shape and other elements, integration with a general property system, a grouping and compositing system, and a two-tiered (element level and resource level) approach so that the user can program in a way that matches flexibility and performance needs. In keeping with one aspect of the present invention, the element object model for dealing with vector graphics correlates with the scene graph object model. In other words, the vector graphics system and the Visual API layer share a set of resources at the element object model level, e.g., the Brush object is used when drawing at the Visual API and it is also the type of the fill property on Shape. Thus, in addition to having elements that correlate with the scene graph objects, the markup

language shares a number of primitive resources (e.g., brushes, transforms, and so forth) with the Visual API layer. The vector graphics system also exposes and extends the animation capabilities of the Visual API layer, which is largely shared between the levels.

[0132] Further, as described below, the vector graphics system can program to different profiles, or levels, including an element level and a resource level. In the element level, each of the drawing shapes is represented as an element at the same level as the rest of the programmable elements in a page/screen. This means that the shapes interact in a full way with the presenter system, events and properties. In the resource level, the vector graphics systems operates in a pure resource format, similar to a traditional graphics metafile. The resource level is efficient, but has somewhat limited support for cascaded properties, eventing and fine-grained programmability. The scene designer thus has the ability to balance efficiency with programmability as needed.

[0133] In keeping with one aspect of the present invention, the vector graphics system at the resource level also correlates to the visual API layer, in that the resource level markup, in one implementation, is expressed as a VisualBrush. When the resource markup is parsed, a visual object is created. The visual object is set into a VisualBrush which may be used by shapes, controls and other elements at the element level.

[0134] FIG. 25 is a representation of the element class hierarchy 2500. The classes of the markup language object model of the present invention are represented via shadowed boxes, and include a shape class 2502, an image class 2504, a video class 2506 and a canvas class 2508. Elements of the shape class include rectangle 2510, polyline 2512, polygon 2514, path 2516, line 2518 and ellipse 2520. Note that in some implementations, a circle element may not be present as indicated by the dashed box 2522 in FIG. 25, however for purposes of the various examples herein, the circle element 2522 will be described. Each element may include or be associated with fill (property) data, stroke data, clipping data, transform data, filter effect data and mask data.

[0135] As described below, shapes correspond to geometry that is drawn with inherited and cascaded presentation properties. The presentation properties are used to construct the pen and the brush needed to draw the shapes. In one implementation, shapes are full presenters, like other control elements. However, in other implementations, a canvas class 2508 may be provided as a container for shapes, and shapes can only be drawn when in a canvas element. For example, to keep shapes lightweight, shapes may not be allowed to have attached presenters. Instead, the canvas has an attached presenter and draws the shapes. Canvas elements are described in more detail below.

[0136] As also described below, the image class is more specific than a shape, and for example can include border data, which may be complex. For example, a border can be specified as one color on the top, a different color on the sides, with possibly various thicknesses specified and other properties set. Position, size rotation and scale may be set for an image or similar boxed element, such as text or video. Note that the image and video elements can exist and be shown outside of a canvas element, and also inherit from BoxedElement, e.g., to get the background, borders and padding support from that element.

[0137] The video element allows video (or similar multimedia) to be played within a displayed element. In this manner, the vector graphics system provides a markup interface to the API layer that is seamlessly consistent across multimedia, including text, 2D graphics, 3D graphics, animation, video, still images and audio. This allows designers to that learn to work with one media to easily integrate other media into applications and documents. The vector graphics system also enables multimedia to be animated in the same way as other elements, again allows designers the ability to use multimedia like other elements, yet without sacrificing the core intrinsic uniqueness of each individual media type. For example, a designer can use the same naming scheme for rotating, scaling, animating, drawing, compositing and other effects across different media types, whereby designers may easily create very rich applications, as well as allowing for a very efficient rendering and compositing implementation to be built underneath.

[0138] FIG. 26 represents one implementation in which the markup code 2602 is interpreted by a parser / translator 2604. In general, the parser / translator 2604 adds elements to an element tree / property system 208 (also represented in FIG. 2) and attaches presenters to those elements. The presenter system 210 then takes the element tree 210 with the attached presenters and translates the data to objects and calls to the visual API layer 212. Note that not all elements need to be translated, only those with attached presenters.

[0139] In general, an element is an object in the element layer that participates in the property system, eventing and layout/presentation system. The parser finds tags and decides if those tags help to define an element or a resource object. In the special case of a VisualBrush, the same tags may be interpreted as elements or also interpreted as resource objects, depending on the context of where those tags appear, e.g., depending on whether appearing in complex property syntax or not.

[0140] In accordance with one aspect of the present invention, the markup language provides distinct ways to describe a resource, including a simple string format or a complex object notation. For a simple string format, the parser / translator 2604 uses a type converter 2608 for converting a string to an appropriate visual API object. By way of example, in the following line of markup, the Fill property value can be converted to a brush object, via the type converter 2608:

```
<Circle CenterX="10" CenterY="10" Radius="5" Fill="Red" />
```

As can be readily appreciated, the conversion of such an inline line of tag-based markup with simple strings of parameters is to a brush object is straightforward, and provides a simple way for a scene designer to add a shape and its attributes to a scene.

[0141] However there are times when the fill attribute is too complex to fit into a single string. In such a situation, complex property syntax, which may be inline in the markup, is used to set this property. For example, the following complex property syntax fills a circle with a gradient rather than a solid color, specifying the colors at various gradient stops (which can range from 0 to 1):

```
<Circle CenterX="10" CenterY="10" Radius="5">
  <Circle.Fill>
    <LinearGradient>
      <GradientStop Color="Red" Offset="0"/>
      <GradientStop Color="Blue" Offset="0.33"/>
      <GradientStop Color="Green" Offset="0.66"/>
      <GradientStop Color="Red" Offset="1.0"/>
    </LinearGradient>
  </Circle.Fill>
```

```
</Circle>
```

[0142] In addition to being present inline in the markup, a resource instance may be located elsewhere (e.g., in the markup or in a file, which can be local or on a remote network and appropriately downloaded), and referenced by a name, (e.g., a text name, reference or other suitable identifier). In this manner, a scene designer can reuse an element in the element tree throughout a scene, including elements described by the complex property syntax.

[0143] The parser handles markup in the complex property syntax by accessing the type converter 2608 as necessary, and also matching specified parameters to the object properties, thereby handling the complexity for the scene designer. Thus, the parser does not just set up the objects, but also sets attributes on the objects. Note that the parser actually instantiates a builder to create the objects, since objects are immutable.

[0144] Because the same rendering model is shared between the element level and the API level, many of the objects are essentially the same. This makes parsing / translation highly efficient, and also allows different types of programming languages (e.g., C#-like languages) the ability to easily convert from the markup to its own syntax, and vice-versa. Note that as represented in FIG. 26, another such programming language 2610 can add elements to the element tree 208, or can directly interface with the visual API layer 212.

[0145] As also represented in FIG. 26 and in accordance with an aspect of the present invention, the same markup 2602 may be used to program at an element level and a resource level. As described above, the element level gives the scene designer full programmability, usage of the property system that provides inheritance (e.g., style-sheet like

features), and eventing (e.g., whereby an element may have attached code to change its appearance, position and so forth in response to a user input event). However, the present invention also provides a resource-level mechanism by which scene designers can essentially shortcut the element tree and presenter system and program directly to the visual API layer. For many types of static shapes, images and the like where element-level features are not needed, this provides a more efficient and lightweight way to output the appropriate object. To this end, the parser recognizes when a fill of type "visual brush" is present, and directly calls the API layer 212 with resource level data 2612 to create the object. In other words, as represented in FIG.22, element level vector graphics get parsed into created elements, which need later translation to the objects, while resource level vector graphics get parsed and directly stored in an efficient manner.

[0146] By way of example, the following markup is directly derived from the object model for the LinearGradient object, and fills an outer circle with a VisualBrush. The contents of that VisualBrush are defined by the inner markup. Note that this syntax is commonly used for expressing various brushes, transforms and animations:

```
<Circle CenterX="10" CenterY="10" Radius="5">
  <Circle.Fill>
    <VisualBrush xmlns="...">
      <Circle CenterX="0.5" CenterY="0.5" Radius="0.25" Fill="Blue"/>
      <Circle CenterX="0.6" CenterY="0.6" Radius="0.25" Fill="Green"/>
      <Circle CenterX="0.7" CenterY="0.7" Radius="0.25" Fill="Red"/>
      <Circle CenterX="0.8" CenterY="0.8" Radius="0.25" Fill="LemonChiffon"/>
    </VisualBrush>
  </Circle.Fill>
</Circle>
```

[0147] Note that while these visual brush-filled objects are efficiently stored, the resource level data (or the objects created thereby) can be referenced by elements and part of the element tree 208, as generally represented in FIG. 26. To this end, these visual brush resources may be named (e.g., with a name, reference or other suitable identifier) and referenced like other resources described via the complex property syntax.

[0148] Turning to an explanation of the canvas, as mentioned above in one alternative implementation, shapes may be kept lightweight and thus may be required to be contained in a canvas. In this alternative implementation, when content is rendered, it is rendered onto an infinite, device-independent canvas which has an associated coordinate system. The canvas element may thus position content according to absolute coordinates. The canvas element can optionally define a viewport, which specifies clipping, a transform, a preferred aspect ratio and a way of mapping the viewport into a parent space. If there is no viewport established, the canvas element only specifies a grouping of drawing primitives and can set up a transform, opacity and other compositing attributes.

[0149] The following is a markup example for a sample canvas:

```
<Canvas Background="black" Top="100" Left="100"Height="600" Width="800">
  <Rectangle Top="600" Left="100" Width="100" Height="50" Fill="red"
Stroke="blue" StrokeWidth="10"/>
  <Line x1="100" y1="300" x2="300" y2="100" Stroke="green" StrokeWidth="5"
/>
</Canvas>
```

[0150] Note that in one implementation, when coordinates are specified without units then they are considered as "logical pixels" of 96ths of an inch, and in the above example, the line will be 200 pixels long. In addition to coordinates, other properties include width, height horizontal and vertical alignment, and ViewBox (of type rect; default is unset or (0,0,0,0), meaning no adjustment is made, and the stretch and align properties get ignored). As generally described above with reference to FIGS. 18-20, other properties include stretch, which when not specified preserves original size, or can 1) specify a fill in which the aspect ratio is not preserved and the content is scaled to fill the bounds established by the top/left/width/height, 2) specify uniform, which scales size uniformly until the image fits the bounds established by the top/left/width/height, or 3) specify UniformToFill, which scales size uniformly to fill the bounds established by top/left/width/height, and clips as necessary.

[0151] To further correlate with the lower-level object model, the transform property establishes a new coordinate

frame for the children of the element, while the clip property restricts the region to which content can be drawn on the canvas, with the default clipping path defined as the bounding box. The ZIndex property can be used to specify rendering order for nested canvas elements within a panel.

[0152] The Viewbox specifies a new coordinate system for the contents, e.g., by redefining the extent and origin of the viewport. Stretch helps to specify how those contents map into the viewport. The value of the viewBox attribute is a list of four "unitless" numbers <min-x>, <min-y>, <width> and <height>, e.g., separated by whitespace and/or a comma, and is of type Rect. The Viewbox rect specifies the rectangle in user space that maps to the bounding box. It works the same as inserting a scaleX and scaleY. The stretch property (in case the option is other than none) provides additional control for preserving the aspect ratio of the graphics. An additional transformation is applied to descendants of the given element to achieve the specified effect.

[0153] In the example above, the effective result of the rectangle in the markup sample above under each stretch rule would be:

```
None - from (100,600) to (200,650)

Fill - from (100,100) to (900,700)

Uniform - from (100,?) to (900,?) - the new height will be
400, and it will centered based on HorizontalAlign and
VerticalAlign.

UniformToFill - from (?,100) to (?,700) The new width is
1200, and will again be centered based on HorizontalAlign and
VerticalAlign.
```

[0154] If there is a transform on the canvas, it is essentially applied above (e.g., in the tree) the mapping to ViewBox. Note that this mapping will stretch any of the elements in a canvas, e.g., boxes, text, and so forth, not just shapes. Further, note that if a viewbox is specified, the canvas no longer sizes to its contents, but rather has a specified size. If y-width and y-height are also specified, then the stretch/align properties are used to fit the viewbox into the specified width and height.

[0155] The elements in the object model can each have a 'Clip' attribute applied. On some elements, notably shapes, this is exposed directly as a common language runtime property, while on others (e.g., most controls) this property is set via a DynamicProperty.

[0156] In general, the clipping path restricts the region to which content can be drawn, as generally represented in FIG. 27 wherein a button is shown in an unclipped form 2702 and a form 2704 in which a clipping path is specified (where the dashed line represents the clipping path). Conceptually, any parts of the drawing that lie outside of the region bounded by the currently active clipping path are not drawn. A clipping path can be thought of as a mask wherein those pixels outside the clipping path are black with an alpha value of zero and those pixels inside the clipping path are white with an alpha value of one (with the possible exception of anti-aliasing along the edge of the silhouette).

[0157] A clipping path is defined by a Geometry object, either inline or more typically in a resource section. A clipping path is used and/or referenced using the "Clip" property on an element, as shown in the following example:

```
<def:Resources>
    <Geometry def:ID="MyClip">
        <Path Data="..." />
        <Rectangle …  />
      </Geometry>
</def:Resources>
     <Element Clip=""%resource; MyClip"  ... />
```

[0158] Note that animating a Clip is similar to animating transforms:

```
<Element>
    <Element.Clip>
        <Circle ….>
        <Rectangle …. >
                <FloatAnimation ... />
        </Rectangle>
    </Element.Clip>
    ... children ...
</Element>
```

[0159] A path is drawn by specifying the 'Geometry' data and the rendering properties, such as Fill, Stroke, and StrokeWidth on the Path element. An example markup for a path is specified as follows:

```
<Path Data="M 100 100 L 300 100 L 200 300 z"
Fill="red" Stroke="blue" StrokeWidth="3" />
```

[0160] The path 'Data' string is of type Geometry. A more verbose and complete way to specify a drawn path is via the complex property syntax, as described above. The markup (such as in the following example) is fed directly into the Geometry builder classes described above:

```
  <Path>
    <Path.Data>
      <CircleGeometry … />
      <RectangleGeometry … />
      <PathGeometry …  />
    </Path.Data>
    <Path.Fill value="red" />
    <Path.Stroke value="blue"/>
</Path>
```

[0161] The path data string is also described, using the following notation to describe the grammar for a path data string:

```
*: 0 or more
+: 1 or more
?: 0 or 1
(): grouping
|: separates alternatives
double quotes surround literals
```

[0162] The following shows the path data string information described with this notation (note that in one implementation, FillMode may be specified here, instead of a property at the element level):

```
wvg-path:
    wsp* moveto-drawto-command-groups? wsp*

moveto-drawto-command-groups:
    moveto-drawto-command-group
    | moveto-drawto-command-group wsp* moveto-drawto-command-
groups

moveto-drawto-command-group:
    moveto wsp* drawto-commands?

drawto-commands:
    drawto-command
    | drawto-command wsp* drawto-commands

drawto-command:
    closepath
    | lineto
    | horizontal-lineto
    | vertical-lineto
    | curveto
    | smooth-curveto
    | quadratic-bezier-curveto
```

```
    | smooth-quadratic-bezier-curveto
    | elliptical-arc

moveto:
    ( "M" | "m" ) wsp* moveto-argument-sequence

moveto-argument-sequence:
    coordinate-pair
    | coordinate-pair comma-wsp? lineto-argument-sequence

closepath:
    ("Z" | "z")

lineto:
    ( "L" | "l" ) wsp* lineto-argument-sequence

lineto-argument-sequence:
    coordinate-pair
    | coordinate-pair comma-wsp? lineto-argument-sequence

horizontal-lineto:
    ( "H" | "h" ) wsp* horizontal-lineto-argument-sequence

horizontal-lineto-argument-sequence:
    coordinate
    | coordinate comma-wsp? horizontal-lineto-argument-
sequence

vertical-lineto:
    ( "V" | "v" ) wsp* vertical-lineto-argument-sequence

vertical-lineto-argument-sequence:
    coordinate
    | coordinate comma-wsp? vertical-lineto-argument-sequence

curveto:
    ( "C" | "c" ) wsp* curveto-argument-sequence

curveto-argument-sequence:
    curveto-argument
    | curveto-argument comma-wsp? curveto-argument-sequence

curveto-argument:
    coordinate-pair comma-wsp? coordinate-pair comma-wsp?
coordinate-pair

smooth-curveto:
    ( "S" | "s" ) wsp* smooth-curveto-argument-sequence

smooth-curveto-argument-sequence:
```

```
    smooth-curveto-argument
    | smooth-curveto-argument comma-wsp? smooth-curveto-
argument-sequence

smooth-curveto-argument:
    coordinate-pair comma-wsp? coordinate-pair

quadratic-bezier-curveto:
    ( "Q" | "q" ) wsp* quadratic-bezier-curveto-argument-
sequence

quadratic-bezier-curveto-argument-sequence:
    quadratic-bezier-curveto-argument
    | quadratic-bezier-curveto-argument comma-wsp?
        quadratic-bezier-curveto-argument-sequence

quadratic-bezier-curveto-argument:
    coordinate-pair comma-wsp? coordinate-pair

smooth-quadratic-bezier-curveto:
    ( "T" | "t" ) wsp* smooth-quadratic-bezier-curveto-
argument-sequence

smooth-quadratic-bezier-curveto-argument-sequence:
    coordinate-pair
    | coordinate-pair comma-wsp? smooth-quadratic-bezier-
curveto-argument-sequence

elliptical-arc:
    ( "A" | "a" ) wsp* elliptical-arc-argument-sequence

elliptical-arc-argument-sequence:
    elliptical-arc-argument
    | elliptical-arc-argument comma-wsp? elliptical-arc-
argument-sequence

elliptical-arc-argument:
    nonnegative-number comma-wsp? nonnegative-number comma-
wsp?
        number comma-wsp flag comma-wsp flag comma-wsp
coordinate-pair

coordinate-pair:
    coordinate comma-wsp? coordinate

coordinate:
    number

nonnegative-number:
    integer-constant
```

```
    | floating-point-constant

number:
    sign? integer-constant
    | sign? floating-point-constant

flag:
    "0" | "1"

comma-wsp:
    (wsp+ comma? wsp*) | (comma wsp*)

comma:
    ","

integer-constant:
    digit-sequence

floating-point-constant:
    fractional-constant exponent?
    | digit-sequence exponent

fractional-constant:
    digit-sequence? "." digit-sequence
    | digit-sequence "."

exponent:
    ( "e" | "E" ) sign? digit-sequence

sign:
    "+" | "-"

digit-sequence:
    digit
    | digit digit-sequence

digit:
    "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

wsp:
    (#x20 | #x9 | #xD | #xA)
```

[0163] The image element (FIG. 25) indicates that the contents of a complete file are to be rendered into a given rectangle within the current user coordinate system. The image (indicated by the image tag) can refer to raster image files such as PNG or JPEG, or to files with MIME type of "image/wvg", as set forth in the following example:

```
<Image Top="200" Left="200" Width="100px" Height="100px"
Source ="myimage.png">
</Image>
```

[0164] The following table provides information on some example properties for images:

Name	Type	R/RW	Default Value	Description
Top	BoxUnit			Coordinate for the top side of the Image
Left	BoxUnit			Coordinate for the left side of the Image
Width	BoxUnit			Width of the Image
Height	BoxUnit			Height of the Image
Source	ImageData			Source of the Image
Dpi	Float		96(?)	Target DPI to use for sizing
HorizontalAlign	enum { Left (?), Center (?), Right(?) }		Center	
VerticalAlign	enum { Top (?), Middle (?), Bottom(?) }		Middle	
Stretch	enum Stretch { None, Fill, Uniform, UniformToFill }		None	**None**: Preserve original size **Fill**: Aspect ratio is not preserved and the content is scaled to fill the bounds established by tlbh **Uniform** Scale size uniformly until the image fits the bounds established by the tlwh. **UniformToFill**: Scale size uniformly to fill the bounds established by tlbh, and clipped.
ReadyState	enum { MetaDataReady, Loading, Loaded LoadError }			
LoadCounter	Int	Read	Null	Counter that increments when ReadyState is Loading
Name	String			Alternate text for the Image.

[0165] As described above, shapes correspond to geometry drawn with inherited and cascaded presentation properties. The following tables set forth example shape properties for the basic shape elements described above (Rectangle, Ellipse, Line, Polyline, Polygon). Note that these basic shapes may have stroke properties, fill properties, and used as clip paths, have inheritance characteristics, and apply to both the element and Resource levels:

Name	Type	R/RW	Default Value	Description
Fill	Brush	RW	null	Coordinate for the top side of the rect
FillOpacity	Float	RW	1.0	Coordinate for the left side of the rect
Stroke	Brush	RW	null	Width of the rect
StrokeOpacity	Float	RW	1.0	Height of the rect
StrokeWidth	BoxUnit	RW	1px	Width of the stroke. 1px = 1/96 of an inch
FillRule	enum { EvenOdd, NonZero }	RW	EvenOdd	FillRule indicates the algorithm which is to be used to determine what parts of the canvas are included inside the shape.
StrokeLineCap	enum { Butt, Round, Square, Diamond }	RW	Butt	StrokeLineCap specifies the shape to be used at the end of open subpaths when they are stroked.
StrokeLineJoi nt	enum { Miter, Round, Bevel }	RW	Miter	StrokeLineJoin specifies the shape to be used at the corners of paths (or other vector shapes) that are stroked when they are stroked.
StrokeMiterLi mit	Float	RW	4.0	The limit on the ratio of the MiterLength to the StrokeWidth. Value to be >= 1
StrokeDashArr ay	PointLis t	RW	null	StrokeDashArray controls the pattern of dashes and gaps used to stroke paths. <dasharray> contains a list of space- or comma-separated <number>s that specify the lengths of alternating dashes and gaps in user units. If an odd number of values is provided, then the list of values is repeated to yield an even number of values. Thus, stroke-dasharray: 5 3 2 is equivalent to stroke-dasharray: 5 3 2 5 3 2.
StrokeDashOff set	Point	RW		StrokeDashoffset specifies the distance into the dash pattern to start the dash.
Transform	Transfer m	RW	null	Transform establishes a new coordinate frame for the children of the element

(continued)

Name	Type	R/RW	Default Value	Description
Clip	Geometry	RW	null	Clip restricts the region to which paint can be applied on the canvas. The default clipping path is defined as the bounding box.

[0166] The following is an example markup syntax for a rectangle:

```
<Rectangle Top="600" Left="100" Width="100" Height="50"
Fill="red" Stroke="blue" StrokeWidth="10"/>
```

[0167] A rectangle has the following properties in the object model (note that rectangles are read/write, have default values equal to zero, support inheritance and apply to both the element and Resource levels):

Name	Type	Description
Top	BoxUnit	Coordinate for the top side of the rect
Left	BoxUnit	Coordinate for the left side of the rect
Width	BoxUnit	Width of the rect
Height	BoxUnit	Height of the rect
RadiusX	BoxUnit	For rounded rectangles, the X-axis radius of the ellipse used to round off the corners of the rectangle. If a negative X-axis radius is specified, the absolute value of the radius will be used.
RadiusY	BoxUnit	For rounded rectangles, the Y-axis radius of the ellipse used to round off the corners of the rectangle. If a negative X-axis radius is specified, the absolute value of the radius will be used.

[0168] The following is an example markup syntax for a circle:

```
<Circle CenterX="600" CenterY="100" Fill="red"
Stroke="blue" StrokeWidth="10"/>
```

A circle has the following properties in the object model (note that circles are read/write, have default values equal to zero, support inheritance and apply to both the element and Resource levels):

Name	Type	Description
CenterX	BoxUnit	X coordinate of the center of the circle
CenterY	BoxUnit	X coordinate of the center of the circle
Radius	BoxUnit	Radius of the circle

[0169] The following is an example markup syntax for an ellipse:

```
<Ellipse CenterX="600" CenterY="100" Fill="red"
Stroke="blue" StrokeWidth="10"/>
```

An ellipse has the following properties in the object model (note that ellipses are read/write, have default values equal to zero, support inheritance and apply to both the element and Resource levels):

Name	Type	Description
CenterX	Coordinate	X coordinate of the center of the ellipse
CenterY	Coordinate	X coordinate of the center of the ellipse
RadiusX	Length	The X-axis radius of the ellipse. If a negative X-axis radius is specified, the absolute value of the radius will be used.
RadiusY	Length	The Y-axis radius of the ellipse. If a negative Y-axis radius is specified, the absolute value of the radius will be used.

[0170] The following is an example markup syntax for a line:

```
<Line x1="100" y1="300" x2="300" y2="100"
StrokeWidth="5" />
```

A line has the following properties in the object model (note that lines are read/write, have default values equal to zero, support inheritance and apply to both the element and Resource levels):

Name	**Type**	**Description**
X1	BoxUnit	The X-axis coordinate of the start of the line. The default value is "0".
Y1	BoxUnit	The Y-axis coordinate of the start of the line. The default value is "0".
X2	BoxUnit	The X-axis coordinate of the end of the line. The default value is "0".
Y2	BoxUnit	The Y-axis coordinate of the end of the line. The default value is "0".

[0171] The 'Polyline' defines a set of connected straight line segments. Typically, a 'Polyline' defines an open shape.

[0172] The following is an example markup syntax for a polyline:

```
<Polyline Fill="None" Stroke="Blue" StrokeWidth="10cm"
Points="50,375
150,375 150,325 250,325 250,375
350,375 350,250 450,250 450,375
550,375 550,175 650,175 650,375
750,375 750,100 850,100 850,375
950,375 950,25 1050,25 1050,375
1150,375" />
```

A polyline has the following properties in the object model (note that lines are read/write, have default values equal to null, support inheritance and apply to both the element and Resource levels):

Name	Type	Description
Points	PointCollection	The points that make up the Polyline. Coordinate values are in the user coordinate system.

[0173] The Polygon element defines a closed shape comprising a set of connected straight line segments. The following is an example markup syntax for a polygon:

```
<Polygon Fill="red" Stroke="blue" StrokeWidth="10"
     points="350,75 379,161 469,161 397,215
     423,301 350,250 277,301 303,215
     231,161 321,161" />
```

A polygon has the following properties in the object model (note that lines are read/write, have default values equal to null, support inheritance and apply to both the element and Resource levels):

Name	Type	Description
Points	PointCollection	The points that make up the Polygon. Coordinate values are in the user coordinate system. If an odd number of coordinates are provided, then the element is in error.

[0174] The grammar for points specifications in 'polyline' and 'polygon' elements is described with the following notation:

```
*: 0 or more
+: 1 or more
?: 0 or 1
(): grouping
|: separates alternatives
double quotes surround literals
```

[0175] The following describes the points specifications in 'Polyline' and 'Polygon' elements using the above notation:

```
list-of-points:
    wsp* coordinate-pairs? wsp*

coordinate-pairs:
    coordinate-pair
    | coordinate-pair comma-wsp coordinate-pairs

coordinate-pair:
    coordinate comma-wsp coordinate

coordinate:
    number

number:
    sign? integer-constant
    | sign? floating-point-constant

comma-wsp:
    (wsp+ comma? wsp*) | (comma wsp*)

comma:
    ","

integer-constant:
    digit-sequence

floating-point-constant:
    fractional-constant exponent?
    | digit-sequence exponent

fractional-constant:
    digit-sequence? "." digit-sequence
```

```
    | digit-sequence "."

exponent:
    ( "e" | "E" ) sign? digit-sequence

sign:
    "+" | "-"

digit-sequence:
    digit
    | digit digit-sequence

digit:
    "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

wsp:
    (#x20 | #x9 | #xD | #xA)+
```

CONCLUSION

[0176] As can be seen from the foregoing detailed description, there is provided a system, method and element / object model that provide program code various mechanisms to interface with a scene graph. The system, method

and object model are straightforward to use, yet powerful, flexible and extensible.

[0177] While the invention is susceptible to various modifications and alternative constructions, certain illustrated embodiments thereof are shown in the drawings and have been described above in detail. It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions, and equivalents falling within the spirit and scope of the invention.

Claims

1. In a computing environment, a system comprising:

   a mechanism that interprets markup to construct an element tree of elements, at least some of the elements in the element tree having associated property data and corresponding to an element object model;
   a scene graph interface layer, comprising a set of at least one interface that populates a scene graph with objects in response to requests to create the objects, the objects corresponding to a scene graph object model; and
   a translator that translates at least some of the elements and property data in the element tree into requests to the scene graph interface layer to create objects in the scene graph.

2. The system of claim 1 wherein the elements of the element object model substantially correlate with the objects of the scene graph object model.

3. The system of claim 1 wherein the markup includes inline text including a string that defines an element property, and the translator communicates with a type converter to convert the string to an object property.

4. The system of claim 1 wherein the markup includes inline text comprising complex property syntax.

5. The system of claim 4 wherein the inline text is identified with a reference that is referred to at another location in the markup.

6. The system of claim 4 wherein the inline text is identified with a reference that refers to a file.

7. The system of claim 4 wherein the inline text is identified with a reference that corresponds to a file that may be downloaded from a remote location in a network.

8. The system of claim 1 wherein the markup includes inline text comprising complex property syntax corresponding to a graphical resource.

9. The system of claim 8 wherein the graphical resource describes a visual brush object, the translator providing resource level data for directly communicating with the scene graph interface layer to create a visual paint object corresponding to the element described by the complex property syntax.

10. The system of claim 9 wherein the resource level data is identified with a reference that is referred to at another location in the markup.

11. The system of claim 9 wherein the resource level data is identified with a reference that refers to a file.

12. The system of claim 9 wherein the resource level data is identified with a reference that refers to a file that may be downloaded from a remote location in a network.

13. The system of claim 1 wherein one of the elements of the element object model comprises an image element.

14. The system of claim 1 wherein one of the elements of the element object model comprises a video element.

15. The system of claim 1 wherein one of the elements of the element object model comprises a canvas element that contains a shape element.

16. The system of claim 1 wherein one of the elements of the element object model comprises a shape element.

17. The system of claim 16 wherein the shape element comprises a rectangle element.

18. The system of claim 16 wherein the shape element comprises a polyline element.

19. The system of claim 16 wherein the shape element comprises a polygon element.

20. The system of claim 16 wherein the shape element comprises a path element.

21. The system of claim 16 wherein the shape element comprises a line element.

22. The system of claim 16 wherein the shape element comprises an ellipse element.

23. The system of claim 16 wherein the shape element comprises a circle element.

24. The system of claim 16 wherein the shape element includes fill property data.

25. The system of claim 16 wherein the shape element includes stroke property data.

26. The system of claim 16 wherein the shape element includes clipping property data.

27. The system of claim 16 wherein the shape element includes transform property data.

28. The system of claim 16 wherein the shape element includes effect data.

29. The system of claim 16 wherein the shape element includes opacity data.

30. The system of claim 16 wherein the shape element includes blend mode data.

31. The system of claim 1 further comprising an engine that processes the scene graph data structure and provides commands to at least one lower level graphics component.

32. The system of claim 31 wherein the engine traverses the scene graph data structure.

33. The system of claim 31 wherein the engine transmits the scene graph data structure.

34. The system of claim 1 wherein the translator requests instantiation of at least one builder to create the objects.

35. A computer-implemented method, comprising:

parsing markup, the markup including tags and associated property data according to an object model;
interpreting a tag in the markup to determine whether the tag is directed to an element level or to a resource level;
and

a) if the tag is directed to the element level, creating an element based on the tag and property data associated with the tag and adding the element to an element tree for later translation into a scene graph object in a scene graph data structure; and
b) if the tag is directed to the resource level, providing data to directly create a scene graph object in the scene graph data structure via an interface to the scene graph data structure.

36. The method of claim 35 wherein objects of the element object model substantially correlate with objects in the scene graph data structure.

37. The method of claim 35 wherein the markup includes inline text for a tag property value and further comprising, communicating with a type converter to convert the inline text to an object property.

38. The method of claim 35 wherein the markup includes inline text for a tag property value having a reference to other text in the markup, and wherein interpreting the tag property value comprises interpreting the other text.

39. The method of claim 35 wherein the markup includes tags comprising complex property syntax for an element, and wherein interpreting the tags comprises interpreting the complex property syntax to determine that the tags are directed to the element level.

40. The method of claim 35 wherein the markup includes tags specifying complex property syntax for an element, and wherein interpreting the tags comprises interpreting the complex property syntax to determine that the element is directed to the resource level.

41. The method of claim 40 wherein interpreting the complex property syntax comprises detecting that the complex property syntax describes a property corresponding to a visual brush object.

42. The method of claim 40 wherein tags defining a visual brush object are referenced by an element in the element tree.

43. A computer-readable medium having computer-executable instructions for performing the method of claim 35.

44. A computer-readable medium having stored thereon a data structure, comprising:

a first set of data comprising a first set of tags and property data, in which the context in which the first set of tags is interpreted indicates that the first set of tags is directed to an element level;
a second set of data comprising a second set of tags and second property data, in which the context in which the second set of tags is interpreted corresponds to complex property syntax and indicates that the second set of tags is directed to a resource level; and
when the data structure is interpreted, the first set of data results in data corresponding to the first set of tags being created and inserted into an element-level tree based on the first information in the first set of text, and the second set of data results in data corresponding to the second set of tags being provided to directly create a scene graph object in a scene graph data structure at the resource level via an interface to the scene graph data structure, based on the second information in the second set of text.

45. The data structure of claim 44 further comprising a third set of data comprising a string corresponding to a property value.

46. The data structure of claim 44 wherein the first set of tags specify an identifier, and further comprising a third set of data that references the identifier.

47. The data structure of claim 46 wherein when interpreted, the third set of data results in data corresponding to the first set of tags being added to the element-level tree in a tree location for the third set of data.

48. The data structure of claim 44 wherein the second set of tags includes an identifier, and further comprising a third set of data that references the identifier.

49. The data structure of claim 44 wherein the second set of tags includes data formatted in a complex property syntax inline in markup.

50. The data structure of claim 49 wherein the complex property syntax describes a resource level element having a fill property corresponding to a visual paint object.

51. The data structure of claim 49 wherein the complex property syntax describes properties of an image element.

52. The data structure of claim 49 wherein the complex property syntax describes properties of a video element.

53. The data structure of claim 44 wherein the first set of tags describes properties of a shape element.

54. The data structure of claim 53 further comprising data in the data structure that describes a canvas element that contains the shape element.

55. The data structure of claim 53 wherein the properties of the shape element comprise fill property data.

56. The data structure of claim 53 wherein the properties of the shape element comprise stroke property data.

57. The data structure of claim 44 wherein the properties of the first element include clipping data.

58. The data structure of claim 44 wherein the properties of the first element include transform data

59. The data structure of claim 44 wherein the properties of the first element include opacity data.

60. The data structure of claim 44 wherein the properties of the first element include blend mode data.

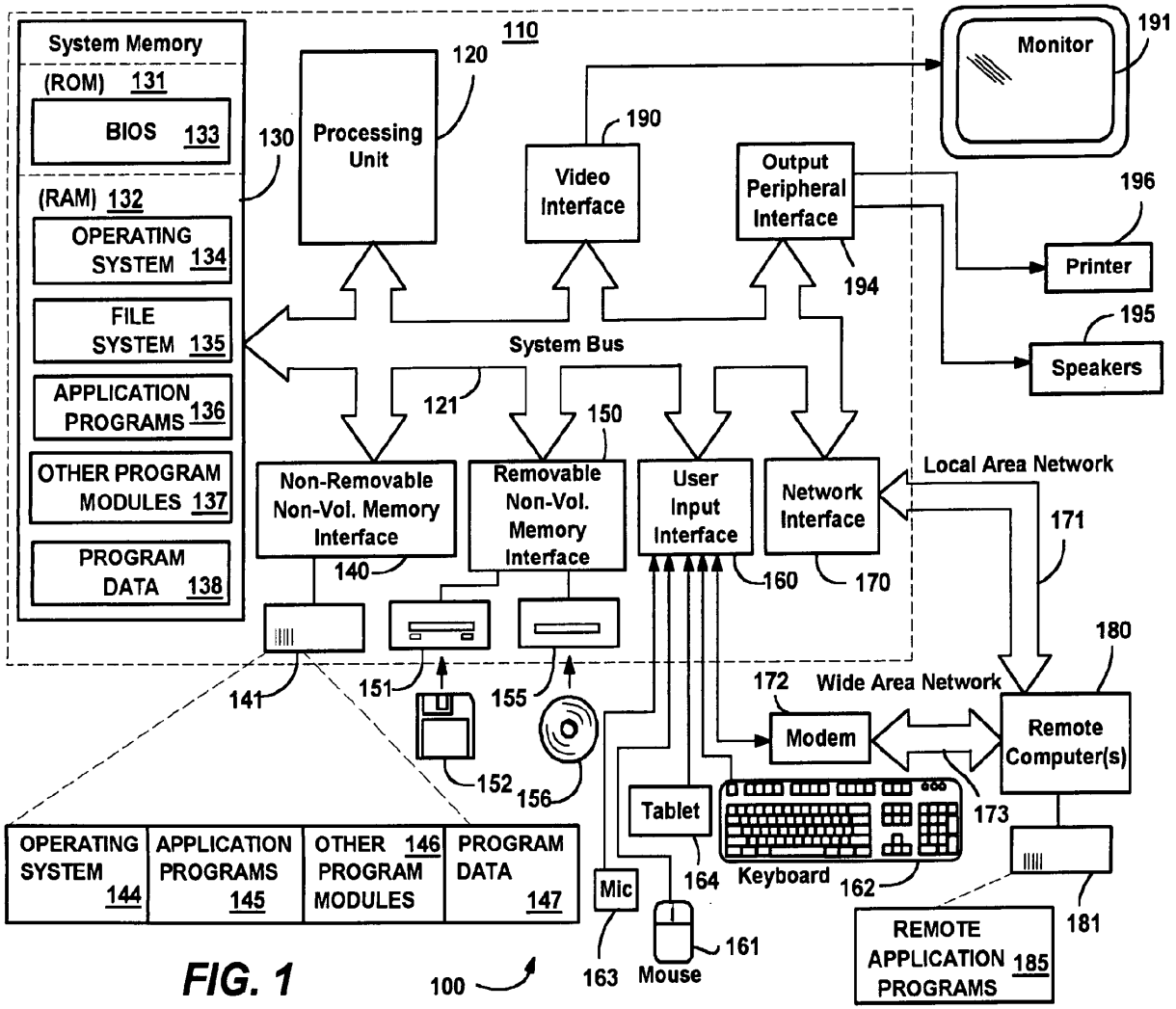

System Memory
(ROM) 131
BIOS 133
(RAM) 132
OPERATING SYSTEM 134
FILE SYSTEM 135
APPLICATION PROGRAMS 136
OTHER PROGRAM MODULES 137
PROGRAM DATA 138
110
120
130
Processing Unit
190
Video Interface
Output Peripheral Interface
194
Monitor
191
196
Printer
195
Speakers
System Bus
121
150
Non-Removable Non-Vol. Memory Interface
140
Removable Non-Vol. Memory Interface
User Input Interface
160
Network Interface
170
Local Area Network
171
180
172
Wide Area Network
Modem
Remote Computer(s)
173
141
151
155
152
156
Tablet
164
Keyboard
162
Mic
163
Mouse
161
181
REMOTE APPLICATION PROGRAMS 185
OPERATING SYSTEM 144
APPLICATION PROGRAMS 145
OTHER PROGRAM MODULES 146
PROGRAM DATA 147
100

FIG. 1

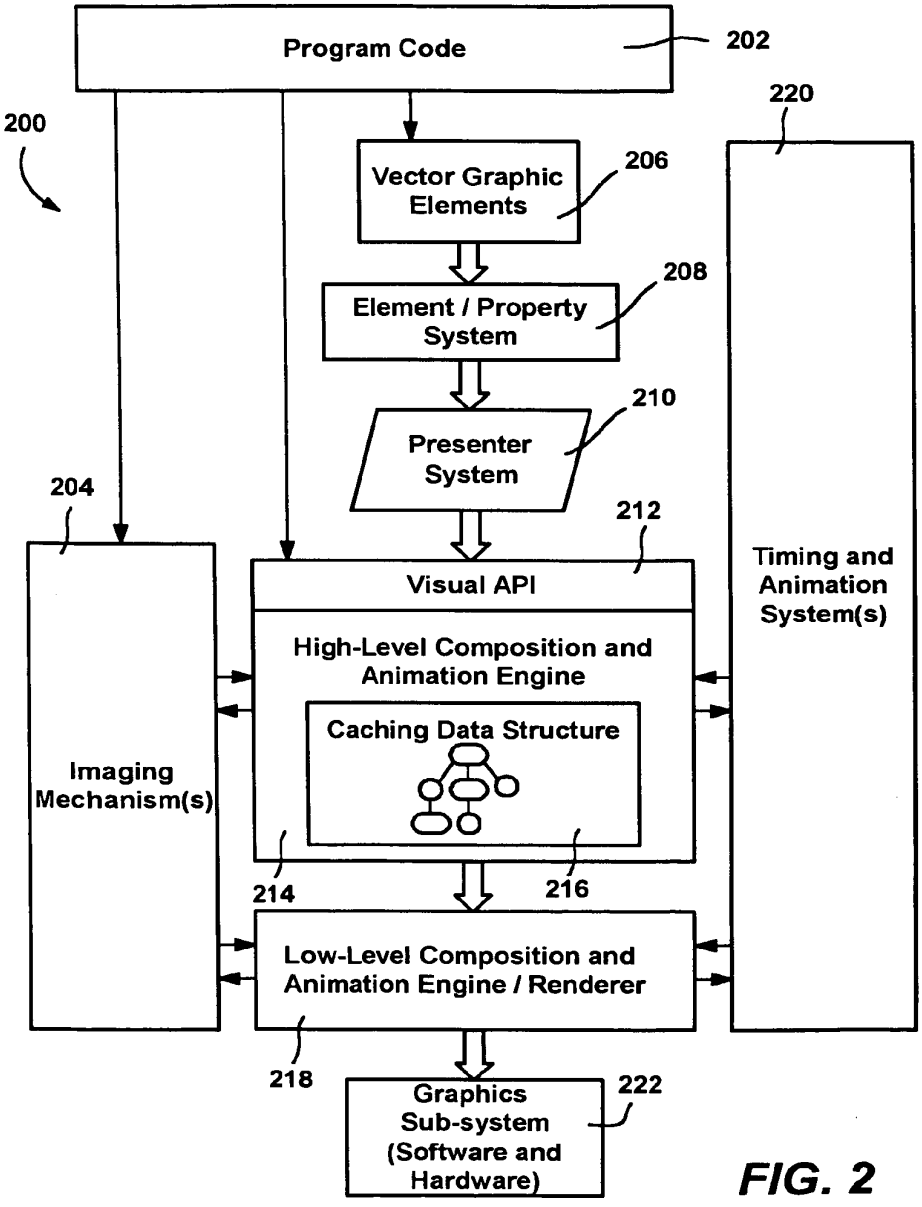

Program Code
202
200
220
Vector Graphic Elements
206
Element / Property System
208
Presenter System
210
204
212
Visual API
Timing and Animation System(s)
High-Level Composition and Animation Engine
Caching Data Structure
Imaging Mechanism(s)
214
216
Low-Level Composition and Animation Engine / Renderer
218
222
Graphics Sub-system (Software and Hardware)

FIG. 2

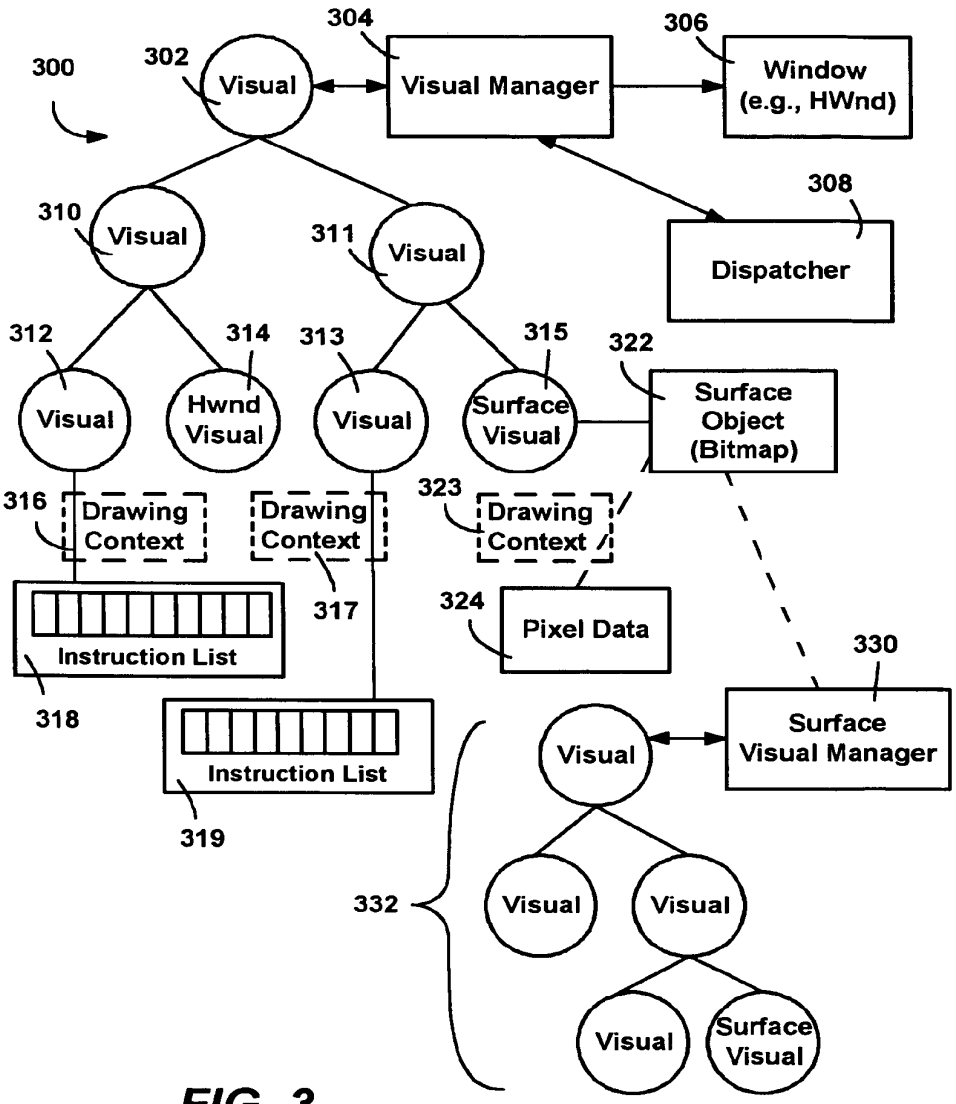

300
302
Visual
304
Visual Manager
306
Window
(e.g., HWnd)
308
Dispatcher
310
Visual
311
Visual
312
Visual
314
Hwnd
Visual
313
Visual
315
Surface
Visual
322
Surface
Object
(Bitmap)
316
Drawing
Context
Drawing
Context
317
323
Drawing
Context
324
Pixel Data
Instruction List
318
Instruction List
319
330
Surface
Visual Manager
332
Visual
Visual
Visual
Visual
Surface
Visual

FIG. 3

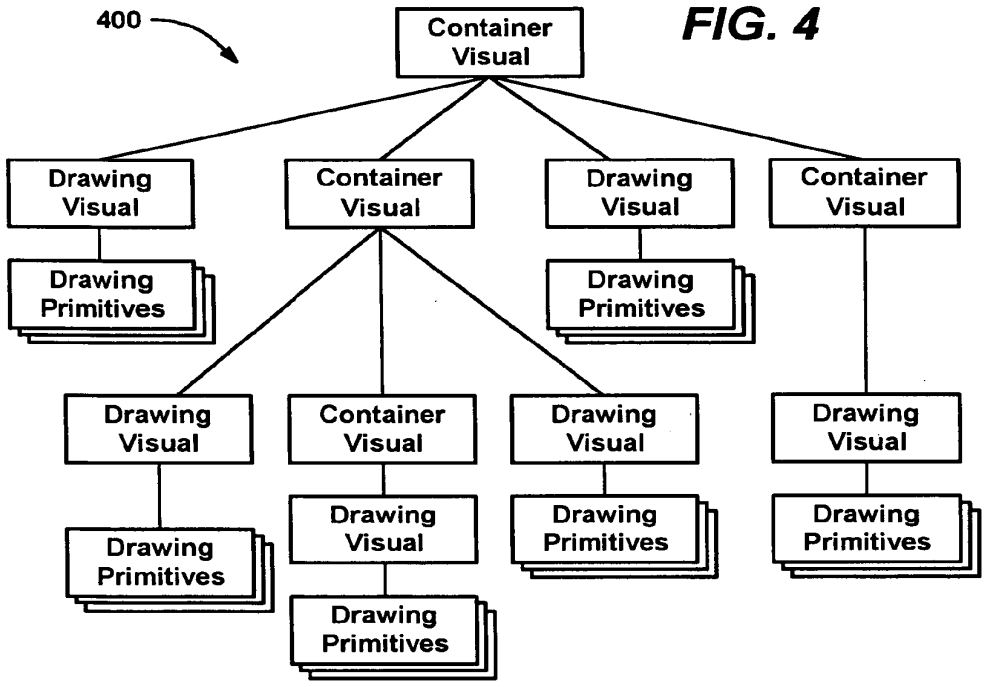

400
Container Visual
Drawing Visual
Container Visual
Drawing Visual
Container Visual
Drawing Primitives
Drawing Primitives
Drawing Visual
Container Visual
Drawing Visual
Drawing Visual
Drawing Primitives
Drawing Visual
Drawing Primitives
Drawing Primitives
Drawing Primitives

FIG. 4

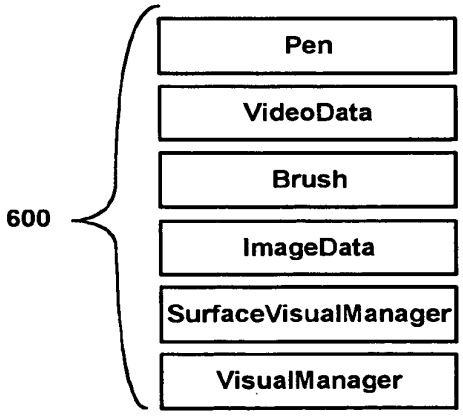

600
Pen
VideoData
Brush
ImageData
SurfaceVisualManager
VisualManager

FIG. 6

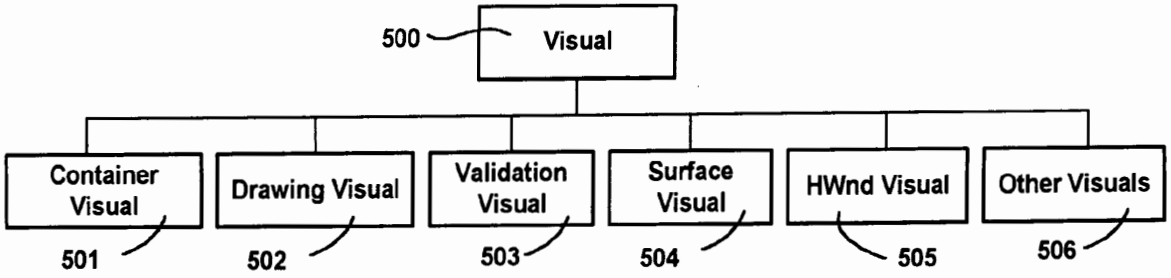

500
Visual
Container Visual
Drawing Visual
Validation Visual
Surface Visual
HWnd Visual
Other Visuals
501
502
503
504
505
506

FIG. 5

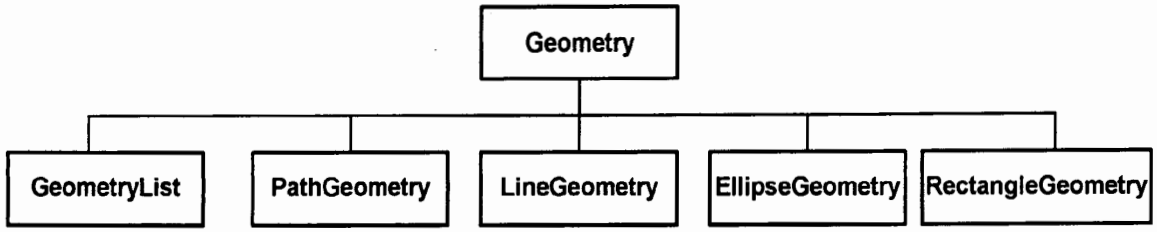

Geometry
GeometryList
PathGeometry
LineGeometry
EllipseGeometry
RectangleGeometry

FIG. 12

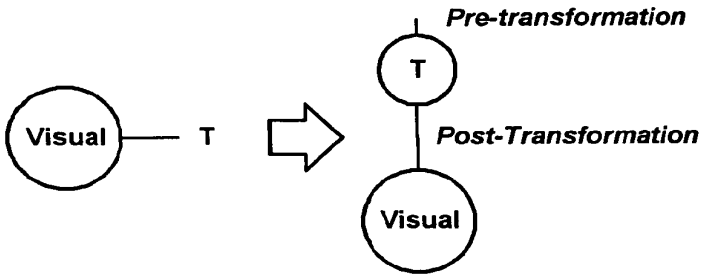

Pre-transformation
T
Visual
T
Post-Transformation
Visual

FIG. 7

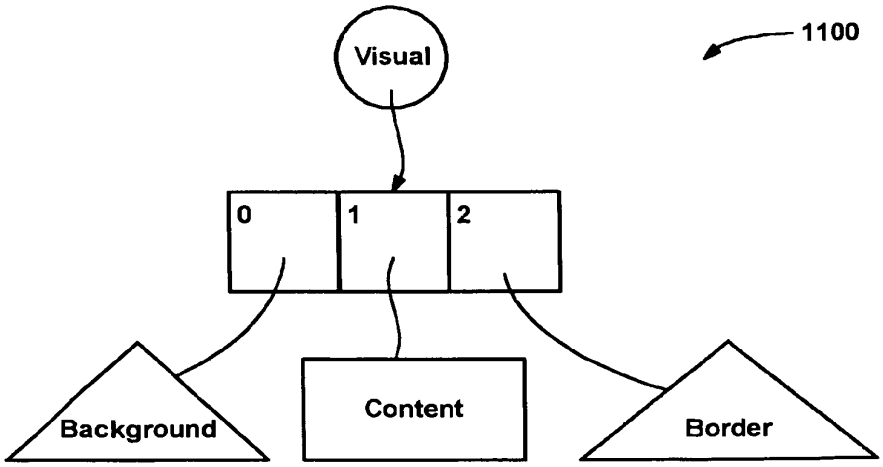

Visual
1100
0
1
2
Background
Content
Border

FIG. 11

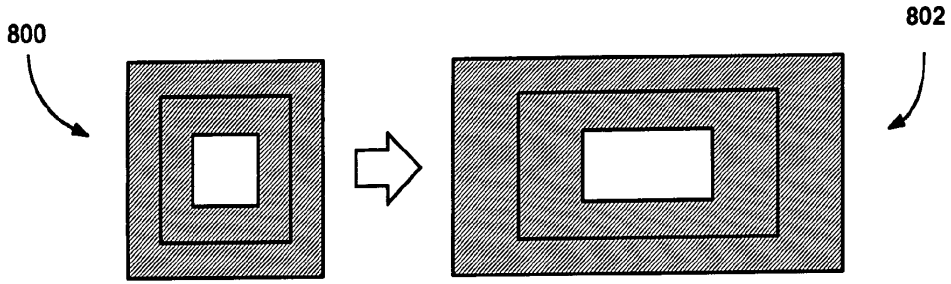


FIG. 8A

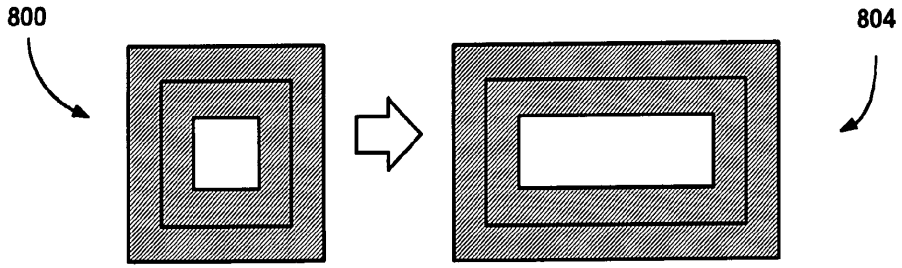


FIG. 8B

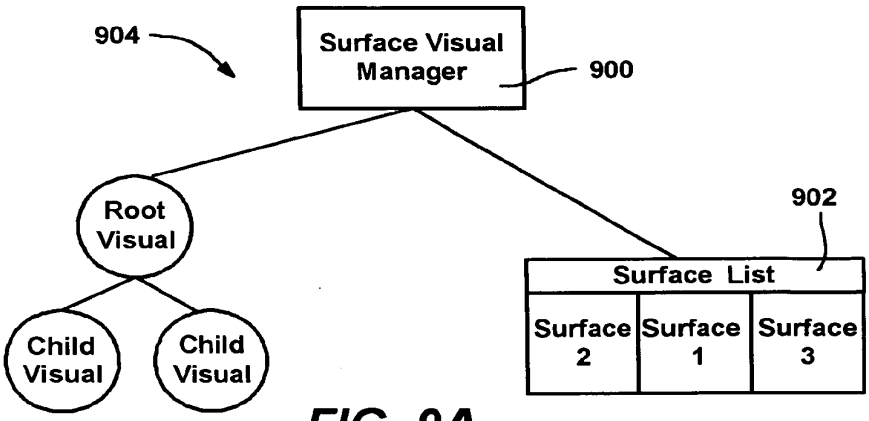

904
Surface Visual Manager
900
Root Visual
902
Surface List
Surface 2
Surface 1
Surface 3
Child Visual
Child Visual

FIG. 9A

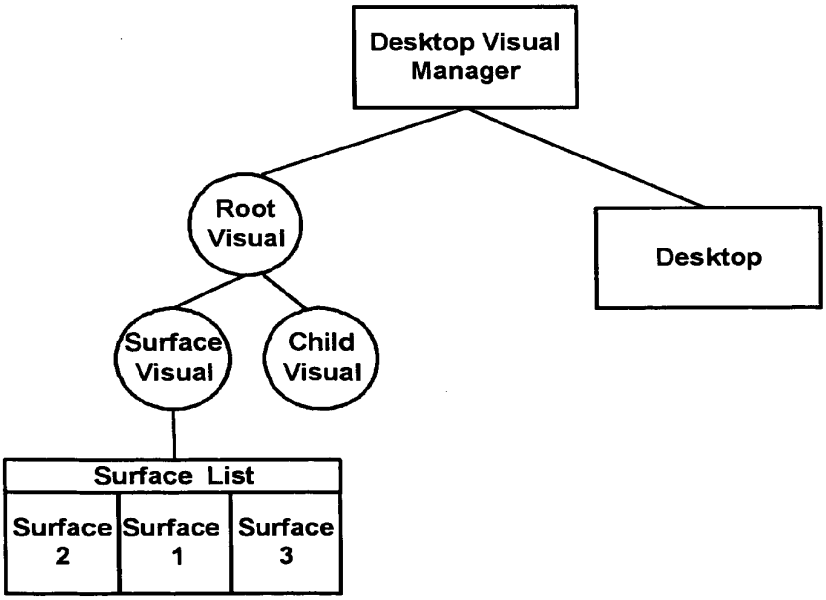

Desktop Visual Manager
Root Visual
Desktop
Surface Visual
Child Visual
Surface List
Surface 2
Surface 1
Surface 3

FIG. 9B

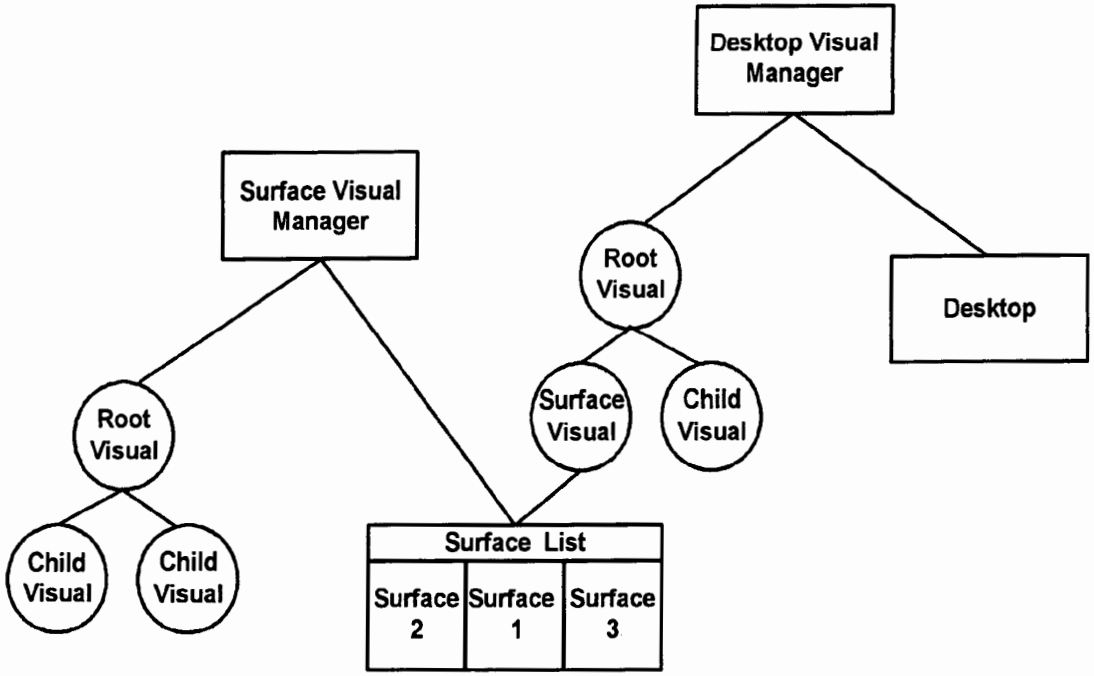

Desktop Visual Manager
Surface Visual Manager
Root Visual
Desktop
Root Visual
Surface Visual
Child Visual
Child Visual
Child Visual
Surface List
Surface 2
Surface 1
Surface 3

FIG. 9C

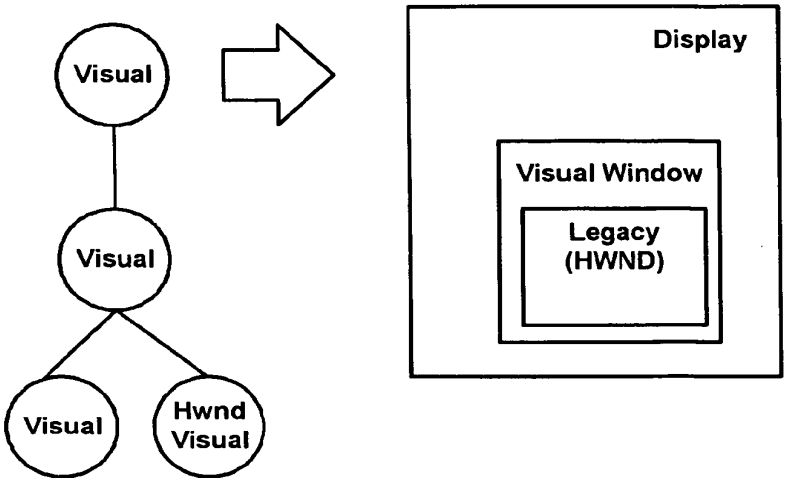


FIG. 10A

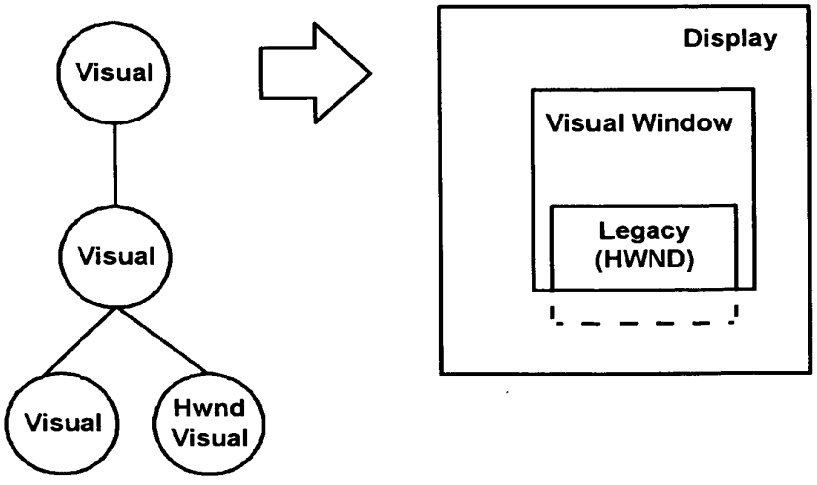


FIG. 10B

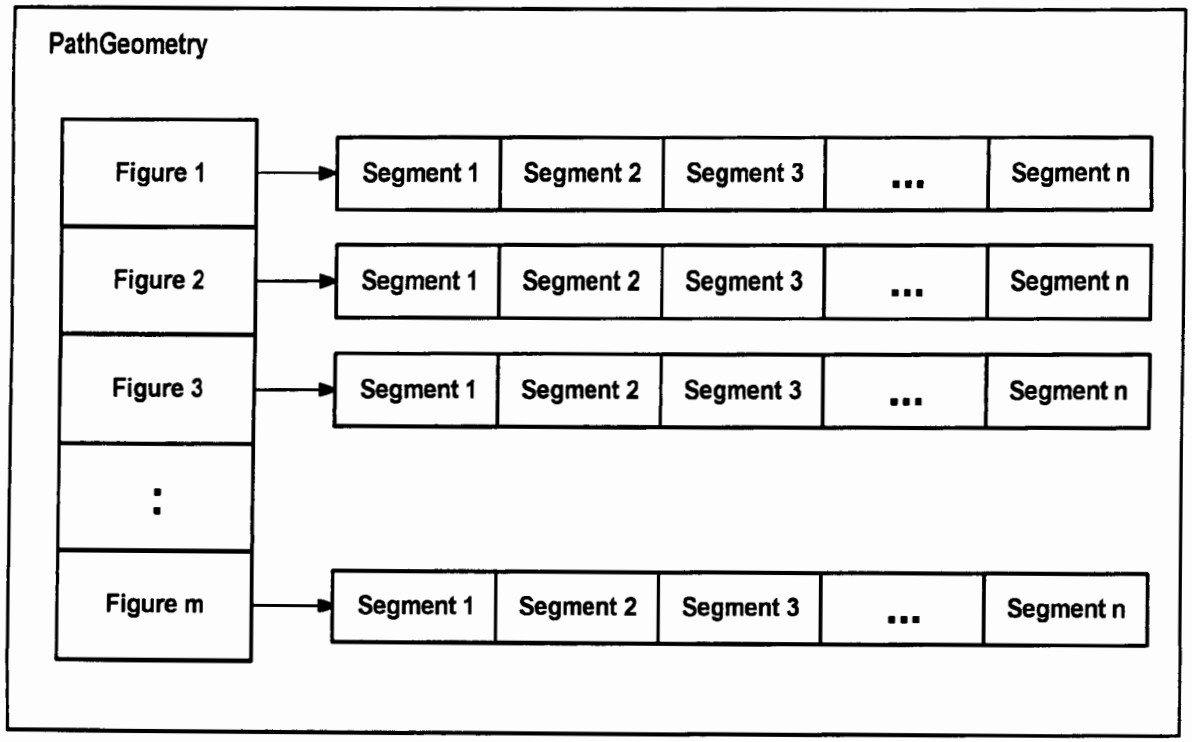

PathGeometry
Figure 1
Figure 2
Figure 3
:
Figure m
Segment 1
Segment 2
Segment 3
...
Segment n

FIG. 13

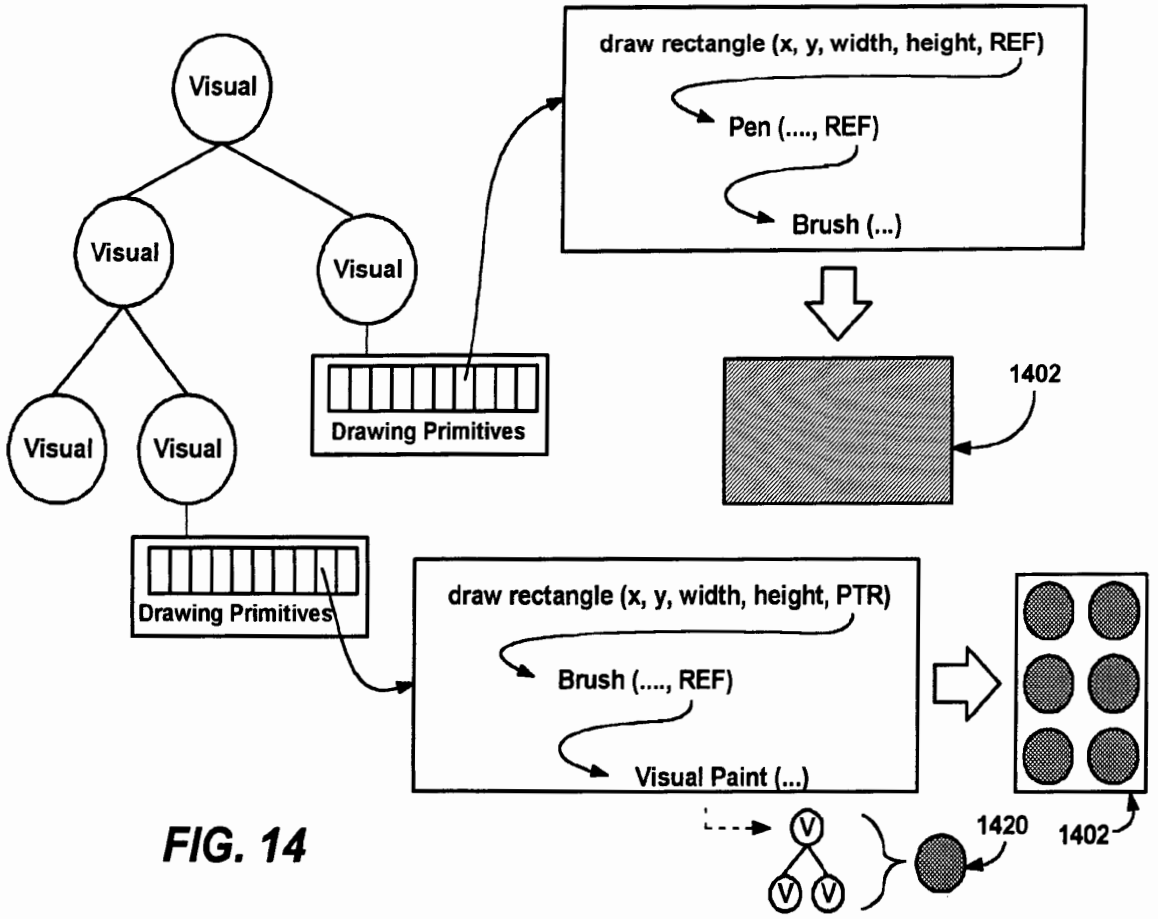

Visual
Visual
Visual
Visual
Visual
Drawing Primitives
Drawing Primitives
draw rectangle (x, y, width, height, REF)
Pen (...., REF)
Brush (...)
1402
draw rectangle (x, y, width, height, PTR)
Brush (...., REF)
Visual Paint (...)
V
V
V
1420
1402

FIG. 14

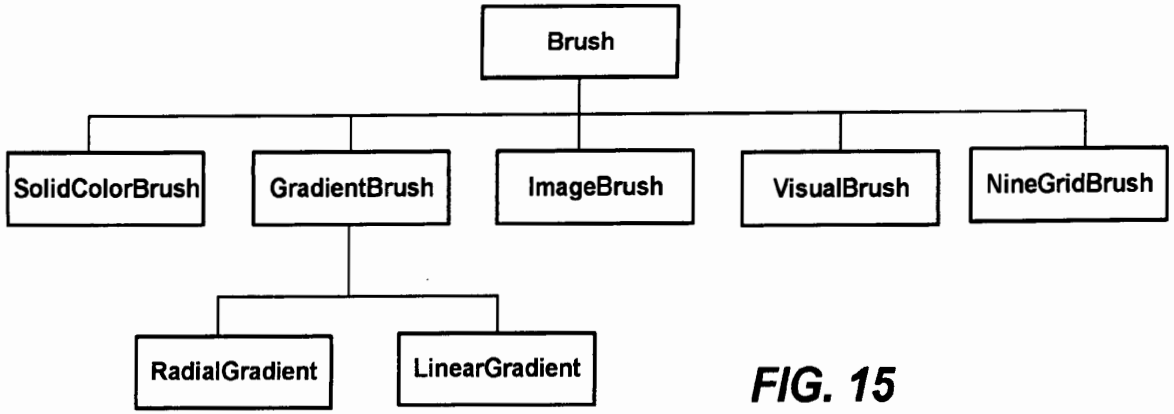

Brush
SolidColorBrush
GradientBrush
ImageBrush
VisualBrush
NineGridBrush
RadialGradient
LinearGradient

FIG. 15

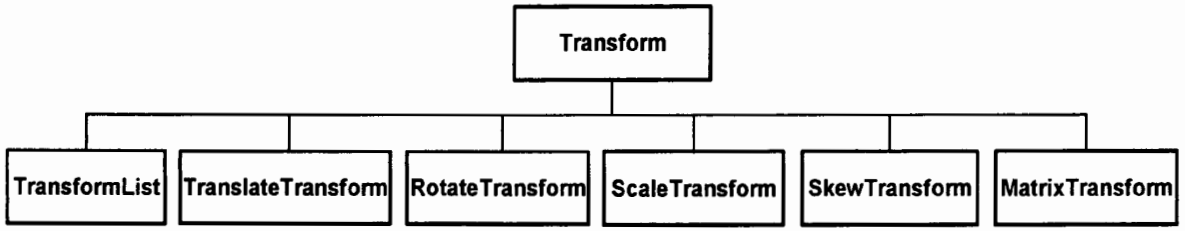

Transform
TransformList
TranslateTransform
RotateTransform
ScaleTransform
SkewTransform
MatrixTransform

FIG. 24

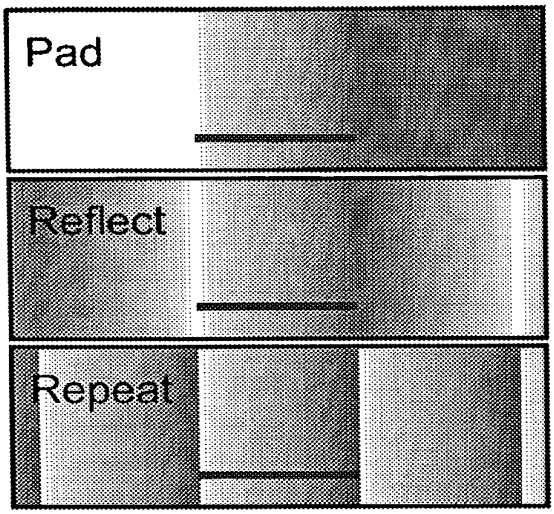


FIG. 16

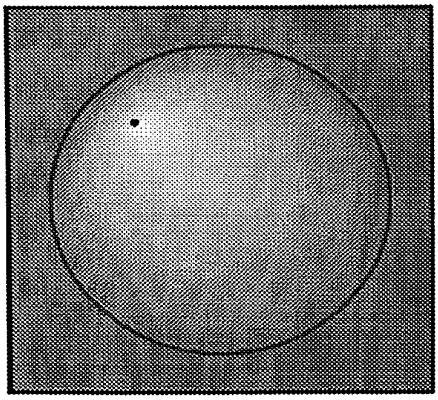


FIG. 17

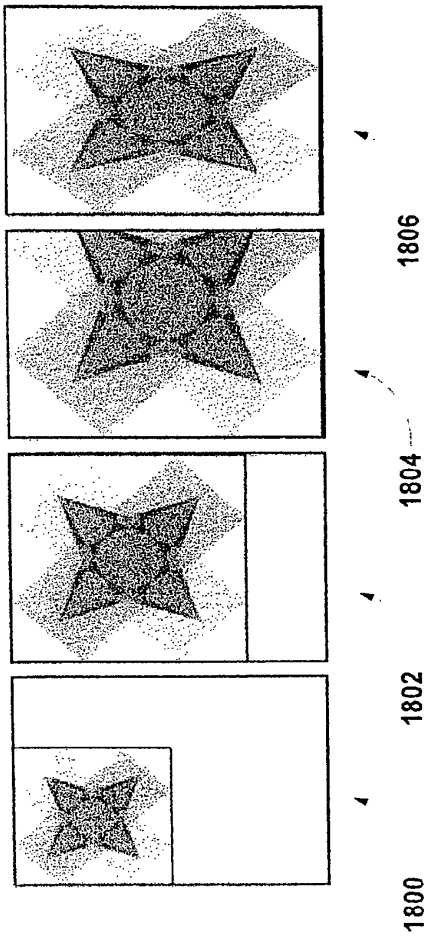


FIG. 18

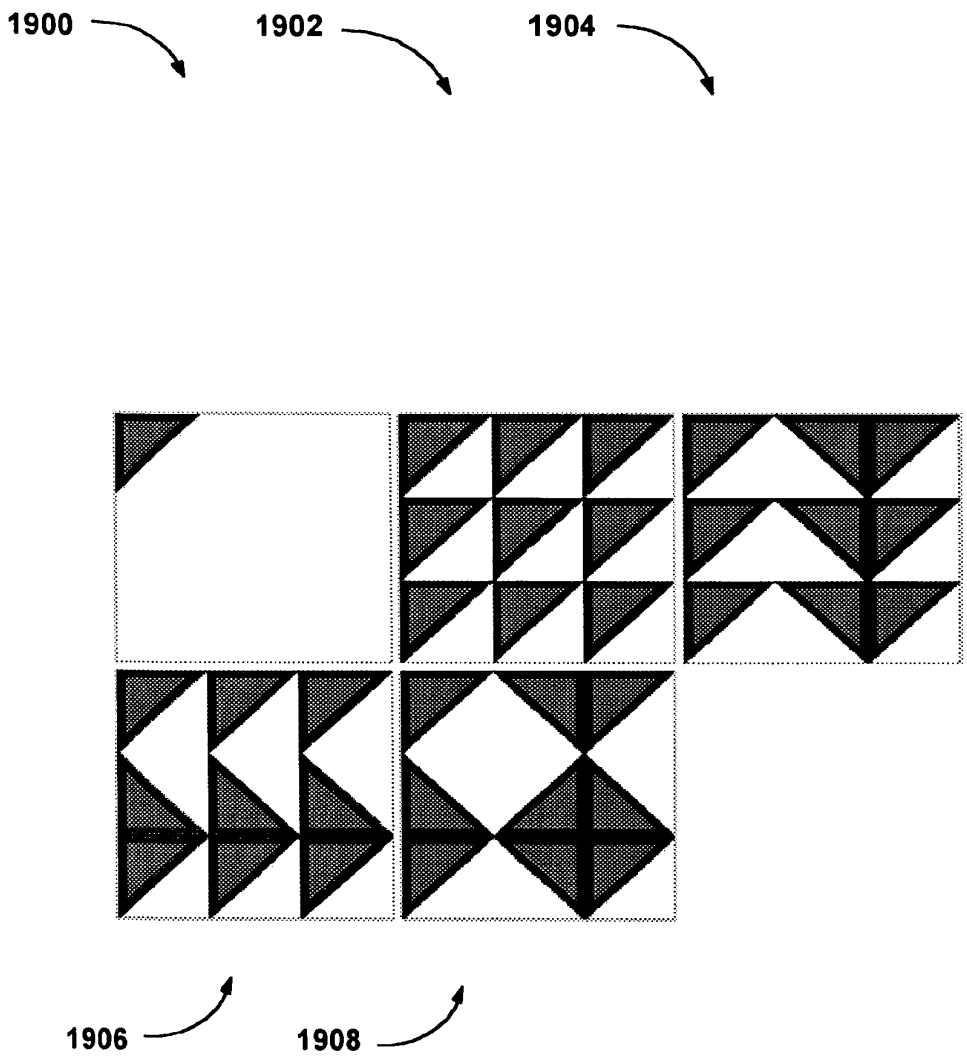


FIG. 19

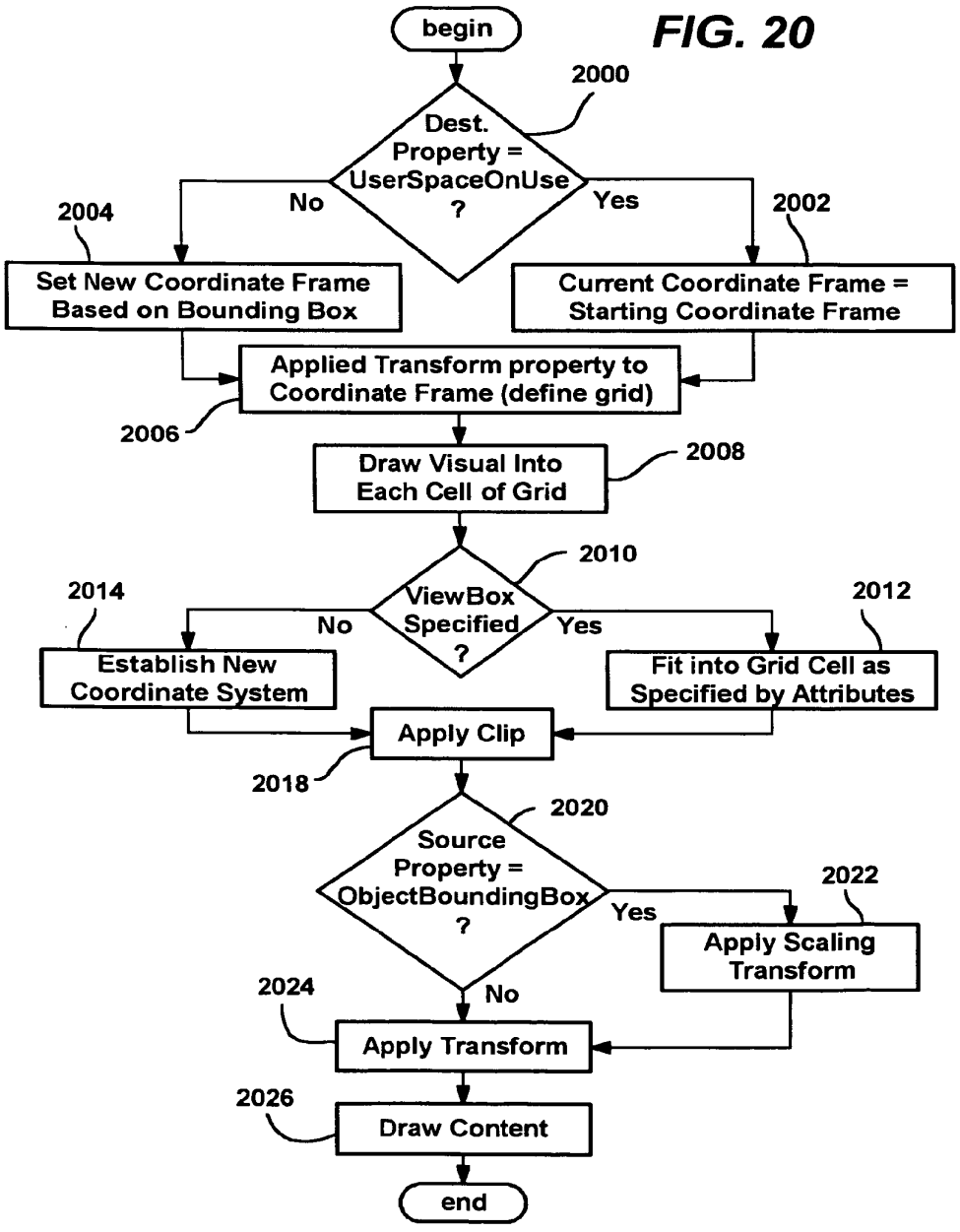

begin
2000
Dest. Property = UserSpaceOnUse ?
No
Yes
2004
2002
Set New Coordinate Frame Based on Bounding Box
Current Coordinate Frame = Starting Coordinate Frame
Applied Transform property to Coordinate Frame (define grid)
2006
Draw Visual Into Each Cell of Grid
2008
2010
ViewBox Specified ?
2014
2012
No
Yes
Establish New Coordinate System
Fit into Grid Cell as Specified by Attributes
Apply Clip
2018
2020
Source Property = ObjectBoundingBox ?
2022
Yes
Apply Scaling Transform
2024
No
Apply Transform
2026
Draw Content
end

FIG. 20

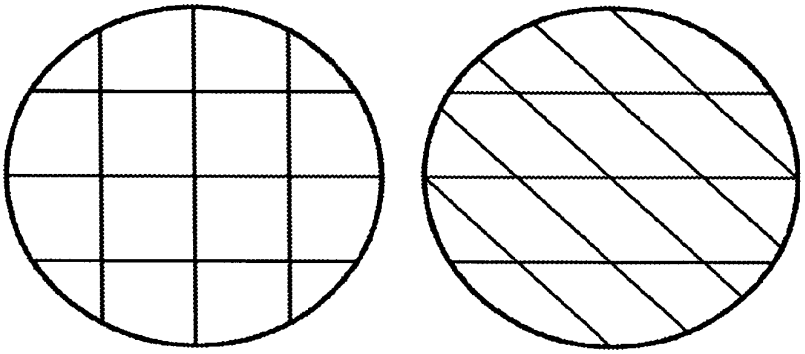


FIG. 21

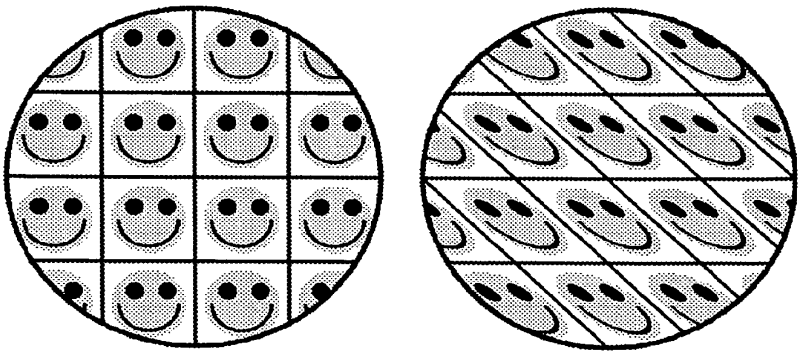


FIG. 22

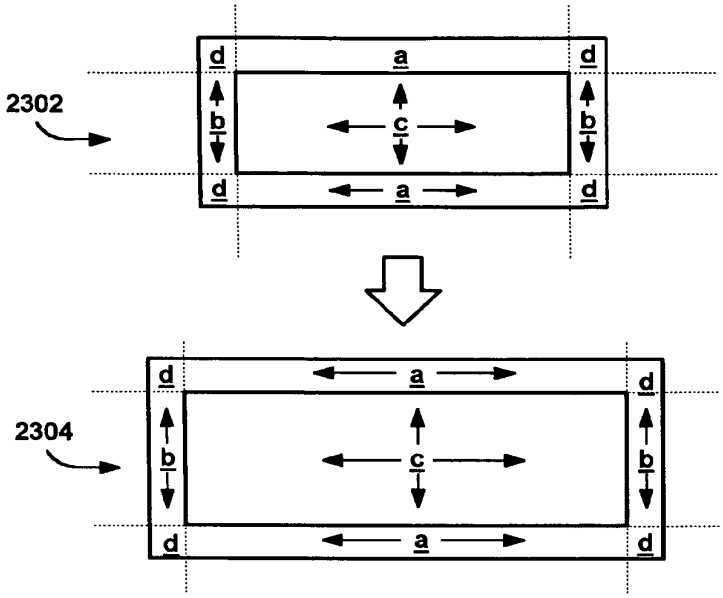

2302
d
a
d
b
c
b
d
a
d
2304
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a
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b
c
b
d
a
d

FIG. 23

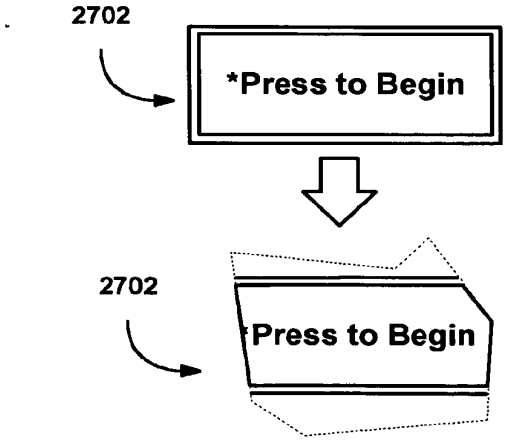

2702
*Press to Begin
2702
*Press to Begin

FIG. 27

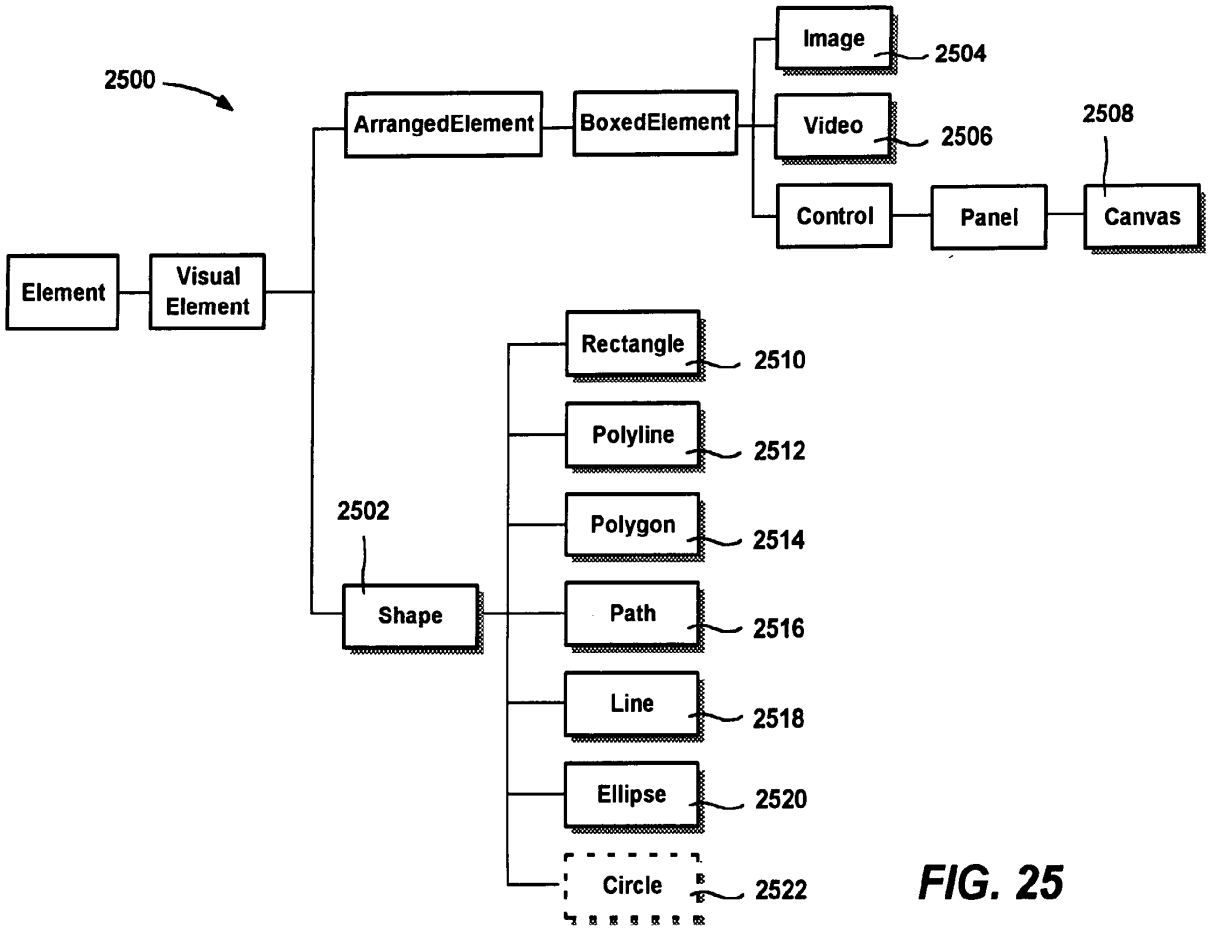

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2510
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Polygon
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Line
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Ellipse
2520
Circle
2522

FIG. 25

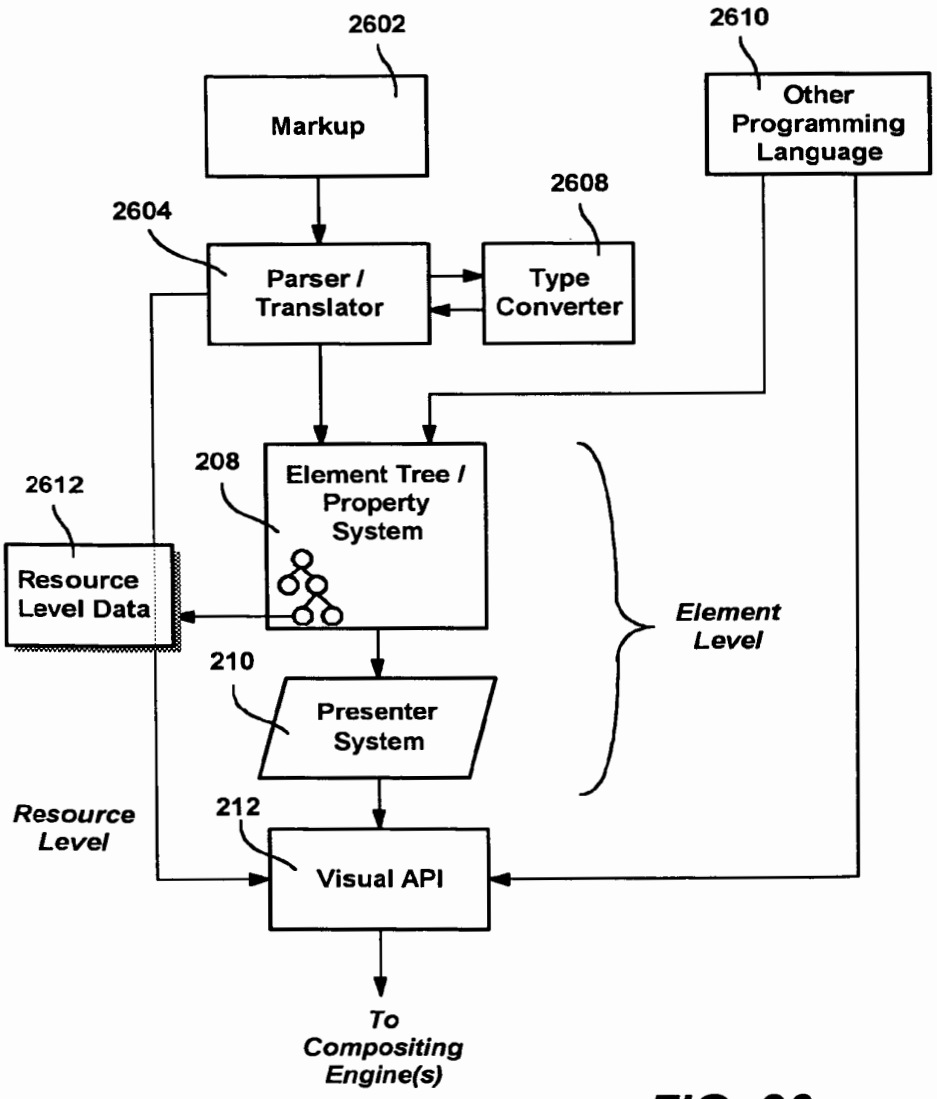

2602
Markup
2610
Other Programming Language
2604
Parser / Translator
2608
Type Converter
208
Element Tree / Property System
2612
Resource Level Data
Element Level
210
Presenter System
Resource Level
212
Visual API
To Compositing Engine(s)

FIG. 26

Electronic Acknowledgement Receipt

EFS ID:	42385640
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas Lee/Shelly Darrenkamp
Filer Authorized By:	Thomas Lee
Attorney Docket Number:	BEEL3004C/TL
Receipt Date:	07-APR-2021
Filing Date:	20-APR-2020
Time Stamp:	09:23:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	BEEL3004C_IDS.pdf	1034458 0a3734d89a6be4802cb6a7b7571c2fac57151269	no	4

Warnings:

Information:					
2	Foreign Reference	EP462998A2.pdf	3272703 27854a80eb58b3698861270b932ed5eaf0e57ba2	no	78
Warnings:					
Information:					
3	Non Patent Literature	ESR_7Apr2021.pdf	472421 6364ec0674c847addf72eab2c2b761059460f494	no	12
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(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Christopher A. Bartels
Attorney Docket Number	BEEL3004C/TL

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

	1	U.S. Office Action in corresponding U.S. Application No. 16/812,755, dated February 19, 2021.	

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	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

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See attached certification statement.

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A certification statement is not submitted herewith.

SIGNATURE

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Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2021-03-10
Name/Print	THOMAS LEE	Registration Number	66396

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

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EFS ID:	42138797
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas Lee/Shelly Darrenkamp
Filer Authorized By:	Thomas Lee
Attorney Docket Number:	BEEL3004C/TL
Receipt Date:	10-MAR-2021
Filing Date:	20-APR-2020
Time Stamp:	15:30:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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2	Non Patent Literature	OA1_19Feb2021.pdf	2904271 e528350d43ee0051813ebbd9ab986aca2fdfadbd	no	71
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Information:					
			Total Files Size (in bytes):	3938638	

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PTO/SB/08a (02-18)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Christopher A. Bartels
Attorney Docket Number	BEEL3004C/TL

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

	1	Chinese Office Action in corresponding Chinese Application No. 201810229467.1, dated January 8, 2021.	X

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	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

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Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2021-01-28
Name/Print	THOMAS LEE	Registration Number	66396

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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DESCRIPTION CN101566940A

10 Method and device for realizing universal serial bus audio transmission of wireless data terminal

[0001]

14 Technical field

[0002]

18 The invention relates to audio data transmission technology, in particular to a method and device for realizing universal serial bus audio transmission of a wireless data terminal.

[0003]

23 Background technique

[0004]

27 At present, Time Division-Synchronous Code Division Multiple Access (TD-SCDMA, Time Division-Synchronous Code Division Multiple Access) technology, as the third-generation mobile communication standard proposed by China, has matured day by day. With the support of TD-SCDMA technology, it can download data and The speed of uploading data to the network has been greatly improved, and the increase in speed will inevitably promote the increase of users' demand for audio services and video services.

[0005]

35 In the prior art, when processing audio data, the wireless data terminal directly sends the analog audio signal received from the air interface to the corresponding radio frequency, codec and other hardware devices for demodulation and decoding, and finally it is played by the speaker; The collected analog audio signal that

needs to be sent is encoded and modulated by the corresponding codec, radio frequency and other hardware devices and then sent out.

40 The disadvantage of this way of processing audio data is that, due to the need to encode and decode audio data, the wireless data terminal must be equipped with a corresponding codec, which increases hardware costs.

[0006]

45 To overcome the shortcomings of the aforementioned audio data processing methods, a currently popular implementation method is Universal Serial Bus Audio Transmission (VOUSB, Voice Over USB). The implementation of this method is briefly described with a widely used PC as a terminal device.

48 The wireless data terminal transmits the demodulated audio data to the PC through the USB interface for decoding and other processing; similarly, the audio data processed in the PC is transmitted to the wireless data terminal through the USB interface.

51 In this way, the wireless data terminal no longer needs a codec on the hardware, reducing the hardware cost. Moreover, compared to wireless data terminals, PCs have stronger computing power and more memory resources, so they have more powerful processing capabilities for audio data and can perform richer processing, such as: denoising, retouching, Mixing and other processing.

[0007]

58 Figure 1 is a schematic diagram of the implementation method of VOUSB in the prior art. The air interface of the wireless data terminal receives the analog audio signal sent by the remote device via the wireless communication network and transmits it to the radio frequency for demodulation. After that, the baseband processing module decodes it. The tuned audio data is amplified and digitally filtered to obtain a pulse code modulation (PCM, Pulse Code Modulation) code stream, and then transmit the PCM code stream to the USB driver on the wireless data terminal side, and the USB driver on the wireless data terminal side converts the PCM The code stream is transmitted to the USB endpoint of the wireless data terminal. Finally, in accordance with the batch transmission method of the USB standard, the PCM code stream is transmitted to the USB endpoint of the terminal device via the USB endpoint of the wireless data terminal.

67 Here, the role of the USB driver on the wireless data terminal side is to receive audio data from the baseband processing module and transmit it to the USB endpoint of the wireless data terminal, or read audio data from the USB endpoint of the wireless data terminal and transmit it to the baseband processing module. The characteristic of the USB standard batch transmission method is to support a large amount of data transmission within an uncertain time, which can guarantee that the data can be transmitted, but the transmission bandwidth and delay are not guaranteed, so the real-time performance of data transmission is not good; In addition, for the audio data transmitted in the USB standard batch transmission mode, the terminal device does not have a standard driver to process it. To process the audio data, it needs to be implemented with the help of a user interface (UI, User Interface). The process is as follows:

[0008]

79 For the PCM code stream sent by the wireless data terminal to the USB endpoint of the terminal device, the

terminal device side USB driver reads it, and the terminal device UI reads and releases it from the terminal device side USB driver. After that, the PCM code stream Transfer to a physical sound card.

82 The physical sound card decodes the transmitted PCM code stream, then obtains the analog audio signal through A/D conversion and other processing, and finally sends the analog audio signal to the speaker for playback. The physical sound card may be a sound card with a PCI interface or a USB sound card. Here, the role of the USB driver on the terminal device side is to read audio data from the USB endpoint of the terminal device and transmit it to the UI, or obtain audio data from the UI and transmit it to the USB endpoint of the terminal device.

[0009]

91 However, in the current implementation method based on VOUSB, the USB audio data transmission channel between the wireless data terminal and the terminal device is only used as the data transmission channel. The problem that this brings is that there is no special optimization for the characteristics of audio data transmission. In terms of real-time performance, it has affected the practical application of VOUSB.

[0010]

98 Summary of the invention

[0011]

102 In view of this, the main purpose of the present invention is to provide a method and device for realizing universal serial bus audio transmission of a wireless data terminal, making full use of the powerful ability of the terminal device to process audio data and enhancing the practical application effect of VOUSB.

[0012]

108 In order to achieve the above objective, the technical scheme of the present invention is achieved as follows:

[0013]

112 The invention discloses a method for realizing universal serial bus audio transmission of a wireless data terminal. The USB audio data transmission channel between the wireless data terminal and the terminal device is enumerated as a USB sound card device. The key is that the method includes the following steps:

[0014]

118 The wireless data terminal sends audio data to the terminal device through the USB sound card device, and the terminal device accesses the USB sound card device through its own audio device driver to obtain audio data; the terminal device sends audio to the USB sound card device through its own audio device driver Data, the wireless data terminal receives the audio data through the USB sound card device.

[0015]

125 The enumerating the USB audio data transmission channel between the wireless data terminal and the terminal device as a USB sound card device includes: the wireless data terminal defines the wireless data terminal USB endpoint that transmits audio data as a sound card, and sets the wireless data terminal USB The endpoint is connected to the USB endpoint of the terminal device through a USB data cable; the terminal device requests the wireless data terminal to obtain the device descriptor, configuration descriptor, and descriptor set of the connected sound card. After the wireless data terminal receives the request, it sends the device description to the terminal device According to the acquired device descriptor, configuration descriptor, and descriptor set, the terminal device determines the driver that can provide USB, loads the corresponding audio device driver that conforms to the USB specification, and the audio device driver performs the operation on the sound card Configure to get a USB sound card device.

[0016]

138 The terminal device includes an audio device driver, a user interface UI, and a physical sound card. The terminal device accesses the USB sound card device to obtain audio data through its own audio device driver, including: the audio device driver accesses the USB sound card device interface The USB sound card device reads and releases the pulse code modulation PCM code stream transmitted to the USB sound card device; the UI accesses the audio device driver through the audio device interface, and transmits the PCM code stream to the physical sound card.

[0017]

147 The terminal device includes an audio device driver, a user interface UI, and a physical sound card. The terminal device sends audio data to the USB sound card device through its own audio device driver, including: the physical sound card obtains a PCM code stream from an analog audio signal; UI Obtain the PCM code stream from the physical sound card, and transmit the PCM code stream to the audio device driver through the audio device interface of the audio device driver, and the audio device driver sends the PCM code stream to the USB sound card device.

[0018]

156 The invention also discloses a device for realizing universal serial bus audio transmission of a wireless data terminal. The device includes: a wireless data terminal, a USB sound card device and a terminal device,

[0019]

161 The wireless data terminal is used to send audio data to the terminal device through a USB sound card device, and to receive audio data from the terminal device through the USB sound card device.

[0020]

166 USB sound card device, used to transmit audio data between the wireless data terminal and the terminal device;

[0021]

171 The terminal device is used to access the USB sound card device through its own audio device driver to obtain audio data from the wireless data terminal, and send audio data to the USB sound card device through its own audio device driver.

[0022]

177 The USB sound card device includes: a wireless data terminal-side USB driver, a wireless data terminal USB endpoint, and a terminal device USB endpoint, wherein the wireless data terminal-side USB driver is connected to the baseband processing module of the wireless data terminal; the wireless data terminal The USB endpoint is connected with the USB endpoint of the terminal device through a USB data line; the USB endpoint of the terminal device is connected with the audio device driver of the terminal device.

[0023]

185 The terminal device includes an audio device driver, a user interface UI, and a physical sound card. The audio device driver is used to access the USB endpoint of the terminal device by accessing the USB sound card device interface, and the PCM code stream transmitted to the USB endpoint of the terminal device Read and release; UI is used to access the audio device driver through the audio device interface, and transmit the PCM code stream to the physical sound card; the physical sound card is used to obtain the analog audio signal from the PCM code stream.

[0024]

194 The terminal device includes an audio device driver, a user interface UI, and a physical sound card. The physical sound card is used to obtain the PCM code stream from the analog audio signal; the UI is used to obtain the PCM code stream from the physical sound card and drive the audio through the audio device. The device interface transmits the PCM code stream to the audio device driver; the audio device driver is used to send the PCM code stream to the USB endpoint of the terminal device.

[0025]

202 It can be seen that, compared with the prior art, the method and device for realizing universal serial bus audio transmission of a wireless data terminal provided by the present invention has the following characteristics and advantages:

[0026]

208 First, the USB audio data transmission channel between the wireless data terminal and the terminal device is enumerated into a USB sound card device to transmit audio data using the standard USB AUDIO CLASS defined by the USB specification, and the operating system on the widely used terminal device Both provide the implementation of audio device drivers conforming to the USB specification by default. Therefore, the audio device driver accesses the USB endpoint of the terminal device by accessing the USB sound card device interface; the audio device driver reads the audio data read from the USB endpoint And release.

[0027]

217 Secondly, using the USB standard synchronous transmission method to transmit audio data has good real-time performance, and the terminal device has a standard driver for the synchronous transmission method, that is, the audio device driver, which reads and releases the audio data of the terminal device USB endpoint. It is done in the audio device driver, and its processing priority is higher than that in the application UI. Therefore, when the terminal device system is heavily loaded, the audio data processing still has good real-time performance.

[0028]

226 Finally, the UI accesses the audio device driver through the audio device interface, and transmits the released audio data to the physical sound card.

228 Since the UI accesses the audio device driver through the audio device interface, it reduces the UI's dependence on the audio device driver; the audio device interface is a standard interface, and there is no need to pay attention to the details of the underlying audio device driver implementation, and the operating system has good portability, allowing the UI It is simpler and more reliable to implement.

[0029]

235 According to the characteristics of audio data transmission, the USB audio data transmission channel is abstracted and optimized, and the powerful ability of terminal equipment to process audio data is fully utilized to enhance the practical application effect of VOUSB.

[0030]

241 Description of the drawings

[0031]

245 Figure 1 is a schematic diagram of a method for implementing VOUSB in the prior art;

[0032]

249 Fig. 2 is a schematic diagram of abstracting the USB audio data transmission channel into a USB sound card device in the present invention;

[0033]

254 Fig. 3 is a transmission flow chart of the wireless data terminal as the audio data receiver in the present invention;

[0034]

259 Figure 4 is a transmission flow chart of the wireless data terminal as the audio data sender in the present invention;

[0035]

264 Fig. 5 is a schematic diagram of the device structure for realizing universal serial bus audio transmission of a wireless data terminal in the present invention.

[0036]

269 Detailed ways

[0037]

273 The present invention will be further described in detail below in conjunction with the drawings and specific embodiments.

[0038]

278 Figure 2 is a schematic diagram of abstracting the USB audio data transmission channel into a USB sound card device in the present invention.

280 Compared with Figure 1, in the present invention, the USB sound card application method in the USB specification is used to abstract the USB audio data transmission channel between the wireless data terminal and the terminal device into a USB sound card device.

283 The USB audio data transmission channel refers to the audio data transmission channel including the USB driver on the wireless data terminal side, the USB endpoint of the wireless data terminal, the USB endpoint of the terminal device, and the USB data line between two USB endpoints.

286 The key to abstract the USB audio data transmission channel into a USB sound card device is to enumerate the USB audio data transmission channel into a USB sound card device using the standard USB AUDIO CLASS defined by the USB specification.

289 The enumeration is achieved through the following steps: first, the wireless data terminal side defines the

wireless data terminal USB endpoint that transmits audio data as a sound card, and connects the wireless data terminal USB endpoint to the terminal device USB endpoint through a USB data cable; After that, the terminal device sends a request to the wireless data terminal to request information such as the device descriptor, configuration descriptor, descriptor set, etc. of the connected sound card; after receiving the request, the wireless data terminal sends the requested device descriptor to the terminal device , Configuration descriptors, descriptor sets and other information; then, after the terminal device obtains this information and determines the driver that can provide USB based on this information, it loads the corresponding audio device driver that conforms to the USB specification; finally, the terminal device gets various descriptions After the symbol, it is considered that the information of the connected sound card is complete, and the sound card is configured by the audio device driver. If the configuration is successful, the audio data transmission between the wireless data terminal and the terminal device can be realized.

301 At this point, the enumeration process ends, and the USB audio data transmission channel is enumerated into a USB sound card device.

303 The wireless data terminal is connected with the USB driver of the wireless data terminal side of the USB sound card device; the terminal device is connected with the USB end point of the terminal device of the USB sound card device.

[0039]

309 Different from the audio data processing capabilities of physical sound cards such as ordinary USB sound cards, and can directly send the processed audio data to the speakers for playback, the USB sound card device is characterized by the same access interface and use method as the physical sound card. To the user, it seems to be an actual physical sound card, but in fact, this USB sound card device only has the function of audio data transmission, and does not have the real audio data processing capability. If you want to process the received audio data, Need to rely on the physical sound card on the terminal device to achieve.

315 For the audio data sent by the terminal device to the wireless data terminal, the wireless data terminal will transmit to the remote device through the wireless communication network.

317 The remote device may be a wireless data terminal or terminal device.

318 If the remote device needs to process the received audio data, if the remote device is a terminal device, directly use the physical sound card on the terminal device to process the audio data and play it; if the remote device is a wireless data terminal , The received audio data is transmitted to the terminal device connected to the wireless data terminal through the USB sound card device, and the audio data is processed by the physical sound card on the terminal device and played.

[0040]

326 Since the USB audio data transmission channel between the wireless data terminal and the terminal device is enumerated into a USB sound card device using the standard USB AUDIO CLASS defined by the USB specification, the audio data transmission is realized, and the operating system on the widely used terminal device Both provide the implementation of audio device drivers that comply with the USB specification by default. Therefore, for the audio data sent by the wireless data terminal to the USB endpoint of the USB sound card device, the audio device driver accesses the terminal by accessing the USB sound card device

interface. Device USB endpoint; when accessing the terminal device USB endpoint, the audio device driver reads and releases the audio data sent to the terminal device USB endpoint. Compared with the existing audio data read and released by the application UI, The audio device driver has a higher priority for reading and releasing. Therefore, even when the terminal device system is heavily loaded, the audio data processing still has good real-time performance; in addition to the audio device driver downward access to the terminal device USB endpoint, The audio device interface can also be provided upwards. The audio device interface is a standard interface. When the UI accesses the audio device interface, there is no need to pay attention to the details of the low-level audio device driver implementation, and the operating system is portable. The UI can be accessed through the audio device interface The audio device drives and transfers the audio data to the physical sound card, which reduces the UI's dependence on the audio device drive, and makes the UI simpler and more reliable.

[0041]

340 Specifically, the process of using a USB sound card device to implement audio data transmission is shown in Figure 3 and Figure 4.

[0042]

351 Figure 3 is a transmission flow chart of a wireless data terminal as a receiver of audio data. The transmission of audio data includes the following steps:

[0043]

356 Step 301: The air interface of the wireless data terminal receives the analog audio signal sent by the remote device via the wireless communication network, and transmits it to the radio frequency and other hardware for demodulation. After that, the baseband processing module amplifies the demodulated audio data. Digital filter processing, get PCM code stream.

[0044]

363 Step 302: The PCM code stream obtained after processing is transmitted by the baseband processing module of the wireless data terminal to the USB driver of the wireless data terminal side of the USB sound card device; after that, according to the synchronous transmission mode of the USB standard, the PCM code stream passes through the USB endpoint of the wireless data terminal And the USB data line is transferred to the USB endpoint of the terminal device of the USB sound card device.

[0045]

371 Step 303: After the PCM code stream is transmitted to the terminal device USB endpoint, the audio device driver of the terminal device accesses the terminal device USB endpoint by accessing the USB sound card device interface, and reads the PCM code stream transmitted to the terminal device USB endpoint After

fetching and releasing, the UI accesses the audio device driver through the audio device interface, and transmits the PCM code stream to the physical sound card.

[0046]

379 Step 304: The physical sound card decodes the transmitted PCM code stream and processes the D/A conversion to obtain an analog audio signal. Finally, the analog audio signal is transmitted to the speaker for playback.

[0047]

385 Figure 4 is a transmission flow chart of a wireless data terminal as a sender of audio data. The transmission of audio data includes the following steps:

[0048]

390 Step 401: The microphone of the terminal device transmits the collected analog audio signal to the physical sound card, and the physical sound card performs A/D conversion, encoding and other processing on it to obtain a digital audio signal in the form of a PCM code stream.

[0049]

396 Step 402: The UI of the terminal device obtains the PCM code stream from the physical sound card, and transmits the PCM code stream to the audio device driver through the audio device interface driven by the audio device. The audio device driver compresses the PCM code stream, and then the audio device driver Return the PCM code stream to the terminal device USB endpoint of the USB sound card device by accessing the USB sound card device interface.

[0050]

404 Step 403: After the PCM code stream is transmitted to the USB endpoint of the terminal device of the USB sound card device, according to the synchronous transmission mode of the USB standard, the PCM code stream is transmitted to the wireless data terminal USB endpoint of the USB sound card device through the USB data line.

[0051]

411 Step 404: The baseband processing module of the wireless data terminal obtains the PCM code stream transmitted to the USB endpoint of the wireless data terminal through the USB driver on the wireless data terminal side, performs amplification and digital filtering, and modulates by radio frequency to obtain an analog audio signal. Finally, The air interface is sent to the remote device via the wireless communication network.

[0052]

419 In order to realize the above method, the present invention also provides a device for realizing universal serial bus audio transmission of a wireless data terminal. As shown in FIG. 5, the device is mainly composed of a wireless data terminal, a USB sound card device, and a terminal device.

[0053]

425 Among them, the wireless data terminal is used to send audio data to the terminal device through a USB sound card device; to receive audio data from the terminal device through the USB sound card device.

[0054]

430 USB sound card device, used to transmit audio data between the wireless data terminal and the terminal device.

[0055]

435 The terminal device is used to access the USB sound card device through its own audio device driver to obtain audio data from the wireless data terminal, and send audio data to the USB sound card device through its own audio device driver.

[0056]

441 Specifically, the audio device driver of the terminal device accesses the USB endpoint of the terminal device by accessing the USB sound card device interface, reads and releases the audio data transmitted to the USB endpoint of the terminal device, and then further transmits the audio data to The physical sound card is decoded, D/A converted, and finally played by the speaker; the audio data collected by the microphone, and further A/D converted and encoded by the physical sound card, is transmitted by the UI to the audio device driver for compression, and then the audio device The driver returns to the terminal device USB endpoint by accessing the USB sound card device interface.

[0057]

451 The foregoing descriptions are only preferred embodiments of the present invention, and are not used to limit the protection scope of the present invention.

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CLAIMS CN101566940A

1.

13 1、A method for realizing universal serial bus audio transmission of a wireless data terminal is characterized in that the USB audio data transmission channel between the wireless data terminal and the terminal device is enumerated as a USB sound card device, and the method includes the following steps:

16 The wireless data terminal sends audio data to the terminal device through the USB sound card device, and the terminal device accesses the USB sound card device through its own audio device driver to obtain the audio data;

19 The terminal device sends audio data to the USB sound card device through its own audio device driver, and the wireless data terminal receives the audio data through the USB sound card device.

2.

24 2、The method according to claim 1, wherein the enumerating USB audio data transmission channels between the wireless data terminal and the terminal device as a USB sound card device comprises:

26 The wireless data terminal defines the wireless data terminal USB endpoint that transmits audio data as a sound card, and connects the wireless data terminal USB endpoint to the terminal device USB endpoint through a USB data cable;

29 The terminal device requests the wireless data terminal to obtain the device descriptor, configuration descriptor, and descriptor set of the connected sound card. After receiving the request, the wireless data terminal sends the device descriptor, configuration descriptor, and descriptor set to the terminal device;

32 The terminal device determines the driver that can provide USB according to the acquired device descriptor, configuration descriptor, and descriptor set, loads the corresponding audio device driver that conforms to the USB specification, and configures the sound card by the audio device driver to obtain the USB sound card device.

3.

3、 The method according to claim 1, wherein the terminal device includes an audio device driver, a user interface UI and a physical sound card,

The terminal device accesses the USB sound card device through its own audio device driver to obtain audio data, including: the audio device driver accesses the USB sound card device by accessing the USB sound card device interface, and modulates the PCM code transmitted to the USB sound card device by pulse code The stream is read and released; the UI accesses the audio device driver through the audio device interface, and transmits the PCM code stream to the physical sound card.

4.

4、 The method according to claim 1, wherein the terminal device includes an audio device driver, a user interface UI and a physical sound card,

The terminal device sends audio data to the USB sound card device through its own audio device driver, including: the physical sound card obtains the PCM code stream from the analog audio signal; the UI obtains the PCM code stream from the physical sound card and uses the audio device interface driven by the audio device The PCM code stream is transmitted to the audio device driver, and the audio device driver sends the PCM code stream to the USB sound card device.

5.

5、 A device for realizing universal serial bus audio transmission of a wireless data terminal, characterized in that the device includes: a wireless data terminal, a USB sound card device and a terminal device,

The wireless data terminal is used to send audio data to the terminal device through a USB sound card device, and to receive audio data from the terminal device through the USB sound card device.

USB sound card device, used to transmit audio data between the wireless data terminal and the terminal device;

The terminal device is used to access the USB sound card device through its own audio device driver to obtain audio data from the wireless data terminal, and send audio data to the USB sound card device through its own audio device driver.

6.

6、 The device according to claim 5, wherein the USB sound card device comprises: a USB driver on the side of a wireless data terminal, a USB endpoint of a wireless data terminal, and a USB endpoint of a terminal device,

The USB driver on the side of the wireless data terminal is connected to the baseband processing module of the wireless data terminal;

The USB endpoint of the wireless data terminal is connected to the USB endpoint of the terminal device through a USB data cable;

The USB endpoint of the terminal device is connected with the audio device driver of the terminal device.

7.

81 7、The apparatus according to claim 6, wherein the terminal device comprises an audio device driver, a user interface UI and a physical sound card,

83 The audio device driver is used to access the USB endpoint of the terminal device by accessing the USB sound card device interface, and read and release the PCM code stream transmitted to the USB endpoint of the terminal device;

86 UI is used to access the audio device driver through the audio device interface, and transmit the PCM code stream to the physical sound card;

88 The physical sound card is used to obtain the analog audio signal from the PCM code stream.

8.

92 8、The method according to claim 6, wherein the terminal device includes an audio device driver, a user interface UI and a physical sound card,

94 The physical sound card is used to obtain the PCM code stream from the analog audio signal;

95 The UI is used to obtain the PCM code stream from the physical sound card, and transmit the PCM code stream to the audio device driver through the audio device interface of the audio device driver;

97 The audio device driver is used to send a PCM code stream to the USB endpoint of the terminal device.

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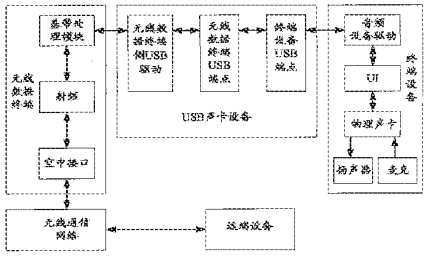
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[54] 发明名称

实现无线数据终端通用串行总线音频传输的方法及装置

[57] 摘要

本发明公开了一种实现无线数据终端通用串行总线音频传输的方法及装置。其方法为将无线数据终端与终端设备之间的 USB 音频数据传输通道，采用 USB 规范定义的标准的 USB AUDIO CLASS 枚举成一个 USB 声卡设备，传输音频数据；该装置包括无线数据终端、USB 声卡设备、终端设备。所述 USB 声卡设备仅传输音频数据，而不对音频数据进行处理；终端设备的音频设备驱动以访问 USB 声卡设备接口的方式访问终端设备 USB 端点，并对音频数据 PCM 码流进行读取和释放，或者，压缩和回传；终端设备的物理声卡对音频数据 PCM 码流进行编解码及 D/A 或 A/D 转换。采用本发明的方法及装置，对 USB 音频数据传输通道进行专门优化，充分利用终端设备处理音频数据的强大能力，增强了 VOUSB 的实际应用效果。



1、一种实现无线数据终端通用串行总线音频传输的方法，其特征在于，将无线数据终端和终端设备之间的USB音频数据传输通道枚举为USB声卡设备，该方法包括以下步骤：

无线数据终端通过所述USB声卡设备向终端设备发送音频数据，终端设备通过自身的音频设备驱动访问所述USB声卡设备获取音频数据；

终端设备通过自身的音频设备驱动向所述USB声卡设备发送音频数据，无线数据终端通过所述USB声卡设备接收该音频数据。

2、根据权利要求1所述的方法，其特征在于，所述将无线数据终端和终端设备之间的USB音频数据传输通道枚举为USB声卡设备，包括：

无线数据终端将传输音频数据的无线数据终端USB端点定义为声卡，并将该无线数据终端USB端点通过USB数据线连接到终端设备USB端点；

终端设备向无线数据终端请求获取所连接声卡的设备描述符、配置描述符、描述符集合，无线数据终端收到请求后，向终端设备发送设备描述符、配置描述符、描述符集合；

终端设备根据获取的设备描述符、配置描述符、描述符集合确定能够提供USB的驱动，加载相应符合USB规范的音频设备驱动，由音频设备驱动对声卡进行配置，得到USB声卡设备。

3、根据权利要求1所述的方法，其特征在于，所述终端设备包括音频设备驱动、用户界面UI和物理声卡，

所述终端设备通过自身的音频设备驱动访问USB声卡设备获取音频数据，包括：音频设备驱动以访问USB声卡设备接口的方式访问所述USB声卡设备，对传输到USB声卡设备的脉冲编码调制PCM码流进行读取和释放；UI通过音频设备接口访问音频设备驱动，将PCM码流传输到物理声卡。

4、根据权利要求1所述的方法，其特征在于，所述终端设备包括音频设备驱动、用户界面UI和物理声卡，

所述终端设备通过自身的音频设备驱动向 USB 声卡设备发送音频数据，包括：物理声卡由模拟音频信号得到 PCM 码流；UI 从物理声卡获取该 PCM 码流，并通过音频设备驱动的音频设备接口将 PCM 码流传输到音频设备驱动，音频设备驱动向 USB 声卡设备发送 PCM 码流。

5、一种实现无线数据终端通用串行总线音频传输的装置，其特征在于，该装置包括：无线数据终端、USB 声卡设备和终端设备，

无线数据终端，用于通过 USB 声卡设备向终端设备发送音频数据，通过 USB 声卡设备接收来自终端设备的音频数据。

USB 声卡设备，用于在无线数据终端和终端设备之间传输音频数据；

终端设备，用于通过自身的音频设备驱动访问 USB 声卡设备获取来自无线数据终端的音频数据，通过自身的音频设备驱动向 USB 声卡设备发送音频数据。

6、根据权利要求 5 所述的装置，其特征在于，所述 USB 声卡设备包括：无线数据终端侧 USB 驱动、无线数据终端 USB 端点和终端设备 USB 端点，

所述无线数据终端侧 USB 驱动与无线数据终端的基带处理模块相连；

所述无线数据终端 USB 端点通过 USB 数据线与终端设备 USB 端点相连；

所述终端设备 USB 端点与终端设备的音频设备驱动相连。

7、根据权利要求 6 所述的装置，其特征在于，所述终端设备包括音频设备驱动、用户界面 UI 和物理声卡，

音频设备驱动用于以访问 USB 声卡设备接口的方式访问所述终端设备 USB 端点，对传输到终端设备 USB 端点的 PCM 码流进行读取和释放；

UI 用于通过音频设备接口访问音频设备驱动，将 PCM 码流传输到物理声卡；

物理声卡用于由 PCM 码流得到模拟音频信号。

8、根据权利要求 6 所述的方法，其特征在于，所述终端设备包括音频设备驱动、用户界面 UI 和物理声卡，

物理声卡用于由模拟音频信号得到 PCM 码流；

UI 用于从物理声卡获取该 PCM 码流，并通过音频设备驱动的音频设备接口将 PCM 码流传输到音频设备驱动；

音频设备驱动用于向所述终端设备 USB 端点发送 PCM 码流。

实现无线数据终端通用串行总线音频传输的方法及装置

技术领域

本发明涉及音频数据传输技术，具体涉及一种实现无线数据终端通用串行总线音频传输的方法及装置。

背景技术

目前，时分同步的码分多址（TD-SCDMA，Time Division-Synchronous Code Division Multiple Access）技术作为中国提出的第三代移动通信标准已经日趋成熟，在 TD-SCDMA 技术支持下，从网络下载数据和向网络上传数据的速度都得到了极大的提高，而速度的提高又必然会促进用户对音频业务和视频业务需求的增加。

现有技术中，无线数据终端在处理音频数据时，对从空口接收到的模拟音频信号，直接送到相应的射频、编解码器等硬件设备进行解调、解码，最后由扬声器播放；对麦克采集的需要发送的模拟音频信号，在相应的编解码器、射频等硬件设备进行编码、调制后发送出去。这种处理音频数据的方式存在的缺陷在于，由于需要对音频数据进行编码和解码，无线数据终端就必须配有相应的编解码器，增加了硬件成本。

为克服上述音频数据处理方式存在的缺陷，目前比较流行的实现方法是通用串行总线音频传输（VOUSB，Voice Over USB），以广泛应用的 PC 作为终端设备对该方法的实现作简单说明。无线数据终端将解调后的音频数据通过 USB 接口传输到 PC 进行解码等处理；类似的，将在 PC 中完成编码等处理的音频数据通过 USB 接口传输到无线数据终端。这样无线数据终端在硬件上就不再需要编解码器，降低了硬件成本。而且，相比于无线数据终端，PC 具有更强的计算能力和更多的内存资源，因此对音频数据具有更强大的处理能力，能够进行更

加丰富的处理，如：可进行去噪、润饰、混音等处理。

图 1 为现有技术中 VOUSB 的实现方法示意图，无线数据终端的空中接口接收远端设备经无线通信网络发来的模拟音频信号，并传输到射频进行解调，之后，由基带处理模块对解调后的音频数据进行放大和数字滤波处理，得到脉冲编码调制（PCM，Pulse Code Modulation） 码流，再将 PCM 码流传输到无线数据终端侧 USB 驱动，由该无线数据终端侧 USB 驱动将 PCM 码流传输到无线数据终端的 USB 端点，最后，按照 USB 标准的批量传输方式，PCM 码流经无线数据终端的 USB 端点传输到终端设备的 USB 端点。这里，无线数据终端侧 USB 驱动的作用是从基带处理模块接收音频数据并传输到无线数据终端的 USB 端点，或从无线数据终端的 USB 端点读出音频数据并传输到基带处理模块。所述 USB 标准的批量传输方式的特点是支持在不确定的时间内进行大量的数据传输，能保证数据一定可以传输，但不保证传输的带宽和延时，因此数据传输的实时性不好；另外，对于以 USB 标准的批量传输方式传输的音频数据，终端设备没有标准驱动对其进行处理，若要对该音频数据进行处理，需要借助于用户界面（UI，User Interface）来实现，其实现过程如下：

对无线数据终端发送到终端设备的 USB 端点的 PCM 码流，终端设备侧 USB 驱动将其读出，并进一步由终端设备的 UI 从终端设备侧 USB 驱动读取并释放，之后，将 PCM 码流传输到物理声卡。物理声卡对传输来的 PCM 码流进行解码，再经 A/D 转换等处理得到模拟音频信号，最后将模拟音频信号送扬声器播放。所述物理声卡可以为 PCI 接口的声卡或 USB 声卡等。这里，终端设备侧 USB 驱动的作用是从终端设备 USB 端点读出音频数据传输到 UI，或从 UI 获取音频数据传输到终端设备的 USB 端点。

但目前基于 VOUSB 的实现方法中，对无线数据终端和终端设备之间的 USB 音频数据传输通道仅仅是作为数据的传输通道，这样带来的问题是没有针对音频数据传输的特点做专门的优化，在实时性等方面影响了 VOUSB 的实际应用效果。

发明内容

有鉴于此，本发明的主要目的在于提供一种实现无线数据终端通用串行总线音频传输的方法及装置，充分利用终端设备处理音频数据的强大能力，增强VOUSB的实际应用效果。

为达到上述目的，本发明的技术方案是这样实现的：

本发明公开了一种实现无线数据终端通用串行总线音频传输的方法，将无线数据终端和终端设备之间的USB音频数据传输通道枚举为USB声卡设备，关键是该方法包括以下步骤：

无线数据终端通过所述USB声卡设备向终端设备发送音频数据，终端设备通过自身的音频设备驱动访问所述USB声卡设备获取音频数据；终端设备通过自身的音频设备驱动向所述USB声卡设备发送音频数据，无线数据终端通过所述USB声卡设备接收该音频数据。

所述将无线数据终端和终端设备之间的USB音频数据传输通道枚举为USB声卡设备，包括：无线数据终端将传输音频数据的无线数据终端USB端点定义为声卡，并将该无线数据终端USB端点通过USB数据线连接到终端设备USB端点；终端设备向无线数据终端请求获取所连接声卡的设备描述符、配置描述符、描述符集合，无线数据终端收到请求后，向终端设备发送设备描述符、配置描述符、描述符集合；终端设备根据获取的设备描述符、配置描述符、描述符集合确定能够提供USB的驱动，加载相应符合USB规范的音频设备驱动，由音频设备驱动对声卡进行配置，得到USB声卡设备。

所述终端设备包括音频设备驱动、用户界面UI和物理声卡，其中，所述终端设备通过自身的音频设备驱动访问USB声卡设备获取音频数据，包括：音频设备驱动以访问USB声卡设备接口的方式访问所述USB声卡设备，对传输到USB声卡设备的脉冲编码调制PCM码流进行读取和释放；UI通过音频设备接口访问音频设备驱动，将PCM码流传输到物理声卡。

所述终端设备包括音频设备驱动、用户界面UI和物理声卡，其中，所述终

端设备通过自身的音频设备驱动向 USB 声卡设备发送音频数据，包括：物理声卡由模拟音频信号得到 PCM 码流；UI 从物理声卡获取该 PCM 码流，并通过音频设备驱动的音频设备接口将 PCM 码流传输到音频设备驱动，音频设备驱动向 USB 声卡设备发送 PCM 码流。

本发明还公开了一种实现无线数据终端通用串行总线音频传输的装置，该装置包括：无线数据终端、USB 声卡设备和终端设备，

无线数据终端，用于通过 USB 声卡设备向终端设备发送音频数据，通过 USB 声卡设备接收来自终端设备的音频数据。

USB 声卡设备，用于在无线数据终端和终端设备之间传输音频数据；

终端设备，用于通过自身的音频设备驱动访问 USB 声卡设备获取来自无线数据终端的音频数据，通过自身的音频设备驱动向 USB 声卡设备发送音频数据。

所述 USB 声卡设备包括：无线数据终端侧 USB 驱动、无线数据终端 USB 端点和终端设备 USB 端点，其中，所述无线数据终端侧 USB 驱动与无线数据终端的基带处理模块相连；所述无线数据终端 USB 端点通过 USB 数据线与终端设备 USB 端点相连；所述终端设备 USB 端点与终端设备的音频设备驱动相连。

所述终端设备包括音频设备驱动、用户界面 UI 和物理声卡，其中，音频设备驱动用于以访问 USB 声卡设备接口的方式访问所述终端设备 USB 端点，对传输到终端设备 USB 端点的 PCM 码流进行读取和释放；UI 用于通过音频设备接口访问音频设备驱动，将 PCM 码流传输到物理声卡；物理声卡用于由 PCM 码流得到模拟音频信号。

所述终端设备包括音频设备驱动、用户界面 UI 和物理声卡，其中，物理声卡用于由模拟音频信号得到 PCM 码流；UI 用于从物理声卡获取该 PCM 码流，并通过音频设备驱动的音频设备接口将 PCM 码流传输到音频设备驱动；音频设备驱动用于向所述终端设备 USB 端点发送 PCM 码流。

由此可见，相比现有技术而言，本发明所提供的一种实现无线数据终端通

用串行总线音频传输的方法及装置具有下述特点和优点：

首先，将无线数据终端和终端设备之间的 USB 音频数据传输通道，采用 USB 规范定义的标准的 USB AUDIO CLASS 枚举成一个 USB 声卡设备来传输音频数据，而广泛使用的终端设备上的操作系统都默认的提供了符合 USB 规范的音频设备驱动的实现，因此，音频设备驱动以访问 USB 声卡设备接口的方式访问终端设备的 USB 端点；音频设备驱动对从 USB 端点读取的音频数据进行读取和释放。

其次，采用 USB 标准的同步传输方式传输音频数据具有好的实时性，且终端设备具有针对该同步传输方式的标准驱动，即音频设备驱动，对终端设备 USB 端点的音频数据的读取和释放都是在音频设备驱动中完成，其处理优先级高于在应用程序 UI 中处理，因此，在终端设备系统负载很重的时候，音频数据的处理依然有很好的实时性。

最后，UI 通过音频设备接口来访问音频设备驱动，将完成释放的音频数据传输到物理声卡。由于 UI 是通过音频设备接口来访问音频设备驱动，减少了 UI 对音频设备驱动的依赖；音频设备接口是标准接口，不用关注底层音频设备驱动实现的细节，且操作系统可移植性好，让 UI 实现起来更加简单、可靠。

针对音频数据传输的特点，对 USB 音频数据传输通道进行抽象和优化，充分利用终端设备处理音频数据的强大能力，增强 VOUSB 的实际应用效果。

附图说明

图 1 为现有技术中 VOUSB 的实现方法示意图；

图 2 为本发明中将 USB 音频数据传输通道抽象成 USB 声卡设备的示意图；

图 3 为本发明中无线数据终端作为音频数据接收方的传输流程图；

图 4 为本发明中无线数据终端作为音频数据发送方的传输流程图；

图 5 为本发明中实现无线数据终端通用串行总线音频传输的装置结构示意图。

具体实施方式

下面结合附图及具体实施例对本发明再作进一步详细的说明。

图 2 为本发明中将 USB 音频数据传输通道抽象成 USB 声卡设备的示意图。对比图 1，本发明中，借用 USB 规范中 USB 声卡应用方法将无线数据终端与终端设备之间的 USB 音频数据传输通道抽象成一个 USB 声卡设备。所述 USB 音频数据传输通道指：无线数据终端侧 USB 驱动、无线数据终端的 USB 端点、终端设备的 USB 端点、以及两个 USB 端点之间的 USB 数据线在内的音频数据传输通道。实现 USB 音频数据传输通道抽象成一个 USB 声卡设备的关键在于，将 USB 音频数据传输通道，采用 USB 规范定义的标准的 USB AUDIO CLASS 枚举成一个 USB 声卡设备。所述枚举通过以下步骤来实现：首先，无线数据终端侧将传输音频数据的无线数据终端 USB 端点定义为一个声卡，并将该无线数据终端 USB 端点通过 USB 数据线连接到终端设备 USB 端点；之后，终端设备向无线数据终端发送请求，请求获取所连接声卡的设备描述符、配置描述符、描述符集合等信息；无线数据终端在收到请求后，向终端设备发送所请求的设备描述符、配置描述符、描述符集合等信息；然后，终端设备在获取这些信息并根据这些信息确定能够提供 USB 的驱动以后，加载相应符合 USB 规范的音频设备驱动；最后，终端设备在得到各种描述符之后，认为所连接的声卡的信息已经齐全，便由音频设备驱动对声卡进行配置，配置成功即可实现无线数据终端与终端设备之间的音频数据传输。至此，枚举过程结束，实现了将 USB 音频数据传输通道枚举成 USB 声卡设备。无线数据终端与 USB 声卡设备的无线数据终端侧 USB 驱动相连接；终端设备与 USB 声卡设备的终端设备 USB 端点相连接。

不同于通常的 USB 声卡等物理声卡所具有的音频数据处理能力，且可将处理后的音频数据直接送到扬声器播放，该 USB 声卡设备的特点是具有和物理声卡一样的访问接口和使用方法，对用户来说就好像是一个实际的物理声卡，但实际上，这个 USB 声卡设备只具有音频数据传输功能，而没有真实的音频数

据处理能力，如果还要对收到的音频数据进行处理，就需要借助于终端设备上的物理声卡来实现。对于终端设备发送到无线数据终端的音频数据，无线数据终端将通过无线通信网络传输到远端设备。所述远端设备可以为无线数据终端或终端设备。如果远端设备还要对收到的音频数据进行处理，对于远端设备是终端设备的情况，直接借助该终端设备上的物理声卡处理音频数据后播放；对于远端设备是无线数据终端的情况，将接收到的音频数据传输到和该无线数据终端通过 USB 声卡设备相连的终端设备，借助于该终端设备上的物理声卡处理音频数据后播放。

由于将无线数据终端和终端设备之间的 USB 音频数据传输通道，采用 USB 规范定义的标准的 USB AUDIO CLASS 枚举成一个 USB 声卡设备，实现音频数据传输，而广泛使用的终端设备上的操作系统都默认的提供了符合 USB 规范的音频设备驱动的实现，因此，对于由无线数据终端发送到 USB 声卡设备的终端设备 USB 端点的音频数据，音频设备驱动以访问 USB 声卡设备接口的方式访问该终端设备 USB 端点；音频设备驱动在访问终端设备 USB 端点时，对发送到该终端设备 USB 端点的音频数据进行读取和释放，相比于现有的由应用程序 UI 读取和释放音频数据，由音频设备驱动进行读取和释放优先级更高，因此，即使在终端设备系统负载很重的时候，音频数据的处理依然具有很好的实时性；音频设备驱动除了向下访问终端设备 USB 端点，向上还可提供音频设备接口，该音频设备接口是标准接口，UI 访问该音频设备接口时，不用关注低层的音频设备驱动实现的细节，且操作系统可移植性好，UI 可通过音频设备接口访问音频设备驱动并将音频数据传送到物理声卡，减少了 UI 对音频设备驱动的依赖，使 UI 实现起来更加简单、可靠。

具体的，利用 USB 声卡设备实现音频数据传输的过程如图 3、图 4 所示。

图 3 为无线数据终端作为音频数据接收方的传输流程图，音频数据的传输包括以下步骤：

步骤 301：无线数据终端的空中接口接收远端设备经无线通信网络发来的模拟音频信号，并传送到射频等硬件进行解调，之后，由基带处理模块对解调

后的音频数据进行放大和数字滤波处理，得到 PCM 码流。

步骤 302：处理后得到的 PCM 码流由无线数据终端的基带处理模块传输到 USB 声卡设备的无线数据终端侧 USB 驱动；之后，按照 USB 标准的同步传输方式，PCM 码流经无线数据终端 USB 端点和 USB 数据线被传输到 USB 声卡设备的终端设备 USB 端点。

步骤 303：在 PCM 码流传输到终端设备 USB 端点之后，终端设备的音频设备驱动以访问 USB 声卡设备接口的方式访问该终端设备 USB 端点，并对传输到终端设备 USB 端点的 PCM 码流进行读取和释放，之后，UI 通过音频设备接口访问音频设备驱动，将 PCM 码流传输到物理声卡。

步骤 304：物理声卡对传送来的 PCM 码流进行解码、D/A 转换等处理后得到模拟音频信号，最后，将该模拟音频信号传输到扬声器播放。

图 4 为无线数据终端作为音频数据发送方的传输流程图，音频数据的传输包括以下步骤：

步骤 401：终端设备的麦克将采集的模拟音频信号传送到物理声卡，由物理声卡对其进行 A/D 转换、编码等处理，得到 PCM 码流形式的数字音频信号。

步骤 402：终端设备的 UI 从物理声卡获取 PCM 码流，并通过音频设备驱动的音频设备接口将 PCM 码流传输到音频设备驱动，由音频设备驱动对 PCM 码流进行压缩，之后，音频设备驱动以访问 USB 声卡设备接口的方式将 PCM 码流回传到 USB 声卡设备的终端设备 USB 端点。

步骤 403：在 PCM 码流传输到 USB 声卡设备的终端设备 USB 端点之后，按照 USB 标准的同步传输方式，PCM 码流经 USB 数据线传输到 USB 声卡设备的无线数据终端 USB 端点。

步骤 404：无线数据终端的基带处理模块通过无线数据终端侧 USB 驱动获取传输到无线数据终端 USB 端点的 PCM 码流，进行放大和数字滤波处理，再经射频进行调制，得到模拟音频信号，最后，由空中接口经无线通信网络发送到远端设备。

为实现上述方法，本发明还提供一种实现无线数据终端通用串行总线音频

传输的装置，如图 5 所示，该装置主要由无线数据终端、USB 声卡设备、以及终端设备组成。

其中，无线数据终端，用于通过 USB 声卡设备向终端设备发送音频数据；通过 USB 声卡设备接收来自终端设备的音频数据。

USB 声卡设备，用于在无线数据终端和终端设备之间传输音频数据。

终端设备，用于通过自身的音频设备驱动访问 USB 声卡设备获取来自无线数据终端的音频数据，通过自身的音频设备驱动向 USB 声卡设备发送音频数据。

具体的，终端设备的音频设备驱动以访问 USB 声卡设备接口的方式访问终端设备 USB 端点，对传输到该终端设备 USB 端点的音频数据进行读取和释放，之后，进一步由 UI 将音频数据传输到物理声卡进行解码、D/A 转换，最后由扬声器播放；对麦克采集，并进一步由物理声卡进行 A/D 转换、编码的音频数据，由 UI 传输到音频设备驱动进行压缩，之后，由音频设备驱动以访问 USB 声卡设备接口的方式回传到终端设备 USB 端点。

以上所述，仅为本发明的较佳实施例而已，并非用于限定本发明的保护范围。

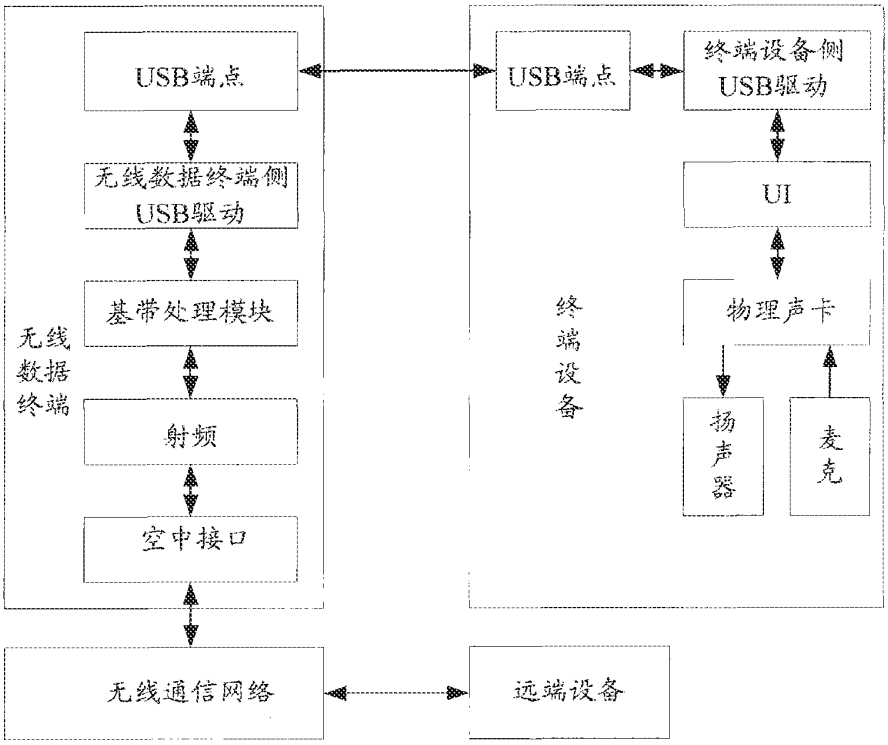

USB端点
无线数据终端侧USB驱动
基带处理模块
射频
空中接口
无线数据终端
USB端点
终端设备侧USB驱动
UI
物理声卡
扬声器
麦克
终端设备
无线通信网络
远端设备

图 1

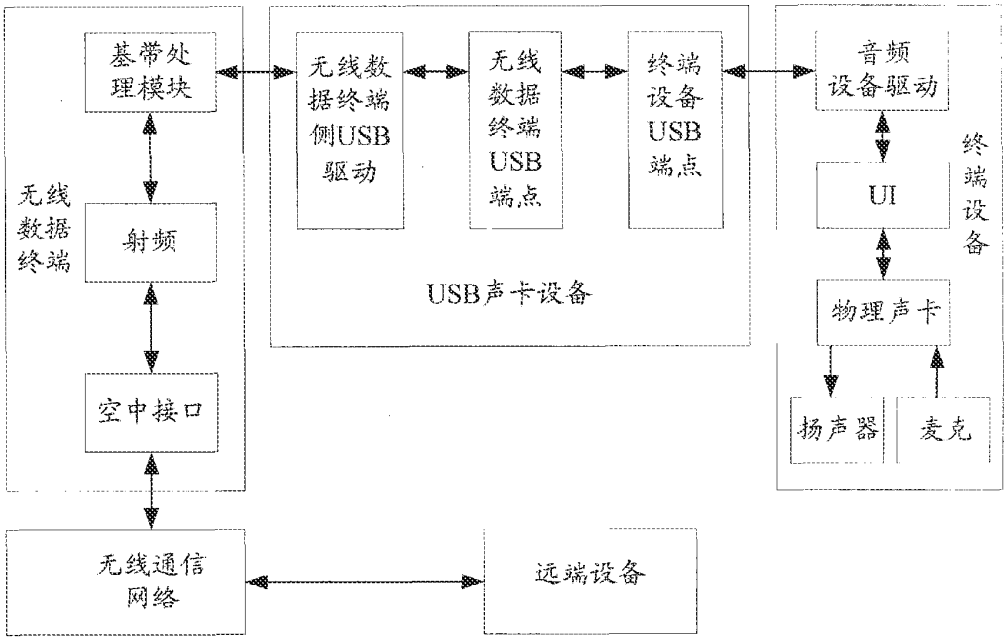

基带处理模块
射频
空中接口
无线数据终端
无线数据终端侧USB驱动
无线数据终端USB端点
终端设备USB端点
USB声卡设备
音频设备驱动
UI
物理声卡
扬声器
麦克
终端设备
无线通信网络
远端设备

图 2

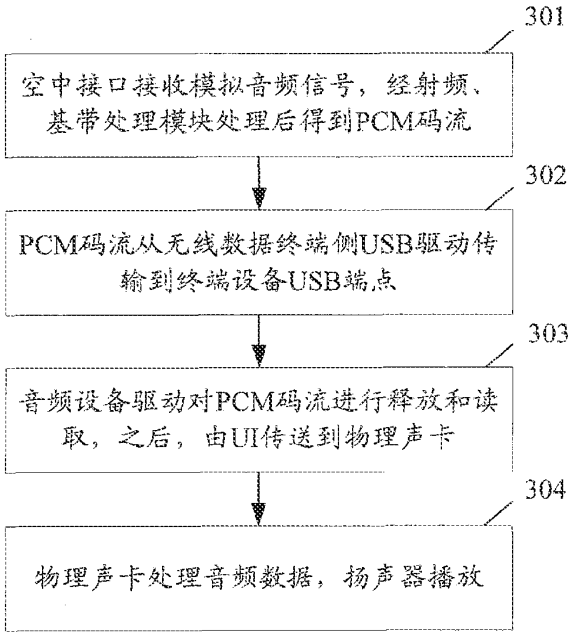

301
空中接口接收模拟音频信号，经射频、基带处理模块处理后得到PCM码流
302
PCM码流从无线数据终端侧USB驱动传输到终端设备USB端点
303
音频设备驱动对PCM码流进行释放和读取，之后，由UI传送到物理声卡
304
物理声卡处理音频数据，扬声器播放

图 3

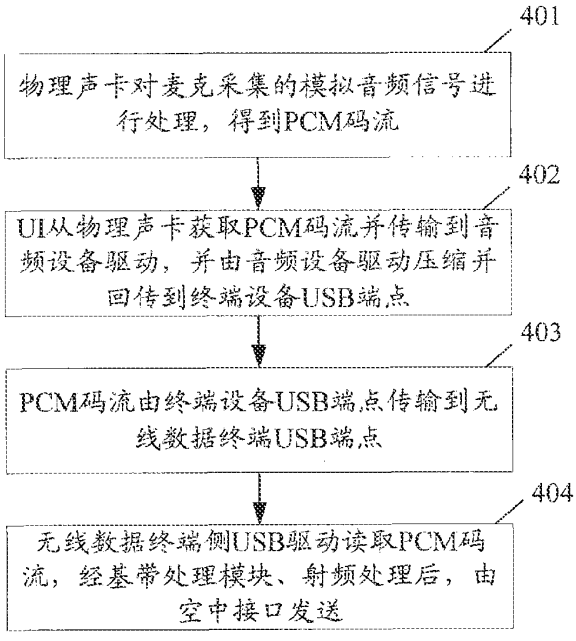

401
物理声卡对麦克采集的模拟音频信号进行处理，得到PCM码流
402
UI从物理声卡获取PCM码流并传输到音频设备驱动，并由音频设备驱动压缩并回传到终端设备USB端点
403
PCM码流由终端设备USB端点传输到无线数据终端USB端点
404
无线数据终端侧USB驱动读取PCM码流，经基带处理模块、射频处理后，由空中接口发送

图 4

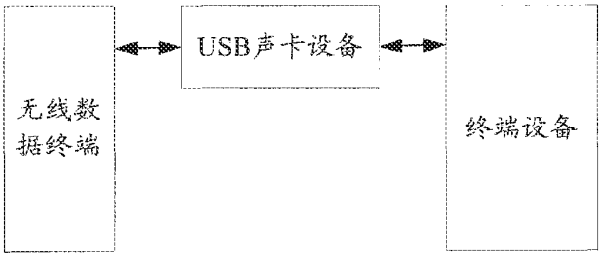


图 5

Electronic Acknowledgement Receipt

EFS ID:	41772772
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas Lee/Shelly Darrenkamp
Filer Authorized By:	Thomas Lee
Attorney Docket Number:	BEEL3004C/TL
Receipt Date:	28-JAN-2021
Filing Date:	20-APR-2020
Time Stamp:	15:51:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	BEEL3004C_IDS.pdf	1034410 90059ed5e115e4741788abfcb9639abbdd3b5583	no	4

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2	Non Patent Literature	CN_OA2_officialnotice_8Jan2021_with_translation.pdf	1300514 878bf12bb4c73de161e0d0b27e220660da31f5ed	no	16
Warnings:					
Information:					
3	Foreign Reference	CN101566940_with_translation.pdf	2695116 1acddc2e0ff49a28ae482e8ae117c76432753505	no	30
Warnings:					
Information:					
			Total Files Size (in bytes):	5030040	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/852,790	04/20/2020	Koen Simon Herman Beel	BEEL3004C/TL	5321

23364 7590 01/14/2021

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EXAMINER	
BARTELS, CHRISTOPHER A.	

ART UNIT	PAPER NUMBER
2184	

NOTIFICATION DATE	DELIVERY MODE
01/14/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

MAIL@BACONTHOMAS.COM

Office Action Summary	Application No. 16/852,790	Applicant(s) Beel et al.	
	Examiner CHRISTOPHER A BARTELS	Art Unit 2184	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 04/20/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-102 is/are pending in the application.

5a) Of the above claim(s) 1-81 is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 82-102 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

This office action is in response to a telephone discussion with Attorney on record Mr. Thomas Lee (01/05/2021). Upon discussion with Mr. Lee indicating the wrong set of claims were examined. The Non-Final dated 10/08/2020 has been vacated. Thus, the statutory period to reply has been restarted with the corresponding claim set. Claims 82-102 are currently pending.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 103

2. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

3. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained through the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 82-84, and 87-102 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nuyttens et al. (USPGPUB No. ***2007/0033289 A1,*** *hereinafter referred to as Nuyttens*) in view of Thompson (USPGPUB No. ***2009/0247006 A1***).

Referring to claim 82, Nuyttens discloses a method for connecting a processing device {CPU mezzanine board 47, see Fig. 8, [0116], lines 1-3} ***to a communications network*** {"eth 1000", see Fig. 7, [0112].}, ***the processing device having a having a memory*** {"flash 33", see Fig. 7.}, ***a display*** {Monitor coupled to graphic accelerator 44, see Fig. 8, [0117].} ***and an operating system*** {Windows or Linux, see Fig. 8, [0117].} ***with pre-installed generic drivers providing a generic communications protocol*** {PCI express to couple peripheral devices, [0116], first 4 lines, see Fig. 8.} ***for communication between processing device and a class of peripheral devices*** {"such as a storage device which is part of mass storage", [0252].}, ***the method comprising:***

b) communicating audio data and display data from the processing device to the external peripheral device {"a characteristic of such a [communication] network is to… route data from one address to another", [0088].};

c) reading the audio data from the port using an audio device on the external peripheral device {"inserting the decoded image [and corresponding audio] on the internal bus of the [pre-installed generic audio driver] the multi-viewer driver 2", [0112].},

Furthermore, Thompson discloses ***a) coupling an external peripheral device*** {external peripheral devices "NCM 104 and 106" (see Fig. 11, [0049].} ***physically to a port*** {"access port of a variety of network configurations", [0049].} ***of the processing device, the peripheral device having a transceiver*** {said nodes "104 and 106" transceiving via COAX, HDMI and ETHERNET (see Fig. 11, [0050]).} ***and a connector configured to couple to the port of the processing device*** {"connectors" via "packet decoder 150", see Fig. 5, [0056].}*;*

d) connecting the processing device to a communications network {processing device "Gateway 200" (see Fig. 11) to a communication network "cable 113", [0062].} ***via the transceiver*** {said nodes "104 and 106", [0050]}*;*

e) display data and audio data being routed between the processing device and the communication network via the transceiver and further to a base node {base node "gateway 200" (see Fig. 11) and displaying data to "HD TV 206" (see Fig. 1, [0026].}.

Nuyttens and Thompson are analogous art because they are from the same field of endeavor, methods and systems communicating with networked peripherals.

At the time of the invention, it would have been obvious to one of ordinary skill in the art, having the teachings of Nuyttens and Thompson before him or her, to modify Nuyttens' "graphics accelerator 44" incorporating Thompson's "gateway 200".

The suggestion/motivation for doing so would have been to provide a simple and flexible means for tapping various types of multimedia analog or digital transmissions carried on any installed cable without

requiring a change in the cable type, connector or enclosure (Thompson [0027]).

Therefore, it would have been obvious to combine Thompson with Nuyttens to obtain the invention as specified in the instant claim(s).

As per claim 83, the rejection of claim 82 is incorporated and Nuyttens discloses wherein the audio device comprises an audio output adapter device {"switching device 16 is a Gbe switch", see Fig. 4, [0102].} ***which is configured as a virtual audio device to transfer the audio data*** {"connected to the display controllers 2, Hydra multi-viewers", [0102], see Fig. 4.} ***from the processing device to the base node via the communications network*** {"network switch for the distribution of the encoded data streams", see Fig. 4, [0102].}.

As per claim 84, the rejection of claim 82 is incorporated and Nuyttens discloses further comprising presenting the external peripheral device to the processing device as any of the following:

a human interface device; a mass storage device {"such as a storage device which is part of mass storage", [0252].}***; and a composite device*** {Examiner's interpretation: this is a Markush claim due to the word "any", thus only one element of the group to be shown by the reference to teach the claim.}.

As per claim 87, the rejection of claim 82 is incorporated and Nuyttens discloses wherein the external peripheral device analyzes an incoming signal from the processing device and if no audio data is

received, the incoming signal is discarded and if audio data is received, the external peripheral device initiates a TCP/IP socket connection {as a "network switch… a GbE switch", GbE refers to Gigabit Ethernet protocol includes support for both TCP and UDP streams/sockets, [0102].} ***to the base unit through the communications network*** {"network switch for the distribution of the encoded data streams", see Fig. 4, [0102].}.

As per claim 88, the rejection of claim 82 is incorporated and Nuyttens discloses further comprising time-stamping synchronously a stream of the audio data with a stream of the display data {time-stamping "Real time encoding at full frame rate… [for the data stream] in-sports events phases", [0109].}.

As per claim 89, the rejection of claim 88 is incorporated, further comprising encoding, optionally encrypting the audio data {encoding "the document [into] SGML, XML, SVG" and so on ([0044]), where the XML format is well-known for encrypting functionalities.}.

As per claim 90, the rejection of claim 82 is incorporated and Nuyttens discloses wherein further comprising time-stamping synchronously the audio with the data stream {time-stamping "Real time encoding at full frame rate… [for the data stream] in-sports events phases", [0109].}.

As per claim 91, the rejection of claim 90 is incorporated and Nuyttens discloses wherein further comprising encoding, optionally encrypting {encoding "the document [into] SGML, XML, SVG" and so on ([0044]), where the XML format is well-known for encrypting functionalities.} ***the audio data.***

Referring to claims 92-95, and 98-101 are system claims reciting claim language corresponding to the method claim of claims 82-84, 87-89, respectively, thereby rejected under the same rationale as claims 82-84, 87-89.

As per claim 96, the rejection of claim 95 is incorporated and Nuyttens discloses wherein if audio is received, the external peripheral device is adapted to initiate an additional connection as a "network switch… a GbE switch", GbE refers to Gigabit Ethernet protocol includes support for both TCP and UDP streams/sockets, [0102].} ***to the base unit*** base unit "baseboard of the multi-viewer driver 2", [0112].} ***through the communications network*** {"eth 1000", see Fig. 7, [0112].}.

As per claim 97, the rejection of claim 96 is incorporated and Nuyttens wherein the client application is a portable application {"X.11 windows" known for its' portability and versatility in different platforms, [0171].}.

Referring to claims 102 is an apparatus claim reciting claim language corresponding to the method claim of claims 82-84, and 87-89 respectively, thereby rejected under the same rationale as claims 82-84, and 87-89.

5. Claims 85 and 86 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nuyttens in view of Thompson and further in view of Carlson et al. (USPGPUB No. ***2013/0060662 A1,*** *hereinafter referred to as Carlson*).

As per claim 85, the rejection of claim 82 is incorporated however neither Nuyttens nor Thompson appears to explicitly disclose any limitation in this dependent claim.

Furthermore, Carlson discloses ***wherein a client application is stored on the peripheral device which when run on the processing device obtains screen scraped data*** {client application "Product catalog system 130" (see Fig. 1) obtaining screen scraped data "screen scraping mechanism", [0023].}.

Nuyttens/Thompson and Carlson are analogous art because they are from the same field of endeavor, methods and systems communicating with networked peripherals.

At the time of the invention, it would have been obvious to one of ordinary skill in the art, having the teachings of Nuyttens/Thompson and Carlson before him or her, to modify Nuyttens/Thompson's device incorporating Carlson's "screen scraping mechanism".

The suggestion/motivation for doing so would have been to provide and facilitate the creation of user interfaces that organize results to reduce cognitive load on the user (Carlson [0003], lines 4-6).

Therefore, it would have been obvious to combine Carlson with Nuyttens/Thompson to obtain the invention as specified in the instant claim(s).

As per claim 86, the rejection of claim 85 is incorporated and Nuyttens discloses wherein the client application is a portable application {“standard [portable] X.11 methods can be used to feed this information to the DGU 14”, [0172], [0171].}.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references indicative of the current state of the art: US 20060101116 A1, and US 20070168481 A1.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTOPHER A. BARTELS whose telephone number is (571)270-3182. The examiner can normally be reached on Monday-Friday 9:00a-5:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Dr. Henry Tsai can be reached on 571-272-4176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. B./
Examiner, Art Unit 2184

/HENRY TSAI/
Supervisory Patent Examiner, Art Unit 2184

Notice of References Cited	Application/Control No. 16/852,790	Applicant(s)/Patent Under Reexamination Beel et al.	
	Examiner CHRISTOPHER A BARTELS	Art Unit 2184	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20070033289-A1	02-2007	Nuyttens; Geert	G06F3/1446	709/230
*	B	US-20090247006-A1	10-2009	Thompson; William H.	H04L12/2898	439/527
*	C	US-20130060662-A1	03-2013	Carlson; Andy	G06Q30/06	705/26.61
*	D	US-20060101116-A1	05-2006	Rittman; Danny	H04L12/1813	709/204
*	E	US-20070168481-A1	07-2007	Lambert; Timothy	G06F13/128	709/223
	F					
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	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/852,790	Beel et al.
	Examiner	Art Unit
	CHRISTOPHER A BARTELS	2184

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant						☐ CPA		☐ T.D.		☐ R.1.47
CLAIM		DATE								
Final	Original	10/01/2020								
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
	6	-								
	7	-								
	8	-								
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/852,790	Beel et al.
	Examiner	Art Unit
	CHRISTOPHER A BARTELS	2184

CLAIM		DATE								
Final	Original	10/01/2020								
	43	-								
	44	-								
	45	-								
	46	-								
	47	-								
	48	-								
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/852,790	Beel et al.
	Examiner	Art Unit
	CHRISTOPHER A BARTELS	2184

CLAIM		DATE								
Final	Original	10/01/2020								
	95	✓								
	96	✓								
	97	✓								
	98	✓								
	99	✓								
	100	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/852,790	Beel et al.
	Examiner	Art Unit
	CHRISTOPHER A BARTELS	2184

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner
(G06F H04L H04M and relevant subgroups) text search in East	10/01/2020	C.A.B.

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search in East (USPAT USOCR USPGPUB)	07/2020	C.A.B.
Text search in IEEE XPlore (see handout)	10/01/2020	C.A.B.
Text search in Google Patents (see handout)	10/01/2020	C.A.B.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/C.A.B/ Examiner, Art Unit 2184	

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Christopher A. Bartels
Attorney Docket Number	BEEL3004C/TL

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1							

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

	1	European Office Action in corresponding European Application No. 16207123.7, dated November 23, 2020.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Christopher A. Bartels
	Attorney Docket Number	BEEL3004C/TL

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2020-12-08
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	41319675
Application Number:	16852790
International Application Number:	
Confirmation Number:	5321
Title of Invention:	ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS
First Named Inventor/Applicant Name:	Koen Simon Herman Beel
Customer Number:	23364
Filer:	Thomas Lee/Shelly Darrenkamp
Filer Authorized By:	Thomas Lee
Attorney Docket Number:	BEEL3004C/TL
Receipt Date:	08-DEC-2020
Filing Date:	20-APR-2020
Time Stamp:	11:56:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	EP_OA1_23Nov2020.pdf	165432 6239cd66902edc85332 4ab2f165eb137311b4451	no	5

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	BEEL3004C_IDS.pdf	1034361 7da2d8879dfbf25f24ed58c49f7cd58801f7a6a7	no	4

Warnings:

Information:

A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

Total Files Size (in bytes):	1199793

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/852,790	04/20/2020	Koen Simon Herman Beel	BEEL3004C/TL	5321

23364 7590 10/08/2020

BACON & THOMAS, PLLC
625 SLATERS LANE
FOURTH FLOOR
ALEXANDRIA, VA 22314-1176

EXAMINER	
BARTELS, CHRISTOPHER A.	

ART UNIT	PAPER NUMBER
2184	

NOTIFICATION DATE	DELIVERY MODE
10/08/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

MAIL@BACONTHOMAS.COM

Office Action Summary	Application No. 16/852,790	Applicant(s) Beel et al.	
	Examiner CHRISTOPHER A BARTELS	Art Unit 2184	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on _____.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-100 is/are pending in the application.

5a) Of the above claim(s) 1-81 is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 82-100 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 04/20/2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date See Continuation Sheet.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Continuation of Attachment(s) 2) Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date: 04/20/2020, 04/20/2020, 06/16/2020, 06/30/2020, 08/06/2020,

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 04/20/2020, 04/20/2020, 06/16/2020, 06/30/2020, and 08/06/2020 was filed. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 103

5. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

6. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained through the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claim 82-85, 87-95, and 97-100 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nuyttens et al. (USPGPUB No. ***2007/0033289 A1,*** *hereinafter referred to as Nuyttens*) in view of Thompson (USPGPUB No. ***2009/0247006 A1***).

Referring to claim 82, Nuyttens discloses a method for connecting a processing device {CPU mezzanine board 47, see Fig. 8, [0116], lines 1-3} ***to a communications network*** {"eth 1000", see Fig. 7, [0112].}, ***the processing device having a memory*** {"flash 33", see Fig. 7.}, ***a display*** {Monitor coupled to graphic accelerator 44, see Fig. 8, [0117].} ***and an operating system*** {Windows or Linux, see Fig. 8, [0117].} ***with pre-installed generic drivers providing a generic communications protocol*** {PCI express to couple peripheral devices, [0116], first 4 lines, see Fig. 8.} ***for communication between processing device and a standard class of peripheral devices, the method comprising:***

b) setting up, by means of a first pre-installed generic audio driver of the operating system, a means for audio communication {"proprietary busses used for transporting video, audio…", [0088].} ***between the peripheral device and the processing device and by means of a second pre-installed generic driver*** {multi-viewer driver 2, see Fig. 7, [0112].} ***of the operating system, a means for data communication*** {"metadata with building blocks based on standard IP and compression technologies", [0088].} ***between the peripheral device and the processing device;***

d) routing audio data between the processing device and the communication network {"a characteristic of such a [communication] network is to… route data from one address to another", [0088].} ***via the means for audio communication and the transceiver, wherein the first pre-installed generic audio driver is used for transferring the audio data*** {"inserting the decoded image [and corresponding audio] on the internal bus of the [pre-installed generic audio driver] the multi-viewer driver 2", [0112].} ***between the processing device and the peripheral device.***

Furthermore, Thompson discloses a) coupling an external peripheral device {external peripheral devices "NCM 104 and 106" (see Fig. 11, [0049].} ***physically to a port*** {"access port of a variety of network configurations", [0049].} ***of the processing device, the peripheral device having a transceiver*** {said nodes "104 and 106" transceiving via COAX, HDMI and ETHERNET (see Fig. 11).}*;*

c) using the peripheral device to connect the processing device to a communications network {processing device "Gateway 200" (see Fig. 11) to a communication network "cable 113", [0062].} ***via the transceiver****;*

Nuyttens and Thompson are analogous art because they are from the same field of endeavor, methods and systems communicating with networked peripherals.

At the time of the invention, it would have been obvious to one of ordinary skill in the art, having the teachings of Nuyttens and Thompson before him or her, to modify Nuyttens' "graphics accelerator 44" incorporating Thompson's "gateway 200".

The suggestion/motivation for doing so would have been to provide a simple and flexible means for tapping various types of multimedia analog or digital transmissions carried on any installed cable without requiring a change in the cable type, connector or enclosure).

Therefore, it would have been obvious to combine Thompson with Nuyttens to obtain the invention as specified in the instant claim(s).

As per claim 83, the rejection of claim 82 is incorporated and Nuyttens discloses wherein Step b) comprises presenting the peripheral device to the processing device as a human interface device {"proper mouse and keyboard", [0006].} ***and wherein the pre-installed generic driver is a human interface device driver*** {"human machine interface is composed of several displays", [0006].}.

As per claim 84, the rejection of claim 82 is incorporated and Nuyttens discloses wherein Step b) comprises presenting the peripheral device to the processing device as a mass storage device {"such as a storage device which is part of mass storage", [0252].} ***and wherein the pre-installed generic driver is a mass storage device driver.***

As per claim 85, the rejection of claim 82 is incorporated and Nuyttens discloses wherein Step b) comprises presenting the peripheral device to the processing device as a composite device {"human machine interface is [a composite] of several displays", [0006].} ***and wherein pre-installed generic drivers drive different***

device interfaces independently {"each compression decoding device 45 may work independently of the other compression decoding devices 45", [0138].}.

As per claim 87, the rejection of claim 86 is incorporated and Nuyttens discloses wherein the client application is a portable application {"standard [portable] X.11 methods can be used to feed this information to the DGU 14", [0172], [0171].}.

As per claim 88, the rejection of claim 82 is incorporated and Nuyttens discloses wherein the peripheral device is adapted to anal se an incoming signal {the Examiner is presuming the claim language meant to say "analyse an incoming signal".} ***from the processing device and if no audio is received, the incoming signal is discarded*** {"monitoring elements within a [incoming signal] source (audio metering) in an effective way", [0175].}.

As per claim 89, the rejection of claim 88 is incorporated and Nuyttens discloses wherein if audio is received, the peripheral device will initiate an additional connection TCP/IP socket {as a "network switch… a GbE switch", GbE refers to Gigabit Ethernet protocol includes support for both TCP and UDP streams/sockets, [0102].} ***to the base unit*** {base unit "baseboard of the multi-viewer driver 2", [0112].} ***through the communications network.***

As per claim 90, the rejection of claim 82 is incorporated and Nuyttens discloses wherein further comprising time-stamping synchronously the audio with the data stream {time-stamping "Real time encoding at full frame rate… [for the data stream] in-sports events phases", [0109].}.

As per claim 91, the rejection of claim 90 is incorporated and Nuyttens discloses wherein further comprising encoding, optionally encrypting {encoding "the document [into] SGML, XML, SVG" and so on ([0044]), where the XML format is well-known for encrypting functionalities.} ***the audio data.***

Referring to claims 92-95, and 98-101 are system claims reciting claim language corresponding to the method claim of claims 81-85, 87-91, respectively, thereby rejected under the same rationale as claims 81-85, 87-91.

As per claim 97, the rejection of claim 96 is incorporated and Nuyttens wherein the client application is a portable application {"X.11 windows" known for its' portability and versatility in different platforms, [0171].}.

Referring to claims 102 is an apparatus claim reciting claim language corresponding to the method claim of claims 81-91, respectively, thereby rejected under the same rationale as claims 81-91.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 86 and 96 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nuyttens in view of Thompson and further in view of Carlson et al. (USPGPUB No. ***2013/0060662 A1,*** *hereinafter referred to as Carlson*).

As per claim 86, the rejection of claim 82 is incorporated however neither Nuyttens nor Thompson appears to explicitly disclose any limitation in this dependent claim.

Furthermore, Carlson discloses ***wherein a client application is stored on the peripheral device which when run on the processing device obtains screen scraped data*** {client application "Product catalog system 130" (see Fig. 1) obtaining screen scraped data "screen scraping mechanism", [0023].}.

Nuyttens/Thompson and Carlson are analogous art because they are from the same field of endeavor, methods and systems communicating with networked peripherals.

At the time of the invention, it would have been obvious to one of ordinary skill in the art, having the teachings of Nuyttens/Thompson and Carlson before him or her, to modify

Nuyttens/Thompson's device incorporating Carlson's "screen scraping mechanism".

The suggestion/motivation for doing so would have been to provide and facilitate the creation of user interfaces that organize results to reduce cognitive load on the user (Carlson [0003], lines 4-6).

Therefore, it would have been obvious to combine Carlson with Nuyttens/Thompson to obtain the invention as specified in the instant claim(s).

As per claim 96, the rejection of claim 92 is incorporated however neither Nuyttens nor Thompson appears to explicitly disclose any limitation in this dependent claim.

Furthermore, Carlson discloses ***wherein a client application is stored on the peripheral device which when run on the processing device obtains screen scraped data*** {client application "Product catalog system 130" (see Fig. 1) obtaining screen scraped data "screen scraping mechanism", [0023].}.

The 103 motivation for this dependent claim relied upon as recited in claim 86 above.

Conclusion

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references indicative of the current state of the art: US 20060101116 A1, and US 20070168481 A1.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTOPHER A. BARTELS whose telephone number is (571)270-3182. The examiner can normally be reached on Monday-Friday 9:00a-5:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Henry Tsai can be reached on 571-272-4176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C.A.B./
Examiner
Art Unit 2184

/C. A. B./

/HENRY TSAI/
Supervisory Patent Examiner, Art Unit 2184

Notice of References Cited	Application/Control No. 16/852,790	Applicant(s)/Patent Under Reexamination Beel et al.	
	Examiner CHRISTOPHER A BARTELS	Art Unit 2184	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20070033289-A1	02-2007	Nuyttens; Geert	G06F3/1446	709/230
*	B	US-20090247006-A1	10-2009	Thompson; William H.	H04L12/2898	439/527
*	C	US-20130060662-A1	03-2013	Carlson; Andy	G06Q30/06	705/26.61
*	D	US-20060101116-A1	05-2006	Rittman; Danny	H04L12/1813	709/204
*	E	US-20070168481-A1	07-2007	Lambert; Timothy	G06F13/128	709/223
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/852,790	Beel et al.
	Examiner	Art Unit
	CHRISTOPHER A BARTELS	2184

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner
(G06F H04L H04M and relevant subgroups) text search in East	10/01/2020	C.A.B.

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search in East (USPAT USOCR USPGPUB)	07/2020	C.A.B.
Text search in IEEE XPlore (see handout)	10/01/2020	C.A.B.
Text search in Google Patents (see handout)	10/01/2020	C.A.B.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/C.A.B/ Examiner, Art Unit 2184	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	CHRISTOPHER A BARTELS	2184

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant						☐ CPA		☐ T.D.		☐ R.1.47
CLAIM		DATE								
Final	Original	10/01/2020								
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/852,790	Beel et al.
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CLAIM		DATE								
Final	Original	10/01/2020								
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	97	✓								
	98	✓								
	99	✓								
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	17,523	(interrupt$3 msi msix msi adj x) with (handl$3 rerout$3 rout$3 mask$3) and (boot bootload$3 (boot firmware firm ware) with (load$3 updat$3 dynamic$4 modifyiing modific$5))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 15:57
S2	305	S1 and ((linux and irq) irqbalance irq adj balance)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 16:01
S3	51	S2 and (isd interrupt$3 adj (source))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 16:02
S4	20	S3 and (partition virtualization hypervisor root adj complex)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 16:03
S5	0	S3 and (partition virtualization hypervisor root adj complex) with (pmi potential$2 near2 miss$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 16:03
S6	0	S2 and (partition virtualization hypervisor root adj complex) with (pmi potential$2 near2 miss$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 16:03
S7	21	S1 and (partition virtualization hypervisor root adj complex) with (pmi potential$2 near2 miss$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/19 16:03
S8	0	"16293525"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/23 17:46

S9	0	"16293525".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/23 17:47
S10	1	"15466150"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/24 12:48
S11	17,702	(interrupt$3 msi msix msi adj x) with (handl$3 rerout$3 rout$3 mask$3) and (boot bootload$3 (boot firmware firm ware) with (load$3 updat$3 dynamic$4 modifyiing modific$5))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S12	312	S11 and ((linux and irq) irqbalance irq adj balance)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S13	51	S12 and (isd interrupt$3 adj (source))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S14	20	S13 and (partition virtualization hypervisor root adj complex)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S15	0	S13 and (partition virtualization hypervisor root adj complex) with (pmi potential$2 near2 miss$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S16	0	S12 and (partition virtualization hypervisor root adj complex) with (pmi potential$2 near2 miss$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S17	21	S11 and (partition virtualization hypervisor root adj complex) with (pmi potential$2 near2 miss$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S18	0	"16293525"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/09/24 19:39

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S20	1	"15466150"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:39
S21	48	S11 and (potential$4 near2 (miss$3 skip$4 avoid$3)) with (msi interrupt vector mask$3 messag$3 adj signal$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:41
S22	48	S11 and (potential$2 near2 (miss$3 skip$4 avoid$3)) with (msi interrupt vector mask$3 messag$3 adj signal$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 19:46
S23	0	"16293525"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 20:41

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Patents (speaker webcam "web camera" webcamera multimedia multi-media) and

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Doc description: Information Disclosure Statement (IDS) Filed

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Application Number	
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	CHRISTOPHER A. BARTELS
Attorney Docket Number	BEEL3004C/TL

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/C.A.B/	1	6966035	B1	2005-11-15	Suess et al.	Cited in Specification
/C.A.B/	2	8316138	B2	2012-11-20	Chang	
/C.A.B/	3	8346753	B2	2013-01-01	HAYES	

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/C.A.B/	1	20100087139	A1	2010-04-08	Glass	Cited in Specification and German Search Report
/C.A.B/	2	20060095376	A1	2006-05-04	Mitchell et al.	Cited in Specification
/C.A.B/	3	20090198839	A1	2009-08-06	Banerjee et al.	Cited in Specification

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	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

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	5	20020196378	A1	2002-12-26	Slobodin et al.	Cited in Specification
	6	20130067121	A1	2013-05-14	Beel et al.	Related U.S. App. 13/270,659
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	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

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	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	26	20110078716	A1	2011-03-31	MACWAN	
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	29	20040128354	A1	2004-07-01	HORIKIRI et al.	corresponds to CN 1499841
	30	20100066806	A1	2010-03-18	LYU	
	31	20070109410	A1	2007-05-17	SIEW	
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	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	1	00/52887	WO	A1	2000-09-08	MICROSOFT CORPORATION		
	2	1246395	EP	A1	2002-10-02	MOTOROLA, INC.		
	3	1187480	EP	A1	2002-03-13	TELESUITE CORP.		
	4	2001/089156	WO	A2	2001-11-22	SONY CORP		
	5	2008/271265	JP	A	2008-11-06	MATSUSHITA ELECTRIC IND CO LTD	English abstract and translation	X
	6	2107463	EP	A2	2009-10-07	OPTION		☐
	7	2756668	EP	A	2014-07-23	BARCO NV	corresponds to WO 2013/037979	☐
	8	1499841	CN	A	2004-05-26	FUJI XEIOX CO LTD	cited in CN OA, corresponds to US 20040128354	☒
	9	101106681	CN	A	2008-01-16	VTRON CORP	cited in CN OA, English machine translation	☒
	10	1788494	CN	A	2006-06-14	TELESUIT CORP	cited in CN OA, English abstract	☒
/C.A.B/	11	101022529	CN	A	2007-08-22	LIXING INTERNAT SCIENCE & TECH	cited in CN OA, English abstract	☒

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	12	101106469	CN	A	2008-01-16	AWIND INC	cited in CN OA, English abstract	☒
	13	101442500	CN	A	2009-05-27	XIAOTAO YIN	cited in CN OA, English abstract	☒
	14	101828392	CN	A	2010-09-08	CREATIVE TECH LTD	cited in CN OA, English abstract	☒
	15	102023852	CN	A	2011-04-20	JULONG EDUCATIONAL TECHNOLOGY CO LTD	cited in CN OA, English abstract	☒
	16	1689275	CN	A	2005-10-26	SONY CORP	English abstract, corresponds to US 20020174254	☒
/C.A.B/	17	2007/137415	WO	A1	2007-12-06	SMART TECH INC	cited in EP Office Communication	☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
/C.A.B/	1	International Search Report (ISR) dated March 6, 2013, for PCT/EP2012/068166.	
/C.A.B/	2	International Search Report (ISR) dated March 19, 2013, for PCT/EP2012/068167.	
/C.A.B/	3	International Search Report (ISR) dated March 4, 2013, for PCT/EP2012/068168.	

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	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	4	International Search Report (ISR) dated January 28, 2013, for PCT/EP2012/068169.	
	5	British Search Report dated August 28, 2012, for GB 1206841.7.	
	6	German Search Report dated November 17, 2011, for DE 102011055443.2.	
	7	Jiang et al., "A Novel Wireless Approach for Conference Projecting and Cooperating", Lecture Notes in Computer Science, Vol. 4159, pp. 688-697, 2006. (cited in GB 1206841.7 Search Report)	
	8	Martin Trautschold, iPhone 4 Made Simple, 2010, Apress, Pages 1-819.	
	9	Office Action in related U.S. Application Number 15/449,048, dated February 16, 2018.	
	10	US Office Action dated March 29, 2016, for 14/395,364.	
	11	Marc AL-HAMES et al., Audio-Visual Processing in Meetings: Seven Questions and Current AMI Answers, 2006.	
	12	Mood indicators on electronic meeting tools" IBM, IP.com number: IPCOMOOOO1171D, Publication Date: March 12, 2003.	
	13	Final Office Action in related U.S. Application No. 14/278,442, dated June 8, 2018.	
/C.A.B/	14	Office Action in related Chinese Application Number 201280055744.2, dated March 30, 2018.	X

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	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	15	Office Action in related U.S. Application Number 14/344,836, dated February 28, 2018.	☐
	16	U.S. Office Action dated October 20, 2017, for U.S. Application No. 14/344,836.	☐
	17	European Notice of Opposition dated September 27, 2017 for EP 2756668.	☐
	18	StarTech.com: USB to DVI External Dual Monitor Video Adapter/USS to VGA External Dual Monitor Video Adapter, User Manual dated May 19, 2011.	☐
	19	Microsoft Community, conversation on August 30, 2011 about USB2VGA Adapter, retrieved on September 7, 2017.	☐
	20	Webopedia Definition of Peripheral Device, retrieved on September 7, 2017.	☐
	21	Trulink Wireless USB2VGA Adapter, Quick Start Guide, retrieved from www.c2g.com.	☐
	22	HWebPage on Availability of Trulink, retrieved on September 7, 2017.	☐
	23	Chinese Office Action dated October 31, 2017, for CN 201280001542.X, and English translation thereof.	☐
	24	European Office Communication dated June 15, 2015, for EP 12762258.7.	☐
/C.A.B/	25	European Office Action dated August 1, 2016, for EP 12762258.7.	☐

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	First Named Inventor	Koen Simon Herman BEEL
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	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	26	U.S. Office Action dated June 17, 2016, for 14/278,442.	☐
	27	U.S. Office Action dated June 17, 2016, for 14/725,401.	☐
	28	Chinese Office Action dated April 5, 2017, for CN 201280055744.2, and English translation thereof.	☐
	29	U.S. Office Action dated May 3, 2017, for U.S. Application No. 14/344,836.	☐
	30	Chinese Office Action dated September 26, 2017, for CN 201280055744.2, and English translation thereof.	☒
	31	U.S. Office Action dated September 28, 2017, for U.S. Application No. 14/278,442.	☐
	32	"Quick Connect Wireless with Epson Projectors", retrieved from https://www.youtube.com/watch?v=9POz4-HyDXY, November 3, 2009.	☐
	33	"Remote Framebuffer Protocol (RFB)", Internet standard IETF RFC 6143 , March 2011.	☐
	34	Richardson & Wood, "The RFB Protocol", Cambridge: ORL, 1998.	☐
	35	"Manual of the Epson projectors", retrieved from http://esupport.epsoneurope.com/ViewArticle.aspx?lng=sv-SE&kbid=328038&data=bOU002FRIftu7YFtMOBp2mpSKntPq1A26Wyw&cl=1, February 14, 2011.	☐
/C.A.B/	36	Chinese Office Action dated December 27, 2016, for CN 201280074077.2, and English translation thereof.	☐

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	Art Unit	2184
	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	37	Final Office Action in corresponding U.S. App. 14/725,401 dated January 26, 2017.	☐
	38	Final Office Action in corresponding U.S. App. 14/278,442 dated January 26, 2017.	☐
	39	Chinese Office Action in Chinese Application Number 201280074077.2, dated January 4, 2018.	☒
	40	International Preliminary Report on Patentability (IPRP) dated March 27, 2014, for PCT/EP2012/068166.	☐
	41	International Preliminary Report on Patentability (IPRP) dated March 27, 2014, for PCT/EP2012/068167.	☐
	42	International Preliminary Report on Patentability (IPRP) dated March 27, 2014, for PCT/EP2012/068168.	☐
	43	Request for Reexamination of Patent No. 8,756,348, dated February 9, 2018.	☐
	44	Request for Reexamination of Patent No. 9,083,769, dated February 9, 2018.	☐
	45	Intervention according to Art. 105 EPC in corresponding European patent 2756668, dated May 3, 2018.	☐
	46	Chinese Office Action dated November 4, 2016, for CN 201280001542.X, and English translation thereof.	☐
/C.A.B/	47	European Office Communication dated December 21, 2015, for EP 12762258.7.	☐

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	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	48	Chinese Office Action dated June 28, 2017, for CN 201280074077.2, and English translation thereof.	☒
/C.A.B/	49	Chinese Office Action dated July 4, 2017, for CN 201280055667.0, and English translation thereof.	☒
/C.A.B/	50	Chinese Office Action dated July 21, 2017, for CN 20128001542.X, and English translation thereof.	☒

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EXAMINER SIGNATURE

Examiner Signature	/CHRISTOPHER A BARTELS/	Date Considered	10/01/2020

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	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	
	Attorney Docket Number	BEEL3004C/TL

CERTIFICATION STATEMENT

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☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2020-04-20
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	BARTELS, CHRISTOPHER A.
Attorney Docket Number	BEEL3004C/TL

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/C.A.B/	1	U.S. Office Action in corresponding U.S. Application No. 16/034,846, dated June 25, 2020.	

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Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2020-06-30
Name/Print	THOMAS LEE	Registration Number	66396

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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Examiner Name	Bartels, Christopher A.
Attorney Docket Number	BEEL3004C/TL

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/C.A.B/	1	7853535	B2	2010-12-14	Colella	
/C.A.B/	2	7908401	B2	2011-03-15	Chang	

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/C.A.B/	1	20060080707	A1	2006-04-13	Laksono	
/C.A.B/	2	20100149206	A1	2010-06-17	Shigehisa et al.	

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/C.A.B/	1	1525300	CN	A	2004-09-01	Microsoft Corp.	Abstract.	X

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	Examiner Name	Bartels, Christopher A.
	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	2	1555197	CN	A	2004-12-15	Shenzhen Postgraduate Inst Tsi	Abstract.	☒
/C.A.B/	3	101046952	CN	A	2007-10-03	Kei Nakayama	Abstract.	☒
/C.A.B/	4	101075896	CN	A	2007-11-21	Polycom Inc.	Abstract.	☒
/C.A.B/	5	102025774	CN	A	2011-04-20	TPV Display Technology Xiamen	Abstract.	☒
/C.A.B/	6	102088593	CN	A	2011-06-08			☒
/C.A.B/	7	2007148904	JP	A	2007-06-14	Toshiba Corp	Abstract.	☒
/C.A.B/	8	201012222	TW	A	2010-03-16	Primax Electronics Ltd	Abstract.	☒

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/C.A.B/	1	Chinese Office Action in corresponding Chinese Application No. 201810229467.1, dated April 7, 2020.	X
/C.A.B/	2	Chinese Office Action in corresponding Chinese Application No. 201811092577.4, dated April 7, 2020.	☒

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Bartels, Christopher A.
	Attorney Docket Number	BEEL3004C/TL

EXAMINER SIGNATURE			
Examiner Signature	/CHRISTOPHER A BARTELS/	Date Considered	10/01/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.B/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
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	Art Unit	2184
	Examiner Name	Bartels, Christopher A.
	Attorney Docket Number	BEEL3004C/TL

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2020-08-06
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1,380,600	(G06F$ H04L$ H04M$).CPC. and (driver audio speaker conference teleconference)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/01 12:07
L2	115,482	L1 and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/01 12:10
L3	129	L2 and (mass adj storage with (driver function$5) screen near2 scrap$4).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/01 12:11
L4	111	L3 AND (network lan local near2 (area network) ethernet usb universal near2 (serial bus) antenna radio wireless$2 wire adj less$2).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/01 12:12
L5	7	l4 and (hypervisor virtual$4 near2 (audio conferenc$3 stream video movie motion media)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/01 12:13
L6	6	l5 and (driver dll)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/01 12:14

S1	2	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/10 20:50
S2	204	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:30
S3	1	S2 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:30
S4	12,070	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:33
S5	95	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/04/03 08:34
S7	13	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:43
S8	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:43

S9	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:47
S10	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 08:57
S11	1	(S7 S8 S9 S10) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 09:05
S12	95	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/04/03 10:57
S13	77	S12 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 10:57
S14	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 10:59
S15	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/04/03 10:59

S16	8	S12 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/04/03 11:03
S17	10	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/04/03 13:24
S18	11	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/04/03 13:24
S19	10	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/04/03 13:24
S20	15	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/04/03 13:24
S21	3	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S22	224	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S23	1	S22 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S24	12,761	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S25	98	(web data screen) near2 scrap$4	US-PGPUB; USPAT;	AND	ON	2017/10/13 22:55

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S26	13	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S27	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S28	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S29	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S30	1	(S26 S27 S28 S29) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S31	98	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/13 22:55
S32	79	S31 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR;	OR	ON	2017/10/13 22:55

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S33	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S34	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/13 22:55
S35	8	S31 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/13 22:55
S36	11	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/13 22:55
S37	12	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/13 22:55
S38	11	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/13 22:55
S39	16	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/13 22:55
S40	3	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S41	224	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2017/10/16 14:06

			DERWENT; IBM_TDB			
S42	1	S41 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S43	12,797	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S44	98	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/16 14:06
S45	13	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S46	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S47	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S48	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2017/10/16 14:06

			DERWENT; IBM_TDB			
S49	1	(S45 S46 S47 S48) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S50	98	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/16 14:06
S51	79	S50 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S52	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S53	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S54	8	S50 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/16 14:06
S55	11	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06

S56	12	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S57	11	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S58	16	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S59	3	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S60	224	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S61	1	S60 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S62	12,797	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S63	98	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/16 14:06
S64	13	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2017/10/16 14:06

			DERWENT; IBM_TDB			
S65	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S66	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S67	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S68	1	(S64 S65 S66 S67) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S69	98	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/16 14:06
S70	79	S69 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S71	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2017/10/16 14:06

			DERWENT; IBM_TDB			
S72	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/10/16 14:06
S73	8	S69 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2017/10/16 14:06
S74	11	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S75	12	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S76	11	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S77	16	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2017/10/16 14:06
S78	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/01/16 08:58
S79	3	(US-20070033289-$ or US-20130060662-$).did. or (US-8346753-$).did.	US-PGPUB; USPAT	OR	OFF	2018/02/16 19:47
S80	1	S79 and (driver)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 19:47
S81	1,096	(audio speaker) with (driver module) and (driver module) with (generic and specific)	US-PGPUB; USPAT; USOCR;	OR	OFF	2018/02/16 19:49

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S82	636	S81 and (adhoc ad adj hoc network$3 lan vpn wan) and (port peripheral)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 19:50
S83	522	S82 and (window microsoft operat$3 near2 system)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 19:50
S84	544	S82 and (window microsoft operat$3 near2 system kernel linux unix mac os adj x)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 19:51
S85	22	S84 not S83	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 19:51
S86	6	"20070033289"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/20 11:18
S87	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/07/18 08:52
S88	7	(US-20070033289-$ or US-20130060662-$ or US-20040125777-$ or US-20070065078-$ or US-	US-PGPUB; USPAT	OR	ON	2018/07/23 15:17

		20090247006-$ or US-20130054348-$).did. or (US-8346753-$).did.				
S89	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S90	255	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S91	2	S90 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S92	14,620	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S93	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S94	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S95	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/26 07:58

			DERWENT; IBM_TDB			
S96	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S97	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S98	1	(S94 S95 S96 S97) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S99	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S100	92	S99 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S101	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S102	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/26 07:58

			DERWENT; IBM_TDB			
S103	12	S99 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S104	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S105	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S106	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S107	19	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S108	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S109	255	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S110	2	S109 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S111	14,620	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58

S112	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S113	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S114	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S115	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S116	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S117	1	(S113 S114 S115 S116) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S118	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58

S119	92	S118 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S120	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S121	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S122	12	S118 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S123	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S124	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S125	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S126	19	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S127	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S128	255	(audio near2 driver audio adj driver) and (hmi human near2 (machine	US-PGPUB; USPAT;	OR	ON	2018/11/26 07:58

		interface)) and (usb with (mass storage class))	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S129	2	S128 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S130	14,620	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S131	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S132	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S133	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S134	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S135	2	"20020174254"	US-PGPUB; USPAT; USOCR;	OR	ON	2018/11/26 07:58

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S136	1	(S132 S133 S134 S135) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S137	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S138	92	S137 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S139	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S140	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S141	12	S137 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S142	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58

S143	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S144	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S145	19	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S146	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S147	255	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S148	2	S147 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S149	14,620	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S150	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S151	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/26 07:58

			DERWENT; IBM_TDB			
S152	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S153	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S154	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S155	1	(S151 S152 S153 S154) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S156	111	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S157	92	S156 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S158	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/26 07:58

			DERWENT; IBM_TDB			
S159	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S160	12	S156 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2018/11/26 07:58
S161	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S162	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S163	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S164	19	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/26 07:58
S165	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S166	3	(US-20070033289-$ or US-20130060662-$).did. or (US-8346753-$).did.	US-PGPUB; USPAT	OR	OFF	2018/11/26 07:58
S167	1	S166 and (driver)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/11/26 07:58
S168	1,203	(audio speaker) with (driver module) and (driver module) with (generic and specific)	US-PGPUB; USPAT; USOCR;	OR	OFF	2018/11/26 07:58

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S169	683	S168 and (adhoc ad adj hoc network$3 lan vpn wan) and (port peripheral)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/11/26 07:58
S170	566	S169 and (window microsoft operat$3 near2 system)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/11/26 07:58
S171	588	S169 and (window microsoft operat$3 near2 system kernel linux unix mac os adj x)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/11/26 07:58
S172	22	S171 not S170	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/11/26 07:58
S173	6	"20070033289"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/11/26 07:58
S174	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 07:58
S175	7	(US-20070033289-$ or US-20130060662-$ or US-20040125777-$ or US-20070065078-$ or US-	US-PGPUB; USPAT	OR	ON	2018/11/26 07:58

		20090247006-$ or US-20130054348-$).did. or (US-8346753-$).did.				
S176	3	"20110180380"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 08:01
S177	7	"20100064063"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 08:06
S178	20	"8756348"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 08:16
S179	2	"8756348".PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 08:16
S180	34	"0189156" "2010105335" "20100302454"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 08:21
S181	18	"0189156"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 08:21
S182	17	("2010105335" "20100302454")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/26 09:48

			DERWENT; IBM_TDB			
S183	8	("2010105335" "20100302454").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 09:48
S184	0	"14725401".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 11:21
S185	2	"20150263905"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 11:21
S186	6	("20090064302" "20100066806").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 11:22
S187	30	("20100064063" "2013037979" "2008165007" "2000242257")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 11:39
S189	440	"l8" and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 12:29
S190	27,066	S188 and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/26 12:30

			DERWENT; IBM_TDB			
S191	74	S190 and (mass adj storage with (driver function$5) screen near2 scrap$4).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 12:38
S192	12	S190 and (mass adj storage with (driver function$5) and screen near2 scrap$4).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/26 12:38
S199	14	"20110188391" "20110092198"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/06/23 13:15
S200	5	("20110188391" "20110092198").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/06/23 13:15
S201	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S202	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S203	3	S202 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:18

			DERWENT; IBM_TDB			
S204	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S205	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:18
S206	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S207	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S208	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S209	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S210	1	(S206 S207 S208 S209) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:18

			DERWENT; IBM_TDB			
S211	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:18
S212	103	S211 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S213	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S214	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:18
S215	14	S211 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:18
S216	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:18
S217	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:18
S218	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S219	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19

S220	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S221	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S222	3	S221 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S223	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S224	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S225	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S226	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19

S227	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S228	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S229	1	(S225 S226 S227 S228) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S230	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S231	103	S230 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S232	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S233	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19

S234	14	S230 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S235	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S236	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S237	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S238	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S239	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S240	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S241	3	S240 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S242	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S243	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT;	AND	ON	2019/11/12 10:19

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S244	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S245	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S246	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S247	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S248	1	(S244 S245 S246 S247) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S249	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S250	103	S249 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR;	OR	ON	2019/11/12 10:19

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S251	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S252	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S253	14	S249 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S254	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S255	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S256	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S257	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S258	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S259	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S260	3	S259 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S261	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S262	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S263	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S264	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S265	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S266	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S267	1	(S263 S264 S265 S266) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S268	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S269	103	S268 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S270	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S271	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S272	14	S268 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S273	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19

S274	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S275	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S276	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S277	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S278	3	(US-20070033289-$ or US-20130060662-$).did. or (US-8346753-$).did.	US-PGPUB; USPAT	OR	OFF	2019/11/12 10:19
S279	1	S278 and (driver)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S280	1,360	(audio speaker) with (driver module) and (driver module) with (generic and specific)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S281	759	S280 and (adhoc ad adj hoc network$3 lan vpn wan) and (port peripheral)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S282	637	S281 and (window microsoft operat$3 near2 system)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19

S283	662	S281 and (window microsoft operat$3 near2 system kernel linux unix mac os adj x)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S284	25	S283 not S282	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S285	7	"20070033289"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S286	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S287	7	(US-20070033289-$ or US-20130060662-$ or US-20040125777-$ or US-20070065078-$ or US-20090247006-$ or US-20130054348-$).did. or (US-8346753-$).did.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S288	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S289	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19

S290	3	S289 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S291	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S292	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S293	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S294	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S295	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S296	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19

S297	1	(S293 S294 S295 S296) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S298	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S299	103	S298 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S300	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S301	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S302	14	S298 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S303	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S304	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19

S305	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S306	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S307	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S308	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S309	3	S308 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S310	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S311	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S312	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19

S313	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S314	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S315	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S316	1	(S312 S313 S314 S315) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S317	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S318	103	S317 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S319	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19

S320	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S321	14	S317 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S322	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S323	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S324	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S325	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S326	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S327	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S328	3	S327 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S329	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT;	OR	ON	2019/11/12 10:19

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S330	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S331	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S332	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S333	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S334	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S335	1	(S331 S332 S333 S334) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S336	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR;	AND	ON	2019/11/12 10:19

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S337	103	S336 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S338	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S339	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S340	14	S336 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S341	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S342	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S343	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S344	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S345	5	"20150169477"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S346	282	(audio near2 driver audio adj driver) and (hmi human near2 (machine interface)) and (usb with (mass storage class))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S347	3	S346 and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S348	16,592	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S349	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S350	15	"2007137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S351	3	"20070137415"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S352	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S353	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S354	1	(S350 S351 S352 S353) and screen near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S355	124	(web data screen) near2 scrap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2019/11/12 10:19
S356	103	S355 and (portable cellular pda smartphone smart adj phone mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S357	2	"20020174254"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S358	9	("20110023096" "20070033289" "20140082227").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S359	14	S355 and usb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	AND	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S360	14	(("BEEL") near3 ("Koen")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S361	15	(("NIR") near3 ("Yoav")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S362	14	(("LOUWET") near3 ("Filip")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S363	20	(("COEN") near3 ("Guy")).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2019/11/12 10:19
S364	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S365	3	(US-20070033289-$ or US-20130060662-$).did. or (US-8346753-$).did.	US-PGPUB; USPAT	OR	OFF	2019/11/12 10:19
S366	1	S365 and (driver)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S367	1,360	(audio speaker) with (driver module) and (driver module) with (generic and specific)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S368	759	S367 and (adhoc ad adj hoc network$3 lan vpn wan) and (port peripheral)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S369	637	S368 and (window microsoft operat$3 near2 system)	US-PGPUB; USPAT; USOCR;	OR	OFF	2019/11/12 10:19

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S370	662	S368 and (window microsoft operat$3 near2 system kernel linux unix mac os adj x)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S371	25	S370 not S369	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S372	7	"20070033289"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/12 10:19
S373	3	"14344836"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S374	7	(US-20070033289-$ or US-20130060662-$ or US-20040125777-$ or US-20070065078-$ or US-20090247006-$ or US-20130054348-$).did. or (US-8346753-$).did.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S375	3	"20110180380"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S376	7	"20100064063"	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2019/11/12 10:19

			JPO; DERWENT; IBM_TDB			
S377	29	"8756348"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S378	3	"8756348".PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S379	48	"0189156" "2010105335" "20100302454"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S380	32	"0189156"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S381	17	("2010105335" "20100302454")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S382	8	("2010105335" "20100302454").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S383	0	"14725401".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S384	2	"20150263905"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S385	6	("20090064302" "20100066806").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S386	30	("20100064063" "2013037979" "2008165007" "2000242257")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S387	492	"l8" and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S388	364,447	(driver software process method) with (generic install$5 pre adj install$5 windows linux osx apple operat$3 near2 system).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S389	28,974	S388 and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S390	75	S389 and (mass adj storage with (driver function$5) screen near2 scrap$4).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/12 10:19

			DERWENT; IBM_TDB			
S391	12	S389 and (mass adj storage with (driver function$5) and screen near2 scrap$4).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S392	15	"20110188391" "20110092198"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S393	5	("20110188391" "20110092198").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/12 10:19
S400	28	("20030120849" | "20060233191" | "20070162661" | "20080088634" | "20080182518" | "20090023475" | "20090029647" | "20090251621" | "20100022274" | "20100077021" | "20100091987" | "20100115145" | "20100154014" | "20100297964" | "20100309896" | "20110010470" | "20110010607" | "20110038005" | "20110210983" | "6601087" | "7584313" | "7762470" | "8069465" | "8327410" | "8521926" | "8601470" | "8717599" | "8896656").PN.	US-PGPUB; USPAT	OR	ON	2020/05/14 12:31
S401	28	S400 and (driver audio speaker conference teleconference)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/05/14 13:10
S402	5	S400 and (driver audio speaker conference teleconference) with (generic proprietary unique intellectual property)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/05/14 13:15

			DERWENT; IBM_TDB			
S403	291,278	("20120331509" | "6966035" | "20070033289" | "20100332663" | "20100064063" | "20110188391" | "20120054372" | "20090023475" | "20100091987" | "7762470" | "20050036509" | "20090046139" | "8316138" | "20090092198" | "20090300520" | "20110150433" | "20100302454" | "20090247006" | "20110188391" | "20100077021" | "20110010470" | "20110038005" | "20020196378" | "20070005809" | "20070244970" | "20060233191" | "20110210983" | "7584313" | "8521926" | "20040263636" | "20090198839" | "20130050254" | "20090064302" | "20070033289" | "20130060662" | "8346753" | "20110092198" | "20030120849" | "20090029647" | "20090251621" | "20100022274" | "20100115145" | "20100154014" | "20100087139" | "20110023096" | "20090235170" | "20110180380" | "20100066806" | "20090189981" | "20070162661" | "8327410" | "8601470" | "20060031779" | "20140082227" | "20070109410" | "20100066806" | "20110078716" | "20040125777" | "20130054348" | "6601087" | "8896656" | "20100302130" | "20130067121" | "20050015719" | "20110179182" | "20020174254" | "20040128354" | "20110092198" | "20080182518" | "20100297964" | "20110010607" | "8069465" | "8717599" | "20060095376" | "20110115689" | "20050122392" | "20070065078" | "20090064302" | "20080088634" | "20100309896")".PN"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/05/14 14:26
S404	212	("20120331509" | "6966035" | "20070033289" | "20100332663" | "20100064063" | "20110188391" | "20120054372" | "20090023475" | "20100091987" | "7762470" | "20050036509" | "20090046139" | "8316138" | "20090092198" | "20090300520" | "20110150433" | "20100302454" | "20090247006" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/05/14 14:39

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S405	0	S400 not S404	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/05/14 14:40
S406	18	"20020054044"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/06/20 19:38
S407	0	((smart adj technology) (smart adj technology).as.) and linq with ((meeting conference ball participant) and (wifi wireless$2 wire adj less$2 radio frequency link))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/06/20 20:24

			DERWENT; IBM_TDB			
S408	0	((smart adj technology) (smart adj technology).as.) and linq with ((meeting conference ball participant))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/06/20 20:24
S409	2	((smart adj technology) (smart adj technology).as.) and linq with ((wifi wireless$2 wire adj less$2 radio frequency link))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/06/20 20:25
S410	2	banerjee.inv. and linq	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/06/20 20:36

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S193	337,912	(driver software process method) with (generic install$5 pre adj install$5 windows linux osx apple operat$3 near2 system).clm.	US-PGPUB; USPAT	OR	ON	2018/11/26 12:27
S194	173,044	(G06F$ H04L$ H04M$).CPC. and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT	OR	ON	2018/11/26 12:41
S195	17,887	S194 AND (driver software process method) with (generic install$5 pre adj install$5 windows linux osx apple operat$3 near2 system).dm.	US-PGPUB; USPAT	OR	ON	2018/11/26 12:42
S196	12	S195 and (mass adj storage with (driver function$5) and screen near2 scrap$4).clm.	US-PGPUB; USPAT	OR	ON	2018/11/26 12:43
S197	71	S195 and (mass adj storage with (driver function$5) screen near2 scrap$4).dm.	US-PGPUB; USPAT	OR	ON	2018/11/26 12:43

S198	59	S197 NOT S196	US-PGPUB; USPAT	OR	ON	2018/11/26 12:44
S394	364,447	(driver software process method) with (generic install$5 pre adj install$5 windows linux osx apple operat$3 near2 system).clm.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S395	184,345	(G06F$ H04L$ H04M$).CPC. and (peripheral endpoint module speaker webcam web adj camera webcamera multimedia multi adj media) with (bus interface network select$5 switch$3).clm.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S396	19,077	S395 AND (driver software process method) with (generic install$5 pre adj install$5 windows linux osx apple operat$3 near2 system).dm.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S397	12	S396 and (mass adj storage with (driver function$5) and screen near2 scrap$4).clm.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S398	72	S396 and (mass adj storage with (driver function$5) screen near2 scrap$4).dm.	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19
S399	60	S398 NOT S397	US-PGPUB; USPAT	OR	ON	2019/11/12 10:19

10/1/2020 12:18:05 PM
C:\Users\cbartels\Documents\EAST\Workspaces\16852790partTwo.wsp

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	BARTELS, CHRISTOPHER A.
Attorney Docket Number	BEEL3004C/TL

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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/C.A.B/	1	20020054044	A1	2002-05-09	Lu et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.B/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	BARTELS, CHRISTOPHER A.
	Attorney Docket Number	BEEL3004C/TL

/C.A.B/	1	LINQ SOFTWARE USER'S GUIDE, Smart Technologies Inc., Copyright 2004-2005, Version 1.0, pages 1-19.	

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EXAMINER SIGNATURE

Examiner Signature	/CHRISTOPHER A BARTELS/	Date Considered	10/01/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	BARTELS, CHRISTOPHER A.
	Attorney Docket Number	BEEL3004C/TL

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2020-06-16
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.B/

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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CONFIRMATION NO. 5321

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
16/852,790	04/20/2020 **RULE**	710	2184	BEEL3004C/TL

APPLICANTS

BARCO N.V., Kortrijk, BELGIUM;

INVENTORS

Koen Simon Herman Beel, Eke, BELGIUM;
Yoav Nir, Komen, BELGIUM;
Filip Josephine Johan Louwet, Knesselare, BELGIUM;
Guy Coen, Aalst, BELGIUM;

**** CONTINUING DATA ***************************

This application is a CON of 14/344,836 03/03/2015 PAT 10762002
which is a 371 of PCT/EP2012/068167 09/14/2012
which claims benefit of 61/534,592 09/14/2011
and claims benefit of 61/635,234 04/18/2012
and is a CIP of 13/270,659 10/11/2011 PAT 8756348

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

04/23/2020

Foreign Priority claimed ❑ Yes ☑ No 35 USC 119(a-d) conditions met ❑ Yes ☑ No Verified and Acknowledged /CHRISTOPHER A. BARTELS/ Examiner's Signature	❑ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		BELGIUM	6	20	4

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UNITED STATES

TITLE

ELECTRONIC TOOL AND METHODS WITH AUDIO FOR MEETINGS

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BIB (Rev. 05/07).

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	~~TBD~~ CHRISTOPHER A. BARTELS
Attorney Docket Number	BEEL3004CTL

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/C.A.B/	1	6601087		2003-07-29	Zhu et al.	
	2	7584313		2009-09-01	Hay et al.	
	3	7762470		2010-07-27	Finn et al.	
	4	8069465		2011-11-29	Bartholomay et al.	
	5	8327410		2012-12-04	Andersen et al.	
	6	8521926		2013-08-27	Hsueh et al.	
	7	8601470		2013-12-03	Yue et al.	
/C.A.B/	8	8717599		2014-05-06	Ochiai et al.	

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	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	9	8896656		2014-11-25	Epstein et al.	

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/C.A.B/	1	20030120849		2003-06-26	Roslak et al.	
	2	20060233191		2006-10-19	Pirzada et al.	
	3	20070162661		2007-07-12	Fu et al.	
	4	20080088634		2008-04-17	Thompson et al.	
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	6	20090023475		2009-01-22	Chang et al.	
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/C.A.B/	8	20090251621		2009-10-08	Ichieda	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	9	20100022274		2010-01-28	Roberts et al.	
	10	20100077021		2010-03-25	Hsueh et al.	
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	12	20100115145		2010-05-06	Banerjee et al.	
	13	20100154014		2010-06-17	Andersen et al.	
	14	20100297964		2010-11-25	Austin et al.	
	15	20100309896		2010-12-09	Sugiyama et al.	
	16	20110010470		2011-01-13	Hulbert et al.	
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	18	20110038005		2011-02-17	Ochiai et al.	
/C.A.B/	19	20110210983		2011-09-01	Theimer et al.	

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	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	20	20110179182	A1	2011-07-21	VADLA RAVNAS	
	21	20050015719	A1	2005-01-20	MARCHON et al.	
	22	20090092198	A1	2011-04-21	Miyata	
	23	20050122392	A1	2005-06-09	Johansen et al.	
	24	20090300520	A1	2009-12-03	Ashutosh et al.	
	25	20120054372		2012-03-01	Chen et al.	
	26	20090189981		2009-07-30	Siann et al.	
	27	20110188391		2011-08-04	Sella et al.	
	28	20100064063		2010-03-11	Deforche et al.	
/C.A.B/	29	20110092198		2011-04-21	Miyata	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
/C.A.B/	1	2006-185359	JP		2006-07-13	Eastman Kodak Co.	English Abstract	
	2	2009-080663	JP		2009-04-16	Brother Ind Ltd.	English Abstract	
	3	2010-263326	JP		2010-11-18	Sumitomo Electric Ind.	English Abstract	
	4	2010/008866	WO		2010-01-21	Schaaf		
	5	2008-090561	JP		2008-04-17	BROTHER IND LTD	cited in EP Search Report, English abstract & mach translation	
	6	1329055	EP		2003-07-23	SONY CORP	cited in EP Search Report, corresponds to WO 01/089156	
	7	1476242	CN		2004-02-18	SEIKO EPSON CORP	English abstract of corresponding EP 1385336, cited in CN OA	
	8	2010/105335	WO		2010-09-23	SMART TECHNOLOGIES ULC	cited in CN OA	
	9	102045864	CN		2011-05-04	NEC CASIO MOBILE COMM LTD	English abstract (Corresponds U.S. 2011/0092198), cited in CN OA	
/C.A.B/	10	101631223	CN		2011-04-20	SHANGHAI HUAPING INFORMATION TECHNOLOGY CO LTD	Cited in CN OA dated 10-10-16, English abstract	

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	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	11	101454762	CN		2013-06-12	SMART TECHNOLOGIES ULC	Cited in CN OA dated 10-10-16, English abstract	
	12	1550996	CN		2004-12-01	SEIKO EPSON CORP	Cited in CN OA dated 10-14-16, English abstract	
	13	101965609	CN		2011-02-02	SMART TECHNOLOGIES ULC	Cited in CN OA dated 10-14-16, English abstract	
	14	1385336	EP		2004-01-28	SEIKO EPSON CORP		
	15	2013037979	WO		2013-03-21	Barco N.V.		
	16	2008165007	JP		2008-07-17	Brother Ind Ltd		☒
	17	2000242257	JP		2000-09-08	Canon KK		☒
	18	102045864	CN		2011-05-04	NEC Casio Mobile Comm Ltd.	English abstract	☐
/C.A.B/	19	2010135894	WO	A1	2010-12-02	ZTE Corporation	English Abstract.	☒

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5

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	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	1	"Universal Serial Bus 3.0 Specification", Revision 1.0 Nov. 12, 2008.	
	2	"Wireless Universal Serial Bus Specification 1.1", Revision 1.1 September 9, 2010.	
	3	AUSTIN et al., "Determinants and Patterns of Control over Technology in a Computerized Meeting Room," CSCW 90 Proceedings, pp. 39-51 (Oct. 1990).	
	4	ROTH, "Building Group Decision Support Rooms Using 'Off-the-Shelf' Computing Resources: Prospects and Issues," Database, pp. 21-31 (May 1993).	
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	6	Products, components, systems, and methods in public use and/or sale related to the Epson Quick Wireless Connection USB key and Quick Wireless Connection , developed by Epson (accessed July 7, 2017)	
	7	Products, components, systems, and methods in public use and/or sale related to the IOGEAR GUW2015VKIT Wireless USB to VGA Adapter Kit, developed by IOGEAR (accessed July 17, 2017).	
	8	Products, components, systems, and methods in public use and/or sale related to the ActionTec MyWirelessTV HDMI Transmitter, developed by ActionTec and Cavium (accessed Feb. 3, 2020).	
	9	European Search Report dated August 1, 2017, for EP 16207123.	
	10	European Extended Search Report dated November 3, 2016, for EP 16170760.9.	
/C.A.B/	11	Chinese Office Action dated October 14, 2016, for CN 201280055744.2.	

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	Application Number	
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	12	Chinese Office Action dated October 10, 2016, for CN 201280055667.0.	
	13	Final Office Action in corresponding U.S. app. 14/395,364 dated November 2, 2016.	
	14	Office Action in related U.S. app. 14/725,401 dated December 31, 2019.	
	15	Summons to attend oral proceedings in corresponding EP 12762258.7 dated December 12, 2019.	
	16	Chinese Office Action in corresponding Chinese Application No. 201280074077.2, dated September 30, 2019.	
	17	U.S. Office Action in corresponding U.S. Application No. 14/278,442, dated September 18, 2019.	
	18	Notice on Reexamination in corresponding Chinese Application No. 201280001542.X, dated June 11, 2019.	X
	19	European Office Action in corresponding European Application No. 12759440.6-1204, dated May 28, 2019.	☐
	20	U.S. Office Action in corresponding U.S. Application No. 15/449,048, dated April 8, 2019.	☐
	21	European Office Action in corresponding European Application No. 12775162.6-1204, dated May 21, 2019.	☐
/C.A.B/	22	Chinese Office Action in corresponding Chinese Application No. 201280074077.2, dated March 5, 2019.	☐

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	Application Number	
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	23	European Office Action in corresponding European Application No. 16170760.9-1216, dated April 2, 2019.	☐
	24	Non-Final Office Action in corresponding U.S. Reexamination No. 90/014,088, dated September 25, 2018.	☐
	25	Final Office Action in corresponding U.S. Reexamination No. 90/014,087, dated January 22, 2019.	☐
	26	Chinese Office Action in related Chinese Application No. 201280001542.X, dated January 2, 2019.	☒
	27	https://www.infocus.com/resources/documents/User-Guides/Liteshow-3-UserGuide.pdf, accessed October 3, 2018.	☐
	28	http://esupport.epson-europe.com/ViewArticle.aspx?lng=sv-SE&kbid=328038&data=bOU002FRlftu7YFtMOBp2mpSKntPq1A26Wyw&cl=1, accessed July 8, 2017.	☐
	29	SIPO Office Action in corresponding app. CN 201280074077.2 dated August 23, 2018.	☒
	30	Office Action in corresponding app. 15/449,048 dated October 12, 2018.	☐
	31	SIPO Office Action in corresponding app. CN 201280001542.X dated July 30, 2018.	☒
	32	EPO Office Action in corresponding app. EP 12759440.6-1204 dated August 9, 2018.	☐
/C.A.B/	33	EPO Office Action in corresponding app. EP 12775162.6-1204 dated August 9, 2018.	☐

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	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

/C.A.B/	34	Office Action in corresponding app. 14/725,401 dated September 10, 2018.	☐
	35	Office Action in corresponding app. 90/014,087 dated September 4, 2018.	☐
	36	Office Action in corresponding app. 16/034,846 dated October 7, 2019.	☐
	37	Office Action in corresponding app. 14/344,830 dated September 27, 2017.	☐
	38	Office Action in corresponding app. 14/344,830 dated October 6, 2016.	☐
	39	Chinese Notice on Reexamination in corresponding Chinese Application No. 201280074077.2, dated March 31, 2020.	☒
	40	European Office Action in corresponding European Application No. 12775162.6, dated April 14, 2020.	☐
	41	Brazil Office Action in corresponding Brazil Application No. BR112014026147-4, dated April 8, 2020.	☒
/C.A.B/	42	Brazil Office Action in corresponding Brazil Application No. BR122015022158-7, dated April 8, 2020.	☒

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Examiner Signature	/CHRISTOPHER A BARTELS/	Date Considered	10/01/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	TBD
	Attorney Docket Number	BEEL3004CTL

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas Lee/	Date (YYYY-MM-DD)	2020-04-20
Name/Print	THOMAS LEE	Registration Number	66396

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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Application Number	16852790
Filing Date	2020-04-20
First Named Inventor	Koen Simon Herman BEEL
Art Unit	2184
Examiner Name	Bartels, Christopher A.
Attorney Docket Number	BEEL3004C/TL

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	1	7853535	B2	2010-12-14	Colella	
	2	7908401	B2	2011-03-15	Chang	

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	Application Number	16852790
	Filing Date	2020-04-20
	First Named Inventor	Koen Simon Herman BEEL
	Art Unit	2184
	Examiner Name	Bartels, Christopher A.
	Attorney Docket Number	BEEL3004C/TL

	2	1555197	CN	A	2004-12-15	Shenzhen Postgraduate Inst Tsi	Abstract.	☒
	3	101046952	CN	A	2007-10-03	Kei Nakayama	Abstract.	☒
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	5	102025774	CN	A	2011-04-20	TPV Display Technology Xiamen	Abstract.	☒
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	Attorney Docket Number	BEEL3004C/TL

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Name/Print	THOMAS LEE	Registration Number	66396

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Espacenet

CN1525300A System and method for real-time whiteboard streaming

Applicants: MICROSOFT CORP [US]

Inventors: HE LI-WEI,ZHANG ZHENGYOU

Classifications:

IPC ***G06T1/00; G06T5/00; G06T5/20; H04L29/06; H04N7/15;*** (IPC1-7): G06F3/033;

CPC **A01K61/10 (KR); E02B3/14 (KR); H04L29/06027 (EP); H04L65/4046 (EP); H04L67/38 (EP); H04N7/15 (EP);**

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System and method for real-time whiteboard streaming

Abstract

A is used for the technology of using flowing in the network environment conveying the content of the white board to system and method of the computational unit. This invention is that one kind produces technical expansion to white board picture, in order to offer the based on network goal meeting to cooperate. In one embodiment of this invention, each network customer can receive audio frequency content and white board content (video image). In another embodiment, each networks the customer and sends content of the audio frequency and note content, content of this note reveals alone that on the white board picture, or is produced from the real white board. The technological content flows in this to set up and cooperate on the outside on the framework.

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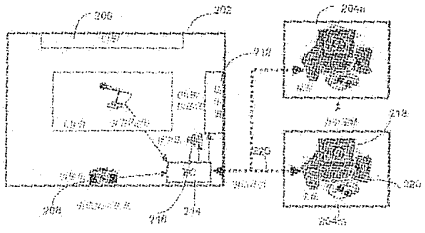
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权利要求书 11 页 说明书 20 页 附图 10 页

[54] 发明名称 用于实时白板流技术的系统和方法

[57] 摘要

一种用于在网络环境中使用流技术将白板内容传送给计算设备的系统和方法。本发明是一种对白板图像生成技术的扩展，以提供基于网络的目标会议协作。在本发明的一个实施例中，每个网络客户可以接收音频内容和白板内容(视频图像)。在另一实施例中，每个联网客户可以发送音频内容和注解内容，该注解内容单独显示在白板图像上，或由实际白板产生。该流技术内容是建立在外部协作构架上。



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1.一种用于创建增强白板内容的数据流的计算机可执行处理，包括下述处理动作：

输入白板图像帧序列；

将每个所述白板的所述图像帧分成各个单元；

判断在所述图像序列中的所述单元内是否存在显著的光照变化；

如果存在显著的光照变化，就执行白板颜色匹配处理以判定白板的颜色是否反映了在白板颜色模型数据库中的一种白板颜色，所述白板颜色用于定义白板背景颜色；

如果不存在显著光照变化，就将图像帧的每个单元分成前景、白板背景或写在白板上的内容的笔划单元；

对所述图像帧序列进行增强，以便在白板上的笔划能以使用所述单元分类的增强形式显示；以及

以数据流形式输出所述白板增强图像帧的序列。

2.如权利要求 1 所述的计算机可执行处理，其特征在于，所述增强图像帧序列以便白板上的笔划可以以增强形式显示的处理动作还包括下述处理动作：

使得在所述图像帧序列中显示白板背景的单元的白板背景颜色更加统一；

减少所述图像帧序列中的图像噪声；以及

增加白板内容笔划的饱和度，以使得所述笔划对于笔划单元来说更加鲜明易读。

3.如权利要求 1 所述的计算机可执行处理，其特征在于，所述以数据流形式输出所述白板增强图像帧的序列的处理动作包括仅使用增强白板单元和增强笔划单元而不使用前景单元。

4.如权利要求 1 所述的计算机可执行处理，其特征在于，所述以数据流形式输出所述白板增强图像帧的序列的处理动作包括使用增强白板单元、增强笔划单元和前景单元。

5. 如权利要求 1 所述的计算机可执行处理，其特征在于，所述白板颜色

匹配处理动作包括：

确定在新亮度条件中的白板背景单元的颜色是否与白板颜色模型数据库中的一种白板颜色模型匹配；

如果在新亮度条件中的白板背景单元的颜色与反映所述白板颜色模型数据库中的白板背景单元颜色的白板颜色模型相对应，将这种白板颜色模型用于后续单元分类中；

如果在新亮度条件中的白板背景单元的颜色没有在所述白板颜色模型数据库中找到，就创建新白板颜色模型以反映在新亮度条件中的白板背景单元的颜色。

6. 如权利要求 5 所述的计算机可执行处理，其特征在于，进一步包括下述处理动作：

将所述新白板颜色模型添加到白板颜色模型数据库中。

7. 如权利要求 1 所述的计算机可执行处理，其特征在于，进一步包括确定笔划是否被加入白板或从白板中去除的处理动作。

8. 如权利要求 7 所述的计算机可执行处理，其特征在于，所述确定笔划是否加入或去除的处理动作包括通过与所述图像帧序列中对应的位置的单元相比较来确定每个单元中的笔划内容是否增加和减少了。

9. 如权利要求 7 所述的计算机可执行处理，其特征在于，进一步包括如果在所述单元中存在变化就通过仅显示增强笔划单元和增强白板背景而不显示前景单元来向所述增强图像序列输出单元。

10. 如权利要求 9 所述的计算机可执行处理，其特征在于，直到确定已经添加或去除了笔划，才将增强白板和增强笔划单元输出到增强图像序列中，并且其中当出现笔划内容变化时，就输出对应于添加或去除的笔划的增强笔划单元。

11. 如权利要求 9 所述的计算机可执行处理，其特征在于，所述将每个所述白板图像帧分成前景、白板背景或写在白板上的内容的笔划单元的处理动作包括下述处理动作：

对于所述图像序列中图像帧的所有图像帧单元：

输入一个图像帧单元；

将所述图像帧单元与先前帧中对应位置上的单元进行比较；

如果该单元寿命不大于寿命阈值，就将该单元分类作为前景单元；所述寿命是该单元未变化的帧数；

如果该单元寿命大于寿命阈值，就确定在单元颜色中是否存在任何显著的差异，

如果单元颜色中不存在显著的差异，就将该单元分类为前景单元；

如果单元颜色中存在显著的差异，确定所述单元是否含有边缘；

如果该单元含有边缘，将其分类为笔划单元；并且

如果该单元不含有边缘，就将其分类为白板背景单元。

12. 如权利要求 11 所述的计算机可执行处理，其特征在于，进一步包括对分类成前景单元的所述单元验证其为前景单元的处理动作，所述动作包括下述处理动作：

确定所述前景单元是否与其它前景单元连接；以及

如果该单元确定为前景单元，且不与其它单元相连，还原其分类为未知。

13. 如权利要求 11 所述的计算机可执行处理，其特征在于，所述确定在单元颜色中是否存在任何显著差异的处理动作包括下述处理动作：

检验单元的 Y,U,V 通道；

如果所述单元颜色的 Y,U,V 通道没有分别处于离所述白板颜色模型中对应位置单元的 15、5 和 5 强度级的范围中，说明在单元颜色中存在显著差异。

14. 如权利要求 12 所述的计算机可执行处理，其特征在于，如果在 5X5 单元邻域中前景单元没有和其它前景单元相连，就说明存在少于 6 个的前景单元。

15. 如权利要求 12 所述的计算机可执行处理，其特征在于，所述判定所述单元是否含有边缘的处理动作包括下述处理动作：

对于每个帧单元，

使用 Sobel 滤波器来识别所述单元的水平边缘以获得第一经滤波的 Sobel 图像；

使用 Sobel 滤波器来识别所述单元的垂直边缘以获得第二经滤波的 Sobel 图像；

确定存在于每个帧中的边缘值数目，其中一个边缘值被定义为是在两个经 Sobel 滤波的图像中对应像素的绝对值的总和；

对于每个单元，对于 N 帧是固定的，其中：

当在帧 N 和 N+1 的单元中的所有像素都相同时，该单元对于连续帧 N 到 N+1 是固定的，

并且该单元含有的边缘值，该值大于预定阈值，

将该单元考虑作为笔划单元。

16. 如权利要求 15 所述的计算机可执行处理，其特征在于，如果所有像素的平均绝对差值低于预定阈值，则在帧 N 和 N+1 的单元中的所有像素是相同的。

17. 如权利要求 16 所述的计算机可执行处理，其特征在于，所述预定阈值以强度级来定义。

18. 如权利要求 15 所述的计算机可执行处理，其特征在于，所述笔划单元中的所述边缘值定义了笔划的边缘。

19. 如权利要求 1 所述的计算机可执行处理，其特征在于，进一步包括在将图像帧的每个单元分成前景、白板背景或写在白板上的内容的笔划单元的处理动作之后，确定白板背景颜色模型是否应被更新的处理动作。

20. 如权利要求 19 所述的计算机可执行处理，其特征在于，确定白板背景颜色模型是否应被更新的处理动作包括下述处理动作：

通过检验过去图像帧序列逐渐到当前白板帧中对应的单元的平均颜色来识别白板颜色中的任何逐渐变化；

如果在白板颜色中识别出逐渐变化，确定所有可用白板颜色模型的白板颜色模型数据库中的当前白板颜色模型是否更新。

21. 如权利要求 20 所述的计算机可执行处理，其特征在于，如果平均单元颜色几乎相等，但与先前帧不相等，进一步包括下述处理动作：

确定发生了逐渐亮度变化；并

对白板背景和具有白板背景颜色的笔划单元更新当前白板背景颜色模型。

22. 如权利要求 21 所述的计算机可执行处理，其特征在于，对白板和笔

划单元更新白板颜色模型的处理动作包括下述处理动作：

将白板图像分成多个单元；

根据像素的亮度值将每个单元中的像素分类；以及

将每个单元中最高的亮度值分配作为该单元所得到的白板颜色。

23. 如权利要求 22 所述的计算机可执行处理，其特征在于，进一步包括滤波单元颜色的处理动作，它包括下述处理动作：

将所得到的单元颜色施加给最小中值平方误差处理，该算法在全平面上使颜色拟合，并将前景单元丢弃；

将剩余的单元指定为白板背景单元；

使用所述剩余白板背景单元来更新白板背景；

并且，对在白板颜色模型中由被丢弃的前景单元所产生的缺口用来自具有白板背景颜色的相邻单元的已知颜色进行填充。

24. 如权利要求 22 所述的计算机可执行处理，其特征在于，所述单元的大小应大致等于在白板上所期望的单个字符的大小。

25. 如权利要求 21 所述的计算机可执行处理，其特征在于，所述为白板和笔划单元更新白板颜色模型的处理动作包括下述处理动作：

将白板图像分成多个单元；

根据像素的亮度值将每个单元中的像素分类；以及

将每个单元中最高 10%的亮度值进行平均，并将该值作为该单元所得到的白板颜色。

26. 如权利要求 25 所述的计算机可执行处理，其特征在于，单元大小应大致等于在白板上所期望的单个字符的大小。

27. 如权利要求 21 所述的计算机可执行处理，其特征在于，更新白板背景颜色的处理动作包括：

取较大百分比的最近白板背景颜色模型和较小百分比的新白板背景颜色，并对它们求和以获得新白板背景颜色。

28. 如权利要求 27 所述的计算机可执行处理，其特征在于，较大百分比的最近白板背景颜色模型为 90%，而较小百分比的新白板背景颜色为 10%。

29. 如权利要求 1 所述的计算机可执行处理，其特征在于，确定在所述

单元中是否存在显著光照变化的处理动作包括下述处理动作：

确定是否多数单元表现出颜色变化，以及如果是，就指定发生了光照变化。

30.如权利要求 29 所述的计算机可执行处理，其特征在于，所述多数定义为有 95%的单元表现出颜色变化。

31.一种用于对白板数据内容采用流技术的系统，所述系统包括：

分类模块，用于将被分成多个单元的白板图像序列中每个单元分成笔划单元、白板背景单元或前景单元；

动态白板背景和初始化模块，用于确定所述单元中的白板背景颜色；

图像增强模块，用于对由白板背景、前景和笔划单元组成的图像进行增强；以及

用于添加和去除白板笔划数据的模块，以使用白板背景和笔划单元来创建白板图像。

32.如权利要求 31 所述的系统，其特征在于，进一步包括用于对白板图像数据形成流的模块，其中所述白板图像数据由白板背景单元、前景单元和笔划单元组成。

33. 如权利要求 31 所述的系统，其特征在于，进一步包括用于对白板内容数据形成流的模块，其中所述白板内容数据由白板背景单元和笔划单元组成。

34. 如权利要求 31 所述的系统，其特征在于，所述对白板内容数据进行分类的模块包括下述子模块：

对所述白板图像序列中所有的单元：

输入图像帧单元；

将所述图像帧单元与先前帧同一位置中的单元图像进行比较；

如果单元寿命不大于寿命阈值，则将该单元分类作为前景单元；

将超过 N 帧都保持固定的所有单元分配为背景候选者；

确定在单元颜色中是否存在任何显著差异，如果存在，将该单元分类作为前景单元；

确定分类为前景单元的单元是否与其它前景单元相连；

如果分类作为前景单元的单元没有和其它单元相连，就将其分类还原为未知；

确定所述单元是否含有边缘；

如果该单元含有边缘，将其分类为笔划单元；并且

如果该单元不含有边缘，就将其分类为白板背景单元。

35. 如权利要求 31 所述的系统，其特征在于，将某些，但不是所有的，记录在白板视频流中的图像用于创建所述图像序列。

36. 如权利要求 31 所述的系统，其特征在于，将所有记录在白板视频流中的图像用于创建所述图像序列。

37.一种计算机可读媒体，具有用于传送白板视频流的计算机可执行指令，所述计算机可执行指令包括：

输入白板图像帧序列；

将每个所述白板图像帧分成各个单元；

判断在所述图像序列中的所述单元内是否存在显著的光照变化；

如果存在显著的光照变化，就执行白板颜色匹配处理以确定白板的颜色；

如果不存在显著光照变化，就将图像帧的每个单元分成前景、白板背景或写在白板上的内容的笔划单元；以及

对所述图像帧序列进行增强，以便能以使用所述单元分类的增强形式仅显示白板上的笔划。

38.如权利要求 37 所述的计算机可读媒体，其特征在于，进一步包括用于仅使用所述白板背景和笔划单元来输出所述增强图像序列的计算机可执行指令。

39. 如权利要求 37 所述的计算机可读媒体，其特征在于，进一步包括用于仅使用所述白板背景、前景单元和笔划单元来输出所述增强图像序列的计算机可执行指令。

40. 一种用于传送增强白板图像视频流的系统，所述系统包括：

发送器，包括：

输入模块，用于输入所捕获白板图像序列和与所捕获白板图像序列同

步化的音频，并将所述每个图像分成多个单元；

分类模块，用于将白板图像数据分类成笔划单元、白板背景单元或前景单元；

动态白板背景和初始化模块；

图像增强模块，用于对所述笔划单元中的笔划进行增强，并使得白板背景单元颜色更加统一；以及

用于添加和去除白板笔划数据的模块；

发送模块，用于通过网络使用所述前景单元、白板背景单元和笔划单元将包含前景对象的第一增强白板图像数据流发送给接收器；以及通过网络使用所述笔划单元和白板背景单元，但不包括前景单元，将不包含前景对象的第二增强白板图像数据流发送给接收器。

41.如权利要求 40 所述的系统，进一步包括接收器，所述接收器包括：

接收模块，通过网络接收从所述发送器发送的所述增强白板图像和同步化的音频；

扬声器模块，播放所述同步化的音频；以及

显示模块，在接收器处显示所述增强的白板图像。

42.如权利要求 41 所述的系统，其特征在于，所述接收器进一步包括用于选择所述接收器是要将第一数据流还是第二数据流显示在所述显示模块上的模块。

43. 如权利要求 41 所述的系统，其特征在于，所述接收器进一步包括将给所述白板数据流的注解发送回所述发送器。

44. 如权利要求 43 所述的系统，其特征在于，所述发送器通过投影仪将所述注解投射在白板上以将所述注解叠加在所述白板上，从而将所述接收机发送的所述注解显示在所述白板上。

45. 如权利要求 43 所述的系统，其特征在于，所述发送器通过将所述注解叠加在单独显示器的所述白板上，从而将所述注解显示在所述白板上，其中所述白板图像和所述注解都被显示。

46. 如权利要求 40 所述的系统，其特征在于，所述发送器进一步包括用于将所述第一和第二数据流归档以供日后查阅或发送的模块。

47. 如权利要求 40 所述的系统，其特征在于，所述动态白板背景估计和初始化模块采用下述方式来估计白板颜色：

对于第一输入图像：

为每个像素初始化白板背景颜色，为每个像素关联一个协方差估值，该估值表征了所述像素颜色的精度，将初始化的白板颜色指定为估计的白板颜色；

给出输入图像，在每个像素处，将白板估计颜色与所述输入图像中实际观测的颜色进行比较，并且

如果所估计的颜色和所观测的颜色差异巨大，则所观测的像素不是笔划的一部分就是前景对象的一部分，并且丢弃该像素的颜色；

否则，该像素的颜色就是白板颜色的观测值，并在更新白板颜色中使用；并且

在概率框架下将没有被丢弃的这些像素的颜色更新，其中每个像素的改变多少取决于当前所观测像素对于所估计颜色来说有多可靠，当前所观测像素对于所估计颜色来说有多大不同，以及所观测像素颜色与相邻像素中的颜色有多大不同。

48. 如权利要求 47 所述的系统，其特征在于，当更新像素颜色时，每个像素的颜色估计的协方差矩阵也会更新。

49. 如权利要求 47 所述的系统，其特征在于，所述动态白板背景估计和初始化模块通过下述方式估计白板颜色：

对于所述第一输入图像之后的后续输入图像：

对每个像素将已更新所估计的白板颜色与所述输入图像中实际观测的颜色进行比较，并且

如果所更新的估计颜色和所观测的颜色差异巨大，则所观测的像素不是笔划的一部分就是前景对象的一部分，并且丢弃该像素的颜色；

否则，该像素的颜色就是白板颜色的观测值，并在更新白板颜色中使用；并且

在概率框架下将没有被丢弃的这些像素的颜色更新，其中每个像素的改变多少取决于当前所观测像素对于所估计颜色来说有多可靠，当前所观测

像素对于所估计颜色来说有多大不同，以及所观测像素颜色与相邻像素中的颜色有多大不同。

50.如权利要求 40 所述的系统，其特征在于，所述动态白板背景估计和初始化模块以下述方式估计白板颜色：

对于第一输入图像：

将白板分成各个单元；

为每个单元初始化白板背景颜色，为每个单元关联一个协方差估值，该估值表征了所述单元颜色的精度，将初始化的白板颜色指定为估计的白板颜色；

给出输入图像，在每个单元，将白板估计颜色与所述输入图像中实际观测的颜色进行比较，并且

如果所估计的颜色和所观测的颜色差异巨大，则所观测的单元不是笔划的一部分就是前景对象的一部分，并且丢弃该单元的颜色；

否则，该单元的颜色就是白板颜色的观测值，并在更新白板颜色中使用；并且

在概率框架下将没有被丢弃的这些单元的颜色更新，其中每个单元的改变多少取决于当前所观测单元对于所估计颜色来说有多可靠，当前所观测单元对于所估计颜色来说有多大不同，以及所观测单元颜色与相邻单元中的颜色有多大不同。

51.如权利要求 50 所述的系统，其特征在于，当更新单元颜色时，每个单元处的颜色估计的协方差矩阵也会更新。

52. 如权利要求 50 所述的系统，其特征在于，所述动态白板背景估计和初始化模块通过下述方式估计白板颜色：

对于所述第一输入图像之后的后续输入图像：

对每个单元将已更新所估计的白板颜色与所述输入图像中实际观测的颜色进行比较，并且

如果所更新的估计颜色和所观测的颜色差异巨大，则所观测的单元不是笔划的一部分就是前景对象的一部分，并且丢弃该单元的颜色；

否则，该单元的颜色就是白板颜色的观测值，并在更新白板颜色中

使用；并且

在概率框架下将没有被丢弃的这些单元的颜色更新，其中每个单元的改变多少取决于当前所观测单元对于所估计颜色来说有多可靠，当前所观测单元对于所估计颜色来说有多大不同，以及所观测单元颜色与相邻单元中的颜色有多大不同。

53. 一种从图像序列中动态实时估计白板颜色的计算机可执行处理，包括下述处理动作：

定义状态变量 $x_{i,j}$ 为要估计的每个单元（i，j）处的白板的颜色，而观察变量 $z_{i,j}$ 是从图像中观测的每个单元（i，j）白板的颜色；

如下计算每个单元的颜色：

$$x'_{i,j}=((\hat{P}^{t|t-1}_{i,j})^{-1}+(Q'_{i,j})^{-1}+(S'_{i,j})^{-1})^{-1}(\hat{P}^{t|t-1}_{i,j})^{-1}\hat{x}^{t|t-1}_{i,j}+(Q'_{i,j})^{-1}z'_{i,j}+(S'_{i,j})^{-1}\bar{x}'_{i,j}$$

对于第一次迭代，使用预期平均值，$\frac{1}{\Omega}\sum_{(k,l)\neq(i,j)}x^{t|t-1}_{k,l}$，作为 $\bar{x}'_{i,j}$，其中Ω是相邻单元的数目，k∈[i-1，i+1]，而 l∈[j-1，j+1]，并且(k，l)≠(i，j)；并且在随后的迭代中，采用来自先前迭代的估计平均值。并且，给出如下 $x'_{i,j}$ 的协方差：

$$P'_{i,j}=((\hat{P}^{t|t-1}_{i,j})^{-1}+(Q'_{i,j})^{-1}+(S'_{i,j})^{-1})^{-1})(2I+(S'_{i,j})^{-1}\bar{P}'_{i,j})$$

其中 I 是单位矩阵，并且 $\bar{P}'_{i,j}=\frac{1}{\Omega}\sum_{(k,l)\neq(i,j)}P'_{k,l}$，并将预期平均数 $\frac{1}{\Omega}\sum_{(k,l)\neq(i,j)}\hat{P}^{t|t-1}_{k,l}$ 作为第一迭代中的 $\bar{P}'_{i,j}$，其中观测协方差是观测协方差是 $Q'_{i,j}$，平滑度协方差矩阵是 $S'_{i,j}$，状态变换噪声 $\eta'_{i,j}$ 和它的协方差矩阵是 $R'_{i,j}$。

用于实时白板流技术的系统和方法

本申请请求在2003年2月24日申请，依据U.S.C第119(e)(1)节第35条下的临时申请号为60/449，683的申请的优先权。

技术领域

本发明针对一种用于在网络环境中使用流技术（streaming）将白板（whiteboard）内容传送给计算设备的系统和方法。更具体地说，本发明涉及一种用于将经增强的白板图像序列实时发送给一个或多个远程会议参与者以允许在会议期间为所有会议参与者提供基于网络的协作。

背景技术

各种会议占据了许多工作人员工作时间的很大部分。如何有效地利用会议时间和节省会议期间往来的费用被企业作为增加生产力和成本节约方面的有效手段而越来越重视。

许多会议组织者已经在头脑风暴会议、讲座、项目计划会议、专利公布等会议中广泛采用了白板技术。在这些会议期间，对写在板上的内容的笔记和复制经常影响到许多参与者的积极投入和贡献。因此，人们已经在以某些自动方式来捕获白板内容的技术方面花费了一些努力。

每个企业都需要信息和意见的自由交流以改善它们的产品和服务。在团队中和团队外的人员之间的有效协作可以提高产品质量、提升产品或项目开发的研制周期并减少成本。然而，有效的协作通常是很难实现的。而阻碍有效会议的一个问题就是通常人们在地域上并不在一起。考虑到冗长的旅程的时间，参加会议的行程是非常耗费时间和金钱的。为参加一个2到3小时会议的人可能将花费一天时间在旅程上，还需要花费一天时间在回程上，特别是当召开跨国界或跨大陆会议时，该问题更加突出。

因此，人们很强烈地需要一种方式来使得在召开地域上不处于一起的许多人

参加的会议时能更加容易轻松，以允许这些远程参与者实时参与会议并共享他们的意见。

发明内容

本发明针对一种用于在网络环境中使用流技术将白板内容传送给计算设备的系统和方法。这种称之为实时白板流技术系统和方法的发明是一种对白板图像生成技术的扩展，以在会议期间提供基于网络的协作。在本发明的一个实施例中，网络客户可以接收会议的音频内容和增强的白板内容（视频图像或快照图像序列）。在另一实施例中，每个联网客户可以发送音频内容和注解内容，该注解内容显示在来自实际白板的单独屏幕上，或由实际白板自身产生。该流技术内容是建立在外部协作构架上，例如微软公司的 Windows Messenger 和 Net Meeting。将白板的增强实况视频以流技术传送给远程会议参与者的个人计算机（PCs），然后，他们可以将评论和注解再传送回来。由此产生的系统可以为分布式会议提供了自然的协作性工具。

该系统的典型方案包括涉及头脑风暴会议。该会议涉及到在聚集在某地（典型的是在会议室中）的 N 个人，以及 M 个（通常是 1 到 3）个人（远程用户），每个人可能在他们自己的办公室中或其它远程地点。

聚集在会议室中的 N 个人配备有白板、捕获白板内容的摄像头、捕获会议音频的麦克风设备、会议服务器、投影仪、电视或其它显示器，它们连接到所述会议服务器上；以及安装在麦克风设备上的扬声器。而 M 个个人中的每个人坐在他们自己的办公室或其它远程地点，配备有桌面计算机或笔记本电脑、扬声器、麦克风以及将远程个人计算机与会议服务器相连的网络连接。

在会议室中的 N 个人使用白板作为协作空间，通过在白板上描绘来共享他们的意见。在白板上的内容迅速被捕获（实际上是实时捕获），并通过网络将白板的增强图像传送给远程人员以使他们能共享内容。而口头上的讨论将由麦克风捕获，并且该音频，最好和定向信息一起，例如使用音频指纹的音频跟踪一起，也通过这个装置发送给远程人员。

而参加会议的远程人员通过在会议室中由扬声器播放的音频来参与会议。远程人员可以通过在捕获的白板帧上注解来参与会议，并且经注解的白板帧会显示

在会议室的显示器上以及其它远程个人计算机的屏幕上。另外，还可以使用例如蜂鸣器或某些视觉提示信号来提醒会议参与者，远程参与者已经向白板内容进行输入。

整个会议（包括注解）都能归档，以便在将来进行查阅。白板和注解作了时间标记，并与音频同步。

如前所述，远程参与者可以在白板内容上提供注解和口头评论。会议室中的屏幕（它与白板不同）显示了白板内容和注解。一种替换的方案是将远程参与者的注解直接投影到会议室的实际白板上。该方案的好处在于远程参与者能积极参与白板内容的进展。

在上述的方案中，远程参与者使用的是传统的 PC。然而，远程参与者也可以使用平板 PC（Tablet PC）。微软公司的平板 PC 是针对全配置个人计算机设计的，它允许用户使用输入笔或数字感应触摸屏代替键盘来通过自然手写笔记。墨水（ink）技术可以使得远程参与者进行注解（无论是公开的和/或私人的）变得更加容易。

如上所述，实时白板流技术系统和方法具有基于服务器的端和基于客户的端。在下面的段落中，将进一步详细描述。

实时白板流技术系统和方法的服务器端通常由 4 个主要部分组成：1）分类处理，将图像序列单元分类成背景、前景或笔划单元（stroke cell）；2）动态白板背景初始化和更新处理，计算白板颜色而不包括前景对象（例如人员）和笔划；3）有效实时处理，对输入视频序列中的白板区域进行增强；4）分析处理，提取白板上新出现的笔划。

如本发明所述的系统和方法最初获取由白板图像帧实时序列构成的一系列快照或实况白板视频输入。该快照序列或视频以逐帧为基础进行实时处理。

白板图像帧序列（快照或视频）输入给基于单元运动检测的处理。在该处理中，在给定帧序列中的每个图像帧分成了几个单元。对每个对应的单元位置随时间变化进行比较，以检测光或色中的任何变化。如果有显著的光照变化，就执行白板颜色匹配处理动作，这将随后进行详细描述。如果没有显著的光照变化，该视频帧的每个单元就分类成前景、白板背景或笔划单元。在单元分类中，其主要意图在于过滤掉遮挡白板部分的人或其它对象的图像部分，以便在白板背景上仅

显示白板内容的笔划。

单元分类也用于创建白板视频流，它是一种具有白板和前景对象（例如站在所显示白板之前的人员）的增强的实况视频流。还会创建其它数据流，如白板和仅有笔划数据流，其中以增强方式在白板上仅显示白板的笔划，而不显示前景对象。

为了显示含有白板和前景对象的增强图像，执行图像增强处理。在图像增强处理中，白板颜色更加统一，而白板内容（也就是写在白板上的内容）的笔划饱和度增加以使得笔划更加鲜明和易读。

单元分类的另一输出是判断是否添加了笔划或从白板中去除了笔划。在这种处理动作中，实时白板流技术系统和方法确定单元中的笔划内容是否增加或减少了（即对应于附加的写或擦除白板内容）。如果单元的笔划内容发生了变化，这些内容的变化就输出给白板数据流。

另外，在单元分类之后，系统判定白板颜色模型是否需要更新。白板颜色模型更新处理是对白板颜色中的逐渐变化的识别。例如，亮度条件中的这些微小变化是由于云彩从太阳前经过或某些东西在白板上投下阴影。如果逐渐的亮度变化被识别，则更新白板颜色模型中当前白板颜色的模型。

如前所述，显著的光变化在基于单元的运动检测处理中被记录，如本发明所述的系统或方法就判定所记录的亮度变化是否包含在当前白板颜色模型中。如果新亮度条件对应于白板颜色模型数据库中的白板颜色模型，该模型就用于后续单元分类。然而，如果没有找到颜色模型，就初始化或估计新的颜色模型，并将其加入到白板颜色模型数据库中。

如本发明所述的系统和方法具有许多优点。它允许远程会议参与者积极参加会议，而不需要花费时间和金钱去远程地点开会。它提供了一种具有前景对象的更加易读的白板数据流形式，以及提供了不具有前景对象的更加易读的白板内容数据流。

除了上述的优点之外，本发明的其它优点可以从下面结合附图的具体描述中进一步体现出来。

附图说明

本申请的文件中含有至少一张彩色的附图。具有彩色附图的本申请文本将在申请人请求并支付所需费用后由美国专利和商标局提供。

本发明的特定特征、方面和优点将通过下述描述、权利要求和附图变得更容易理解。

图 1 是描述构成实现本发明的示范系统的通用计算设备的框图。

图 2 是实时白板流技术系统和方法的主要系统部件的框图。

图 3 是实时白板流技术系统和方法的主要功能部分的框图。

图 4 是如本发明所述的系统和方法概括流程图。

图 5 是一系列输入图像的框图。

图 6 是如本发明所述的系统和方法所使用的白板图像单元的单元分类的概括流程图。

图 7 是如本发明所述的系统和方法所使用的白板颜色估计处理的概括流程图。

图 8 是如本发明所述的系统和方法所使用的白板图像增强的概括流程图。

图 9 是如本发明所述的系统和方法所述的笔划识别和提取的概括流程图。

图 A-1 是用于说明如本发明所述的系统和方法所述的白板颜色估计和过滤的框图。

具体实施方式

在本发明的较佳实施例的下述描述中，参考了作为说明书一部分的附图进行描述，所述附图说明了本发明可以采用的特定实施例。本领域技术人员应该理解在不背离本发明精神的情况下，还可以使用其它实施例或对这些实施例进行修改。这都没有超出本发明的公开范围。

1.0 示范工作环境

图 1 示出了可以实现本发明的一种合适的计算系统环境 100 实例。该计算系统环境 100 只是一个合适的计算环境的实例，并不是要将本发明的使用和功能范围局限在该环境中。也不是要将计算环境 100 解释为与示范工作环境 100 中所示部件之一或其组合具有联系或要求。

本发明可以在许多其它通用或专用计算系统环境或配置中工作。这些适用于本发明的众所周知的计算系统、环境和/或配置的实例可以包括（但不局限于）个人计算机、服务器计算机、手提或膝上型设备、多处理器系统、基于微处理器的系统、机顶盒、可编程消费类电子产品、网络 PC、微型计算机、大型机、包含上述任意系统和设备的分布式计算环境，等等。

本发明从计算机可执行指令的概括角度进行描述，例如以计算机可执行的程序模块来进行描述。通常，程序模块包括例行程序、程序、对象、部件、数据结构等，它们能执行特定任务或实现特定抽象数据类型。本发明也可以在分布式计算环境中实现，在这种环境中，由通过通信网络连接的远程处理设备来执行任务。在分布式计算环境中，程序模块可以位于包含存储器存储设备的本地和远程计算机存储媒体中。

参照图 1，一种执行本发明的示范系统包括以计算机 110 形式出现的通用计算设备。该计算机 110 的部件包括（但不局限于）处理单元 120、系统存储器 130 和系统总线 121，它将各种系统部件（包括系统存储器到处理单元 120）都连接在一起。系统总线 121 可以是下述几种总线结构类型中任意一种：存储器总线或存储器控制器、外设总线和使用各种总线体系的局域总线。这种体系包括例如（但不局限于）工业标准结构（ISA）总线、微通道结构（MCA）总线、扩展 ISA（EISA）总线、视频电子标准协会（VESA）局域总线以及外设部件互连（PCI）总线，也称为中层总线（Mezzanine bus）。

计算机 110 通常包括各种计算机可读媒体。计算机可读媒体包括任何可由计算机 110 存取的可用媒体，包括易失和非易失媒体、可移动和非可移动媒体。计算机可读媒体可以包括例如（但不局限于）计算机存储媒体和通信媒体。计算机存储媒体包括易失和非易失、可移动和非可移动媒体，这些媒体可以用于任何存储信息，例如计算机可读指令、数据结构、程序模块或其它数据，的方法或技术实现。计算机存储媒体包括（但不局限于）RAM、ROM、EEPROM、闪存或其它存储器技术、CD-ROM、数字通用光盘（DVD）或其它光盘存储、磁带盒、磁带、磁盘存储或其它磁性存储设备、或任意其它可用于存储所需信息并可被计算机 110 存取的媒体。通信媒体通常包含计算机可读指令、数据结构、程序模块或其它调制数据信号（例如载波）或其它传输机制

中的数据，并且包括任何信息传递媒体。术语“调制数据信号”是指以对信号中信息编码的方式使其一个或多个特性被设定或改变的信号。通信媒体包括（但不局限于）有线媒体例如有线网络或直线连接、以及无线媒体例如声音、RF、红外线和其它无线媒体。上述媒体的任意组合也应包含在计算机可读媒体的范畴。

系统存储器 130 包括易失和/或非易失存储器形式的计算机存储媒体，例如只读存储器（ROM） 131 和随机访问存储器（RAM） 132。 基本输入/输出系统 133（BIOS），含有例如在启动期间帮助在计算机 110 中的元件之间传送信息的基本例行程序，通常存储在 ROM 131 中。RAM 132 通常含有立刻就要存取和/或目前正在被处理单元 120 处理的数据和/或程序模块。图 1 示例出（但不局限于）操作系统 134、应用程序 135、其它程序模块 136 以及程序数据 137。

计算机 110 可以包括其它可移动/非可移动、易失/非易失计算机存储媒体。图 1 示例出（但不局限于）可以对非可移动、非易失磁性媒体进行读写的硬盘驱动器 141，可对可移动、非易失磁盘 152 进行读写的磁盘驱动器 151，以及可对可移动、非易失光盘（例如 CD-ROM 或其它光学媒体 156）进行读写的光盘驱动器 155。其它可用于示范操作环境的可移动/非可移动、易失/非易失计算机存储媒体包括（但不局限于）磁带盒、闪存卡、数字通用光盘、数字摄像带、固态 RAM、固态 ROM 等等。硬盘驱动器 141 通常通过即时-可移动（anon-removable）存储器接口（例如接口 140）与系统总线 121 连接，而磁盘驱动器 151 和光盘驱动器 155 通常通过可移动存储器接口（例如接口 150）与系统总线 121 相连。

在如上所述和图 1 中所示的驱动器及其相关的计算机存储媒体为计算机可读指令、数据结构、程序模块和计算机 110 的其它数据提供了存储。在图 1 中，例如，硬盘驱动器 141 如图所示存储了操作系统 144、应用程序 145、其它程序模块 146 以及程序数据 147。注意这些部分可以与操作系统 134、应用程序 135、其它程序模块 136 以及程序数据 137 相同，也可以不同。操作系统 144、应用程序 145、其它程序模块 146 以及程序数据 147 在这里用不同的标号是为了说明至少它们是不同的副本。用户可以通过输入设备例如键盘 162 和指点设备 161（通常指鼠标、轨迹球或触摸板）将命令和信息输入到计算机

110 中。其它输入设备（未示出）可以包括麦克风、操纵杆、游戏手柄、卫星天线、扫描仪等。这些和其它输入设备通常通过连接到系统总线 121 的用户输入接口 160 连接到处理单元 120，但也可以由其它接口或总线结构连接，例如并行口、游戏端口或通用串行总线（USB）。监视器 191 或其它类型的显示设备也通过接口（例如视频接口 190）连接到系统总线 121。除了监视器外，计算机还可以包括其它外围输出设备，例如扬声器 197 和打印机 196，它们可以通过输出外围接口 195 进行连接。而能捕获图像 164 序列的摄像头 163（例如数字/电子静态或视频摄像机）作为本发明特别重要的设备也可作为输入设备包括在个人计算机 110 中。而且，虽然只描述了采用一个摄像头的情况，但个人计算机 110 也可采用多个摄像头作为输入设备。来自一个或多个摄像头的图像 164 通过合适的摄像头接口 165 输入到计算机 110 中。该接口 165 连接到了系统总线 121，因而允许图像发送并存储在 RAM 132 或与计算机 110 相关的其它数据存储设备中的一个中。然而，需要注意，图像数据也可以从任意上述计算机可读媒体中输入到计算机 110，而不需要使用摄像头 163。

计算机 110 可以在使用物理连接一个或多个远程计算机（例如远程计算机 180）的联网环境中运行。该远程计算机 180 可以是个人计算机、服务器、路由器、网络 PC、对等设备或其它公共网络节点，并且虽然在图 1 中仅示出存储器存储设备 181，但通常还包括上述有关计算机 110 的许多或所有元件。在图 1 中所示的物理连接包括局域网(LAN)171 和广域网（WAN）173，但也可以包括其它网络。这些网络环境在办公室、企业计算机网络、内联网和互联网中已经广泛采用。

当在 LAN 网络环境中使用时，计算机 110 通过网络接口或适配器 170 连接到 LAN 171。当在 WAN 网络环境中使用时，计算机 110 通常包括调制解调器 172 或其它与 WAN 173，例如互联网，建立通信的装置。调制解调器 172 可以是内置的，也可以是外置的，可通过用户输入接口 160 连接到系统总线 121，或其它合适的机构。在网络环境中，有关计算机 110 所描绘的程序模块或其部分可以存储在远程存储器存储设备中。图 1 示例出（但不局限于）驻留在存储器设备 181 上的远程应用程序 185。需要注意，所示的网络连接是示例性的，也可以使用其它装置在计算机之间建立通信连接。

现在，已经讨论了示范操作环境，本说明书部分的剩余内容将致力于描述实现本发明的程序模块。

2.0 实时白板流技术的系统和方法

2.1 概述

实时白板流技术的系统和方法通常具有基于服务器的部件，并且能具有一个或多个安排在基于网络的环境中的远程客户机。增加的实况视频或增强实时白板快照序列以流技术传送给远程会议参与者的 PC，而他们可以在白板内容上发送回注解以及在会议进程中进行口头评论。

如图 2 所示，典型的这种系统的方案包括头脑风暴会议，它涉及到处于某地（例如典型的会议室 202）的 N 个人员，以及 M 个（通常是 1 到 3 个）远程人员 204a …， 204m，每个人员位于他们自己的办公室中或其它远程地点。

聚集在会议室 202 中的 N 个人配备有白板 206、捕获白板内容的摄像头 208、捕获会议音频的麦克风 210、会议服务器、投影仪、电视或其它显示器 212，它们连接到所述会议服务器 214 上；以及安装在麦克风设备上的扬声器 216。而 M 个个人中的每个人坐在他们自己的办公室或其它远程地点 204a …， 204m，配备有桌面计算机或笔记本电脑 218、扬声器（未示出）、麦克风/耳机 220 以及将远程个人计算机 218 与会议服务器 214 相连的网络连接 222。

在会议室 202 中的 N 个人使用白板 206 作为协作空间，通过在白板上描绘来共享他们的意见。在白板上的内容迅速被捕获，并通过将增强白板内容传送到远程人员的计算机 218a …，218m，使得远程人员能共享内容。而口头上的讨论将由麦克风 210 捕获，并且该音频（最好和定向信息一起）发送给远程人员。

而参加会议的远程人员通过在会议室中由扬声器 216 播放的音频来参与会议。远程人员也可以通过在捕获的白板帧上注解来参与会议，并且经注解的白板帧会显示在会议室的显示器 212 上以及其它远程个人计算机 218a …，218m 的屏幕上。另外，还可以使用例如蜂鸣器或某些视觉闪烁警示信号来提醒会议参与者，远程参与者已经作出了注解。

2.2 基于服务器的实时白板流技术系统和方法

通常，如图 3 所示，实时白板流技术系统和方法在功能上由 4 个主要部分组成：1）分类处理，将图像序列单元分类成背景、前景或笔划单元（处理动作 302）；2）动态白板背景初始化和更新处理，计算白板颜色而不包括前景对象（例如人员）和笔划（处理动作 304）；3）有效实时处理，对输入视频序列中的白板区域进行增强（处理动作 306）；4）分析处理，提取白板上新出现的笔划（处理动作 308）。图像增强处理的输出是一个增强白板图像序列（处理动作 310），而笔划分析处理的输出仅是流技术化白板数据（处理动作 312）。

更具体地说，如图 4 所示，如本发明所述的系统和方法最初获取由白板图像帧实时序列构成的实况白板输入，如在处理动作 402 中所示。该视频、快照或图像序列以逐帧为基础进行实时处理。

白板图像帧序列输入给基于单元运动检测的处理 404。在该处理中，在给定帧序列中的每个图像帧分成了几个单元。对每个对应的单元位置随时间变化进行比较，以检测亮度中的任何变化（处理动作 406）。如果有显著的亮度变化，就执行白板颜色匹配处理动作（处理动作 408），这将随后进行详细描述。如果没有显著的亮度变化，该视频帧的每个单元就分类成前景、白板背景或笔划单元（处理动作 410）。在单元分类中，其主要意图在于过滤掉遮挡白板部分的人或其它对象的图像部分，以便在白板背景上仅显示白板内容的笔划。单元分类也用于创建白板图像流，它是一种具有白板和前景对象（例如站在所显示白板之前的人员）的增强的实况视频或快照流，如处理动作 414 所示。该流通过增强处理进行增强，如处理动作 412 所示。还会创建其它数据流（白板数据流），其中在笔划处理（处理动作 416）执行之后，以增强方式在白板上仅显示笔划，而不显示前景对象（处理动作 418）。

为了显示含有白板和前景对象的增强图像，执行图像增强处理，如处理动作 412 所示。在图像增强处理（处理动作 412）中，白板颜色更加统一，而白板内容（也就是写在白板上的内容）的笔划饱和度增加以使得笔划更加鲜明和易读。

单元分类的另一输出是判断是否添加了笔划或从白板中去除了笔划，如处理动作 416 所示。在这种处理动作中，实时白板流技术系统和方法判定单元中的笔划内容是否增加或减少了。如果单元的笔划内容发生了变化，该内容就输出给白板数据流（处理动作 418）。

另外，如处理动作 420 所示，在单元分类之后，系统判定白板颜色模型是否需要更新。白板颜色模型更新处理是对白板颜色中的逐渐变化的识别。这种变化是由于例如，光照条件中的微小变化，而这些微小变化是由于例如云彩从太阳前经过或某些东西在白板上投下阴影。如果变化被识别，则更新白板颜色模型数据库 422（是所有可用白板颜色模型的数据库）中当前白板颜色的模型。

如前所述，如果显著的光照变化在基于单元的运动检测处理中被记录（处理动作 406），如本发明所述的系统或方法就判定所记录的光照变化是否体现在当前白板颜色模型中（处理动作 408）。如果新光照条件对应于白板颜色模型数据库中的白板颜色模型（处理动作 424），该模型就用于后续单元分类。然而，如果没有找到该颜色模型，就初始化新的颜色模型（处理动作 426），并将其加入到白板颜色模型数据库中。

上面已经描述了根据本发明的通用系统和方法，随后将详细描述先前所述的处理动作。

2.2.1 实况白板视频或快照序列输入

根据本发明的系统和方法最初获取实况白板视频输入或一系列由白板图像帧实时序列组成的快照。该视频或快照序列以逐帧为基础基本上进行实时处理。在图 5 示出的示例视频序列中展示了一些选中的帧。有多少序列的帧可以被处理在某种程度上取决于会议服务器 214 的中央处理器（CPU）的利用率。一些（但不是全部）输入帧基于 CPU 利用率用于后续白板背景颜色的处理。用于创建增强白板视频流和白板数据流的前景、笔划计算以及增强处理的实时处理在会议服务器处理带宽受到限制时会比白板背景计算优先进行。

2.2.2 基于单元的运动检测和单元分类

单元分类将单元分成 1）前景；2）白板背景或 3）写在白板上的笔划。实时白板流技术系统和方法从输入图像序列中计算空白的白板颜色。该处理的难点在于整个白板在任意单个帧中可能是不可见的，这主要是由于在白板前的阻碍物。因此，白板背景必须通过先将图像帧部分分类成前景或背景来构造。仅有背景部分用于计算白板的背景色。

在根据本发明的一种系统和方法的工作实施例中，前景/背景的判决针对16X16 像素的图像块进行，该图像块称之为单元。通常，有两种主要直观推断用于执行单元分类中：1）由于摄像头和白板都是固定的，白板背景单元在这个序列中也是固定的；2）虽然有时前景对象（例如站在白板前的人）会阻碍白板，但属于白板背景的单元通常是多数。

这样，本发明的一个实施例中，如图 6 所示，输入图像帧单元（处理动作 602）。单元的图像与先前帧的同一单元（例如在同一位置中的单元）的图像进行比较，如在处理动作 604 中所示。在每个帧，所有对于超过 N 帧（在实时白板流技术系统和方法的工作实施例中为 4 帧）都是固定的单元被视作是背景候选者，并馈送给白板颜色模型更新模块（处理动作 610）。如果单元寿命没有超过寿命阈值（在实施例中是 4），该单元就被分类为前景单元，如处理动作 608 所示；而该单元的寿命重置为 1。如果在单元颜色中存在任何显著的差异，该单元分类成前景单元（处理动作 610）。该差异测试是这样的：单元颜色的 Y、U、V 通道必须分别位于白板颜色中它们的对应部分的 15、5 和 5 强度级的范围中。对于前景单元，为了验证这些单元没有被错误分类，还要执行附加测试以判定单元是否和其它前景单元连接（处理动作 612）。如果一组前景单元是孤立的，它们的分类就还原，并且继续分类处理。在本发明一个实施例中的孤立定义为在 5X5 单元的邻域，少于 6 个前景单元。如果所讨论的单元先前并没有由上述的测试确定为前景单元，就判定该单元是否含有边缘，如处理动作 614 所示。如果该单元含有边缘，就将其指派为笔划单元（处理动作 616）。如果不具有边缘，就将其分类为白板背景单元（处理动作 618）。

2.2.3 白板颜色估计和白板颜色模型更新

白板颜色模型更新（处理动作 420）寻找白板背景颜色中的逐渐变化。在一般意义上，实时白板流技术系统和方法通过判断每个单元的平均颜色来检测是否存在逐渐变化。如果每个单元的平均颜色几乎与先前相同，就判定逐渐变化发生了。在实施例中的系统也采用了在确定单元是否是背景单元中所使用的相同测试。当记录了逐渐变化时，就更新现有的白板颜色模型而不是

创建新的白板颜色模型。在现有白板颜色模型中仅更新背景单元或笔划单元的颜色模型。前景单元没有被更新。

更具体地说，如图 7 所示，在本发明的一个工作实施例中，白板图像被分成许多单元，如处理动作 702 所示。单元的大小最好大致等于白板上所预期的单个字符的大小（在本发明的工作实施例中是 16X16 像素）。由于墨水吸收了入射光，白板像素的亮度高于笔划像素。在该单元中的白板颜色因而是具有最高亮度的颜色。实际上，在最高的十分之一的像素颜色被平均，以减少传感器噪声所引起的错误。因此，通过先以亮度将（例如 16X16＝256）个像素分类，再取最高亮度 10%的值进行平均以计算每个单元的颜色，如处理动作 706 所示。所得到的单元颜色作为给最小中值平方误差算法（least-median-square error_algorithm）的输入，该算法对颜色在全平面（global plane）上拟合，并将含有界外颜色（前景颜色）的单元丢弃，如在处理动作 708 中所示。剩余的单元就被看作是背景单元，并且使用它们的颜色来更新白板背景。为了对被前景对象阻挡的单元所产生的缺口进行填充，具有已知颜色的单元也被扩展到没有颜色的邻近单元。利用在附件 A 中所描述的颜色估计和过滤技术，将这些剩余的单元颜色和先前计算的单元颜色进行整合。

为了执行白板颜色模型的更新，实时白板流技术系统和方法针对背景或笔划采用了较大百分比的原始颜色模型（例如 90%）和较小百分比的新颜色（例如 10%）。

2.2.4 显著的亮度变化

如上所述，考虑了显著的光照变化（处理动作 406）。例如，如果关闭会议室中的一盏灯，几乎所有的给定白板图像中的单元都会变化。如果存在显著的光照变化，基于单元的运动检测（处理动作 404）将报告大多数的单元已经变化（例如，在本发明的工作实施例中使用 95%的单元作为阈值来表示光照的显著变化）。随后，重置白板背景，并初始化新的颜色模型或从白板颜色模型数据库中提取新模型。随后，再次开始执行单元分类等处理。

2.2.5 图像增强

白平衡或图像增强的目的在于将输入白板图像转化为在统一背景（通常是白色）上具有相同笔划的图像。对于每个像素，颜色值＝C_{light}，笔划颜色＝C_{pen}，而白板背景颜色＝C_{wb}。由于白板在物理上通常由统一的颜色构成，因此，可以假设 C_{wb} 对于所有像素都是常数。因此，输入图像的缺乏统一性是由于给每个像素的入射光量不同而造成的。因而，白平衡或颜色增强中的第一步处理是估计每个像素的 C_{light}，其结果实际上是一幅空白白板的图像，如图 7 所示，处理动作 702，并且如前面在白板颜色估计章节所述。

一旦计算了空白白板颜色，就可将其用于使输入视频序列的白板区域统一成白色，而笔划的颜色也能更饱和。如图 8 所示，一旦计算了空白白板图像（处理动作 802），输入图像就通过下述两个步骤进行颜色增强：

1.使得背景统一成白色（处理动作 804）。对于每个单元，经计算的白板颜色（等于入射光 C_{light}）就用于衡量单元中每个像素的颜色：

$$C_{out}=\min\left(1,\ \frac{C_{input}}{C_{light}}\right)$$

2.减少图像噪声，并增强笔划的颜色饱和度。根据 S 型曲线：0.5-0.5cos（$C_{out}^{p}\pi$）来重新映射每个像素每个颜色通道的值。S 曲线的斜度由 p 控制。在本发明的工作实施例中，p 设定为 0.75（处理动作 806）。

2.2.6 笔划识别和提取

也提取单元块级别的笔划以作为白板数据流输出。笔划具有下述属性：1）它们是固定的；2）它们具有某些边缘。如图 9 所示，为了识别边缘和识别直线，对每个输入帧执行两种 Sobel 滤波[-1 -2 -1; 0 0 0; 1 2 1]和[-1 0 1; -2 0 2; -1 0 1]（处理动作 902 到 906）。执行第一 Sobel 滤波以识别水平边缘，而第二 Sobel 滤波则识别垂直边缘。该处理识别了输入图像中存在的边缘值（edge1）。而边缘值定义为在两个经滤波的图像中对应的像素的绝对值的总和。对于每个单元，它必须对于 N 帧（本发明工作实施例中是 4）是固定的，且含有一个边缘值，其值大于阈值（本发明工作实施例中是 60），以作为笔划单元。这些笔划单元的边缘值定义了这些笔划的边缘，如处理动作 908 所示。

2.2.7 白板颜色模型匹配

当系统开始运行或检测到光照变化时，就获取 N 帧（例如 4 帧），而在此期间的固定单元的颜色与数据库中每个白板背景图像进行比较。如果固定的单元与数据库中的一个图像的对应单元颜色都匹配（使用 YUV 颜色模型，和对于不同的测试使用 15，5，5），就存在一个匹配，系统就用来自匹配的图像的颜色来初始化剩余非固定单元。一旦背景颜色更新过程稳定，就在此对数据库进行匹配。如果不存在匹配，就将当前颜色加入到数据库中。

2.3 基于客户机的实时白板流技术系统和方法

如前所述，在会议室中的口头讨论由麦克风捕获，并且该音频（最好和定向信息一起）发送到远程人员。如前所述，增强白板图像流和白板数据流发送给远程参与者。远程参与者可以选择接收一个或另一个或都接收两者实时数据流。

会议中的远程人员通过音频（由会议室中的扬声器播放）和通过注解捕获的白板帧来参与会议。远程参与者的注解可以包括，例如使用鼠标或其它输入设备在白板上加入文本、圆圈定白板上的项目或绘图或作其它标记。远程参与者所作的注解通过网络使用任何适合的实时通信协议来传送给会议服务器并显示。由于白板信息已经驻留，因此，只需要传送注解，而不需要将整个白板图像都传送给会议服务器。这有利于使得传送注解所需的网络带宽很小。

2.3.1 给单独显示器的注解

经注解的白板帧显示在会议室的显示器上。该显示器独立于会议室中的实际白板，但含有白板的内容和远程参与者的注解。远程参与者的注解也显示在其他远程人员的桌面上。还可以使用例如蜂鸣器或闪烁屏幕这样的信号来提醒会议参与者和远程参与者，有远程参与者已经向白板内容进行注解。

2.3.2 在实际白板上投影注解

或者，远程参与者的注解可以显示在会议室的实际物理白板上。这可以通过将远程客户的注解使用投影仪投射在实际白板上来实现。

2.4 使用平板 PC 注解

在上述方案中，远程参与者采用的是传统的 PC。然而，远程参与者也可以使用平板 PC。微软公司的平板 PC 是针对全配置个人计算机设计的，它允许用户使用输入笔或数字感应触摸屏代替键盘来通过自然手写记录笔记。墨水（ink）技术可以使得远程参与者进行注解（无论是公开的和/或私人的）变得更加容易。

2.5 归档

整个会议（包括注解）都能归档，以便在将来进行查阅。白板和注解作了时间标记，并与音频同步。这样，会议参与者可以在空闲的时间回顾该会议。另外，不能参加会议的人员也可以在随后的时间查阅此次会议。

前面所述的本发明的内容都是为了对本发明进行说明和描述。这些内容并不是要将本发明局限于前面所述的内容中。可以通过上述示例进行修改和变化。

附页 A

白板颜色估计

为了对在将单元分成前景单元时出现白板颜色缺口进行填充，就使用下述处理来估计要填充这些缺口的颜色。所述处理基于下述两个观察资料：

1）白板颜色填充随单元的变化而变化，但这种变化并不剧烈。白板颜色具有平滑性和连续性。

2）由于光照条件在短周期期间通常不会变化，因此，如果没有前景对象，就将白板颜色保持不变。

本处理的目标是从具有变化前景但处于恒定或渐变光照条件的图像序列中估计白板颜色。（当光照条件突然变化，例如关闭或开启一盏灯，的情况已经在 2.2.4 节中描述过了，是通过检测变化并使用多个颜色模型来处理）。恒定或渐变光照条件的假设是指每个白板像素的颜色只能随时间在限定范围内变化，并且，在本发明的一个实施例中，这种变化已经模型化为用零平均值和小标准偏差的随机处理。还假设相邻像素之间的白板反射率属性是类似的，这意味着相邻像素之间的白板颜色只能在限定范围内变化，并且，在本发明的一个实施例中，这种假设模型化为 Markov 随机场，因此，在一个像素的白板颜色仅由相邻像素制约。该估计处理包括下述步骤：

1. 初始化。白板颜色需要初始化。这可以通过多种方法来实现。一种方法是通过利用邻近平滑度约束仅从一个图像来估计白板颜色。每个像素的颜色估计与协方差矩阵相关联，该矩阵表示了这种估计的精度。

2. 颜色匹配。给出一个输入图像，对每个像素将期待的白板颜色和实际观测的颜色进行比较。如果它们差异巨大，所观测的像素不是笔划的一部分就是前景对象的一部分，并且在下一步骤将丢弃该像素的颜色；否则，该像素的颜色就是白板颜色的观测值，并在更新白板颜色中使用。

3. 颜色更新。将输入图像中有效的白板颜色像素在概率性框架（probabilistic framework）下用于更新白板颜色。每个像素的白板颜色改变多少取决于当前所观测像素相对于所估计颜色来说有多可靠，当前所观测像素对于所估计颜色来说有多大不同，以及所观测颜色与相邻像素中的颜色

有多大不同。每个像素颜色估计的协方差矩阵也会相应更新。

步骤 2 和 3 针对每个输入图像进行重复。

为了减少计算的复杂性并考虑到白板颜色实际上在空间上变化非常缓慢，白板区域可以分成一组小单元，而可以以每个单元（不是每个像素）为基础来估计白板颜色。更具体地说，估计白板颜色的数学细节将在下面的章节说明。

A.1 目标

该处理的目标是从图像系列中实时动态估计白板颜色。在此假设亮度随时间是恒定的。（当光照突然变化，例如当关闭一盏灯，就需要使用多个白板颜色模型）

A.2 表示

参照图 A-1，状态变量 $x_{i,j}$ 是要估计的每个单元（i,j）白板的颜色。观察变量 $z_{i,j}$ 是从图像观测的每个单元（i,j）处的白板的颜色，该变量可以通过例如直方图（histogramming）来计算。

A.3 问题陈述

给出：

- 在时间 t-1，状态：$\hat{x}_{i,j}^{t-1}$；协方差矩阵：$\hat{P}_{i,j}^{t-1}$；
- 状态变换：$x_{i,j}^{t}=x_{i,j}^{t-1}+\eta_{i,j}^{t}$，即对于随机变量 $\eta_{i,j}^{t}\sim N(0, R_{i,j}^{t})$（即以 0 为中心具有协方差矩阵 $R_{i,j}^{t}$ 的正态/高斯分布）恒定；
- 在时间 t，观察：$z_{i,j}^{t}=x_{i,j}^{t}+\zeta_{i,j}^{t}$，其中观察噪声 $\zeta_{i,j}^{t}\sim N(0, Q_{i,j}^{t})$；在 t 时的估计状态：$\hat{x}_{i,j}^{t}$；协方差矩阵 $\hat{P}_{i,j}^{t}$，这是在 $\hat{x}_{i,j}^{t}$ 需要在空间上非常平滑作为限制条件下。

A.4 平滑度

人们可以使用 4 或 8 个邻域来如下建立平滑度模型：

$(x_{i,j}^{t}-x_{k,l}^{t})\sim N(0, S_{i,j}^{t})$

其中，k∈[i-1, i+1]，而 l∈[j-1, j+1]，并且(k, l)≠(i, j)。

在 t 时间的状态预测如下：

$$x_{i,j}^{t|t-1} = E[x_{i,j}^{t-1} + \eta_{i,j}^{t}] = \hat{x}_{i,j}^{t-1}$$

$$\hat{P}_{i,j}^{t|t-1} = V[x_{i,j}^{t-1} + \eta_{i,j}^{t}] = \hat{P}_{i,j}^{t-1} + R_{i,j}^{t}$$

A.4 目标函数

随后给出试图最小化的总体能量：

$$F=\sum_{i,j}\{(x_{i,j}^{t}-x_{i,j}^{t|t-1})^{T}(\hat{P}_{i,j}^{t|t-1})^{-1}(x_{i,j}^{t}-\hat{x}_{i,j}^{t|t-1})+(x_{i,j}^{t}-z_{i,j}^{t})^{T}(Q_{i,j}^{t})^{-1}(x_{i,j}^{t}-z_{i,j}^{t})$$

$$\frac{1}{\Omega}\sum_{(k,l)\neq(i,j)}\{(x_{i,j}^{t}-x_{k,l}^{t})^{T}(S_{i,j}^{t})^{-1}(x_{i,j}^{t}-x_{k,l}^{t})+(x_{i,j}^{t}-z_{i,j}^{t})\}$$

其中Ω是邻域的数目。这三个项分别是预测、观察和邻域的差异。所有的差异是统计距离，并由协方差矩阵归一化。

A.6 解答

对于 $\hat{x}_{i,j}^{t}$ 到 0 设定 F 的偏导数，产生：

$$(\hat{P}_{i,j}^{t|t-1})^{-1}(x_{i,j}^{t}-\hat{x}_{i,j}^{t|t-1})+(Q_{i,j}^{t})^{-1}(x_{i,j}^{t}-z_{i,j}^{t})+(S_{i,j}^{t})^{-1}(x_{i,j}^{t}-\bar{x}_{i,j}^{t})=0$$

其中 $\bar{x}_{i,j}^{t}$ 是邻域中状态的平均值，即：

$$\bar{x}_{i,j}^{t}=\frac{1}{\Omega}\sum_{(k,l)\neq(i,j)}x_{k,l}^{t}$$

这给出了下列解答：

$$x_{i,j}^{t}=((\hat{P}_{i,j}^{t|t-1})^{-1}+(Q_{i,j}^{t})^{-1}+(S_{i,j}^{t})^{-1})^{-1}(\hat{P}_{i,j}^{t|t-1})^{-1}\hat{x}_{i,j}^{t|t-1}+(Q_{i,j}^{t})^{-1}z_{i,j}^{t}+(S_{i,j}^{t})^{-1}\bar{x}_{i,j}^{t}$$

不幸地是，右侧的 $\bar{x}_{i,j}^{t}$ 涉及到未知的 $x_{k,l}^{t}$。因此，为了解决相互依赖的问题，使用了下述迭代处理：对于第一次迭代，使用预期平均值，$\frac{1}{\Omega}\sum_{(k,l)\neq(i,j)}x_{k,l}^{t|t-1}$，作为 $\bar{x}_{i,j}^{t}$；并且在随后的迭代中，我们采用来自先前迭代的估计平均值。注意，这种迭代处理是非常有效的，因为迭代之间唯一的修改就在于 $\bar{x}_{i,j}^{t}$；其它的都能被高速缓冲。同样，给出如下 $x_{i,j}^{t}$ 的协方差：

$$P_{i,j}^{t}=((\hat{P}_{i,j}^{t|t-1})^{-1}+(Q_{i,j}^{t})^{-1}+(S_{i,j}^{t})^{-1})^{-1})(2I+(S_{i,j}^{t})^{-1}\bar{P}_{i,j}^{t})$$

其中 I 是单位矩阵，并且

$$\overline{P}^{t}_{i,j} = \frac{1}{\Omega}\sum_{(k,l)\infty(i,j)} P^{t}_{k,l}$$

再次使用迭代过程，将预测平均值 $\frac{1}{\Omega}\sum_{(k,l)\infty(i,j)}\hat{P}^{t|t-1}_{k,l}$ 作为第一迭代中的 $\overline{P}^{t}_{i,j}$。

A.7 实际考虑事项

在实现时，需要注意下述问题：

- 观测协方差 $Q^{t}_{i,j}$。它应该包括传感器噪声和判决的不肯定性。判决的不肯定性是我们认为 $z^{t}_{i,j}$ 是白板颜色的有多少可信度的倒数。如果是界外值，就设定 $Q^{t}_{i,j}=\infty$（无限值）。
- 状态转换噪声 $\eta^{t}_{i,j}$ 和它的协方差矩阵 $R^{t}_{i,j}$。这用于说明由于灯或日光引起的光照中的小变化。（巨大的变化例如当关闭一盏灯时需要考虑使用多个模型。）
- 平滑度协方差矩阵 $S^{t}_{i,j}$。它应该比协方差 $\hat{P}^{t|t-1}_{k,l}$ 的当前估值和理想情况下期望的变量之和要小。如果期望的变量为每颜色通道 5 个强度级，就可使用 $S^{t}_{i,j}=\hat{P}^{t|t-1}_{k,l}+5^{2}I$。

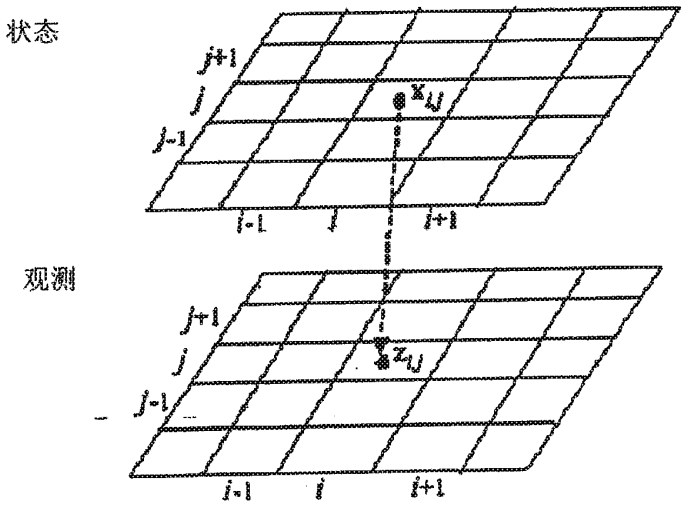


图 A1

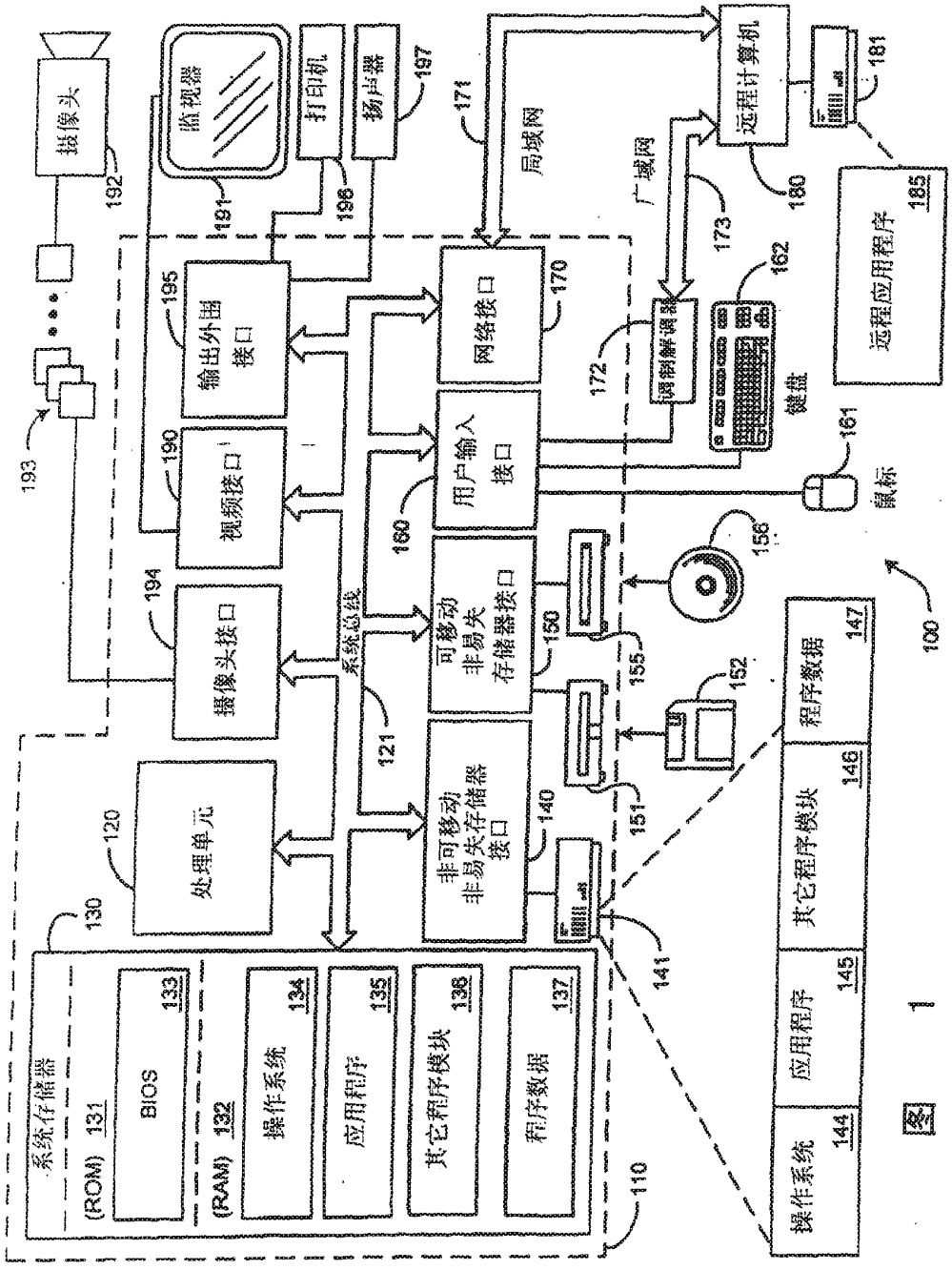

摄像头
192
监视器
191
打印机
196
扬声器
197
局域网
171
广域网
173
远程计算机
180
181
远程应用程序
185
输出外围接口
195
视频接口
190
网络接口
170
调制解调器
172
键盘
162
鼠标
161
用户输入接口
160
193
摄像头接口
194
系统总线
121
可移动非易失存储器接口
150
非可移动非易失存储器接口
140
处理单元
120
系统存储器
130
(ROM) 131
BIOS
133
(RAM) 132
操作系统
134
应用程序
135
其它程序模块
136
程序数据
137
110
操作系统
144
应用程序
145
其它程序模块
146
程序数据
147
100
141
151
152
155
156

图 1

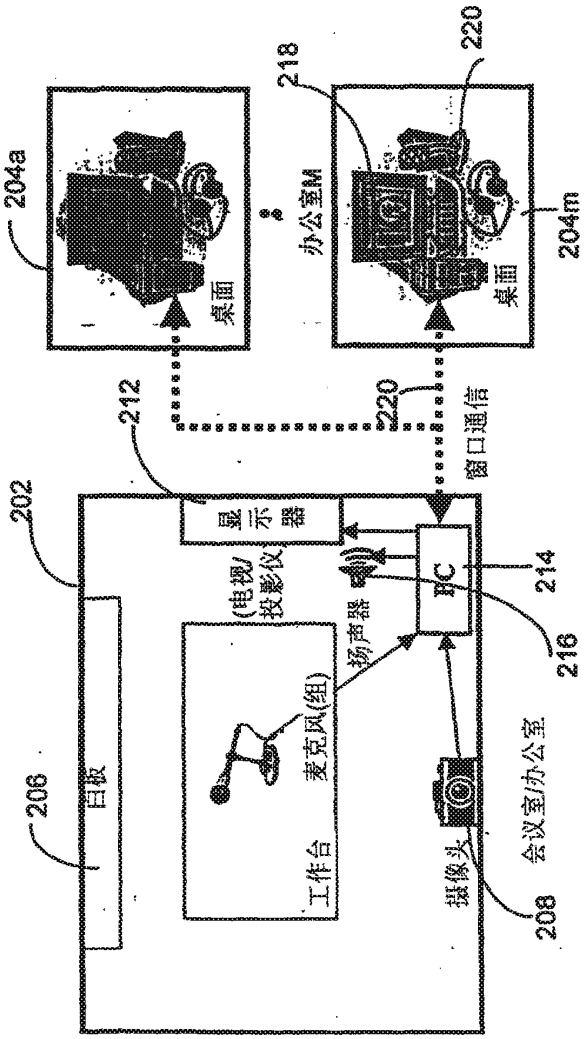

204a
桌面
218
220
办公室M
204m
桌面
212
220
窗口通信
202
显示器
(电视/投影仪
扬声器
IC
214
216
麦克风(组)
工作台
206
白板
摄像头
208
会议室/办公室

图 2

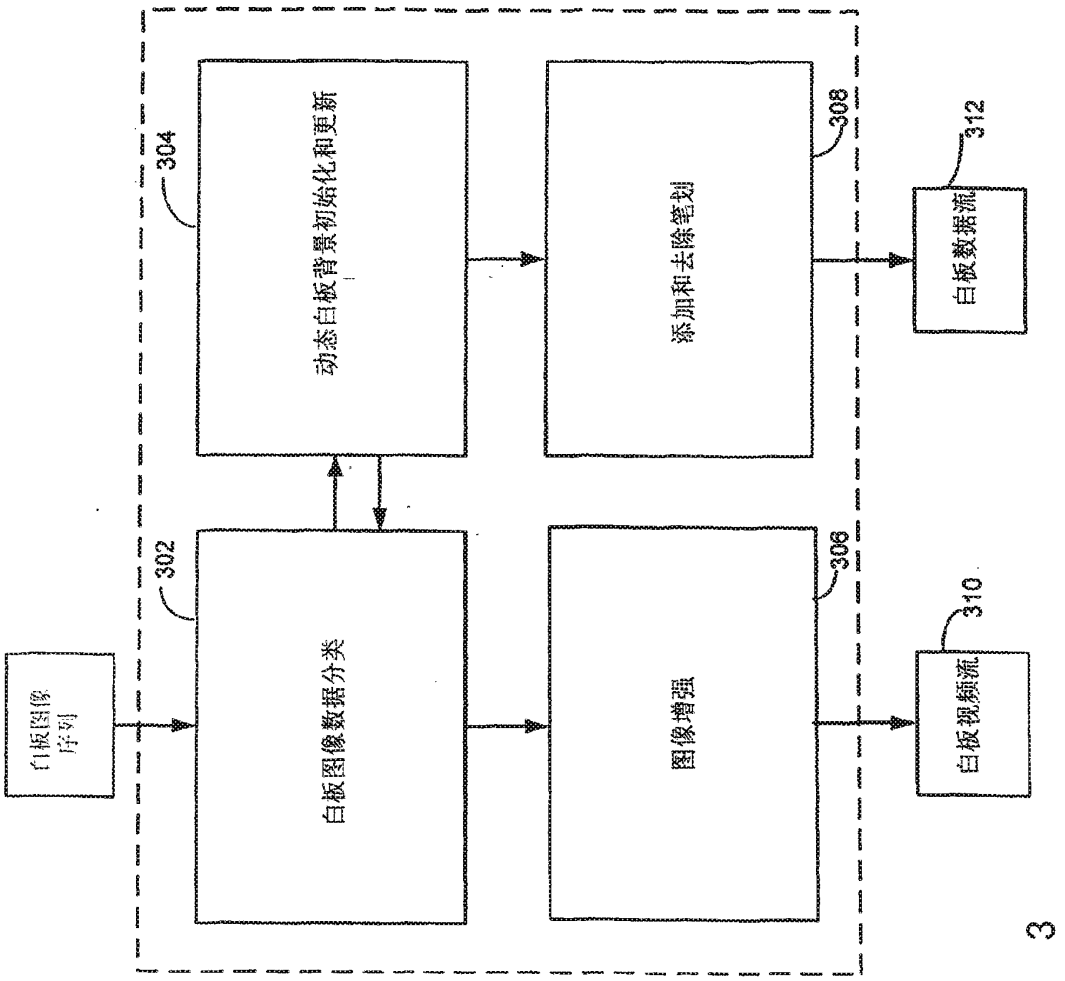

白板图像序列
302
白板图像数据分类
304
动态白板背景初始化和更新
306
图像增强
308
添加和去除笔划
310
白板视频流
312
白板数据流

图 3

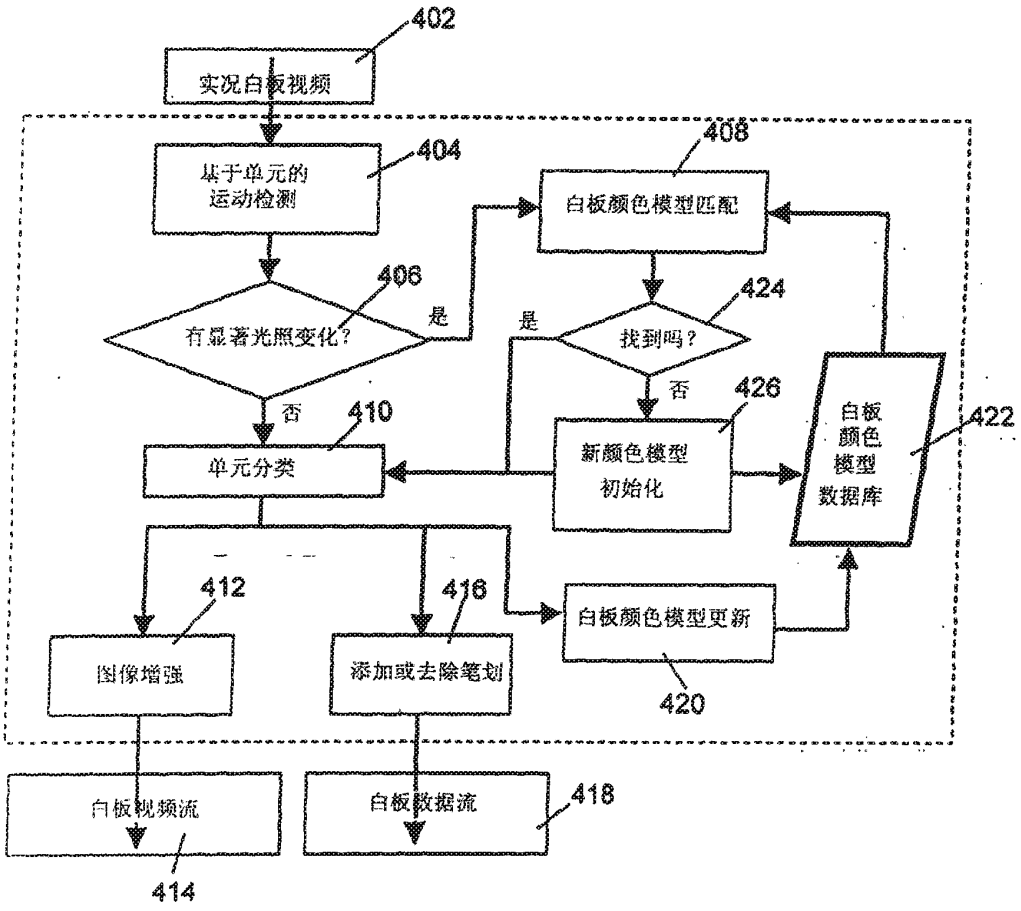

402
实况白板视频
404
基于单元的运动检测
406
有显著光照变化?
是
否
408
白板颜色模型匹配
424
找到吗?
是
否
426
新颜色模型初始化
422
白板颜色模型数据库
410
单元分类
412
图像增强
416
添加或去除笔划
白板颜色模型更新
420
白板视频流
414
白板数据流
418

图 4

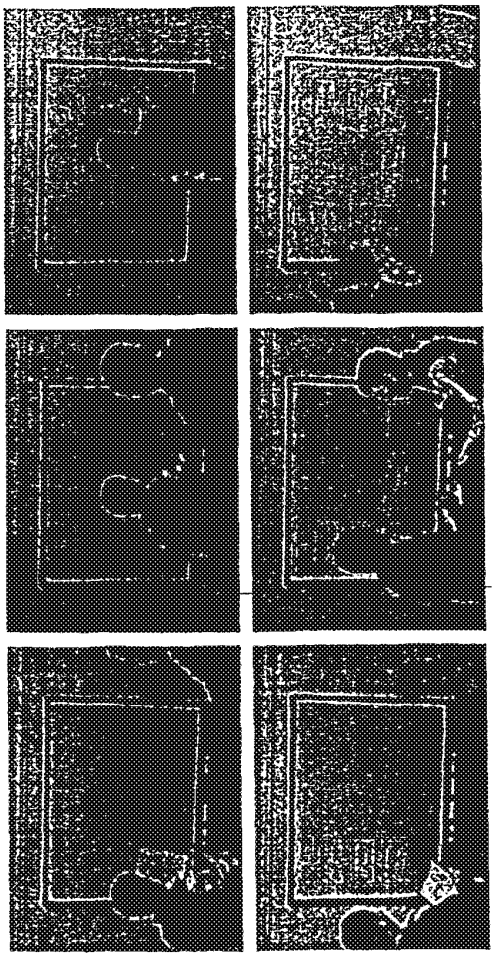


图 5

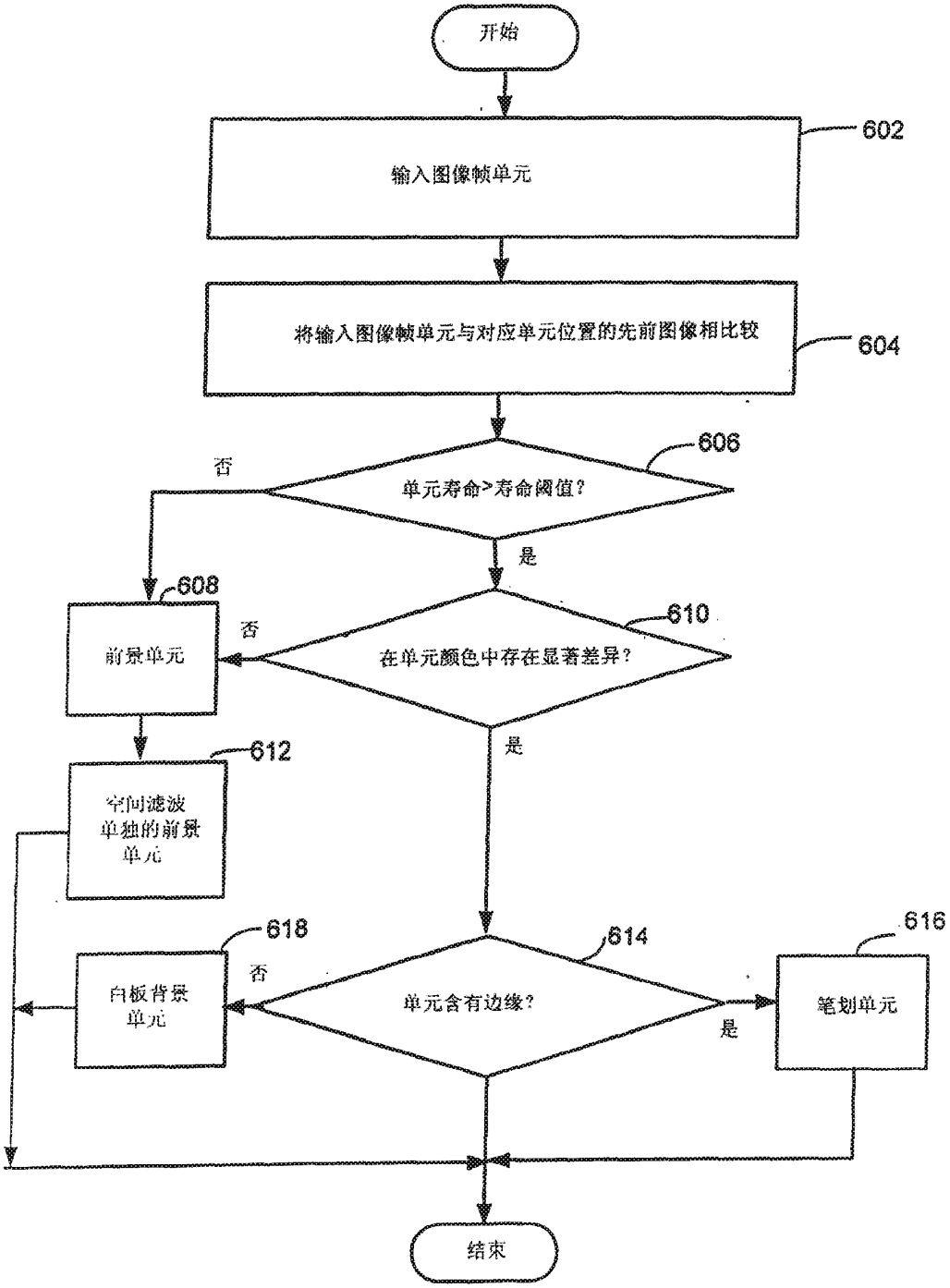

开始
602
输入图像帧单元
604
将输入图像帧单元与对应单元位置的先前图像相比较
606
单元寿命>寿命阈值?
否
是
608
前景单元
否
610
在单元颜色中存在显著差异?
是
612
空间滤波单独的前景单元
618
白板背景单元
否
614
单元含有边缘?
是
616
笔划单元
结束

图 6

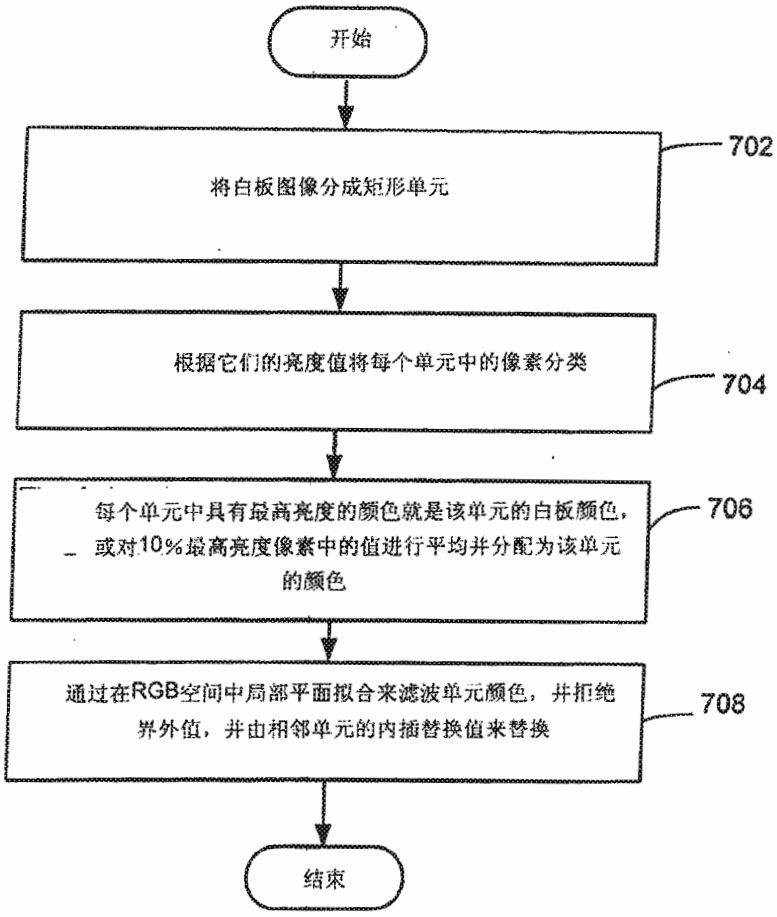

开始
将白板图像分成矩形单元
702
根据它们的亮度值将每个单元中的像素分类
704
每个单元中具有最高亮度的颜色就是该单元的白板颜色，或对10%最高亮度像素中的值进行平均并分配为该单元的颜色
706
通过在RGB空间中局部平面拟合来滤波单元颜色，并拒绝异外值，并由相邻单元的内插替换值来替换
708
结束

图 7

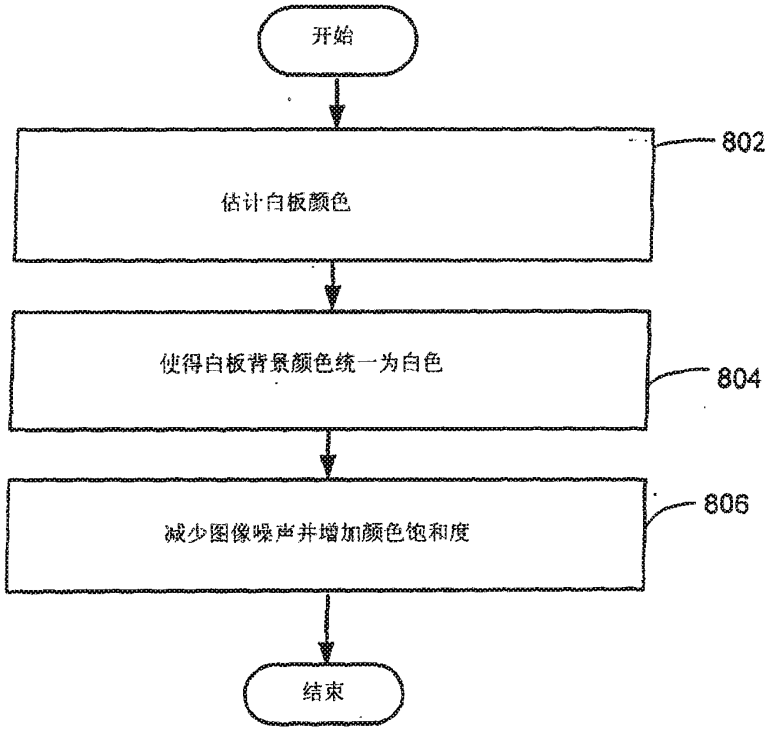


图 8

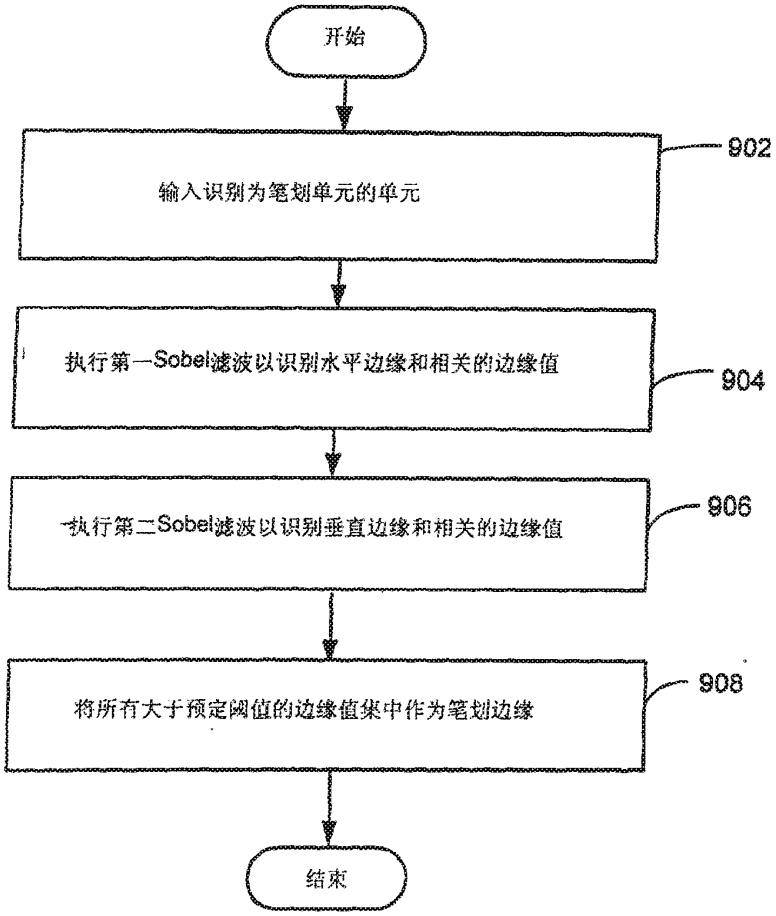

开始
输入识别为笔划单元的单元
902
执行第一Sobel滤波以识别水平边缘和相关的边缘值
904
执行第二Sobel滤波以识别垂直边缘和相关的边缘值
906
将所有大于预定阈值的边缘值集中作为笔划边缘
908
结束

图 9

Espacenet

CN1555197A Video frequency meeting shared white plate realizing method based on Internet

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Video frequency meeting shared white plate realizing method based on Internet

Abstract

A realization method for TV conference shared white panel based on Internet includes: a. A client sends a connection request to a server which generates SK answering the said required client and joins it in the tail of a chained list, b. The client draws on its plate and carries out vector sequential process to the drawings to be sent to Internet via its SK port, C. After receiving the said upbound data, the server reproduces the drawing on its plate by counter-sequential process and reviews the said chained list to transfer the data to all the shared clients via related SK ports. d. The shared client receives the said data and reproduces the drawings on the plate by counter-sequential process.

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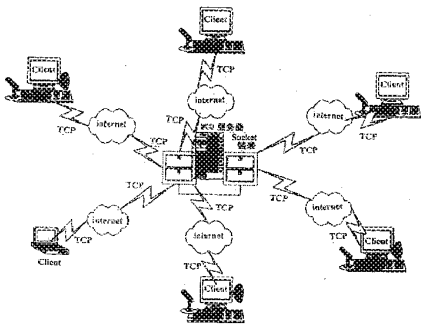
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[54] 发明名称 基于 Internet 的视频会议共享白板实现方法

[57] 摘要

一种基于 Internet 的视频会议共享白板实现方法，包括：a. 客户机向服务器发连接请求，服务器产生响应该请求客户机的套接字，将套接字加入链表的尾部；b. 客户机在其画板上绘制图形，将所绘图形进行矢量序列化处理，通过其套接字端口发送到 Internet 上；c. 服务器接收到上传的所述数据后，通过反序列化处理将图形再现于它的画板上；同时遍历所述链表，将所述数据通过相应的套接字端口转发给所有共享客户机；d. 共享客户机接收所述数据，通过反序列化处理将图形再现于画板上。本发明实现了白板图形在互联网上高速可靠传输，具有多种绘图工具，避免了传统系统占用频带宽、设备昂贵、升级不便、运营费用高的缺点。



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1、一种基于 Internet 的视频会议共享白板实现方法，其特征在于包括以下步骤：

a、启动安装于服务器和客户机中的白板系统，在服务器和客户机的显示屏上出现画板、绘图工具栏和控制面板，客户机登录所述服务器，并向服务器发出连接请求，服务器接受客户机的连接请求，同时产生一个响应该请求客户机的套接字，并将套接字加入套接字链表的尾部；

b、客户机在其画板上绘制一个或几个图形，将所绘图形进行矢量序列化处理、存档，最后通过其套接字端口发送到 Internet 上；

c、所述服务器通过其套接字端口侦听、接收到客户机上传的图形序列化数据后，首先进行存档，并记录接收顺序，然后通过反序列化处理将图形再现于服务器的画板上；

同时，所述服务器遍历套接字链表，将所述图形序列化数据通过相应的套接字端口转发给所有参加会议的客户机；

d、所有登录的客户机接收到图形序列化数据后，通过反序列化处理将图形再现于各自的画板上。

2、根据权利要求 1 所述的基于 Internet 的视频会议共享白板实现方法，其特征在于，在步骤 b 中，客户机将其画板上绘制的图形进行矢量序列化处理的方法如下：

①、客户机对应于白板系统的每一种绘图工具，创建一个数组；

②、将各绘图工具所绘图形元素的特征值添加到对应的数组中；

③、将各数组的数组元素按指定顺序序列化。

3、根据权利要求 1 所述的基于 Internet 的视频会议共享白板实现方法，其特征在于：在步骤 c 中，服务器将图形序列化数据进行反序列化处理的步骤如下：

①、服务器对应于白板系统的每一种绘图工具，创建一个数组；

②、从收到的图形序列化数据中找出当前绘图工具名字信息，从而确定使用的绘图工具；

③、根据所确定的绘图工具，并按照图形序列化数据中对应的图形元素的特征值创建图形元素，同时将该图形元素加入服务器白板系统的相应数组中。

4、根据权利要求 1 所述的基于 Internet 的视频会议共享白板实现方法，其特征在于：在步骤 d 中，登录的客户机对接收的图形序列化数据进行反序列化处理的步骤如下：

①、客户机对应于白板系统的每一种绘图工具，创建一个数组；

②、从收到的图形序列化数据中找出当前绘图工具名字信息，从而确定使用的绘图工具；

③、根据所确定的绘图工具，并按照图形序列化数据中对应的图形元素的特征值创建图形元素，同时将该图形元素加入客户机白板系统的相应数组中。

5、根据权利要求 1 所述的基于 Internet 的视频会议共享白板实现方法，其特征在于：客户机之白板系统记录有绘图的顺序，能够进行回撤和恢复操作。

6、根据权利要求 1 所述的基于 Internet 的视频会议共享白板的方法，其特征在于：客户机在其画板上绘制椭圆形的步骤是，在画板上先取两点，

确定横轴的半径及角度，再取第三点，确定椭圆纵轴的半径。

7、根据权利要求 1 所述的基于 Internet 的视频会议共享白板的方法，其特征在于：客户机在其画板上绘制画笔轨迹曲线的步骤是，设置一个记录轨迹曲线的点的链表，当画笔在画板上移动时，不断发送轨迹点的数据，将轨迹点的数据不断加入链表中，同时在相邻两点间画直线，将轨迹显示出来。

8、根据权利要求 1 所述的基于 Internet 的视频会议共享白板的方法，其特征在于：所述绘图工具栏包含直线、矩形、圆角矩形、多边形、椭圆形、圆形、画笔轨迹曲线、内切椭圆、圆弧、椭圆弧、贝赛尔曲线以及文字输入工具。

9、根据权利要求 1 所述的基于 Internet 的视频会议共享白板实现方法，其特征在于：所述控制面板包括画笔、画刷、背景的颜色设置和风格设置。

10、根据权利要求 9 所述的基于 Internet 的视频会议共享白板实现方法，其特征在于：所述背景的颜色设置采用滑杆条取色。

基于 Internet 的视频会议共享白板实现方法

技术领域

本发明涉及视频会议系统技术 ，具体是一种基于 Internet 的视频会议共享白板实现方法。

背景技术

面对面的交谈是人类表达思想最丰富的一种方式，人们会充分调动眼睛、表情和动作来渲染话语。对于商业事务来说，电话交谈无法表达图表、文件、数据表格之类有说服力和感染力的东西。一个企业或团体需要召开会议时，经常遇到其各个部门或人员无法集中的情况（甚至分布在世界各地）。对此，人们提出了利用通信媒体开视频会议的需求。所谓视频会议，就是利用通信线路把两个或多个会议室连接起来，以电视方式召开会议的一种图像通信手段。视频会议的主要特征是能实时传送与会者的形象、声音以及会议资料图表和相关事物的图像等，身居不同地点的与会者可以闻声见影，如同坐在同一间会议室中开会一样。

目前的视频会议系统大都采用模拟方式传输图像，由于占用频带宽，设备昂贵（需要很多专有硬件设备），升级不便，运营费用很高，难以普及。

数字式视频和音频技术的进步导致了计算机和网络的革命，并为计算机系统的应用开拓了新的设计空间。高速网络技术、分布式处理技术、多媒体信息处理技术、多媒体工作站技术等的进步为分布式多媒体系统的发展奠定了基础。美国 In-Stat/MDR 公布的关于视频会议系统的调查结果显

示，到2006年为止，视频会议系统的全球市场将从2001年的7亿7200万美元增长为22亿美元的规模。

目前数字视频会议的研究主要集中于LAN和ATM网。带宽在视频会议应用中是一个比较大的问题。LAN通常能提供足够带宽，因而不存在带宽问题，而Internet就不一样了。如今的企业LAN和ATM网已能提供足够带宽，并具备相关QoS控制机制，而对基于Internet的视频会议应用来说，这些因素往往是不可预知的。对于LAN视频会议白板系统来说，图形可以位图方式保存并传输，但在Internet上，通信量在一天中的不同时段变化很大，因此需要引入某种通信压缩机制，以降低视频会议的带宽需求。

发明内容

为了克服现有技术的存在的上述不足，本发明提供一种基于Internet的视频会议共享白板实现方法，以满足数字视频会议系统的市场需求。

本发明基于Internet的视频会议共享白板实现方法，包括以下步骤：

a、启动安装于服务器和客户机中的白板系统，在服务器和客户机的显示屏上出现画板、绘图工具栏和控制面板，客户机登录所述服务器，并向服务器发出连接请求，服务器接受客户机的连接请求，同时产生一个响应该请求客户机的套接字，并将套接字加入套接字链表的尾部；

b、客户机在其画板上绘制一个或几个图形，将所绘图形进行矢量序列化处理，存档，最后通过其套接字端口发送到Internet上；

c、所述服务器通过其套接字端口侦听、接收到客户机上传的图形序列化数据后，首先进行存档，并记录接收顺序，然后通过反序列化处理将图形再现于它的画板上；

同时所述服务器遍历（即依次轮流查询）套接字链表，将图形序列化

数据通过相应的套接字端口转发给所有参加会议的客户机；

d、所有登录的客户机接收到图形序列化数据后，通过反序列化处理将图形再现于各自的画板上，从而实现共享白板的目的。

在步骤 b 中，客户机将其画板上绘制的图形进行矢量序列化处理的方法如下：

①、客户机对应于白板系统的每一种绘图工具，创建一个数组；

②、将采用各绘图工具所绘图形元素的特征值添加到对应的数组中；

③、将各数组的数组元素按指定顺序序列化，形成图形序列化数据。

在步骤 c 中，服务器将图形序列化数据进行反序列化处理的步骤如下：

①、服务器对应于白板系统的每一种绘图工具，创建一个数组；

②、从收到的图形序列化数据中找出当前绘图工具名字信息，从而确定使用的绘图工具；

③、根据所确定的绘图工具，并按照图形序列化数据中对应的图形元素的特征值创建图形元素，同时将该图形元素加入服务器白板系统的相应数组中。

在步骤 d 中，客户机对接收的图形序列化数据进行反序列化处理的步骤如下：

①、客户机对应于白板系统的每一种绘图工具，创建一个数组；

②、从收到的图形序列化数据中找出当前绘图工具名字信息，从而确定使用的绘图工具；

③、根据所确定的绘图工具，并按照图形序列化数据中对应的图形元素的特征值创建图形元素，同时将该图形元素加入客户机白板系统的相应数组中。

本发明使数字视频会议系统的白板图形可以在 Internet 上高速可靠传输，从而实现基于 Internet 的数字视频会议系统，克服了传统视频会议系统占用频带宽、设备昂贵、升级不便、运营费用高的缺点。

具有多种绘图工具和用于设置画笔、画刷、背景的风格及颜色的控制面板，通过 TrackBar 滑杆条微调颜色，画笔不但可以设置线宽，而且可以设置为多种虚线。不但可以设置实心或空心两种画刷，还可以设置阴影画刷，而且有 6 种阴影图形可供选择，可以选择背景模式，极大地丰富了白板的表现能力。

本系统记录绘图的顺序，可以实现回撤和恢复操作，在错误绘图时和实验绘图时，能够方便地修改。

附图说明

图 1 为本发明一典型实施案例的系统结构图；

图 2 为其白板图形的传输流程图；

图 3 为其绘图工具栏的示意图；

图 4 为其控制面板的示意图。

具体实施方式

下面结合附图进一步说明。

图 1 为本发明一典型实施案例的系统结构图，本实施案例由一台服务器和若干台客户机共同构成，系统采用星型的 Client/Server 结构和 TCP 传输协议，服务器和客户机之间通过套接字进行通信。本实施案例的具体配置如下：

服务器配置：

CPU：Intel P4 1.4GHz

内存：256M

操作系统：Windows 2000 Server

客户端配置：

CPU: Intel PIII 800MHz

内存：256M

操作系统：Windows 2000 Professional

参照图1、图2说明本发明基于Internet的视频会议共享白板实现过程：

1、首先启动服务器，使之处于监听状态。客户机后启动，登录服务器，向服务器发出连接请求。服务器接受客户机的连接请求，同时创建一个新的套接字（socket + port），专门对应客户机套接字的连接，这样就在两者之间建立了一对可相互通信的套接字。

由于服务器与客户机之间是一对多的星型连接结构，服务器产生多个套接字与多个客户机一一对应，服务器设置了一个套接字链表来管理这些套接字。每当一个客户机发出连接请求时，服务器接受其请求，产生一个新套接字，同时将这个套接字加入套接字链表的尾部。

2、客户机在其画板上可绘制一个或几个图形，将所绘图形进行矢量序列化处理，存档，最后通过其套接字端口通过Internet发送给服务器；

3、所述服务器通过其套接字端口侦听、接收到客户机上传的图形序列化数据后，首先进行存档，并记录接收顺序，然后通过反序列化处理将图形再现于它的画板上；并且遍历记录着连接关系的套接字链表，将图形序列化数据通过相应的套接字端口一一转发给所有参加会议的客户机。

4、所有参加会议的客户机接收到服务器转发的图形序列化数据后，通过反序列化处理将图形再现于各自的画板上，这样就实现了绘制图形元素

的共享。

本发明在客户端启动后，出现画板，在画板的旁边显示 12 种绘图工具的工具栏（见图 3），以及设置画笔、画刷、背景风格的控制面板（见图 4）。工具栏的 12 种绘图工具按次序依次是：直线、矩形、圆角矩形、多边形、椭圆、圆、画笔轨迹曲线、内切椭圆、圆弧、椭圆弧、贝赛尔曲线以及文字输入，另外三个按钮是：选择和移动图形元素、取消对绘图工具的选择、关闭绘图工具框。

如果服务器已先启动，正在监听，客户端可以向服务器程序发出连接申请。点击主工具栏的连接图标。如果服务器没有启动，客户端连接不成功，提示，等待再次连接。选择“是”，再次尝试连接；选择“否”，取消连接申请。如果已经和服务器连接，要断开这个连接，选择主工具栏的断接图标点击，完成断开操作。

客户端选择某一绘图工具后，就可以在画板中画出相应图形。将其画板上绘制的图形进行矢量序列化处理。矢量序列化处理过程为：①、对应于白板系统的 12 种绘图工具，创建 12 个数组；②、将各绘图工具所绘图形元素的特征值添加到对应的数组中；③、将各数组的数组元素按指定顺序序列化。

绘制的图形通过序列化（Serialize）保存，序列化按照属性顺序保存数据特征值，（相当于一种压缩方式，）所以通过 Serialize 保存的数据文件，占用磁盘空间很小，读写很快。例如本程序的画板文件，一般不超过 100K，如果保存为.bmp 格式文件，需要 n M 的空间。序列化后的图形数据通过套接字端口传到网络上并发往服务器。

本发明在服务器端实现了文档类的序列化，它由多达 12 种图形元素的

序列化组成。在整个白板中，每种图形元素的数量可能从 0 到任意多个。对应每种图形元素，使用了一个数组进行管理。共 12 个数组，每个数组中有 0 到任意多个元素。

服务器通过其套接字端口侦听、接收到客户机上传的图形序列化数据后，首先进行存档，并记录接收顺序，然后通过反序列化处理将图形再现于它的画板上。服务器将图形序列化数据进行反序列化处理的步骤如下：

①、服务器对应于白板系统的每一种绘图工具，创建一个数组，共 12 个数组；

②、从收到的图形序列化数据中找出当前绘图工具名字信息，从而确定上传请求的客户端使用的绘图工具；

③、根据所确定的绘图工具，并按照图形序列化数据中对应的图形元素的特征值创建相应的图形元素，同时将该图形元素加入服务器白板系统的相应数组中。

服务器在接收到客户绘图的同时，将这个图形元素转发给其它的共享客户。服务器中保存有一个套接字链表，记录着和客户端的所有连接。服务器遍历这个套接字链表，将图元元素转发给其它客户端，转发通过套接字端口完成。

本发明在服务器端实现了系统托盘功能。白板服务器正常启动后，将在系统托盘中显示一个小图标。实现系统托盘功能，分 5 步执行：

1) 建立一个处理托盘通知消息的窗口对象

2) 建立一个结构体

3) 建立相应的托盘通知消息映射机制

4) 调用脚本方法

5) 在窗口对象中编写事件响应方法。

在共享的客户端也通过套接字端口接收服务器转发来的上述图形序列化数据，对接收的图形序列化数据进行如下反序列化处理，①、对应于白板系统的每一种绘图工具，创建一个数组；②、从收到的图形序列化数据中找出当前绘图工具名字信息，从而确定使用的绘图工具；③、根据所确定的绘图工具，并按照图形序列化数据中对应的图形元素的特征值创建图形元素，同时将该图形元素加入共享的客户机白板系统的相应数组中。

然后采用循环遍历的方法将各图形数组中的元素一个不漏地显示出来。

如图 3 所示绘图工具栏中的按钮从左到右依次为：直线、矩形、圆角矩形、多边形、椭圆形、圆形、画笔轨迹曲线、内切椭圆、圆弧、椭圆弧、贝赛尔曲线和文字输入 12 种绘图工具，另外三个按钮是：选择和移动图形元素、取消对绘图工具的选择、关闭绘图工具框。所述 12 种绘图工具的具体实现原理如下：

直线：在画板上取 2 个点，在两点间绘制一条直线。

矩形：在画板上取 2 个点，以两点为对角线，绘制一个矩形。

圆角矩形：在画板上取 2 个点，以两点为对角线，绘制一个圆角矩形。

多边形：利用链表记录绘图过程中所取的各点，这些点是多边形的顶点。在相邻点之间绘制直线，就完成了多边形的绘制。

椭圆形：在画板上取 3 个点，确定椭圆长短轴半径。这种方法可以绘制倾斜的椭圆，比内切法灵活。先取两点，确定横轴的半径及角度，再取第三点，确定椭圆纵轴的半径。椭圆的中心为前两点的中点。

圆形：在画板上取两个点，调用绘内切椭圆的方法，从中心点向左上和右下偏移相等的距离。这个距离等于所取的两点间的距离，即圆的半径。

画笔轨迹曲线：系统设置一个记录轨迹曲线的点的链表，当画笔在画板上移动时，不断发送轨迹点的数据，将轨迹点的数据不断加入链表中，同时在相邻两点间画直线，将轨迹显示出来。系统封装了一个绘制直线的方法，在相邻两点间画直线。由于两点间的直线很细小，不会影响到曲线的外观。

内切椭圆：与绘制圆形的原理相同，只是外切的不是正方形而是矩形。

圆弧：在画板上取三个点，三个点构成一个三角形，求其外接圆，再显示第一点和第三点之间外接圆逆时针方向上的圆弧。三角形三条边的中点垂线必交于一点，这一点称为“外心”，实际上就是外接圆的圆心。可以求出两条边中点垂线的斜率，进而求出两条边中点垂线的焦点，这个交点就是外接圆的圆心。

椭圆弧：绘制椭圆弧分两步，首先是绘制椭圆，然后取其中的椭圆弧。椭圆弧的取向是顺时针方向。

贝赛尔曲线：贝赛尔样条曲线是由两个终点和两个起“牵拉”作用的中间点确定的一条光滑曲线，最初是帮助工程师给汽车车身建立数学模型的，如今从字体到弹头的设计都使用这样的样条曲线。绘制贝赛尔样条曲线，使用两个参数，一个是 Point 数组指针，另一个 *nCount* 表示数组点的个数。*nCount* 必须是一个 3 的倍数加 1 的整数(3n + 1)，如 4、7、11……，因为绘制一条贝赛尔曲线需要 4 个点，如果绘制连续的两条，则前一条的终点将作为后一条的起点，这样需要 7 个点的数组。

文字输入：当选择文本输入工具时，显示文本框，同时显示文字输入工具栏。

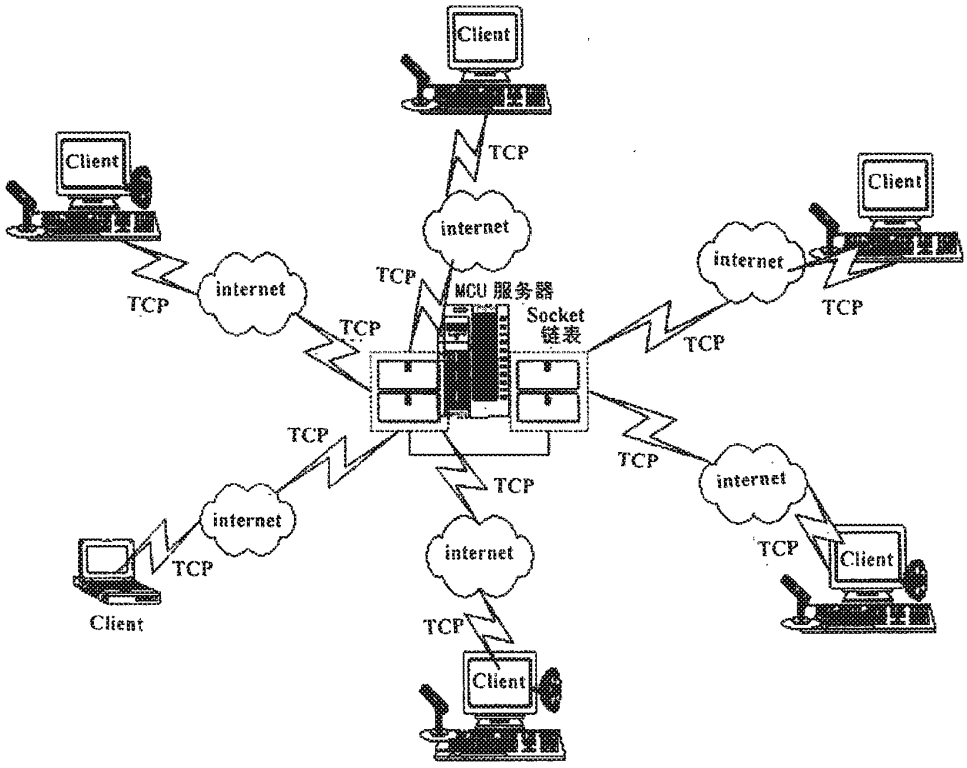
如图 4 所示的控制面板包括画笔、画刷、背景的颜色设置和风格设置。

其中，进行画笔、画刷或背景颜色设置时，可以通过滑杆选择多达16,777,216种颜色，而且设置方法简单直观。通过滑杆条取色，在窗口显示配制的颜色，这种功能还没有在其它系统中使用。

在风格设置中，可以设置画笔的线宽，还可以将画笔设为实线或各种虚线，画刷的风格可以设为空心、实心或阴影画刷，而且有6种阴影图形可供选择。

本发明白板系统可以查看本机的IP地址和其它性能参数，如内存大小、硬盘空间大小等，这对于网络通信时发出正确的连接请求，以及系统的移植很有帮助。如果一个用户将本系统移植在一台陌生的机器上使用，那么他可以很快知道这台机器的IP地址和机器性能参数，如内存大小、硬盘空间大小。

本白板系统记录有绘图的顺序，可以回撤和恢复，在错误绘图时和实验绘图时，能够方便地修改，这也是其它白板没有出现的功能。


Client
TCP
internet
MCU 服务器
Socket
链表
Client
Client
Client

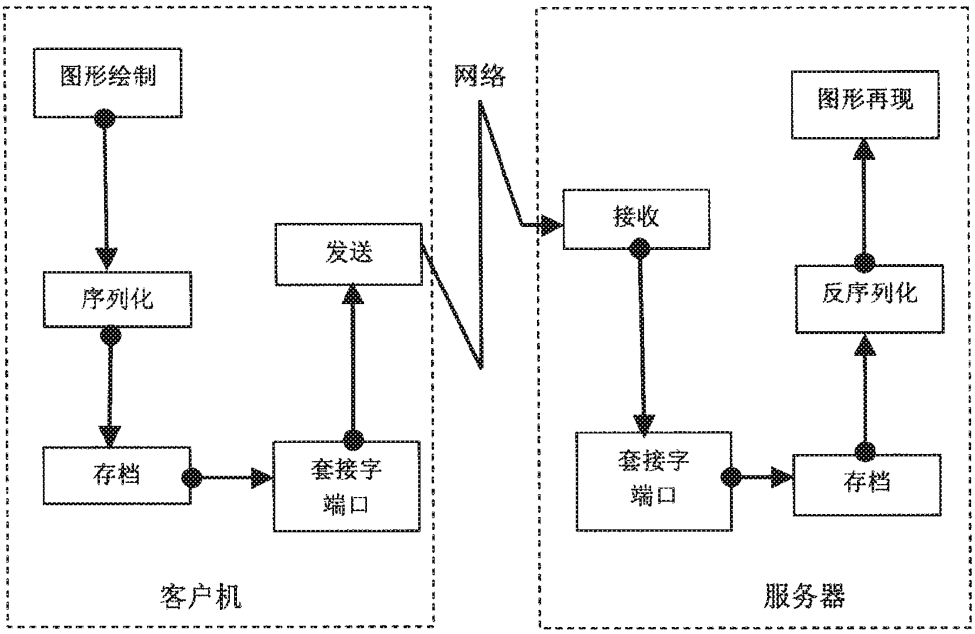


图 2

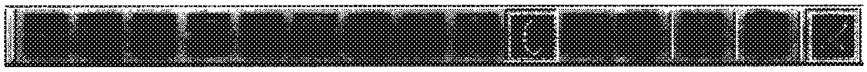


图 3

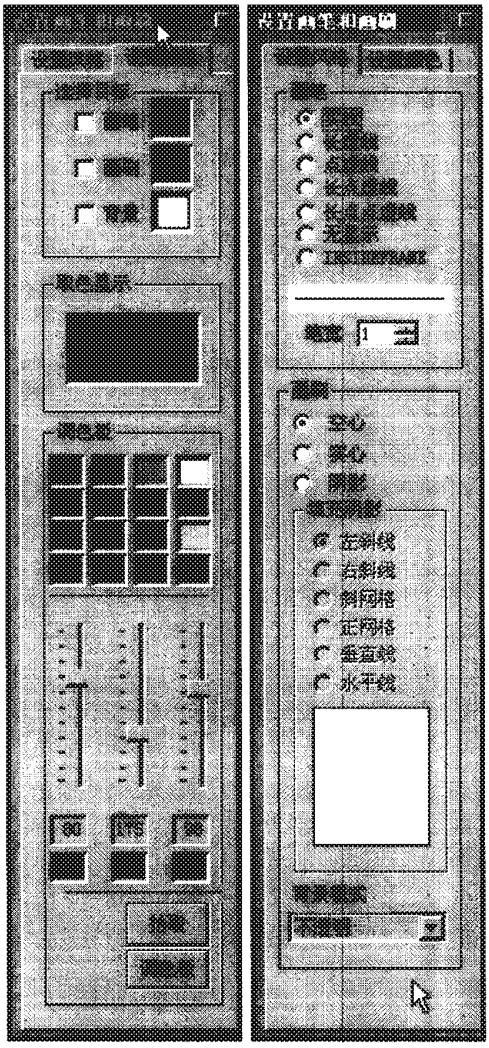


图 4

Espacenet

CN101046952A Audio network system

Applicants: YAMAHA CORP [JP]

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Audio network system

Abstract

An audio network system allows any two nodes among a plurality of nodes to transmit and receive audio data to and from each other. The plurality of the nodes are connected in loop so as to allow transmission of the audio data in loop manner through the plurality of the nodes; and the transmission of the audio data is performed in one direction from an upstream node to a downstream node. One of the plurality of the nodes is set as a master node and the other nodes are set as slave nodes. The master node periodically transmits a packet of frame data containing the audio data every sampling period, such that the packet transmitted from the master node circulates through the plurality of the nodes to return to the master node within one or more sampling period. The packet has a specific data length and includes an audio data storage region divided into a plurality of blocks corresponding to a plurality of channels, such that each of the blocks stores audio data of the corresponding channel.

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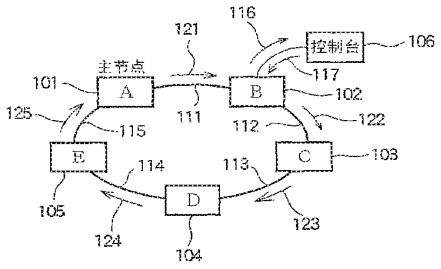
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音频网络系统

[57] 摘要

一种音频网络系统，允许多个节点中的任两个节点之间相互发送和接收音频数据。所述多个节点连接成环以允许经由多个节点以环的形式发送音频数据，并且在环中从上游节点至下游节点的一个方向上执行音频数据的发送。所述多个节点中的一个节点设定为主节点，而将其它节点设定为从节点。主节点在每个采样周期中周期性发送包含音频数据的一个帧数据包，使得主节点在每个采样周期中发送的包在一个或多个采样周期中经由多个节点循环而返回到主节点。所述包具有预定的数据长度，并包括对应于多个信道而划分成多个区块的音频数据存储区，使得每个区块存储对应信道的音频数据。



1．一种音频网络系统，包括多个节点并允许所述多个节点中的任两个节点相互发送和接收音频数据，

其中，所述多个节点连接成环以允许经由所述多个节点以环的形式发送所述音频数据，并且在该环中从上游节点至下游节点的一个方向上执行所述音频数据的发送；

其中，将所述多个节点中的一个节点设定为主节点，将其它节点设定为从节点；

其中，所述主节点在每个采样周期中周期性发送包含所述音频数据的帧数据包，使得所述主节点在每个采样周期中发送的包在一个或多个采样周期中经由所述多个节点循环而返回到所述主节点；

其中，所述包具有预定的数据长度，并包括对应于多个信道而划分成多个区块的音频数据存储区，使得每个区块存储对应信道的音频数据；

其中，为所述多个节点中的每个节点设定发送信道或接收信道，所述发送信道和所述接收信道均表示所述包的多个区块之一；

其中，每一所述从节点在每个采样周期中从所述包的报头开始逐个区块地从上游节点接收所述包，如果所述包的已接收区块对应于为所述从节点设定的发送信道，所述从节点运行为：用所述从节点待发送的音频数据重写所述已接收区块；另一方面，如果所述包的已接收区块对应于为所述从节点设定的接收信道，所述从节点运行为：从所述已接收区块获取所述从节点待接收的音频数据，然后在从所述从节点开始接收所述包的报头时起已经过去预定时间之后，所述从节点开始将所述包发送至下游节点；

其中，所述主节点在每个采样周期中从所述包的报头开始逐个区块地接收已从最下游节点返回的包，并基于已接收的包构建待在下一个采样周期中发送的下一个包或所述下一个包之后的包的每个区块，如果所述包的区块对应于为所述主节点设定的发送信道，所述主节点运行为：用所述主节点待发送的音频数据重写所述区块；另一方面，如果所述包的区块对应于为所述主节点设定的接收信道，所述主节点运行为：从所述区块获取所述主节点待接收的音频数据，并且在所述下一个采样周期开始时，所述主节点开始将已构

建的包发送至下游节点；

其中所述已构建的包与所述主节点构建该包所基于的包包含相同的音频数据；以及

其中在所述音频网络系统中一个发送信道仅设定给一个节点，以使音频数据在所述音频网络系统中的循环期间由所述一个节点写入区块的音频数据不被另一节点重写，并且所述音频网络系统中的任一节点能够接收所述音频数据。

2．根据权利要求 1 所述的音频网络系统，其中所述包除了包括所述音频数据存储区之外还包括控制数据存储区，所述包的控制数据存储区用于允许所述多个节点中的任两个节点相互发送和接收控制数据。

3．根据权利要求 1 所述的音频网络系统，其中所述包具有符合以太网标准的数据大小和数据结构，并且由以太网标准定义的发送器、接收器以及传输电缆可用于所述包的传输。

4．根据权利要求 1 所述的音频网络系统，其中所述多个节点连接成允许所述包以环发送的形式，使得所述多个节点通过一条线路级联连接以便沿一个方向发送所述包，并且所述多个节点还通过另一条线路级联连接以便沿另一方向发送所述包。

5．根据权利要求 1 所述的音频网络系统，其中所述多个节点连接成允许所述包以环发送的形式，使得所述多个节点从第一节点至最末节点级联连接以便沿一个方向发送所述包，并且所述最末节点连接至所述第一节点以使所述包返回至所述第一节点。

6．一种音频网络系统，包括多个节点并允许所述多个节点中的任两个节点相互发送和接收音频数据，

其中，所述多个节点连接成环以允许经由所述多个节点的环发送所述音频数据，并且在该环中从上游节点至下游节点的一个方向上执行所述音频数据的发送；

其中，将所述多个节点中的一个节点设定为主节点，将其它节点设定为从节点；

其中，所述主节点在一个采样周期中依次发送包含所述音频数据的预定数量的帧数据包，使得在每个采样周期中所依次发送的包在一个或多个采样

周期中经由所述多个节点循环而返回到所述主节点；

其中，所述预定数量的包中的每一个具有预定的数据长度，并包括对应于多个信道而划分成多个区块的音频数据存储区，使得每个区块存储一个信道的音频数据；

其中，为所述多个节点中的每个节点设定发送信道或接收信道，所述发送信道和所述接收信道均表示所述包的多个区块之一；

其中，每一所述从节点在每个采样周期中从所述包的报头开始逐个区块地从上游节点接收所述依次发送的包中的每一个，如果所述包的已接收区块对应于为所述从节点设定的发送信道，所述从节点运行为：用所述从节点待发送的音频数据重写所述已接收区块；另一方面，如果所述包的已接收区块对应于为所述从节点设定的接收信道，所述从节点运行为：从所述已接收区块获取所述从节点待接收的音频数据，并且在从所述从节点开始接收所述包的报头时起已经过去预定时间之后，所述从节点将所述包发送至下游节点；

其中，所述主节点在每个采样周期中从每个包的报头开始逐个区块地接收已从最下游节点依次返回的预定数量的包中的每一个，并基于已接收的包创建待在下一个采样周期中发送的预定数量的后续包的每个区块，如果所述包的所述区块对应于为所述主节点设定的发送信道，所述主节点运行为：用所述主节点待发送的音频数据重写所述区块；另一方面，如果所述包的所述区块对应于所述主节点的接收信道，所述主节点运行为：从所述区块获取所述主节点待接收的音频数据，然后在所述下一个采样周期开始时，所述主节点开始将所创建的预定数量的后续包发送至下游节点，

其中所创建的包与所述主节点创建该包所基于的包包含相同的音频数据；以及

其中在所述音频网络系统中一个发送信道仅设定给一个节点，以使音频数据在所述音频网络系统中的循环期间由所述一个节点写入区块的音频数据不被另一节点重写，并且所述音频网络系统中的任一节点能够接收所述音频数据。

7．根据权利要求 6 所述的音频网络系统，其中所述预定数量的包中的至少一个包除了包括所述音频数据存储区之外还包括控制数据存储区，所述包的控制数据存储区用于允许所述多个节点中的任两个节点相互发送和接

收控制数据。

8. 根据权利要求 6 所述的音频网络系统，其中所述包具有符合以太网标准的数据大小和数据结构，并且由以太网标准定义的发送器、接收器以及传输电缆可用于所述包的传输。

9. 根据权利要求 6 所述的音频网络系统，其中所述多个节点连接成允许所述包以环发送的形式，使得所述多个节点通过一条线路级联连接以便沿一个方向发送所述包，并且所述多个节点还通过另一条线路级联连接以便沿另一方向发送所述包。

10. 根据权利要求 6 所述的音频网络系统，其中所述多个节点连接成允许所述包以环发送的形式，使得所述多个节点从第一节点至最末节点级联连接以便沿一个方向发送所述包，并且所述最末节点连接至所述第一节点以使所述包返回至所述第一节点。

音频网络系统

技术领域

本发明涉及一种连接多种音频装置的音频网络系统。

背景技术

用于 PA（例如演奏和音乐会）、音乐制作和专用广播中的音频网络系统中的音频信号通信的现有技术包括：非专利文献 1 中描述的 CobraNET（商标），非专利文献 2 中描述的 SuperMAC（商标），和非专利文献 3 中描述的 EtherSound（商标）。

CobraNet 是由 Peak Audio 公司（美国）开发的专业音频网络系统。CobraNET 提供一种利用 IEEE802.3u 的标准以太网（standard Ethernet）（商标）协议的技术，其中通过以太网传输多信道的未压缩音频信号和控制信号。这种技术可以传输的采样率为 48 kHz 且位数为 16、20 和 24 位的采样数据，并且可以双向处理音频信号和控制信号，其中在每个方向具有一直到 64 信道（即，在双向具有一直到 128 信道）。SuperMAC 和 EtherSound 为用于通过以太网传输音频数据的相似技术。

具有各种功能（例如模拟输入、模拟输出、数字输入、数字输出、混合、效果、记录/再现、远程控制和这些功能中的任何两种的组合）的音频装置可以选择性地连接至使用上述技术的音频网络。[非专利文献 1]

http://www.balcom.co.jp/cobranet.htm

[非专利文献 2]

http://www.sonyoxford.co.uk/pub/supermac/

[非专利文献 2]

http://www/ethersound.com/news/getnews.php?enews_key=101

在任一种传统音频网络中，根据上述 Ethernet 标准执行音频传输。在 Ethernet 标准中，最大的包大小限于 1526 字节。

在传统技术中，不只音频数据包，如指令、对指令的回应以及节拍（meter）

显示的等级数据之类的控制数据包也能够在网络上流动。然而，当多个相同或不同种类的包被获准在网络上流动时，用于传输音频数据的带宽相应减少。由于除了音频数据之外其它包也在网络上流动，因此这些包可能干扰音频数据的传输。这种情况在采用 CSMA/CD 方法的 Ethernet 中尤为严重。

此外，由于对应于多个采样周期的采样是通过合并成一个包而传输的，因此将多个采样打包成为一个包和将一个包重构成为多个采样是很花时间的，并且用于打包和重构的电路复杂。

发明内容

本发明的目的是提供能够稳定地传输音频数据并能够简化每个节点处数据传输和接收电路的音频网络系统。

根据本发明，上述目的可通过提供一种音频网络系统来实现，所述音频网络系统包括多个节点并允许所述多个节点中的任两个节点相互发送和接收音频数据。所述多个节点连接成环以允许经由所述多个节点以环的形式发送所述音频数据，并且在该环中从上游节点至下游节点的一个方向上执行所述音频数据的发送。将所述多个节点中的一个节点设定为主节点，将其它节点设定为从节点。所述主节点在每个采样周期中周期性发送包含所述音频数据的帧数据包，使得所述主节点在每个采样周期中发送的包在一个或多个采样周期中经由所述多个节点循环而返回到所述主节点。所述包具有预定的数据长度，并包括对应于多个信道而划分成多个区块的音频数据存储区，使得每个区块存储对应信道的音频数据。为所述多个节点中的每个节点设定发送信道或接收信道，所述发送信道和所述接收信道均表示所述包的多个区块之一。每一所述从节点在每个采样周期中从所述包的报头开始逐个区块地从上游节点接收所述包，如果所述包的已接收区块对应于为所述从节点设定的发送信道，所述从节点运行为用所述从节点待发送的音频数据重写所述已接收区块；另一方面，如果所述包的已接收区块对应于为所述从节点设定的接收信道，所述从节点运行为从所述已接收区块获取所述从节点待接收的音频数据，然后在从所述从节点开始接收所述包的报头时起已经过去预定时间之后，所述从节点开始将所述包发送至下游节点。所述主节点在每个采样周期中从所述包的报头开始逐个区块地接收已从最下游节点返回的包，并基于已

接收的包构建待在下一个采样周期中发送的下一个包或所述下一个包之后的包的每个区块，如果所述包的区块对应于为所述主节点设定的发送信道，所述主节点运行为：用所述主节点待发送的音频数据重写所述区块；另一方面，如果所述包的区块对应于为所述主节点设定的接收信道，所述主节点运行为：从所述区块获取所述主节点待接收的音频数据，并且在所述下一个采样周期开始时，所述主节点开始将已构建的包发送至下游节点。所述已构建的包与所述主节点构建该包所基于的包包含相同的音频数据。在所述音频网络系统中一个发送信道仅设定给一个节点，以使所述音频数据在所述音频网络系统中的循环期间由所述一个节点写入区块的音频数据不被另一节点重写，并且所述音频网络系统中的任一节点能够接收所述音频数据。

尽管在一个至几个采样周期中以环形式发送一个包，但是在不脱离本发明范围的情况下，也可以在一个至几个采样周期中以环形式发送预定数量的包。

一个或预定数量的包（优选地，预定数量的包中的至少一个）除了包括所述音频数据存储区之外还包括控制数据存储区，其中所述包的控制数据存储区用于允许所述多个节点中的任两个节点相互发送和接收控制数据。

尽管包的大小和结构是可变的，但是优选地，所述包具有符合 Ethernet 标准的数据大小和数据结构，并且由 Ethernet 标准定义的发送器、接收器以及传输电缆可用于所述包的传输。

在一种形式下，所述多个节点连接成允许所述包以环发送的形式，使得所述多个节点通过一条线路级联连接以便沿一个方向发送所述包，并且所述多个节点还通过另一条线路级联连接以便沿另一方向发送所述包。

在另一种形式下，所述多个节点连接成允许所述包以环发送的形式，使得所述多个节点从第一节点至最末节点级联连接以便沿一个方向发送所述包，并且所述最末节点连接至所述第一节点以使所述包返回至所述第一节点。

根据本发明，在每个采样周期中的任何时刻，预定数量的包（例如，一个包）在网络上循环。这实现了非常稳定的通信。例如，在每个采样周期循环一个包的情况下，能够接收和发送包的每个节点在每个采样周期中可发送音频数据的一个采样，从而以逐个采样的方式进行输出，或者在每个采样周

期中可接收音频数据的一个采样，从而以逐个采样的方式进行接收。这使得可以容易地再现采样时钟和简化打包（packetization）电路。此外，由主节点发送的包在保持其数据结构的同时被以环的形式运送，并且每个从节点只需要用音频数据重写分配给该从节点的一个信道的区域，或者从为该从节点设定的另一信道的区域提取音频数据。这显著简化了每个从节点中用于输出或输入一个包的音频数据的电路。使用 Ethernet 标准的包使得能够使用与 Ethernet 兼容的发送器、接收器以及传输电缆，从而能够使用易于获得的廉价硬件。

附图说明

图 1a 和图 1b 示出在应用根据本发明的音频网络系统时节点之间的连接实例和节点之间的传输实例。

图 2a 至图 2f 示出本实施例的音频网络系统中包中的位数据流。

图 3 示出一个包的帧数据结构。

图 4 示出每个节点中包含的帧数据发送/接收单元的结构。

图 5 示出每条传输线上的包的时序图。

图 6 为示出本实施例中音频采样的传输流的示意图。

图 7a 和图 7b 为示出从节点中的硬件处理的流程图。

图 8a 至图 8c 为示出主节点中的硬件处理的流程和缓冲器结构图。

图 9a 和图 9b 为主节点中的采样时钟中断处理和 1 字节发送事件处理的流程图。

具体实施方式

下面将参照附图描述本发明的实施例。

图 1a 和图 1b 示出在应用根据本发明的音频网络系统时节点之间的连接实例和节点之间的传输实例。图 1a 示出主节点 A101 和从节点 B102、C103、D104 和 E105 的环形连接实例。标号“111”至“115”表示节点之间连接的物理连接线。在这种网络系统中，连接的节点中只有一个节点是主节点。这里，节点 A101 是主节点，而其它节点是从节点。箭头“121”至“125”均表示包的每位数据的传输方向。

主节点 A101 定期发送多个包，每一个采样周期发送一个包，所述采样周期为网络系统中的音频信号采样时钟的周期。具体来说，在一个采样周期中，每个节点 101 至 105 从上游节点接收一个包的位数据，并将这一个包的位数据输出至下游节点。主节点 A101 执行采样周期的同步。具体来说，在一个采样周期的开始时刻，主节点 A101 开始将一个包的位数据发送至下游节点 B102。在完成一个包的位数据的发送之后，主节点 A101 等候直到该采样周期终止。在下一个采样周期的开始时刻，主节点 A101 开始将下一个包的位数据发送至下游节点 B102。

本实施例的网络系统中的包与传统 Ethernet 标准中使用的包相同。然而，在传统 Ethernet 中，以包为基础执行传输，并且直到节点之间的传输终止时节点之间传输的数据包才会被重写。另一方面，在本实施例中，在从主节点发送的包经过回路中的各从节点直到返回主节点的同时，数据包被重写，下面将对此进行更详细地描述。在本实施例中，每个采样周期传输音频数据的容器称为“包”。不限于 Ethernet 标准的包，本发明可使用任何其它格式的包。

尽管在 OSI 基准模式下在层 3 中处理的数据单元称为“包”，而在层 2 中处理的数据单元称为“帧”，但在本实施例中如上所述，每个采样周期传输的音频数据的容器称为“包”，而实现包的实际数据序列称为“帧”。因此，在本实施例中术语“包”和“帧”指代相同内容。

一个包包括这样的区域，所述区域包含音频数据和多个信道的控制数据（如指令、对指令的回应以及节拍显示的等级数据之类）。对于每个节点，在节点中设定用于从该节点发送的多个信道之一（发送信道），和/或在节点中设定用于该节点接收的另一信道（接收信道）。因此，当在一个采样周期中一个包的位数据经过每个节点而使得该节点从上游节点接收位数据并将其输出至下游节点时，该节点用从该节点待发送的音频数据的采样重写包中位于该节点的发送信道区域中的位数据，并加载包中位于节点的接收信道区域中的位数据，这是因为位于接收信道区域中的位数据是该节点待接收的音频数据。在一个包的位数据经过每个节点的时，该节点执行至发送信道的上述数据写操作和从接收信道的上述数据加载操作。之后，该节点将这一个包的位数据发送至紧接着的下游节点。在主节点 A101 中执行相同的处理。具

体来说，主节点 A101 接收从最下游节点 E105 发送的包，并用从主节点 A101 待发送的音频数据的采样重写包中分配给主节点 A101 的发送信道，并将主节点 A101 通过分配给主节点 A101 的接收信道待接收的音频数据加载至包中。通过上述处理产生的数据包是下一个采样周期将发送的数据包。

作为将参照图 3 描述的每个包（帧）的具体结构，在每个包中不仅设定上述用于设定每个信道音频数据的区域，而且设定用于存储控制数据的区域。利用用于存储控制数据的区域，能够在节点之间发送和接收（即通信）各种控制数据。

控制台 106 连接至节点 B102。例如，当前往控制台 106 的数据包含在节点 B102 接收的控制数据中时，如箭头 116 所示，将控制数据从节点 B102 发送至控制台 106。当控制台 106 具有待发送至节点的控制数据时，如箭头 117 所示，控制台 106 将控制数据发送至节点 B102，并且节点 B102 在对应区域中设定在网络上循环的控制数据包，并将其发送至目标节点。将参照图 3 描述发送和接收控制数据的具体方法。

图 1b 示出通过双连接线将节点级联连接的实例。在本实例中，在使用前向线和后向线的回路中传送包，其中包通过前向线在向前的方向上流动，包通过后向线在向后的方向上流动。标号“141”表示主节点 A，而标号“142”至“144”表示从节点 B、C 和 D。主节点 A141 和从节点 B142 通过前向信号线 151 和后向信号线 156 连接。类似地，节点 B142 和节点 C143 通过连接线 152 和 155 连接，节点 C143 和节点 D144 通过连接线 153 和 154 连接。包流动的方向由箭头 161 至 166 表示。图 1b 所示的实例与图 1a 所示的实例基本相同之处在于：从主节点 A141 输出的一个包的位数据经由各节点循环并返回至节点 A141，如箭头 161 至 166 所示。然而，在图 1b 所示的实例中，在到达末端从节点 D144 之后在返回主节点 A 的过程中，包经过节点 C 和 B。在前向路径上执行每个节点 A 至 D 的音频数据和控制数据的写和读。在沿着节点 A 至 D 的返回路径上，不执行数据加载或写，使得数据只经过各节点。在图 1b 所示的实例中，末端节点 A 是主节点。然而，同样在将中间节点 B 或 C 设定为主节点时，箭头 161、162 和 163 的路径称为“前向路径”，而箭头 164、165 和 166 的路径称为“后向路径”，并且在前向路径上执行数据加载或写（在图 1b 中在前向路径上包在向右的方向上行进）。在这种

情况下，主节点（其位于图的中部）左侧的从节点首先在前向路径上接收包，然后在后向路径上接收包，但是在前向路径上执行数据加载或写。此外，在后向路径上可以执行数据加载或写，而不是在后向路径上仅使数据经过每个节点。

在环形连接的情况下，在多个节点依次连接之后，多个节点中的末端节点必须相互连接。另一方面，在级联连接的情况下，只需要使用双连接线依次连接多个节点。因此，级联连接的装置可具有更简单的结构。

图 2a 至图 2f 示出本实施例的音频网络系统中包中的位数据流。在以下对本实例的描述中，假定主节点 A 和从节点 B 和 C 通过前向路径和后向路径连接，如图 1b 所示。

在一个采样周期的开始时刻，主节点 A 开始传输一个包的位数据。图 2a 示出主节点 A 将包的头位 B0 发送至下游节点 B 的状态，如箭头 201 所示。之后，以与从主节点 A 输出的网络时钟同步的方式，主节点 A 依次逐位发送包中的头位 B0 后面的各位数据。图 2b 示出在对应于 50 位的时间已经过去的时刻主节点 A 将包的第 51 位 B1 发送至节点 B 的状态，如箭头 203 所示。此时，节点 B 将接收到的头位 B0 发送至下一节点 C，如箭头 202 所示。当然，中间的各位也被传输，尽管图中只关注第五十位。类似地，主节点 A 相继输出由第 101 位 B2、第 151 位 B3 和第 201 位 B4 表示的位数据，如图 2c 至图 2e 所示，并且输出的位数据在经过各节点之后返回主节点 A。图 2e 示出已返回主节点 A 的包的头位 B0 被存储在缓冲器中的状态，如标号“211”所示。图 2f 示出已相继返回主节点 A 的 500 位数据 B0-B10 被存储在缓冲器中的状态，如标号“216”所示。主节点 A 在以上述方式发送包的所有位之后等候直到该采样周期终止，然后开始发送下一采样周期的包，如图 2a 所示。然而，在图 2f 的时刻主节点 A 还没有接收到该采样周期的包的最末位。

当如上所述一个包的位数据在一个采样周期中循环一次时，每个节点加载在该节点处待加载的接收信道的位数据，并写入在该节点处待写入的传输信道的位数据。例如，如果节点 B 接收到的位数据是已设定为在节点 B 处待加载的接收信道的采样数据，则节点 B 将该位数据加载至节点 B 的缓冲器中。此外，如果接收到的位数据是已设定为从节点 B 待发送的发送信道的采样数据，则用待写入的数据重写该位数据。在执行这一处理之后，将该位数据发

送至下一节点 C。在下一节点处执行相同处理。控制数据的加载和写以相同方式执行。如上所述，在前向路径（图 2 中沿着节点 A→B→C）上执行本实施例中每个节点处的数据加载或写，而在后向路径（沿着节点 C→B→A）上数据仅经过各节点。

图 3 示出在本实施例的音频网络系统中在一个采样周期中循环经由所有连接节点的一个包的帧数据结构。例如，一个包的帧数据的字节总数为 1282。

标号“301”表示存储前同步码（preamble）、目标 MAC 地址、源 MAC 地址以及数据长度的区域。前同步码是用于在传输帧数据时在每个节点处建立同步的数据。每个节点从自上游节点接收的数据中检测前同步码，并根据检测到的前同步码确定包的帧数据已经开始。在目标 MAC 地址中设定表示广播的十六进制值“FF…FF”（其可以是根据包的流动接收该包的下一节点的 MAC 地址），并且在源 MAC 地址中设定主节点的 MAC 地址（其可以是发送包的节点的 MAC 地址）。本音频网络系统中的每个节点（包括图 1a 或图 1b 中的控制台 106 和 145）均具有 MAC 地址。“长度”表示本帧数据的总长度（例如 1282 字节）。

标号“302”表示存储包序号 TN、每个采样周期中的包数 PN、采样延迟值 SD、和音频信道数 ACN 的 8 字节区域。包序号 TN 是分配给包的序号，其在每次主节点开始发送包时增加。当在一个采样周期中循环多个包时（在修改例中将对此进行描述），包的每个采样周期中的包数 PN 为表示采样周期中包序数的包序号。在本实施例中没有使用每个采样周期中的包数 PN，这是因为在一个采样周期中循环一个包。音频信道数 ACN 表示下文描述的音频数据存储区 303 的信道数量。

标号“303”表示存储音频数据的区域。这里，采样频率 Fs 为 96kHz，并且一个采样被分为可存储 256 信道的 32 位数据的区块。因此，ACN 被设定为 256。256 信道的各个区块是设定从头起依次为第 1 信道、第 2 信道、…第 256 信道的采样数据的区域。这里，为了确保稳定的音频传输，甚至于对未用于节点间传输的信道，也总是确保其带宽。例如，即使在网络系统中的任一节点处对某一信道的区块不执行写时，主节点也不去除该信道的区块。因此，音频信道数 ACN 具有恒定值，其等于可传输信道的最大数。主节点可将无声音频信号写至未被使用信道的区块。

标号“304”表示存储控制数据的 224 字节区域。控制数据包括多种数据，例如指令、回应和等级数据。例如，当某一节点成为需要将一些数据发送至接收节点的发送节点时，执行以下过程。首先，由于在控制数据存储区 304 的预定位置设定表示发送数据权的标志，因此需要发送控制数据的节点获得在每个采样周期经由各节点循环的包中所包含的令牌（token）。当某一节点获得该令牌时，则该节点取得发送权，并且其它节点在该节点释放该令牌之前不能获得该令牌。已获得令牌而具有发送权的节点创建传统 Ethernet 标准（其中在目标 MAC 地址中设定接收节点的 MAC 地址）的发送数据包（所述发送数据包包括该节点需要发送的数据），然后该节点划分发送数据包并将其插入控制数据存储区 304，以将其以具有图 3 所示格式的多个已划分包的形式分别进行发送。已接收该包的每个节点加载控制数据存储区 304 的数据。如果加载的数据是 Ethernet 标准的发送数据包的已划分数据，则该节点组合分别接收到的多个已划分数据，以重构 Ethernet 标准的发送数据包并确定其目标 MAC 地址是否为该节点的地址。如果目标 MAC 地址是该节点的地址，则该节点加载发送数据包。当目标 MAC 地址不是该节点的地址时，该节点放弃该发送数据包。通过以上述方式在图 3 所示的循环包中携带控制数据，能够在各节点之间发送和接收控制数据。

令牌可以不总循环。例如，每次包循环预定次数时，令牌可以经由以环形连接的各节点循环一次。当音频网络系统启动时，在其初始化过程中为所有节点提供连接至网络的节点（包括图 1a 或图 1b 的控制台 106 或 145）的相应 MAC 地址或连接位置。因此，能够以与一般 LAN 相同的方式在节点之间传递控制数据。或者，执行系统整体控制的控制台可管理令牌。例如，在包的控制数据区设定用于存储标记（flag）（其用于请求对应于每个节点的令牌）的区域，并且通过设定标记从控制台请求令牌，响应于该请求控制台为进行该请求的节点分配令牌。在这种情况下，在完成包发送时，该节点将令牌返回控制台。

标号“305”表示用于错误检验的 FCS 区域。在本实施例中，FCS 区域 305 仅对一对发送和接收节点有效，这是因为图 3 所示的包在经由每个节点循环的同时被重写，如以上参照图 1a 或图 1b 所述。例如，节点 A 在其 FCS 区域 305 中设定帧数据的 FCS 之后将帧数据发送至节点 B，并且节点 B 通过

校验接收到的帧数据的 FCS 来确定帧数据是否被正常接收。当帧数据被正常接收时，从帧数据读出的音频采样被再现，或者基于从帧数据读出的控制数据执行控制，并且基于已进行音频采样写入的帧数据或者在对应节点处待重写的控制数据也产生 FCS，然后在 FCS 区域 305 中设定产生的 FCS 之后将帧数据发送至节点 B。当帧数据被异常接收时，从帧数据读出的音频采样或控制数据被放弃，而再现的音频采样被消减，并在对应节点的 FCS 区域 305 中或者在紧接着的前一区域中设定表示对应节点的接收出现错误的信息之后，将帧数据发送至节点 B。

图 4 示出每个节点中包含的帧数据发送/接收单元的结构。帧数据发送/接收单元包括帧接收器 401、帧重构器 402、帧发送器 403、音频采样提取器 404、信道寄存器（CH）405、音频输出缓冲器 406、音频输入缓冲器 407、信道寄存器 408、帧接收器 409 以及帧发送器 410。

从帧接收器 401 经由帧重构器 402 至帧发送器 403 的路径为本节点的前向路径，而从帧接收器 409 至帧发送器 410 的路径为本节点的后向路径。如果节点（例如，图 1b 的节点 A）未连接至既用作帧发送器 410 的输出目标节点又用作帧接收器 401 的输入源节点的任一节点，则帧发送器 410 自动连接至帧接收器 401，使得数据从帧发送器 410 直接被传递至帧接收器 401。如果节点（例如，图 1b 的节点 D）未连接至既用作帧发送器 403 的输出目标节点又用作帧接收器 409 的输入源节点的任一节点，则帧发送器 403 自动连接至帧接收器 409，使得数据从帧发送器 403 直接被传递至帧接收器 409。

在图 4 中，从上游节点发送的位数据依次被帧接收器 401 接收。帧接收器 401 从接收到的位数据提取网络时钟，还检测以上参照图 3 描述的前同步码部分，并基于前同步码部分的末端检测音频数据 303 范围内的数据。音频采样提取器 404 提取音频数据 303 的每个信道的时隙的采样数据。如果在信道寄存器 405 中已设定该信道，则采样数据被复制到音频输出缓冲器 406。信道寄存器 405 是存储在对应节点处待加载的一个接收信道（或多个接收信道）的寄存器。

另一方面，帧接收器 401 依次接收的位数据被发送至帧重构器 402。帧重构器 402 包括预定位数的缓冲器（例如，几十位至几百位的移位寄存器）。在接收到的位数据流过缓冲器时，帧重构器 402 基于前同步码的末端检测每

个信道的时隙（时钟）的数据。如果在信道寄存器 408 中已经设定该时隙的信道，则帧重构器 402 用存储在音频输入缓冲器 407 中的待写入信道的采样数据重写该时隙。尽管该缓冲器 407 设置为用于执行数据重写，但是该缓冲器也用于补偿节点接收到的位数据的网络时钟与节点发送的位数据的网络时钟之间的差异。然而，由于缓冲器的大小对应于节点处的传递延迟，因此该缓冲器不能设计为过大。信道寄存器 408 是存储本节点处待重写的一个发送信道（或多个发送信道）的寄存器。由帧重构器 402 重构的帧数据经由帧发送器 403 被发送至下游节点。

在后向路径上，从上游节点的帧发送器发送且被帧接收器 409 接收的数据未经改变而被传递至帧发送器 410，然后被发送至下游节点。

基于由上游节点的帧发送器产生的网络时钟执行从上游节点的帧发送器至帧接收器 401 的数据传输，并且基于由帧发送器 403 产生的网络时钟执行从帧发送器 403 至下游节点的数据传输。因此，帧接收器 401 的接收操作和帧发送器 403 的发送操作异步执行。在后向路径上亦如此。

以上述方式，为本节点设定的信道的采样可被加载到本节点的音频输出缓冲器 406 中。此外，本节点处输入的音频数据的采样可在音频输入缓冲器 407 中设定，并且可通过在帧数据中设定信道的时隙中携带该采样而将其发送至另一节点。

下面将描述系统中使用的采样时钟 C_S（字时钟）。系统的各节点为多种音频装置，每个音频装置以与其产生的采样时钟 C_S 同步的方式处理音频数据。如果在将音频数据从发送音频装置发送至接收音频装置时发送音频装置的采样时钟 C_S 的频率不同于接收音频装置的采样时钟 C_S 的频率，接收音频装置必须转换其采样频率，这是因为接收音频装置不能处理未转换的音频数据。然而，采样频率转换可能降低音频数据的质量。因此，在本系统中，由音频装置产生的采样时钟 C_S 与以采样周期的间隔从主节点接收包的时序（即，主节点产生采样时钟的时序）在相位上同步，由此近似匹配音频装置的采样时钟。这使得能够在不转换采样频率的情况下在音频装置之间发送和接收音频数据。更具体来说，主节点在其采样时钟 C_S 的产生时刻开始发送包。在接收包时，每个从节点通过帧接收器 401 检测包的前同步码部分，并基于前同步码部分的终止时刻通过锁相环（PLL）振荡器产生其采样时钟 C_S。

由于图 3 所示的包在每个采样周期经由系统的所有节点循环，因此每个节点能够产生同步的采样时钟。尽管每个节点处执行的处理引起延迟并且各节点之间的电缆也引起延迟，但是这些延迟实际上可忽略。在考虑这些延迟的情况下，可校正每个节点的时序以产生更准确的同步时钟。

图 5 示出每条传输线上包的时序图。例如，这可以视为图 1b 所示的传输线 111 上的包时序图，在所述传输线 111 上将包从主节点 A101 传送至下游节点 B101。这里，假定采样频率 F_S 为 96kHz。一个采样周期的时间长度为 10.4 微秒。标号“501”、“502”和“503”表示采样周期的开始时间。各节点之间的传输线的协议使用如上所述 Ethernet 标准的传输介质或物理层。这里，假定以 1000BASE-T Ethernet 标准的 1Gbps 速度在各节点之间进行数据传输。以上述速度，传输 1 位花费 1 纳秒，从而以上参照图 3 所述的一个包的帧数据的时间长度为 10.26 微秒（=1 纳秒×8 位×1282 字节）。这确保了一个包将包含在一个采样周期的时段中。因此，如图 5 所示，包“i”的位数据传输在采样周期的开始时刻 501 开始，而包“i”的传输在到达下一个采样周期的开始时刻 502 之前终止。对于包“i+1”和“i+2”亦如此。

图 6 为示出本实施例中音频采样的传输流的示意图。尽管图 6 中示出一个包被依次从图 6 中的每个节点传送到相邻节点，但是应注意实际的包遍布在多个节点上，如图 2 所示。这里假定节点 A601 是主节点，而 B602 和 C603 是从节点，并且各节点通过以上参照图 1b 所述的前向和后向路径连接。首先，假定采样 Ch1(s-2)、Ch2(s-2)和 Ch3(s-2)存储在帧 614 中，帧 614 是已准备为在预定时间（t）将由主节点发送的包。时间（t）的时间分辨率对应于采样周期，并且在 Ch*的当前时间（t）的采样数据表示为 Ch*(s)。因此，“Ch*(s-3)”表示从 Ch*的当前时间起 3 个采样之前的数据。已经返回到节点 A 的信道 Ch1、Ch2 和 Ch3 的 2 个采样之前的数据(s-2)被表示为包含在帧“611”中。

假定在时间（t）信道 Ch1、Ch2 和 Ch3 的采样数据 Ch1(s)、Ch2(s)和 Ch3(s)被输入到节点 601、602 和 603。标号“612”、“622”和“632”表示存储将被输入到节点 A、B 和 C 的相应信道的采样数据的缓冲器。标号“613”、“623”和“633”表示分别设置在节点 A、B 和 C 中的缓冲器（对应于图 4 所示的音频输入缓冲器 407）。这些缓冲器 613、623 和 633 均具有

能够存储 2 个采样的容量，并且当前输入的采样数据 Ch1(s)、Ch2(s)和 Ch3(s)被写至缓冲器 613、623 和 633。

主节点 A 基于帧 611 创建当前时间(t)的帧 614，其中在对应于时间(t-1)的紧接着的前一个采样周期中帧 611 循环并返回到主节点 A，在时间（t-1）采样数据 Ch1(s-1)、Ch2(s-1)和 Ch3(s-1)被存储在帧 611 中。主节点重写信道 Ch1 的采样数据 Ch1(s-2)，其中在存储于所创建的帧 614 中的采样数据 Ch1(s-2)、 Ch2(s-2)和 Ch3(s-2)中采样数据 Ch1(s-2)被设定为在节点 A 处被写，并且下一个采样 Ch1(s-1)被存储在缓冲器 613（618）中。已经返回到节点 A 的帧 611 中存储的其它信道的采样按目前的样子设定。在当前时间（t）的采样周期的开始时刻，节点 A 将以这种方式创建的包的帧数据发送到节点 B。这里，假定已经设定在节点 A 处信道 Ch1、Ch2 和 Ch3 的各个采样数据将从循环的包加载。因此，在节点 A 处，返回的帧 614 的采样数据 Ch1(s-2)、Ch2(s-2)和 Ch3(s-2)被加载到各个信道的缓冲器 615、616 和 617 中。这些缓冲器 615、616 和 617 对应于图 4 所示的音频输出缓冲器 406。信道的各个缓冲器 615、616 和 617 均构成为具有两个区域，一个区域存储从在时间（t）接收到的包加载的当前采样数据，而另一个区域存储一个周期之前的采样数据。在图 6 中，由节点写至包的信道的采样数据被表示为由同一节点加载。然而，这样表示仅为了示出多个信道的采样数据被加载的实例。实际上，由于由同一节点加载浪费资源，因此不由同一节点加载采样数据。

节点 B 重写信道 Ch2 的采样数据 Ch2(s-2)，其中在存储于帧 624 中的采样数据 Ch1(s-1)、 Ch2(s-2)和 Ch3(s-2)中采样数据 Ch2(s-2)被设定为在节点 B 处被写，并且下一个采样 Ch2(s-1)被存储在缓冲器 623（628）中。其它信道的采样按目前的样子设定。节点 B 将以这种方式创建的包的帧数据发送到节点 C。这里，假定已经设定在节点 B 处信道 Ch1、Ch2 和 Ch3 的各个采样数据将从循环的包加载。因此，在节点 B 处，帧 624 的采样数据 Ch1(s-1)、Ch2(s-2)和 Ch3(s-2)被加载到各个信道的缓冲器 625、626 和 627 中。缓冲器 625、626 和 627 具有与节点 A 的缓冲器相同的结构。

节点 C 重写信道 Ch3 的采样数据 Ch3(s-2)，其中在存储于帧 634 中的采样数据 Ch1(s-1)、 Ch2(s-1)和 Ch3(s-2)中采样数据 Ch3(s-2)被设定为在节点 C 处被写，并且下一个采样 Ch3(s-1)被存储在缓冲器 633（638）中。其它信

道的采样按目前的样子设定。节点 C 将以这种方式创建的包的帧数据返回到后向路径。这里，假定已经设定在节点 C 处信道 Ch1、Ch2 和 Ch3 的各个采样数据将从循环的包加载。因此，在节点 C 处，帧 634 的采样数据 Ch1(s-1)、Ch2(s-1)和 Ch3(s-2)被加载到各个信道的缓冲器 635、636 和 637 中。缓冲器 635、636 和 637 具有与节点 A 的缓冲器相同的结构。已经返回到后向路径的包仅经过由“631”、“621”和“631”表示的节点，从而返回到主节点 A。以相同的方式，主节点创建将在下一个采样周期发送的包，并在下一个采样周期的开始时刻将该包发送。

在本实施例中，只有主节点 A 能够在无任何采样滞后的情况下从每个节点获得音频采样数据，如从每个节点的采样加载缓冲器的状态看出的。另一方面，由于节点 B 或 C 具有将被上游节点处的下一采样重写的信道，因此在节点B或C处在从包加载采样数据时产生采样滞后。为了校正这种采样滞后，每个节点可以包含关于网络的所有布线状态的信息和关于哪个节点存储每个信道的信息，并且可以通过将在前一阶段存储的采样数据延迟一个采样而输出在前一阶段存储的采样数据，如从该节点看出的。

图 7a 示出当在从节点的帧接收器 401（参见图 4）处检测到前同步码时，为了引起“包接收发生事件”而进行的硬件处理。尽管图 7a 至图 9b 所示的处理因表示为流程图而看似软件处理，但是图 7a 至图 9b 所示的处理实际上是通过逻辑电路或数字信号处理器（DSP）执行的硬件处理。在步骤 701，从节点既能够进行接收从上游节点发送的包的位数据并收集对应于一个字节的上述位数据以激活图 7b 所示的接收事件处理这样的处理（接收处理），又能够进行在一定量的数据已经存储在其帧重构器 402 的缓冲器中的时刻开始将帧重构器 402 的缓冲器中的数据发送至下游节点这样的处理（发送处理）。这里，从节点在其前同步码部分终止的时刻还提供时序信号至产生采样时钟 Cs 的 PLL 振荡器（Fs 发生器），由此控制采样时钟的频率。

图 7b 示出在开始接收处理之后接收对应于一个字节的位数据时，从节点的帧数据发送/接收单元进行的硬件处理。尽管在本实例中基于字节处理接收到的数据，但是可以基于位或字处理接收到的数据。在步骤 702，加载接收到的 1 字节数据。在步骤 703，确定哪个时隙对应于接收到的 1 字节数据。如果接收到的 1 字节数据是报头（header）数据（图 3 中的“301”和“302”），

则在步骤 704 该 1 字节数据被写至帧重构器 402 的缓冲器，并执行对应于接收到的报头数据的处理。这里，通过发送处理，在达到一定量（几十至几百位）的数据保存在缓冲器中的时刻，通过接收事件处理被存储在帧重构器 402 的缓冲器中的数据通过帧发送器 403 被自动发送到下一个节点。因此，在上述接收事件处理中的“发送”处理是将待发送的数据写至缓冲器的处理。帧发送器 403 的发送是根据基于帧数据发送/接收单元的运行时钟产生的网络时钟而执行的。上述用于发送的网络时钟与帧接收器 401 提取的用于接收的网络时钟不同步。

当接收到的 1 字节数据是对应于节点的发送信道（图 4 中的信道 408）的音频数据时，在步骤 705，存储在音频发送缓冲器（图 4 中的音频输入缓冲器 407）中的一个字节被提取并被重写到帧重构器 402 的缓冲器中对应于接收到的 1 字节数据的位置，然后被从帧发送器 403 发送到下一个节点。当接收到的 1 字节数据是节点的接收信道（图 4 中的信道 405）的音频数据时，在步骤 706，该 1 字节数据被写至帧重构器 402 的缓冲器中的对应位置，然后在被加载到音频接收缓冲器（图 4 中的音频输出缓冲器 406）的同时，通过帧发送器 403 被发送到下一个节点。如果接收到的 1 字节数据是其它数据，例如，既非发送也非接收的信道的音频数据之类的数据，则在步骤 707 该 1 字节数据未经改变而被写至帧重构器 402 的缓冲器，然后被发送到下一个节点。

如果接收到的 1 字节数据是控制数据存储区（图 3 中的“304”）中的数据，则在步骤 708 确定节点是否具有发送数据权。如果节点没有发送权，则在步骤 709 该 1 字节数据未经改变而被写至帧重构器 402 的缓冲器，然后被发送到下一个节点。在步骤 709，该 1 字节数据还作为部分数据被加载，并且执行对应于该部分数据的处理。例如，如果部分数据是令牌的已划分数据并且节点需要获得发送权，则节点将分别接收到的多个已划分数据合并以重构令牌，由此获得发送权并删除写至缓冲器的令牌以防止其被发送到下一个节点。如果已划分数据是通过划分用于发送控制数据的发送数据包而产生的数据（以上参照图 3 所描述的），则节点将分别接收到的多个已划分数据合并以重构发送数据包。如果其目标地址为节点地址，则节点加载该发送数据包并提取包含在发送数据包中的控制数据，然后执行对应于控制数据的操

作。当节点在步骤 708 已经获得发送权时，则节点在步骤 710 将 D 发送缓冲器（其中存储待发送数据）中的 1 字节部分数据重写到帧重构器 402 的缓冲器中对应于接收到的 1 字节数据的位置，然后将其发送到下一个节点。在完成存储在 D 发送缓冲器中的所有数据的发送时，节点创建令牌并将其写至缓冲器中对应于控制数据存储区的位置，然后将其发送到下一个节点，从而释放发送权。如果存储在 D 发送缓冲器中的数据大于对应于控制数据存储区大小的 224 字节，则数据不能包含于一个包的控制数据存储区中，因此数据被划分为多个部分数据（每个部分数据小于 224 字节），然后通过被包含在多个连续采样周期的各个包的控制数据存储区中而被发送。

在步骤 704-707、709 和 710 之后，节点确定在步骤 711 接收到的 1 字节数据是否为最末字节。如果接收到的 1 字节数据是最末字节，则节点在步骤 712 执行终止发送/接收的处理。发送/接收终止处理包括与上述 FCS 纠错相关的一系列处理和在完成最末字节数据的发送时终止发送的处理。

图 8a 示出在主节点的帧接收器 401（参见图 4）处检测到前同步码时，为了引起“包接收发生事件”而进行的硬件处理。在步骤 801，主节点执行接收开始处理，并激活用以接收从系统的多个从节点发送的包的位数据和收集对应于一个字节的上述位数据的处理，以激活图 8b 所示的接收事件处理。从而，开始用以接收包的帧数据的处理。由于其它节点的采样时钟是基于在主节点处产生的采样时钟而产生的，因此在步骤 801 不必控制采样时钟 C_S 的频率。

图 8b 示出在开始接收处理之后接收对应于一个字节的位数据时，主节点的帧数据发送/接收单元进行的硬件处理。在步骤 802，加载接收到的 1 字节数据。在步骤 803，确定哪个时隙对应于接收到的 1 字节数据。步骤 804-810 类似于图 7b 所示的步骤 704-710。然而，在步骤 704-707、709 和 710，在达到一定量（几十至几百位）的数据保存在缓冲器中的时刻，从节点自动开始至下一个节点的发送，主节点不根据缓冲器中的数据量自动开始发送，而在等到一个采样周期终止之后（即在下一个采样周期的开始时刻）开始发送。因此，步骤 804-807、809 和 810 表示为“将 1 字节数据保存在缓冲器中”，而不是图 7b 所示的“将 1 字节数据写至帧重构器 402 的缓冲器”。此外，尽管接收到的帧数据是当前采样周期的帧数据，但是将由主节点发送的下一

个数据是下一个采样周期的帧数据。因此，主节点在将接收到的帧数据转换为下一个采样周期的帧数据的同时执行写入缓冲器的操作。步骤 811 和 812 类似于图 7b 所示的步骤 711 和 712。然而，在步骤 812，由于还没有开始发送，因此主节点仅执行接收终止处理。

图 8c 示出如何使用包含在主节点的帧重构器 402 中的缓冲器（帧数据队列缓冲器）。由于缓冲器“822”和“823”用于下文将描述的修改例，因此这里我们仅关注队列缓冲器 A821。队列缓冲器 A821 具有能够存储图 3 所示的一个帧数据的长度。在一个采样周期中经由各节点循环之后返回到主节点的帧数据被转换为下一个采样周期的帧数据，并且转换的帧数据被存储在队列缓冲器 A821 中。通过图 8b 所示的处理，上述帧数据预先被待重写入帧数据的采样或控制数据重写。因此，当到达下一个采样周期的开始时间时，使用提取指针 825，自队列缓冲器 A821 的头部开始，从队列缓冲器 A821 提取帧数据的位序列，并且提取的帧的位序列被依次发送到下一个节点。随着数据的提取，提取指针 825 前进，如箭头“824”所示，并且如果所有的帧数据已被提取，则提取指针 825 被初始化而指向队列缓冲器 A821 的头部。

另一方面，在预定采样周期中已经经由各节点循环并返回到主节点的帧数据的位序列，被转换为下一个采样周期的帧数据，并被依次保存在队列缓冲器 A821 中。上述保存是通过图 8b 所示的处理而执行的。具体来说，上述保存是通过重复执行如下处理而执行的：将数据写至保存指针 826 所表示的位置，然后使保存指针 826 前进，如箭头 824 所示。在返回的帧数据的所有位序列被保存在队列缓冲器 A821 中时，保存指针 826 被初始化，以指向队列缓冲器 A821 的头部。

当主节点在每个采样周期发送一个包以使其经由多个节点循环时，在主节点从队列缓冲器 A821 提取帧数据并开始将该帧数据发送至下一个节点之后，帧数据的报头在主节点完成帧数据的发送之前返回到主节点。这是当节点不是很多并且每个节点迅速完成其处理时帧数据在经由各节点循环之后返回到主节点的情况。当节点的数量很大时，帧数据的报头可在主节点完成帧数据的发送之后返回到主节点。在这种情况下，提取指针 825 看上去在保存指针 826 之前。此外，在返回到主节点的帧数据被完全保存在队列缓冲器 A821 中之前，下一个采样周期的开始时间可能到达而开始从队列缓冲器

A821 提取和发送数据。在这种情况下，保存指针 826 看上去在提取指针 825 之前。

图 9a 示出主节点中的采样时钟中断处理。主节点根据每个采样周期产生的中断来执行上述处理。在步骤 901，主节点使包序号 TN 的值增加。在步骤 902，主节点从图 8c 所示的队列缓冲器 A821 提取包序号为 TN-1 的包的帧数据，并用 TN 重写包序号，然后开始将帧数据发送到下一个节点。

图 9b 示出主节点中的 1 字节发送事件处理。在步骤 902 开始发送之后，主节点重复执行上述操作，直到队列缓冲器 A821 的帧数据的发送终止。首先，在步骤 911 处，主节点从队列缓冲器 A821 的由提取指针 826 指示的位置提取 1 字节数据，并使提取指针 826 前进。在步骤 912，主节点将该 1 字节数据发送到下一个节点。在步骤 913，主节点确定该 1 字节数据是否为最末字节，如果其为最末字节，则在步骤 914 执行终止发送的处理。

尽管在上述实施例中如图 7b 或图 8b 所示在发生 1 字节接收事件时采样数据或控制数据被重写，但是在发生 1 字节发送事件时采样数据或控制数据也可被重写。

尽管参照在一个采样周期中循环一个包（如图 5 所示）的实例描述了上述实施例，但是本发明也可以应用于在一个采样周期循环多个包的修改例。例如，如果根据 10Gbit Ethernet 标准而不是 1000BASE-T Ethernet 标准在节点之间进行通信，则在一个采样周期中可以循环大约 8 个包。在这种情况下，要求如下。

（1）作为以上参照图 8c 描述的队列缓冲器，设置 8 个队列缓冲器 A821 至 H828，其依次用于存储 8 个包的循环帧数据。在一个采样周期的开始时间，主节点连续发送并循环 8 个包，在完成 8 个包的发送之后，主节点等待直到下一个采样周期的开始时间到达。当到达下一个采样周期的开始时间时，主节点开始发送接下来的 8 个包。一个采样周期中的多个包被分配每个采样周期中的各个包数 PN，其表示包的各个序号，如以上参照图 3 中的“302”描述的。也就是说，在本实例中，包数 PN 具有 1-8 范围内的值。

（2）以与 PN=1 的包（即，一个采样周期的第一个包）的开始时间同步，每个从节点产生采样时钟。

（3）在图 9a 的步骤 902 的中断处理中，从具有包序号“TN-8”的包（其

为从包“TN”起 8 个包之前的包）的帧数据创建具有包序号“TN”的包。

在上述实施例的级联连接中，主节点可以是中间节点，而不是级联连接的末端节点。例如，如果图 1b 所示的节点 B 是主节点，则在每个采样周期节点 B 首先将图 3 所示的包发送至节点 C。然后，节点 B 将上述包（其按照节点 B→节点 C→节点 D→节点 C→节点 B 的顺序依次经过各节点之后返回到节点 B）未经改变而发送至节点 A，并基于按照节点 B→节点 A→节点 B 的顺序经过各节点之后返回到节点 B 的包创建下一个采样周期的包。

尽管在上述实施例中使用根据 Ethernet 标准的包格式，但是也可以使用根据除了 Ethernet 标准之外的其它标准的包格式。为了控制信号发送，可为每个节点配置 IP 地址。

在级联连接的情况下，每个从节点可对从下游节点返回的包（而不是从上游节点接收的包）执行一系列处理，例如报头处理、音频发送/接收以及控制数据发送/接收。

在上述实施例中，主节点在每个采样周期运行以基于前一帧数据生成当前采样周期的新帧数据，其中所述前一帧数据在当前采样周期之前的一采样周期中生成并馈送至网络，并且所述前一帧数据在经由多个从节点循环之后在生成新帧数据时返回至主节点。或者，主节点可以基于前一帧数据之前的一帧数据生成新帧数据，其中前一帧数据之前的一帧数据在当前采样周期之前的两个或更多采样周期中生成，并且前一帧数据之前的一帧数据在生成新帧数据时返回至主节点。在这种情况下，在要生成新帧数据时，先前的两个或更多采样周期中生成的采样数据可由主节点从头至尾完全接收。因此，主节点可以在生成新帧数据之前基于所接收帧数据的 FCS 对所接收帧数据进行错误检验。主节点仅当未从所接收帧数据中检测到错误时才基于所接收帧数据生成新帧数据。由此，能够减少或防止帧传送错误将导致的问题。

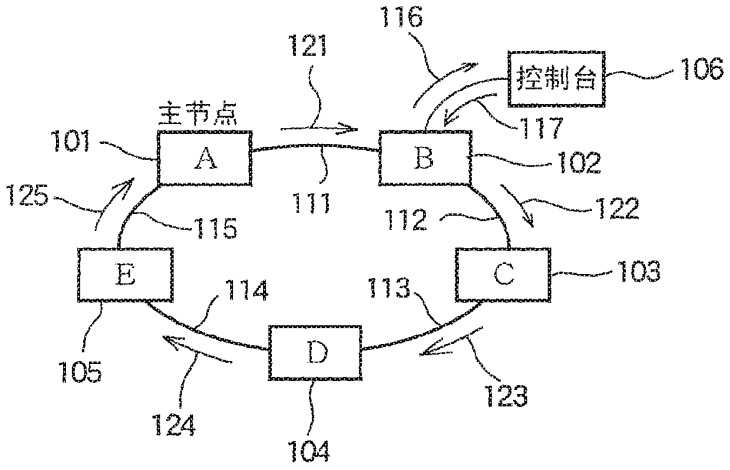

116
121
控制台
106
主节点
101
A
B
102
117
111
125
115
112
122
E
C
103
114
113
105
D
123
124
104

图1a

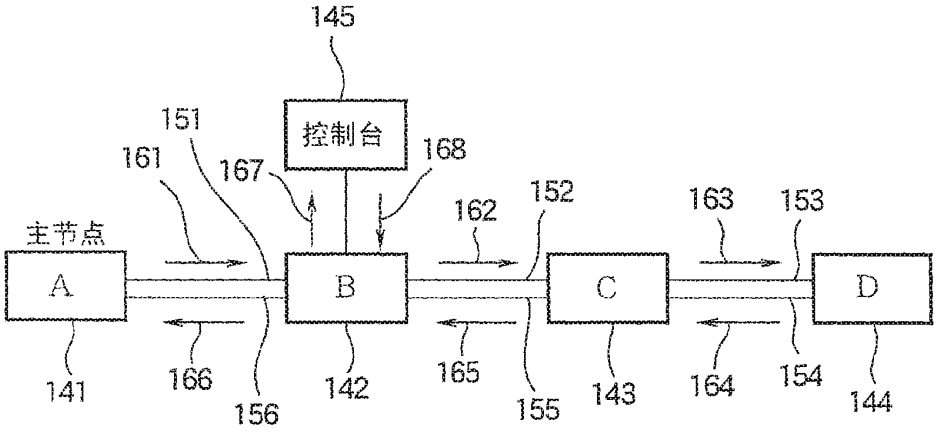

145
控制台
151
161
167
168
162
152
163
153
主节点
A
B
C
D
141
166
156
142
165
155
143
164
154
144

图1b

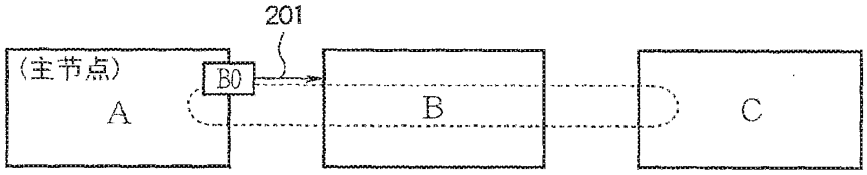


图2a

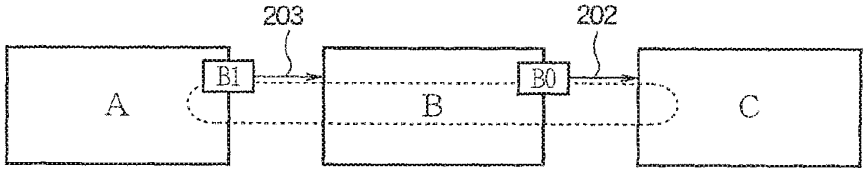


图2b

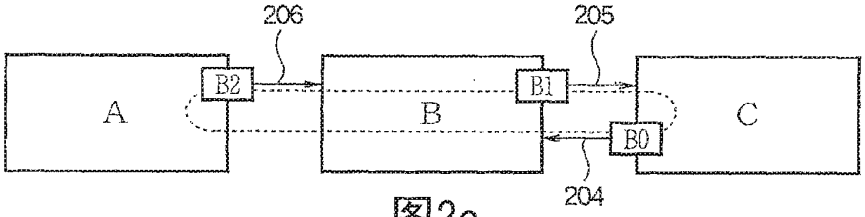


图2c

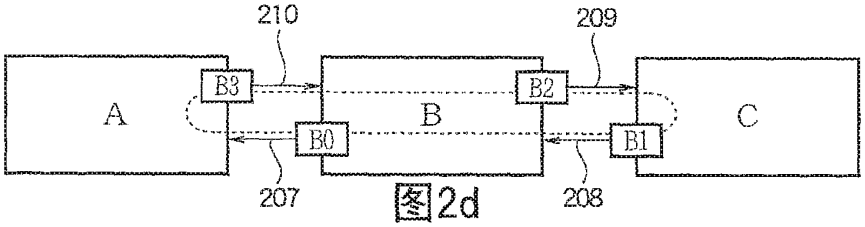


图2d

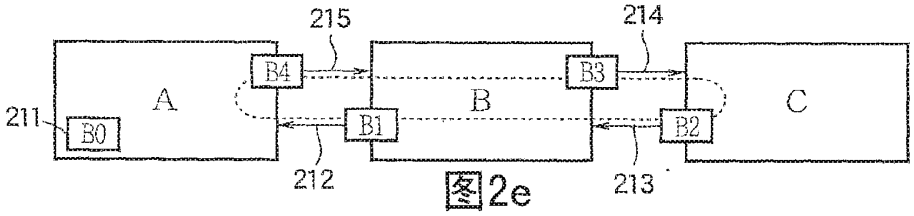


图2e

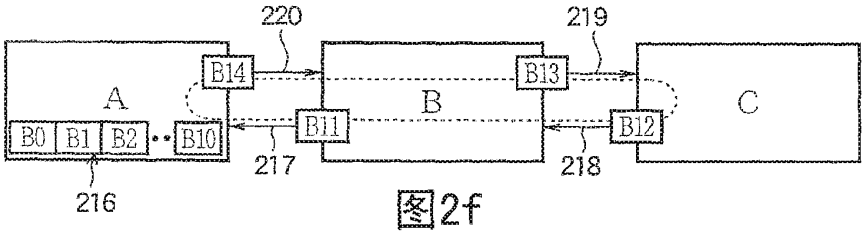


图2f

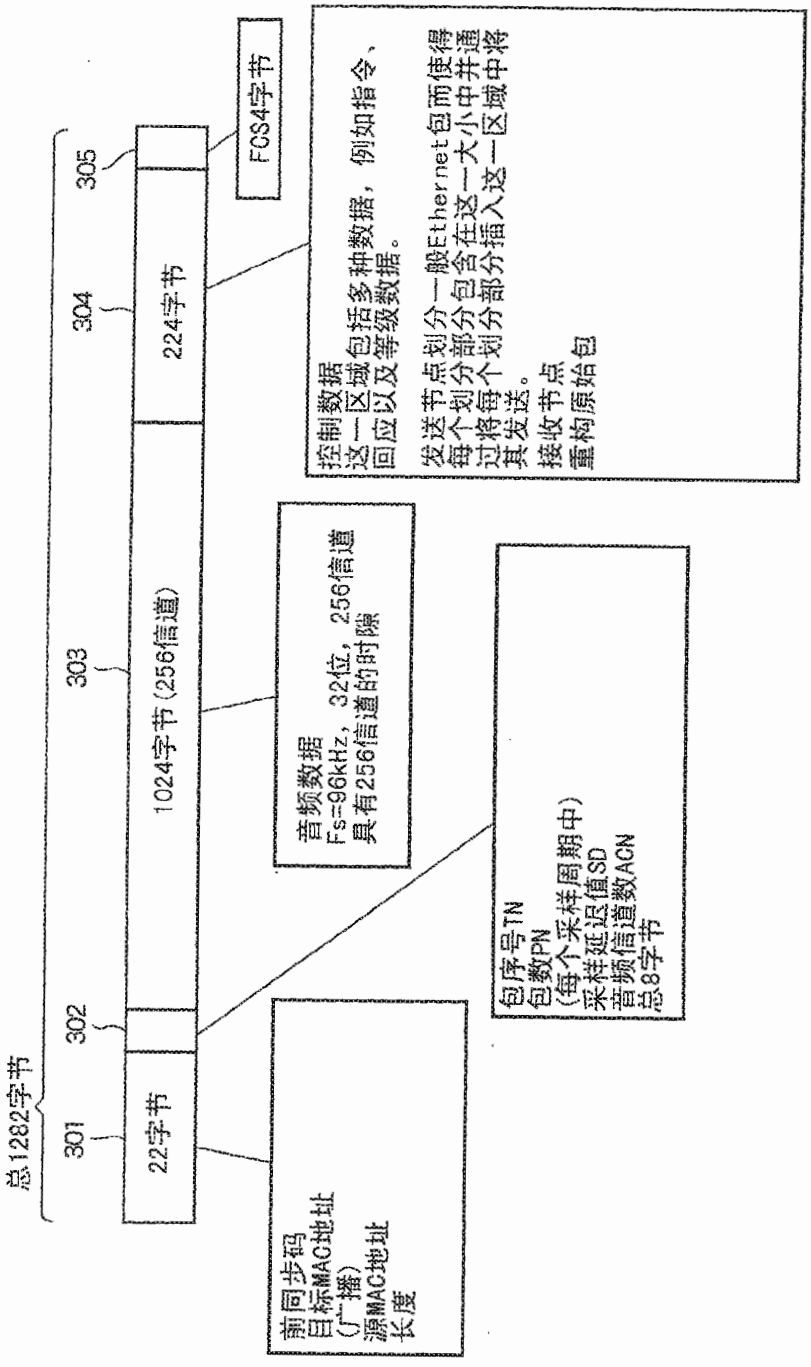

总1282字节
301
302
303
304
305
22字节
1024字节(256信道)
224字节
FCS4字节
前同步码
目标MAC地址
(广播)
源MAC地址
长度
音频数据
Fs=96kHz，32位，256信道
具有256信道的时隙
包序号TN
包数PN
(每个采样周期中)
采样延迟值SD
音频信道数ACN
总8字节
控制数据
这一区域包括多种数据，例如指令、
回应以及等级数据。
发送节点划分一般Ethernet包而使得
每个划分部分包含在这一大小中并通
过将每个划分部分插入这一区域中将
其发送。
接收节点
重构原始包

图3

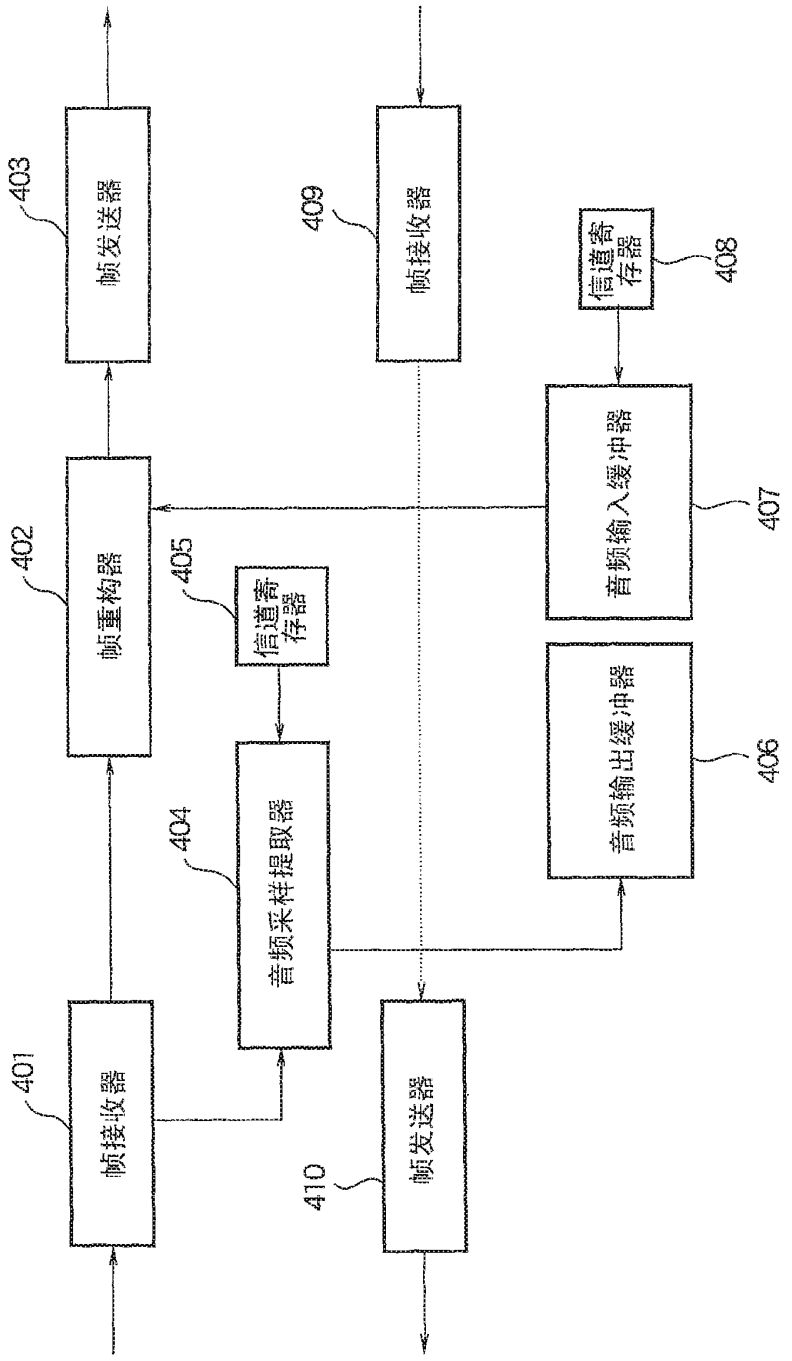

帧发送器
403
帧接收器
409
信道寄存器
408
帧重构器
402
信道寄存器
405
音频输入缓冲器
407
音频采样提取器
404
音频输出缓冲器
406
帧接收器
401
帧发送器
410

图4

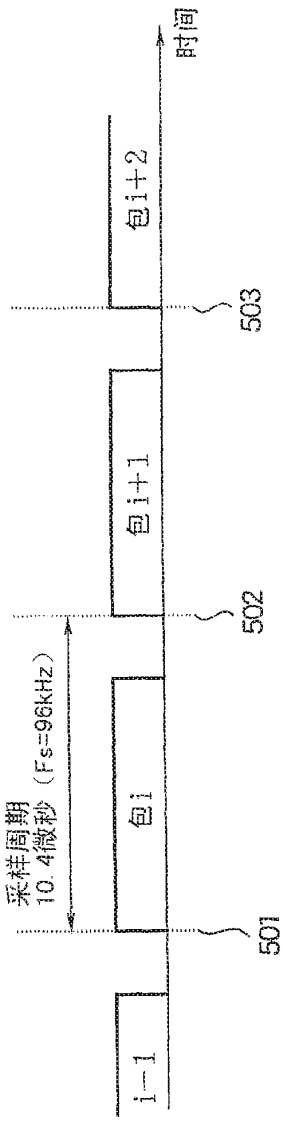


图5

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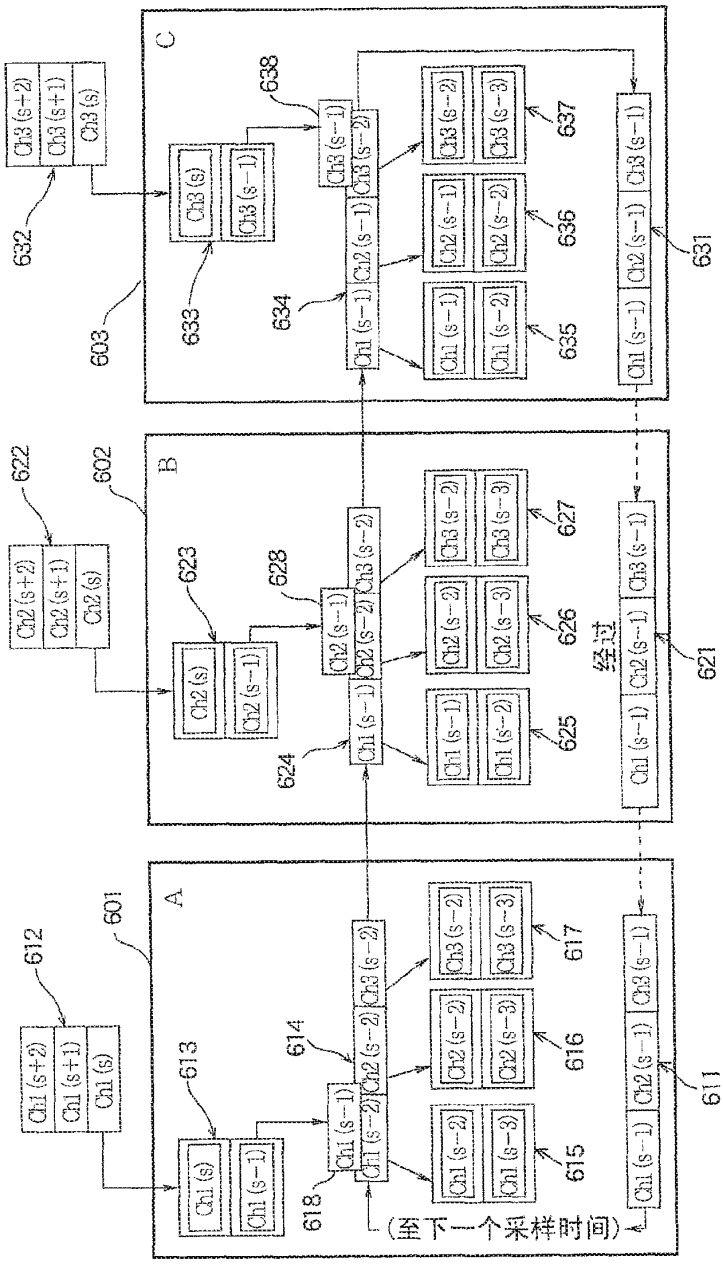

A
B
C
601
602
603
611
612
613
614
615
616
617
618
621
622
623
624
625
626
627
628
631
632
633
634
635
636
637
638
Ch1 (s)
Ch1 (s-1)
Ch1 (s-2)
Ch1 (s-3)
Ch1 (s+1)
Ch1 (s+2)
Ch2 (s)
Ch2 (s-1)
Ch2 (s-2)
Ch2 (s-3)
Ch2 (s+1)
Ch2 (s+2)
Ch3 (s)
Ch3 (s-1)
Ch3 (s-2)
Ch3 (s-3)
Ch3 (s+1)
Ch3 (s+2)
经过
(至下一个采样时间)

图6

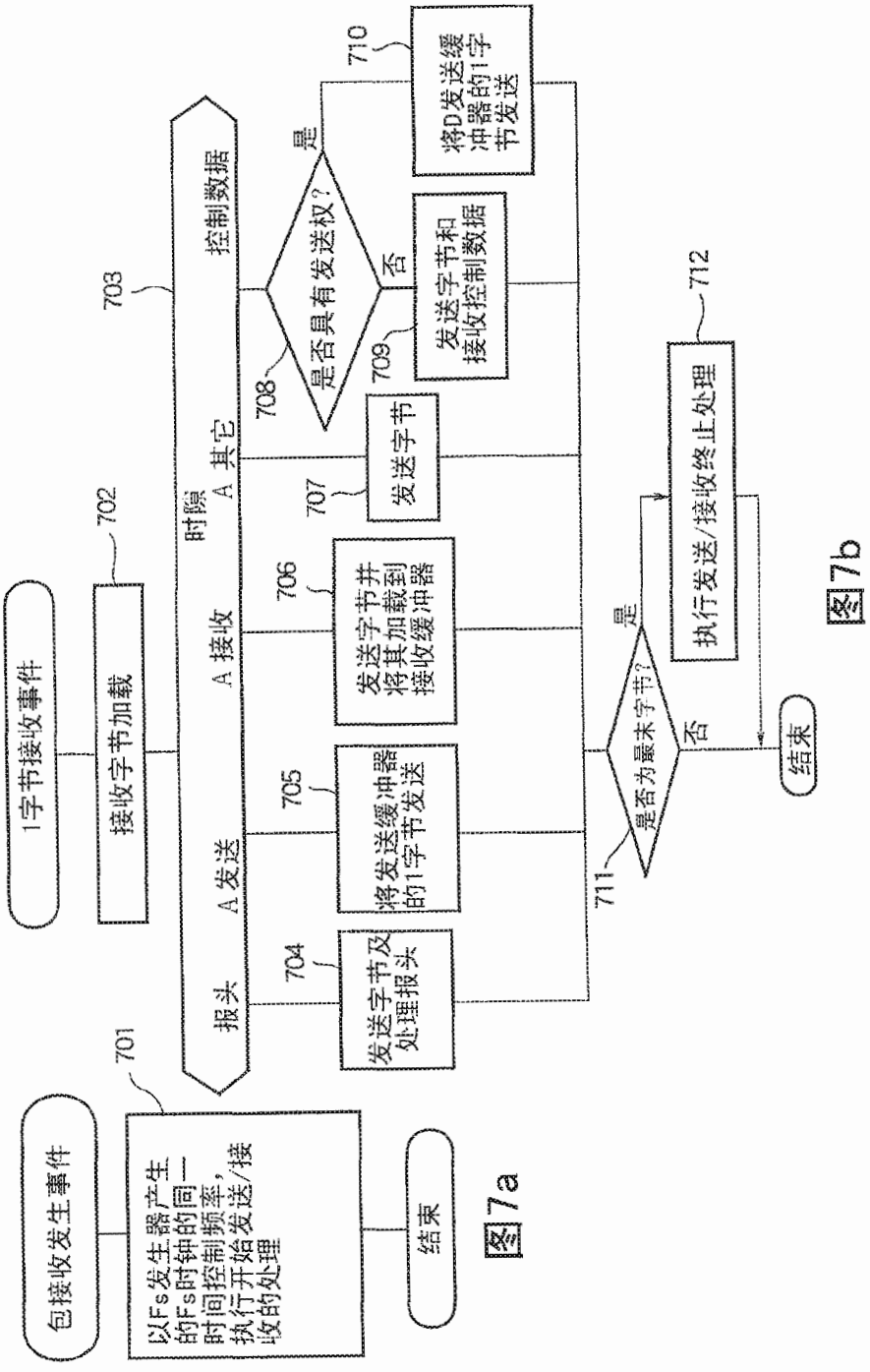

包接收发生事件
701
以Fs发生器产生的Fs时钟的同一时间控制频率，执行开始发送/接收的处理
结束
1字节接收事件
702
接收字节加载
703
时隙
报头
A 发送
A 接收
A 其它
控制数据
704
发送字节及处理报头
705
将发送缓冲器的1字节发送
706
发送字节并将其加载到接收缓冲器
707
发送字节
708
是否具有发送权?
是
否
709
发送字节和接收控制数据
710
将D发送缓冲器的1字节发送
711
是否为最末字节?
是
否
712
执行发送/接收终止处理
结束

图7a

图7b

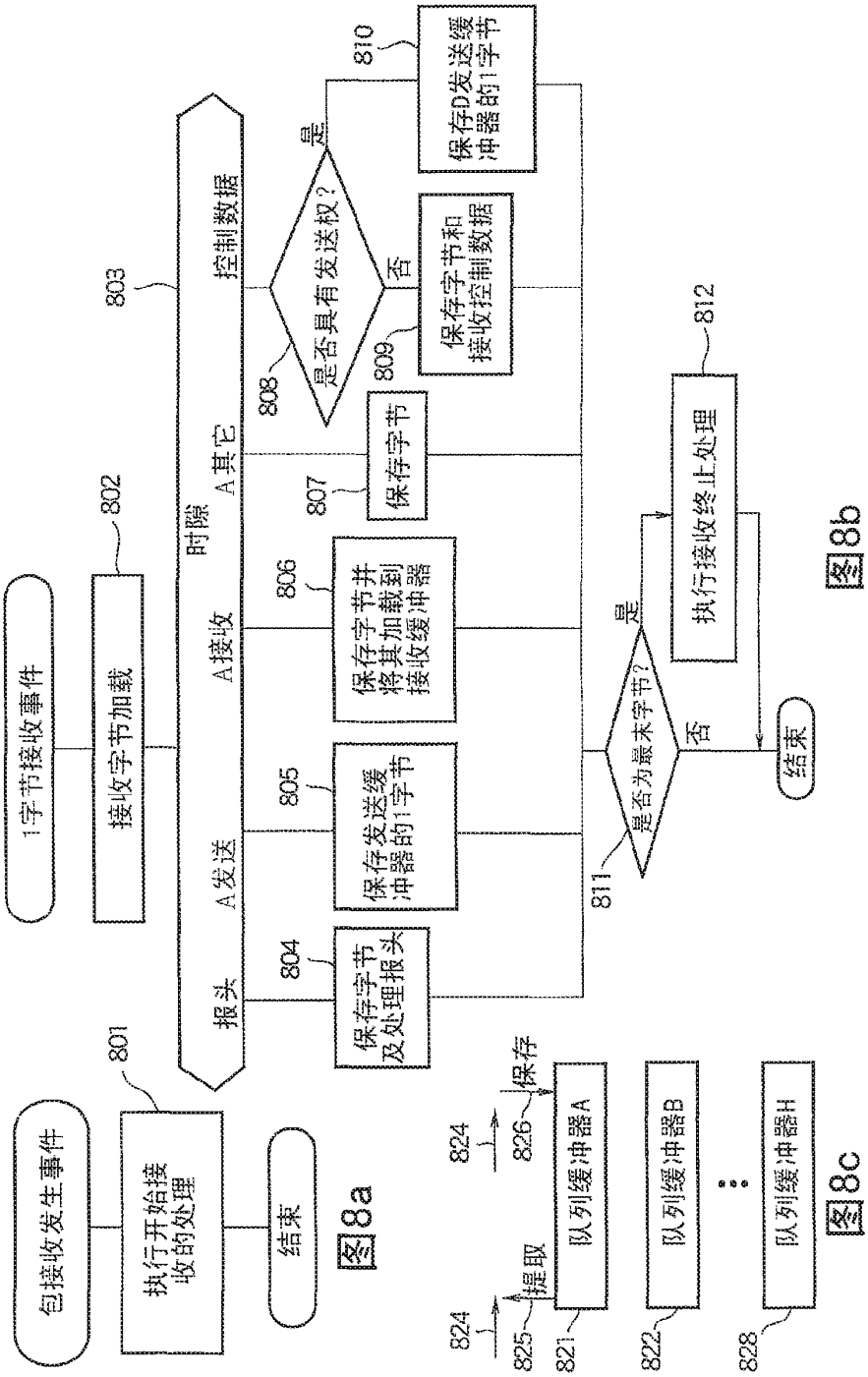

包接收发生事件
801
执行开始接收的处理
结束
1字节接收事件
802
接收字节加载
803
时隙
报头
A发送
A接收
A其它
控制数据
804
保存字节及处理报头
805
保存发送缓冲器的1字节
806
保存字节并将其加载到接收缓冲器
807
保存字节
808
是否具有发送权?
是
否
809
保存字节和接收控制数据
810
保存D发送缓冲器的1字节
811
是否为最末字节?
是
否
812
执行接收终止处理
结束
824
825
提取
821
队列缓冲器A
824
826
保存
822
队列缓冲器B
828
队列缓冲器H

图8a 图8b 图8c

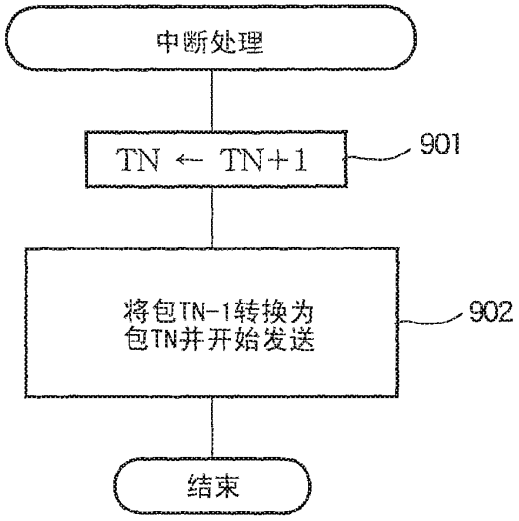

中断处理
TN ← TN+1
901
将包TN-1转换为
包TN并开始发送
902
结束

图9a

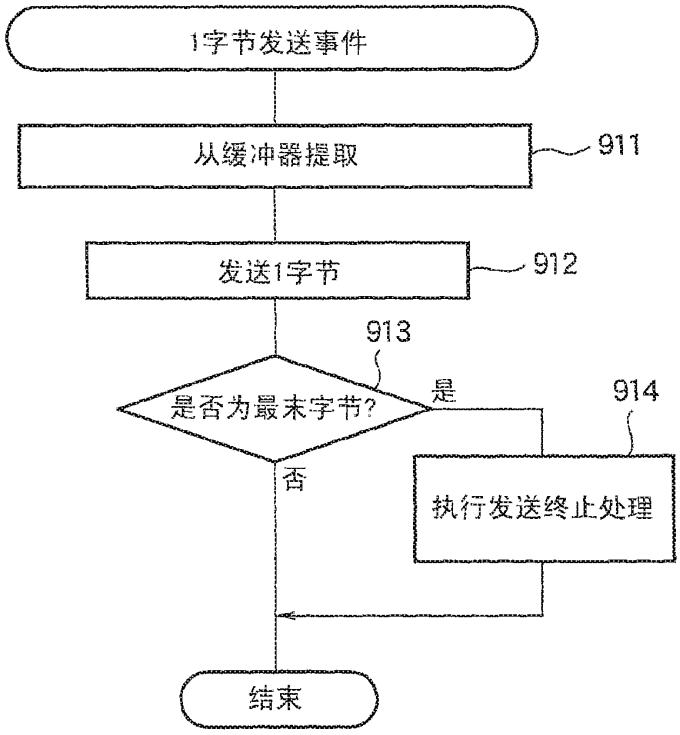

1字节发送事件
从缓冲器提取
911
发送1字节
912
913
是否为最末字节?
是
914
否
执行发送终止处理
结束

图9b

Espacenet

CN101075896A System, method and device for using meeting connection expanding unlimit regional network

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Inventors: GREGORY WILSON GEORGE JADE D N [US]

Classifications:

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CPC **H04L12/1813 (EP); H04L65/4038 (EP); H04L67/04 (EP); H04L67/16 (EP); H04L69/24 (EP); H04W4/80 (EP);** H04L12/189 (EP); H04W84/18 (EP); H04W92/02 (EP);

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System, method and device for using meeting connection expanding unlimit regional network

Abstract

A system, method, and apparatus are disclosed whereby a wireless Personal Area Network (110,160) such as a Bluetooth piconet may be extended to a remote location beyond the normal range by means of a conferencing connection (145). The conferencing connection (145) may comprise, for example, one or more ISDN lines or an IP connection between two or more conference endpoints (100, 150). The broadband connection may include a video channel, an audio channel, a control channel, and a Bluetooth channel.

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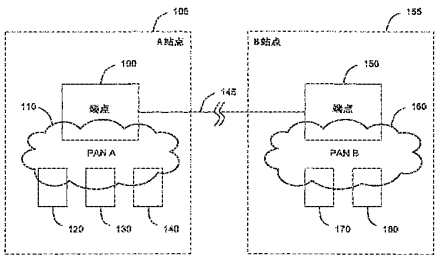
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[54] 发明名称

使用会议连接扩展无线个域网的系统、方法和装置

[57] 摘要

公开了一种系统、方法和装置，从而使无线个域网，例如蓝牙微微网，可以通过会议连接的方法扩展至比通常范围大的远程位置。 该会议连接可以包括例如：在两个或多个会议端点之间的一个或多个 ISDN 线路或 IP 连接。 该宽带连接可以包括视频信道、音频信道、控制信道和蓝牙信道。



1.一种扩展无线个域网（PAN）的方法，所述方法包括步骤：

建立第一无线个域网，所述第一无线个域网包括第一无线个域网使能设备和第一无线个域网使能会议单元；

在所述第一无线个域网使能会议单元和第二无线个域网使能会议单元之间建立会议连接，其中所述第二无线个域网使能会议单元位于远离所述第一无线个域网使能会议单元的位置；

建立第二无线个域网，所述第二无线个域网包括第二无线个域网使能设备和第二无线个域网使能会议单元；和

通过会议连接将所述第一无线个域网链接至所述第二无线个域网。

2.根据权利要求1所述的方法，其中所述第一无线个域网使能设备、所述第二无线个域网使能设备、所述第一无线个域网使能会议单元和所述第二无线个域网使能会议单元分别符合蓝牙规范。

3.根据权利要求1所述的方法，其中所述会议连接包括蓝牙信道。

4.根据权利要求1所述的方法，其中所述会议连接包括综合业务数字网线路。

5.根据权利要求1所述的方法，其中所述会议连接包括互联网协议连接。

6.根据权利要求1所述的方法，其中所述会议连接包括宽带连接。

7.根据权利要求1所述的方法，其中所述第一无线个域网使能会议单元包括视频会议单元。

8.根据权利要求1所述的方法，其中所述第一无线个域网使能会议单元包括音频会议单元。

9.一种扩展无线个人局域网（PAN）的方法，所述方法包括步骤：

建立第一无线个域网，所述第一无线个域网包括第一蓝牙使能设备和第一蓝牙使能视频会议单元；

建立第二无线个域网，所述第二无线个域网包括第二蓝牙使能设备和第二蓝牙使能视频会议单元，其中所述第二蓝牙使能视频会议单元位于远离所述第一蓝牙使能视频会议单元的位置；

在所述第一蓝牙使能会议单元和所述第二蓝牙使能视频会议单元之间建立视频会议连接；和

通过所述视频会议连接将所述第一无线个域网链接至所述第二无线个域网。

10.根据权利要求 9 所述的方法，其中所述视频会议连接包括音频信道、视频信道、控制数据信道和蓝牙信道。

11.根据权利要求 9 所述的方法，其中所述视频会议连接包括综合业务数字网线路。

12.根据权利要求 9 所述的方法，其中所述视频会议连接包括互联网协议连接。

13.根据权利要求 9 所述的方法，其中所述视频会议连接包括宽带连接。

14.一种通过无线个域网（PAN）交换数据的方法，所述方法包括步骤：

建立第一无线个域网，所述第一无线个域网包括第一无线个域网使能设备和第一无线个域网使能视频会议单元；

建立第二无线个域网，所述第二无线个域网包括第二无线个域网使能设备和第二无线个域网使能视频会议单元，其中所述第二无线个域网使能视频会议单元位于远离所述第一无线个域网使能视频会议单元的位置；

在所述第一无线个域网使能会议单元和所述第二无线个域网使能会议单元之间建立视频会议连接；

通过所述视频会议连接将所述第一无线个域网链接至所述第二无线个域网；

分别确定所述第一无线个域网使能视频会议单元和所述第二无线个域网使能视频会议单元的性能；

识别所述第一无线个域网中的一个或多个设备；

识别所述第二无线个域网中的一个或多个设备；和

从所述第一无线个域网使能设备向所述第二无线个域网使能设备发射数据。

15.根据权利要求 14 所述的方法，其中从所述第一无线个域网使能设备向所述第二无线个域网使能设备所发射的数据包括电子商务卡。

16.根据权利要求 14 所述的方法，其中从所述第一无线个域网使能设备向所

述第二无线个域网使能设备所发射的数据包括绘制在蓝牙使能白板上的图像。

17.根据权利要求 14 所述的方法，其中从所述第一无线个域网使能设备向所述第二无线个域网使能设备所发射的数据包括使用蓝牙使能笔所绘制的图像。

18.根据权利要求 14 所述的方法，其中从所述第一无线个域网使能设备向所述第二无线个域网使能设备所发射的数据包括绘制在个人数字助理上的图像。

19.一种通过虚拟个域网（PAN）实现无线通信的会议系统，所述系统包括：

第一无线个域网，所述第一无线个域网包括第一个域网使能会议单元、第一个域网使能设备和第二个域网使能设备；和

第二无线个域网，所述第二无线个域网包括第二个域网使能会议单元、所述第一个域网使能设备和所述第二个域网使能设备；

其中所述第一个域网使能会议单元和所述第一个域网使能设备位于第一位置；

其中所述第二个域网使能会议单元和所述第二个域网使能设备位于第二位置，该第二位置在物理上远离所述第一位置；和

其中所述第一个域网使能会议单元和所述第二个域网使能会议单元能够通过会议连接进行通信。

20.根据权利要求 19 所述的系统，其中所述会议连接包括蓝牙信道。

21.根据权利要求 19 所述的系统，其中所述会议连接包括综合业务数字网线路。

22.根据权利要求 19 所述的系统，其中所述会议连接包括互联网协议连接。

23.根据权利要求 19 所述的系统，其中所述会议连接包括宽带连接。

24.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括个人数字助理。

25.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括个人电脑。

26.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括移动电话。

27.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括摄像机。

28.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括麦克

风。

29.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括扬声器。

30.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括蓝牙白板。

31.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括蓝牙笔。

32.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括打印机。

33.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括鼠标。

34.根据权利要求 19 所述的系统，其中所述第一个域网使能设备包括键盘。

35.根据权利要求 19 所述的系统，其中所述第一个域网使能会议单元包括视频会议单元。

36.根据权利要求 19 所述的系统，其中所述第一个域网使能会议单元包括音频会议单元。

37.一种近端的会议端点，所述会议端点包括：

处理器；

与所述处理器耦合的接口，其中所述接口被构造为通过会议链路向位于远端的远程端点发送和接收音频数据、控制数据和蓝牙数据；和

通过串行链路与所述接口耦合的蓝牙模块，其中所述蓝牙模块被构造为无线地向和从近端蓝牙使能设备发送和接收数据。

38.根据权利要求 37 所述的会议端点，进一步包括具有用于拨打电话号码的计算机可执行指令的计算机可读介质，其中从近端蓝牙使能设备无线地接收所述电话号码。

39.根据权利要求 37 所述的会议端点，进一步包括具有用于向远端蓝牙使能设备发送电子商务卡的计算机可执行指令的计算机可读介质，其中从近端蓝牙设备无线地接收所述电子商务卡。

40.根据权利要求 37 所述的会议端点，进一步包括具有用于向远端蓝牙使能设备发送图像的计算机可执行指令的计算机可读介质，其中从近端蓝牙使能设备无线地接收所述图像。

41.根据权利要求37所述的会议端点，进一步包括具有用于向远端蓝牙使能打印机发送文件的计算机可执行指令的计算机可读介质，其中从近端蓝牙使能设备无线地接收所述文件。

42.根据权利要求37所述的会议端点，进一步包括具有计算机可执行指令的计算机可读介质，用于将存储在近端蓝牙使能设备上的第一组数据与存储在远端蓝牙设备上的第二组数据同步。

43.一种位于第一站点的视频会议单元，所述视频会议单元包括：

处理器；

与所述处理器耦合的接口，其中所述接口被构造为通过会议链路向位于远离所述第一站点的第二站点的端点发送和接收音频数据、视频数据和蓝牙数据；和

通过串行链路与所述接口耦合的蓝牙模块，其中所述蓝牙模块被构造为无线地向和从位于所述第一站点的蓝牙使能设备发送和接收数据。

44.根据权利要求43所述的视频会议单元，进一步包括具有用于拨打视频号码的计算机可执行指令的计算机可读介质，其中从位于第一站点的蓝牙使能设备无线地发射所述视频号码。

45.根据权利要求43所述的视频会议单元，进一步包括具有用于向位于所述第二站点的蓝牙使能设备发送电子商务卡的计算机可执行指令的计算机可读介质，其中从位于第一站点的蓝牙使能设备无线地接收所述电子商务卡。

46.根据权利要求43所述的视频会议单元，进一步包括具有用于向位于所述第二站点的蓝牙使能设备发送图像的计算机可执行指令的计算机可读介质，其中从位于第一站点的蓝牙使能设备无线地接收所述图像。

47.根据权利要求43所述的视频会议单元，进一步包括具有用于向位于所述第二站点的蓝牙使能打印机发送文件的计算机可执行指令的计算机可读介质，其中从位于第一站点的蓝牙使能设备无线地接收所述文件。

48.根据权利要求43所述的视频会议单元，进一步包括具有计算机可执行指令的计算机可读介质，用于将存储在位于第一站点的蓝牙使能设备上的第一组数据与存储在位于第二站点的蓝牙使能设备上的第二组数据同步。

使用会议连接扩展无线个域网的系统、方法和装置

技术领域

本发明涉及会议，尤其是，涉及通过使用会议连接来扩展无线微微网(piconets)或无线个域网（PANs）的范围。

背景技术

音频会议和视频会议能够使在地理上相隔很远的个人或集体在其各自的位置相互通信。会议通过减少了个人旅行会面所需要的时间和花费而起到了重要的作用。因此，电话会议在组织内部或组织之间实现了增长的利润率、生产率和效率。同时，会议还使公司能够加速做出决定，和对分散的部门授权。会议在商业、医疗、教育和政府领域尤其有用。

在音频会议中，免提式电话机是作为用于实现在两方或多方的参与者之间的音频通信的端点设备的一个例子。可以在POLYCOM® SOUNDSTATION®的产品线中找到免提式电话机的例子。视频会议还具有另外的能力，能够通信图形信息和观看位于远处的与会者的面部表情和肢体语言。视频会议提供了面对面进行通信的好处，且不产生与旅程有关的不便、花费和不确定性。可以在POLYCOM® VIEWSTATION®的产品线中找到视频会议单元的例子。

经常希望在会议期间与远程的与会者共享数据。视频会议与协作，和数据共享与协作一起，日益使分散的机构能够将其人力和信息资源集中在一起，以产生新的工作和交互方式。视频会议系统可以提供丰富有效的协作环境，即使参与者可能相隔数千英里。

发明内容

无线设备正日益变得普及。线路的消失提供了灵活性和移动性，并且消除了混乱。大量的无线设备被用于世界范围的无线技术和标准。但是，当前的无线技术，例如蓝牙、802.11 和 IR（红外），都限于在严格的范围之内使用。

因此，产生了对提供能克服上述现有技术缺点的会议解决方案的需求。本发明的实施例有利地将长距离音频和视频会议的特点与短距离无线技术的特点结合在一起。

视频会议单元在该视频会议单元的附近建立了无线微微网。当加入到与远程一个或多个会议单元的音频或视频会议中时，该微微网可以被扩展到包括使用由该视频会议系统所采用的数据信道的远程位置。以这种方式，任何一个与该会议单元进行无线通信的设备可以连接到该远程微微网，以通过会议连接接收和/或发射数据。本发明的实施例提供了允许虚拟物理临近的蓝牙桥。

因此，在语音或视频会议期间，有利地提供了另一种通信模式，其中远程设备可以如同在相同的房间内一样进行无线通信。例如，近端的无线设备可以将数据无线发射至近端的视频会议单元，该视频会议单元将该数据通过会议连接发送至远端会议单元，该远端会议单元将该数据无线发射至远端无线设备。这种经无线发射的数据的例子包括电子商务卡、图像、蓝牙笔数据、蓝牙白板数据、电话号码、视频号码、日历数据、地址簿数据、键盘数据、鼠标数据、来自无线麦克风的音频、去往无线扬声器的音频等。从而，本发明的实施例增进和加强了位于远程的用户之间的协作。

附图说明

图 1 描绘了根据本发明一个实施例的会议系统的方框图。

图 2 描绘了根据本发明一个实施例的典型视频会议的方框图。

图 3 描绘了根据本发明一个实施例的典型视频会议的方框图。

具体实施方式

现在参考图 1 进行描述，图 1 描绘了位于第一物理位置 105（A 站点）的无线网络使能会议端点 100。端点 100 可以包含无线网络使能（wireless-network-enabled）视频会议单元（VCU）。图 3 描绘了一个适合的视频会议单元的典型方框图。在其它的实施例中，端点 100 可以包含不具有视频功能的无线网络使能音频会议单元。例如，端点 100 可以包括无线网络使能免提式电话机，该免提式电话机包括图 3 的 VCU 的部件，但不包括任何视频信道、视频编码器、视频解码器、视频监视器和视频摄像机。

端点100能够与一个或多个相似的使能设备120、130和140建立射频个域网110（PAN A）。在一些实施例中，所述一个或多个设备120、130和140可以包括能够根据蓝牙标准进行短距离无线通信的蓝牙使能设备。所述一个或多个设备120、130和140可以包括例如个人数字助理（PDA）、移动电话、打印机、膝上电脑、显示设备、放映机、照相机、蓝牙白板、蓝牙笔、扬声器、麦克风、耳机、键盘、鼠标的设备，以及其他任何能够在PAN中无线通信的设备。PAN A110并不限于蓝牙微微网，可以是例如包括超宽频带（“UWB”）网络，或其他合适的网络。在其它的实施例中，可以使用红外（IR）或802.11通信。

图1还示出了在远离位置105（A站点处）的物理位置155（B站点处）的无线网络使能会议端点150。端点150可以包括无线网络使能视频会议单元150。在图 3 中描绘了适合的视频会议单元的典型方框图。在其它的实施例中，端点150可以包括不具有视频能力的无线网络使能音频会议单元。例如，端点150可以包括无线网络使能免提式电话机，该免提式电话机包括图3的VCU的部件，但不包括任何视频信道、视频编码器、视频解码器、视频监视器和视频摄像机。

在一个实施例中，端点100和150能够通过会议连接145进行音频视频(AV)和数据通信。该会议连接145可以包括视频信道、音频信道、控制信道和蓝牙信道。该会议连接 145 可以包括例如，一个或多个ISDN(综合业务数字网)线路、通过局域网（LAN）、广域网（WAN）或互联网，或其它任何合适的数据通信方式连接，例如光纤连接、微波或卫星链路等的互联网协议（IP）。可以采用任何基于IP的标准，无论是已知的还是之后所提出的。其中，当前已知的基于IP的标准的例子包括但不限于实时传输协议（RTP）、实时流协议（RTSP）、会话初始协议（SIP）、H系列（如，H.323和H.324等）和T系列（如，T.120等）。在其它的音频会议使能而视频会议非使能的实施例中，会议连接145可以包括例如VoIP（通过互联网协议的语音）、SIP或ISDN连接。

端点150能够与一个或多个设备170和180建立无线个域网160(PAN B)。PAN B160可以包括蓝牙微微网。该一个或多个设备170和180可以包括，例如，能够使用蓝牙系统进行短距离无线通信的蓝牙使能设备。该一个或多个设备170和 180 可以包括例如个人数字助理（PDA）、移动电话、打印机、膝上电脑、显示设备、放映机、摄像机、蓝牙白板、蓝牙笔、扬声器、麦克风、耳机、键盘、鼠标的设备，以及其他任何能够在PAN中无线通信的设备。

通过使用连接145，PAN A 110可以链接至PAN B 160，这样，设备120、130、140、170和180（和任何其他能够加入PAN A 或PAN B 的设备）可以相互进行数据通信。从而，会议连接145实现了远在几百或几千英里之外的设备的虚拟物理临近。

尽管图1描绘了点对点会议系统，但是该系统可以升级以提供多点会议，在该多点会议中通过连接145链接其它的视频会议单元。连接145可以包括多点控制单元（MCU），以使得多个视频会议单元能够加入到单独的视频会议中。例如，在三方会议中，在该会议中的每个PAN都包括蓝牙微微网，在每个PAN中的设备的最大数量增至三倍。

蓝牙是用于在移动PC、移动电话、外围设备和其它便携式设备之间的小型组建规模、低成本、短距离无线链路的标准和规范。与传统的无线操作网不同，蓝牙微微网不需要接入点，与红外通信（例如，由IrDA标准）不同，蓝牙不需要视线连接。

蓝牙设备可以工作于电路交换模式和分组交换模式。电路交换模式是语音通信最通常使用的模式，而分组交换模式通常优选用于互联网数据和更高带宽移动通信系统。

蓝牙个人局域网包括一个主设备和多达七个从设备，从而在有限的范围内（例如，10 米）实现多达八个设备的相互连接。在称为设备发现（Device Discovery）的过程中，所述主设备通过广播请求来寻找设备；处在“可发现”状态中的从设备使用其识别码进行应答。对于需要额外安全的用户和应用可以提供数据加密。

蓝牙描述文件（profile）是所公开的对特定使用实现蓝牙无线技术的规定。描述文件是由设备所提供的“服务”。为了使两个蓝牙使能设备能够共同操作以完成用户任务，这两个设备必须都完成一组通常的描述文件。

由蓝牙连接所发射的信号可以是半双工或全双工。蓝牙微微网中的全双工链路可以以大于64Kbps的速率发送数据，足够容纳若干语音信道的速率。半双工链路可以以在一个方向上是721千比特每秒，在另一个方向上是57.6Kbps的数据速率来建立。如果需要在两个方向上都具有相同速率的半双工链路，可以使用在每个方向上为432.6Kbps的链路。

与许多其它的无线标准不同，蓝牙无线规范包括链路层和应用层定义两者，

以用于支持数据、语音和文本中心应用的产品开发者。

在蓝牙规范中进一步描述了蓝牙协议架构。可以在http://www.bluetooth.com找到最近的蓝牙规范 Rev v2.0 +EDR，2004 年 11 月 4 日公布，在此引入该规范作为参考。但是，本发明的各种实施例的原理可以使用之前和以后版本的蓝牙规范。

该蓝牙规范可以被描述为具有以蓝牙无线层作为基础的协议栈。该无线层定义了对在 2.4GHz ISM(工业、科学和医疗)频段工作的蓝牙收发信机的要求。参与功率-控制链路的收发信机必须能够测量其自身的接收机信号强度，并确定在该链路另一侧的发射机是否应该增大或降低其输出功率电平。其使用接收信号强度指示符（RSSI）来实现。在 LMP（链路管理协议）链路中承载用于改变发射机功率的指令。

在蓝牙栈中，在所述无线层之上是基带层，该基带层描述了执行基带协议和其它低级链路事务的蓝牙链路控制器（LC）的规范。该基带是蓝牙栈的物理层。其管理除其它服务之外的物理信道和链路，所述其它服务例如是误差校正、数据白化、跳选择和蓝牙安全。所述基带协议作为链路控制器而实现，其与链路管理器一起工作以执行链路级事务，例如链路连接和功率控制。该基带还管理异步和同步链路，处理分组和进行寻呼，并询问接入和询问该区域中的蓝牙设备。该基带收发信机使用时分双工（TDD）结构（交替发射和接收）。因此，除了不同的跳率（频分），时间也被划分。

为蓝牙系统的基带层定义了十三种不同的数据包类型。每个数据包包括三个实体：访问码（68/72 比特）、报头（54 比特）和有效载荷（0-2745 比特）。存取码用于定时同步、偏移补偿、寻呼和询问。报头包含用于报头的数据包确认、乱序数据包重排的数据包编号、流控制、从设备地址和错误校验的信息。数据包有效载荷可以包含语音字段、数据字段或两者都有。如果具有数据字段，则有效载荷还包含有效载荷报头。

蓝牙控制器以两种主要的状态操作：等待和连接。还有七个子状态用于在微微网中添加从设备或建立连接。这些状态是：寻呼、寻呼扫描、询问、询问扫描、主设备响应、从设备响应和询问响应。等待状态是在蓝牙单元中的默认低功率状态。仅运行其内部时钟，并且不与其它设备交互。在连接状态，主设备和从设备可以使用信道（主设备）访问码和主设备蓝牙时钟来交换数据包。

所述链路管理器完成链路设置、验证、链路配置和其它协议。其发现其它的远程链路管理器，并通过链路管理协议（LMP）与之通信。为了完成其服务提供者的任务，该链路管理器使用底层链路控制器（LC）的业务。

该链路管理协议主要包括多个PDU（协议数据单元），该PDU从一个设备向另一个设备发送，并由数据包报头中的AM_ADDR来确定。链路管理器PDUs通常以单独时隙的数据包进行发送，因此有效载荷的报头为一字节。

当在两个蓝牙设备之间已经建立了连接时，该连接包括ACL链路。之后可以建立一个或多个SCO链路。

每个蓝牙链路都具有用于链路监视的定时器。该定时器用于检测由设备移动出范围、设备电源耗尽或其它相似的故障所造成的链路损耗。使用LMP步骤用于设置监视超时的值。

主机控制器接口（HCI）向基带链路控制器和链路管理器提供命令接口，并且访问硬件状态和控制寄存器。其提供进入蓝牙基带能力的通用命令方法。该HCI链路命令向主机提供控制与其它蓝牙设备连接的链路层的功能。上述命令使链路管理器能够与远程蓝牙设备交换LMP命令。

逻辑链路控制和自适应协议（L2CAP）在该蓝牙栈中的基带协议之上，并驻留于数据链路层中。其支持更高级协议复用、数据包分割和重组及服务质量信息的传输。L2CAP 允许更高级协议和应用以发射和接收长度多达 64 千字节的L2CAP 数据包。同时支持同步面向连接（SCO）链路和异步无连接（ACL）链路。L2CAP 是基于数据包的，但是遵循基于信道的通信模型。信道代表在远程设备中的L2CAP实体之间的数据流。信道可以是面向连接或无连接的。L2CAP依赖由基带中的链路管理器层所提供的流控制机制。

RFCOMM 协议在 L2CAP 协议之上提供 RS-232 系列端口的仿真。存在两种RFCOMM可适应的设备类型：类型1设备（通信端点，例如计算机和打印机）；和类型2设备（通信段的一部分，例如调制解调器）。在类型1设备上，一些端口驱动器必须提供如其所仿真的 API 所规定的流控制业务。例如，一个应用可能会请求特定的流控制机制，例如XON/XOFF或RTS/CTS，并要求该端口驱动器处理该流控制。在类型2设备上，该端口驱动器可能需要在通信路径，即物理RS-232端口的非RFCOMM部分上执行流控制。

业务发现协议（SDP）为应用提供了发现蓝牙设备所提供或通过蓝牙设备

可获得的业务的方法。其还允许应用来确定上述可获得的业务的特性。在蓝牙环境中要求的特定业务发现协议，因为所获得的一组服务是基于可能正在运动中的蓝牙使能设备的 RF 临近区域而动态变化的。SDP 使用请求/响应模型，其中每个事务（transaction）都包含一个请求协议数据单元（PDU）和一个响应 PDU。每个 SDP PDU 都包括 PDU 报头，在该 PDU 报头之后是 PDU-特定参数。该报头包含三个字段：PDU ID，标识 PDU 的类型；事务 ID 字段，唯一地标识请求 PDU，从而使响应 PDU 与请求 PDU 相匹配；和参数长度字段，说明包含在该 PDU 中的所有参数的长度（按字节）。

SDP 使蓝牙使能设备能够发现其它能够以业务方式所提供的蓝牙使能设备。寻找任何所提供的业务的过程通常称作“浏览”；“搜索”通常指寻找特定的业务。在 SDP，浏览业务的机制是基于由所有称作业务等级所共享的称为浏览组名单属性的属性。该属性的值包括全球唯一标识符（UUIDs）的列表。所述每个 UUID 代表与业务相关的用于浏览目的的浏览组。

现在参考图 2，图 2 描绘了根据本发明一个实施例的典型视频会议系统的方框图。在图 2 的例子中，会议室 A 中的视频会议单元 200 能够与该会室 A 中的各种蓝牙使能设备建立射频 PAN。在该例中，在会议室 A 的 PAN 中的蓝牙使能设备包括打印机 220、PDA 230 和蜂窝电话 240。在该会议室 A 的 PAN 中还可以包括其它的蓝牙使能设备，包括但不限于上述与图 1 有关的设备。

在图 2 中描绘了视频会议单元 200 的各个层，包括无线层 202、硬件层 204、HCI 层 206、L2CAP 层 208、其它蓝牙栈部分 210 和应用层 212。还可以包括其它的层，例如在蓝牙规范中所描述的，但是为了简洁起见没有表示。

网络接口（NI）214 通过信道 216 与 HCI 层 206 链接。该网络接口 214 可以根据 H.323 标准操作，用于基于 IP 的网络，包括互联网的音频、视频和数据通信。该网络接口 214 还可以根据 H.320 标准操作，用于 ISDN 视频会议。该网络接口 214 还可以根据其它的标准和协议操作，不论是当前已知的还是今后所开发的。根据本实施例，信道 216 可以包括用于发送和接收蓝牙数据的专有 RTP 信道。

在会议室 A 中的视频会议单元 200 能够通过宽带连接 245 向和从在会议室 B 中的视频会议单元 250 发送和接收音频、视频和数据，该会议室 B 远离会议室 A。在本例中，该宽带连接 245 可以包括例如通过 IP 网络或 ISDN 线路的连

接。该会议连接245可以包括视频信道、音频信道、控制信道和蓝牙信道。

该视频会议单元250的各个层包括图2中所描述的无线层252、硬件层254、HCI层256、L2CAP层258、其它蓝牙栈部分260和应用层262。还可以包括其它层，例如在蓝牙规范中所描述的，但是为了简洁起见未示出。

网络接口264通过信道266与HCI层256链接。根据本实施例，信道266可以包括用于发送和接收蓝牙数据的专有RTP信道。该网络接口264可以根据H.323标准操作，用于基于IP的网络，包括互联网的音频、视频和数据通信。该网络接口264还可以根据H.320标准操作，用于ISDN视频会议。该网络接口264还可以根据其它的标准和协议操作，不论是当前已知的还是今后开发的。

在会议室B中的视频会议单元250能够与该会议室B中的各种蓝牙使能设备建立射频PAN。在本例中，在会议室B的PAN中的蓝牙使能设备包括个人电脑270（例如手持PC或膝上型PC等）和PDA 280。

一旦连接了会议，例如H.323或H.320视频会议，则VCUs 200和250交换符合其各自性能的数据。例如，VCU200可以通知其能够发送和接收视频、音频和蓝牙数据，VCU 250也可以通知其能够发送和接收视频、音频和蓝牙数据。

在交换性能之后，执行设备识别（也称为设备发现）的步骤。每个VCUs 200和250都执行本地和远程的无线扫描，其收集结果并交换。因此，在图2所示的例子中，VCU 200发现本地设备（打印机220、PDA 230和蜂窝电话240）和远程设备（PC 270和PDA 280）；VCU 250发现本地设备（PC 270和PDA 280）和远程设备（打印机220、PDA 230和蜂窝电话240）。所有这种设备（打印机220、PDA 230、蜂窝电话240、PC 270和PDA 280）都像是位于同一个房间内，位于同一个无线网络中。每个设备都具有地址（例如，网络地址等）和一组属性（例如，支持什么样的蓝牙描述文件，例如耳机描述文件、数据交换描述文件等）。

在表示本发明原理的一个例子中，会议室A中的PDA 230和会议室B中的PDA 280能够执行RS232数据交换，从而通过连接245以电子商务卡的形式交换联系信息。尽管其各自的物理位置可能是几百或几千英里远，但是该数据交换表现为像在同一个物理微微网中。

可以按如下执行在蓝牙PDA之间交换联系信息的方法。首先，每个PDA搜寻相似的设备。接着，在所述PDA之间建立连接，例如在图2的PDA 230和PDA 280之间。所述包括电子商务卡数据（该数据可以例如以vCard或文本格式

存储）的数据依照设备描述文件被发射。可以基于在蓝牙 v1.1 描述文件所规定的对象推描述文件（Object Push profile）来执行类似数据的交换。最后，关闭该连接。

在表示本发明的原理的另一个例子中，与会者可以从他的或她的 PDA230、PDA280 或蜂窝电话 240 等直接拨打视频号码或电话号码。用户通常将地址簿和联系信息存储在其 PDA 和蜂窝电话中。使用户能够直接拨打这样的电话号码有利地使用户能够将其联系信息保持在中心资料库中。

可以按如下方法执行从无线设备，例如蓝牙 PDA 直接拨打号码的方法。首先，与会者拨打存储在它的或她的 PDA 中的通讯簿中的视频或音频号码，该 PDA 例如是图 2 的 PDA 230。该视频会议单元 200 包括电话驱动器。该 PDA 230 连接至视频会议单元 200，并通过蓝牙链路 216 向视频会议单元 200 发送该号码，之后该视频会议单元 200 拨打该号码。

在表示本发明的原理的另一个例子中，与会者可以对存储在其无线设备中的一组数据进行同步，该数据例如是地址簿或日历。可以基于在蓝牙 1.1 描述文件中所规定的对象同步描述文件（Object Synchronization）来执行对例如地址簿或日历数据的同步。

在表示本发明的原理的另一例子中，与会者可以参加到合作绘图中。例如，近端用户可以在他的或她的 PDA 上绘图，并将该绘图与远端共享。执行该绘图合作的应用可以在所使用的特定 PDA 的 SDK（软件开发工具包）的顶层开发，并基于 SDK 所使用的特定描述文件。

在表示本发明的原理的另一例子中，可以将音频电话呼叫添加至视频会议中。该会议站，例如 VCU 200，包括内建的插入（POTS-like）音频端口，用于蓝牙蜂窝电话，例如蜂窝电话 240。该会议站作为蓝牙耳机，而该蓝牙蜂窝电话充当音频网关。实现此特征的应用可以基于在蓝牙 v1.1 描述文件中所规定的手持机描述文件（或免提电话描述文件）。

在表示本发明的原理的另一例子中，与会者可以在白板上进行绘图，以向其它的与会者表达他的或她的想法。不需要移动视频摄像机使其对准白板或使用有线白板，该图像可以被无线发送至 VCU，该 VCU 之后将该图像发送至远端，并将该绘图在显示设备上显示。因此，蓝牙白板可以加入到会议室 A 的 PAN 中，且在该蓝牙白板上的绘图可以在位于远端的会议室 B 中的监视器上观看。实现

该特征的应用可以基于串行端口描述文件，并在特定白板供应商的 SDK 的顶层开发。

在表示本发明的原理的另一例子中，与会者可以使用蓝牙笔在纸张上绘画图表，该蓝牙笔例如是由 Anoto 所许可的。蓝牙笔可以捕捉图像，并通过蓝牙链路将其发送至视频会议单元。实现该特征的应用可以基于 Anoto 的 SDK。

在表示本发明的原理的另一例子中，通过使用蓝牙使能鼠标和键盘而提供了更加用户友好的方式，用于导航 UI（用户接口）项目或接收用户输入。实现该特征的应用可以基于在蓝牙 v1.1 描述文件中所规定的 HID（人机接口设备）。

在表示本发明的原理的另一例子中，音频数据可以被无线地从蓝牙使能麦克风发送至 VCU 基站。与传统的造成集成空间困难的麦克外壳（micpod）有线连接至基站相反，可以使用无线麦克外壳作为替代。实现该特征的应用可以基于专有的协议，以实现通过蓝牙链路 216 的最大数据吞吐量。

在表示本发明的原理的另一例子中，在 VCU 上运行的应用提供了在会议期间从远端打印文件，例如文档、幻灯片和商务卡等的能力。例如，存储在会议室 B 中的个人电脑 270 上的文档可以由位于远端的会议室 A 中的打印机 220 打印。实现该特征的应用可以根据特定的打印机而基于一个或多个以下提供蓝牙打印功能的描述文件：基本打印描述文件、硬拷贝电缆替代描述文件、基本图像描述文件、PAN 描述文件、对象推描述文件或串行端口描述文件等。

在表示本发明的原理的另一例子中，上述应用，例如同步、协作等，可以根据在你的 PC 中所具有的应用而进行组合。Windows®和 Mac OS 提供了一些蓝牙支持。应用可以基于该 OS 支持和描述文件，或者与第三方应用使用。

图 3 描绘了根据本发明一个实施例的典型视频会议单元的方框图。该视频会议单元包括媒体处理器 310，该媒体处理器与接口 320 进行数据通信，该接口由现场可编程门阵列（FPGA）组成。蓝牙模块 330 与天线板 340 相连接用于 RF 通信，并与接口 320 连接用于数据通信。可以使用高速串行链路来连接该蓝牙模块 330 和接口 320。蓝牙模块 330 包括用于根据蓝牙规范进行通信的软件和代码。其中，蓝牙模块 330 可以包括用于执行上述任何应用的软件，以用于商务卡交换、直接拨号、数据同步、绘图协作、添加音频呼叫、蓝牙白板传输、蓝牙笔绘图、蓝牙用户输入、无线麦克风、无线打印和无线 PC 应用。在其它实施例中，可以根据不同的标准或协议执行通信，例如 UWB、802.11 或其它无线通信

规范。

图 3 所示的各个部分都可以作为视频会议单元的外围。例如，摄像机、监视器、麦克风、扬声器和超低音音响喇叭中的一个或多个都可以作为视频会议单元的外围。

尽管本发明已经结合有限个实施例进行描述，但是本领域技术人员将了解其大量的修改和变化。应注意，所附的权利要求覆盖了在本发明的实质精神和范围之内的所有修改和变化。

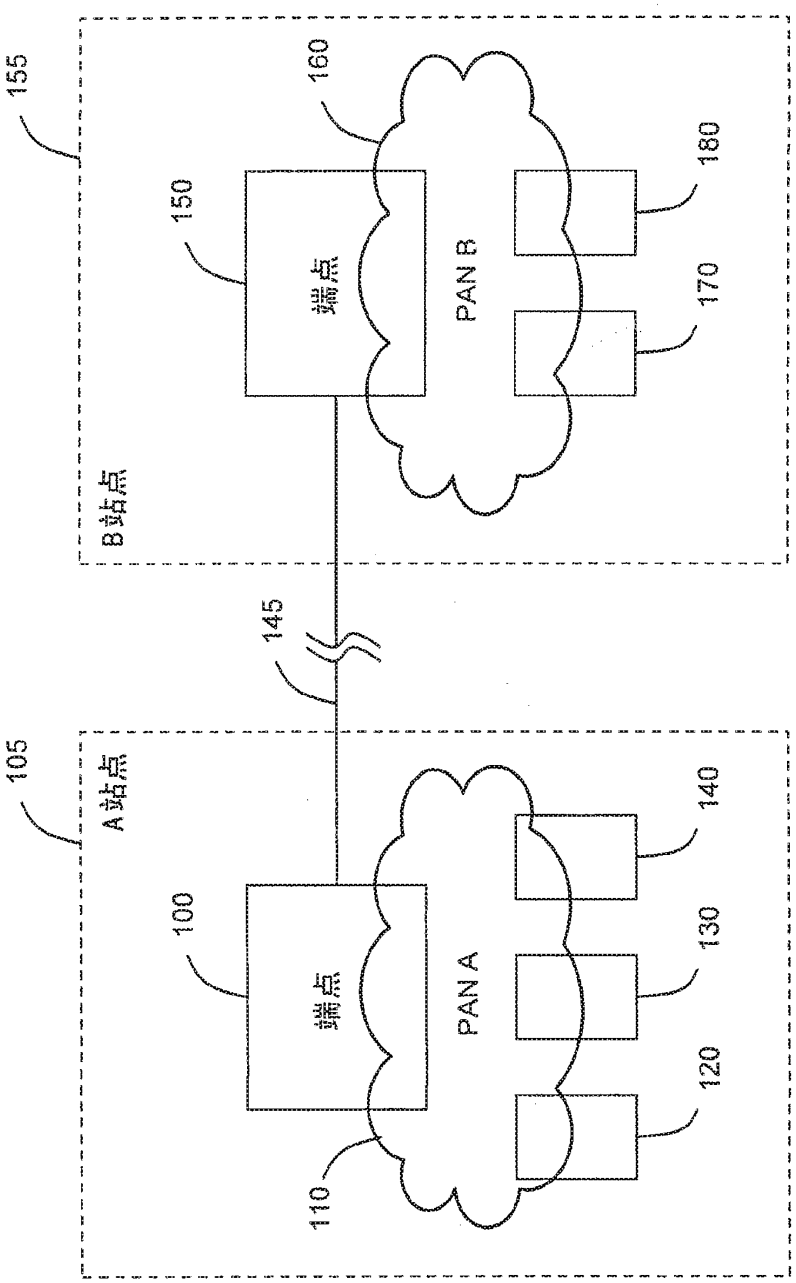

155
160
150
端点
PAN B
180
170
B站点
145
105
A站点
100
端点
PAN A
140
130
120
110

图 1

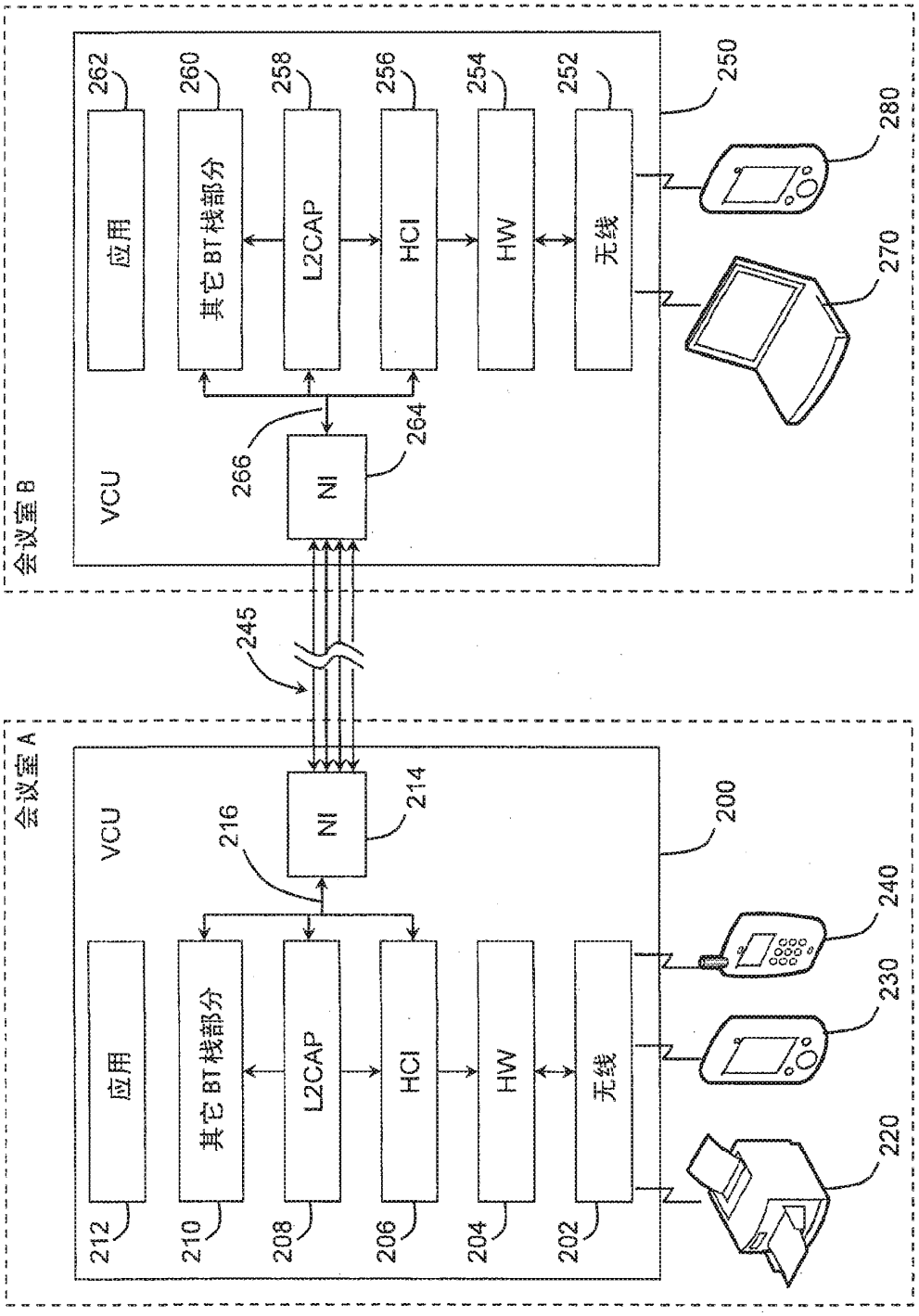

会议室 A
VCU
应用
其它 BT 栈部分
L2CAP
HCI
HW
无线
NI
212
210
208
206
204
202
216
214
200
240
230
220
245
会议室 B
VCU
应用
其它 BT 栈部分
L2CAP
HCI
HW
无线
NI
262
260
258
256
254
252
266
264
250
280
270

图 2

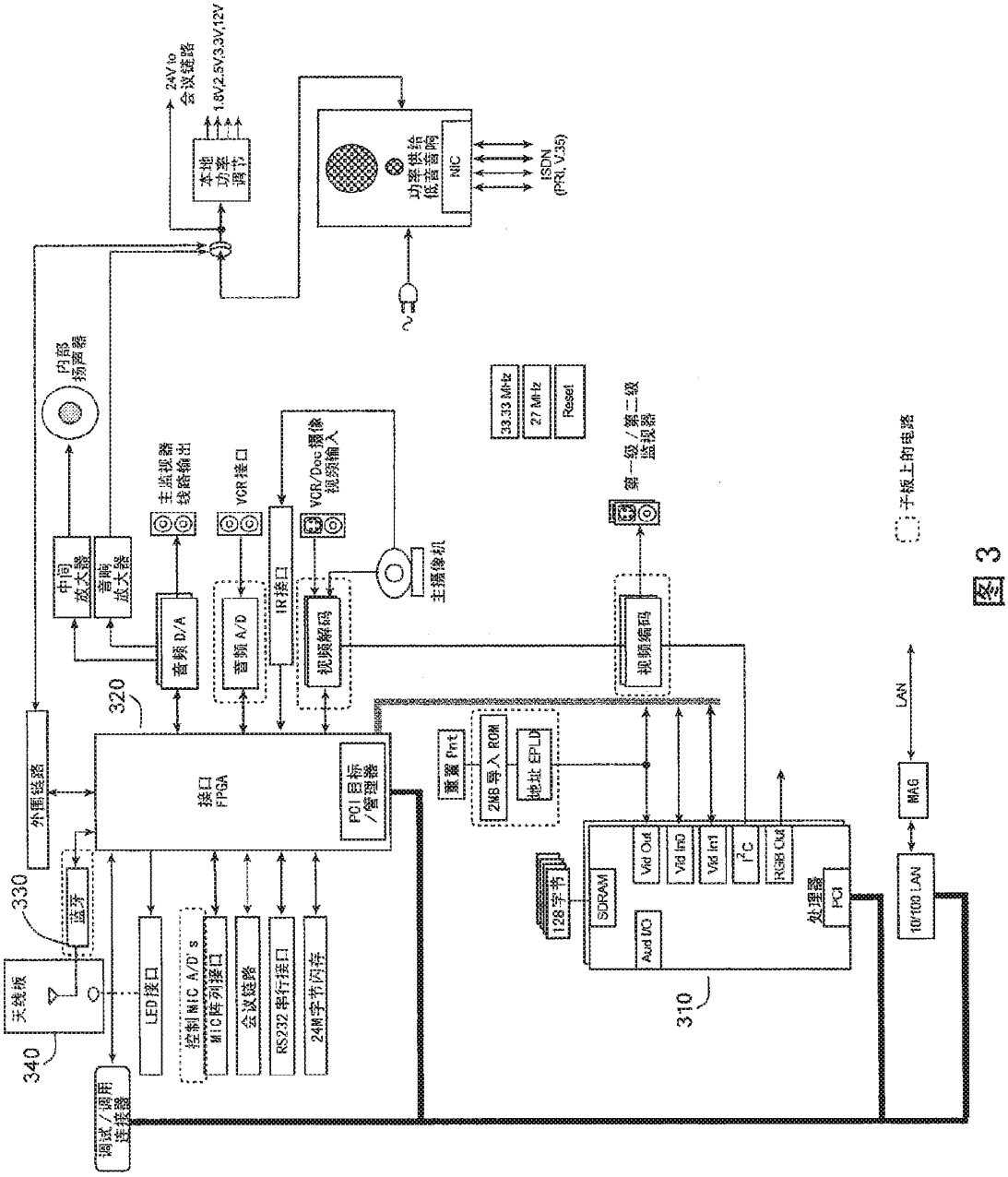

24V to 会议链路
1.8V/2.5V/3.3V/12V
本地功率调节
功率供给低音音响
NIC
ISDN (PRI, V.35)
内部扬声器
中间放大器
音响放大器
主监视器线路输出
音频 D/A
VCR 接口
音频 A/D
IR接口
VCR/Doc 摄像视频输入
视频解码
主摄像机
33.33 MHz
27 MHz
Reset
第一级/第二级监视器
视频编码
子板上的电路
320
外围链路
接口 FPGA
PCI 目标/管理器
蜂鸣 Pmt
ZMB 导入 ROM
地址 EPLD
330
蓝牙
天线板
340
LED 接口
控制 MIC A/D's
MIC 阵列接口
会议链路
RS232 串行接口
24M 字节闪存
调试/调用连接器
128 字节
SDRAM
Aud I/O
Vid Out
Vid In0
Vid In1
I²C
RGB Out
处理器
PCI
310
LAN
MAG
10/100 LAN

图 3

Espacenet

CN102025774A Device for realizing interactive communication of white board television information among multiple users by wireless transmission

Applicants: TPV DISPLAY TECHNOLOGY XIAMEN

Inventors: FAN ZENG,HAOZHENG LIN

Classifications:
IPC ***H04L29/08; H04N7/15;***

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Published as: CN102025774A

Device for realizing interactive communication of white board television information among multiple users by wireless transmission

Abstract

The invention discloses a method for realizing interactive communication of white board television information among multiple users by wireless transmission. A device for implementing the method comprises a white board television server, handwrite control display terminals, wireless communication modules, a data storage module and a remote controller, and is characterized in that: a plurality of handwrite control display terminals and the white board television server are provided with the wireless communication modules; the white board television server is started by a user to start a white board television function; the handwrite control display terminals request to be connected with the television server through a wireless display (Wi-Di) communication mode; the server is controlled by the remote controller to receive a connection request; after the connection is established, one of the handwrite control display terminals transmits a server control right request to the television server; and the server receives the request through the remote controller and a shared data region is opened. The handwrite control display terminals transmit the information to be written to the white board television server through the Wi-Di communication mode and newly uploaded information is stored in the data storage module of the television server by using the remote controller so as to finish data updating. Multi-user interactive communication can be realized in a television conference through the equipment; and users can simultaneously share the information resource, update the information on the server and immediately store and issue the information.

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H04L 29/08(2006.01)
H04N 7/15(2006.01)

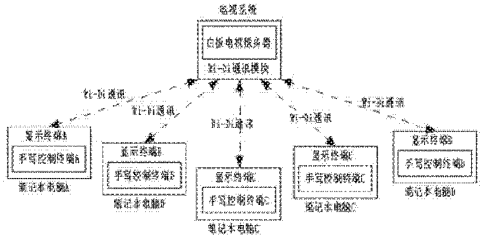
权利要求书 1 页 说明书 2 页 附图 3 页

(54)发明名称

无线传输实现多用户对白板电视信息的交互沟通的装置

(57)摘要

一种无线传输实现多用户对白板电视信息的交互沟通的方法，包括：白板电视服务器，手写控制显示终端，无线通信模块，数据存储模块，遥控器，其特征在于：多台手写控制显示终端与白板电视服务器上均装有无线通信模块，用户启动白板电视服务器，开启白板电视功能，手写控制显示终端与电视服务器通过Wi-Di通信方式请求建立连接，通过遥控器控制服务器接受连接请求，连接建立后，其中一台手写控制显示终端向电视服务器发送服务器控制权的请求，通过遥控器使服务器接受请求并开启共享数据区。手写控制显示终端将要书写的信息通过Wi-Di通信方式上传给白板电视服务器，并用遥控器将新上传信息存至设置在电视服务器的数据存储模块，完成数据更新。通过该设备在电视会议时可实现多用户交互沟通，用户可以同时共享信息资源，也可以对服务器上的信息进行更新，并可及时保存发布。



CN 102025774 A

1. 一种无线传输实现多用户对白板电视信息的交互沟通的方法，包括：白板电视服务器，手写控制显示终端，无线通信模块，数据存储模块，遥控器，其特征在于：多台手写控制显示终端与白板电视服务器上均装有无线通信模块，用户启动白板电视服务器，开启白板电视功能，手写控制显示终端与电视服务器通过 Wi-Di 通信方式请求建立连接，通过遥控器控制服务器接受连接请求，连接建立后，其中一台手写控制显示终端向电视服务器发送服务器控制权的请求，通过遥控器使服务器接受请求并开启共享数据区。 手写控制显示终端将要书写的信息通过 Wi-Di 通信方式上传给白板电视服务器，并用遥控器将新上传信息存至设置在电视服务器的数据存储模块，完成数据更新。

2. 根据权利要求 1 所述的无线传输实现多用户对白板电视信息的交互沟通的方法，其特征在于：该台手写控制显示终端向电视服务器发送释放对白板电视服务器的控制权的请求后，其他的白板电视可继续申请对服务器端的控制权，得到控制权后，其他用户可以将白板电视上的数据通过 Wi-Di 通信方式同步到自己手写控制单元的软件上显示出来，也可以对原来保存在电视服务器数据存储模块上的信息通过手写控制显示终端继续进行修改并传输到白板电视上供其他用户观看。

3. 根据权利要求 1 所述的无线传输实现多用户对白板电视信息的交互沟通的方法，其特征在于：用户交互沟通过程最终完成后，可以通过白板电视的网络功能或最终连接服务器的手写控制显示终端使用网络对先前所交流沟通的信息进行保存和发布。

4. 根据权利要求 1 所述的无线传输实现多用户对白板电视信息的交互沟通的方法，其特征在于：电视服务器端内嵌有操作系统，无线通信模块，数据存储模块；手写控制显示终端装有显示器，无线通信模块，手写控制模块。

5. 根据权利要求 1 所述的无线传输实现多用户对白板电视信息的交互沟通的方法，其特征在于：手写控制终端上传信息后，服务器将信息进行保存，同时该信息也已保存在手写控制终端。

6. 根据权利要求 1 所述的无线传输实现多用户对白板电视信息的交互沟通的方法，其特征在于：白板电视服务器内嵌有白板电视服务器软件，操作系统，手写控制显示单元装有白板电视终端软件。

7. 根据权利要求 1 所述的无线传输实现多用户对白板电视信息的交互沟通的方法，其特征在于：手写控制显示终端可通过具有 Wi-Di 通信模块功能的笔记本电脑实现。

无线传输实现多用户对白板电视信息的交互沟通的装置

技术领域

[0001] 本发明涉及一种无线传输实现多用户对白板电视信息的交互沟通的方法，通过该设备在电视会议时可实现多用户交互沟通。

背景技术

[0002] 目前在电子白板领域，主要是单用户实现信息的输入或者通过远程获取白板信息。在进行多人电视会议时，只能由其中一个人进行信息的输入修改，其他参会人员则通过显示终端观看会议内容，要进行多人的信息交流沟通，通常都是借助于语音设备，再由人工将语音信息转化为文本信息，导致沟通的不及时、不顺畅，甚至出现信息的遗漏，造成不必要的麻烦。

发明内容

[0003] 本发明目的是要提供一种无线传输实现多用户对白板电视信息的交互沟通的方法，该方法能通过无线传输实现多用户对白板电视信息的交互沟通使用户可以同时共享信息资源，也可以对服务器上的信息进行更新。

[0004] 本发明的无线传输实现多用户对白板电视信息的交互沟通的装置，包括：白板电视服务器，手写控制显示终端，无线通信模块，数据存储模块，遥控器，其特征在于：多台手写控制显示终端与白板电视服务器上均装有无线通信模块，用户启动白板电视服务器，开启白板电视功能，手写控制显示终端与电视服务器通过 Wi-Di 通信方式请求建立连接，通过遥控器控制服务器接受连接请求，连接建立后，其中一台手写控制显示终端向电视服务器发送服务器控制权的请求，通过遥控器使服务器接受请求并开启共享数据区。手写控制显示终端将要书写的信息通过 Wi-Di 通信方式上传给白板电视服务器，并用遥控器将新上传信息存至设置在电视服务器的数据存储模块，完成数据更新。本装置控制思路清晰，易操作，可广泛应用于电视、显示器等显示产品领域，实现的多用户输入、显示的交互应用。

附图说明

[0005] 图 1 是本发明系统硬件与模块框图。

[0006] 图 2 是本发明软件流程。

[0007] 图 3 是本发明的具体实施例系统连接图。

具体实施方式

[0008] 如图 1 所示，将笔记本电脑作为手写控制显示终端进行交流，硬件方面笔记本电脑内嵌有 Wi-Di(Wireless Display) 无线功能模块，电视系统端装有 Wi-Di(Wireless Display) 无线功能模块，数据存储模块，服务器模块。软件方面笔记本端装有白板电视终端软件，电视系统装有白板电视服务器软件及操作系统（OS）。笔记本电脑与电视系

统间通过 Wi-Di 方式进行通信，实现从 PC 机向其他高清电视机以无线方式传输图像和视频。

[0009] 如图 2 所示，服务器端的软件工作流程：用户开启服务器白板电视功能，系统进行初始化，初始化完毕，服务器判断是否有终端设备连接服务器请求，有则接受并建立连接，无就返回继续判断。连接建立完毕，判断是否有终端对服务器控制权的请求，有则接受请求开启共享数据区，接收手写终端的输入，并将信息进行修改、存储，等待传送到其他终端进行显示。完成信息处理后，继续判断终端是否释放对服务器的控制权，不释放，则按照上述信息交流方式及时更新信息，若终端释放控制权，服务器则返回至判断是否有控制权请求的环节进行工作。

[0010] 手写控制显示终端的软件工作流程：开启白板电视终端软件，进行参数配置及屏幕初始化，初始化完毕，手写控制终端发送服务器连接请求，判断服务器有无请求应答，有则进入下一步骤，无则范围继续发送连接请求，服务器应答后，控制终端进行参数配置，建立连接，接着向服务器发送控制权请求，判断服务器是否有返回的释放控制权的应答，有则获取服务器控制权并开辟数据通信缓冲区，输入信息上传至服务器端并存储在控制终端，再从服务端接受信息显示，若无释放控制权应答，则继续发送控制权请求，数据发送完毕，释放控制权。

[0011] 以上所述仅为本发明的较佳实施例，凡依本发明申请专利范围所做的均等变化与修饰，皆应属本发明的涵盖范围。

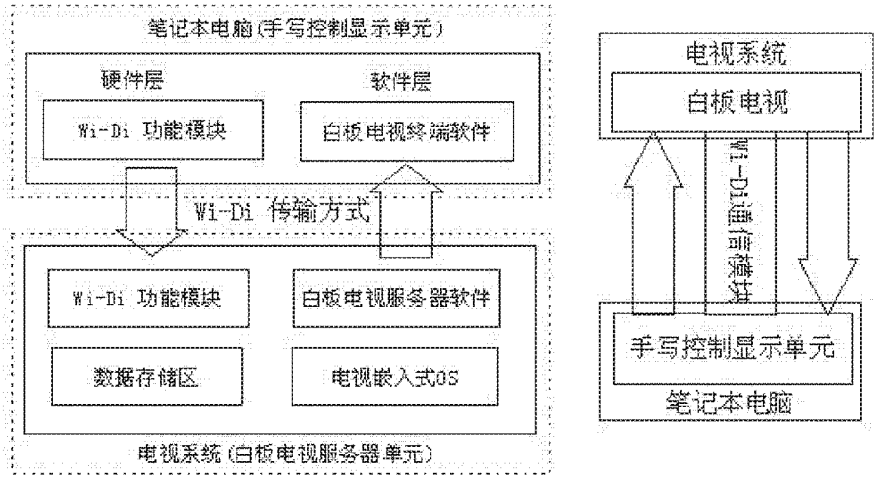

笔记本电脑(手写控制显示单元)
硬件层
软件层
Wi-Di 功能模块
白板电视终端软件
Wi-Di 传输方式
Wi-Di 功能模块
白板电视服务器软件
数据存储区
电视嵌入式OS
电视系统(白板电视服务器单元)
电视系统
白板电视
Wi-Di 传输方式
手写控制显示单元
笔记本电脑

图 1

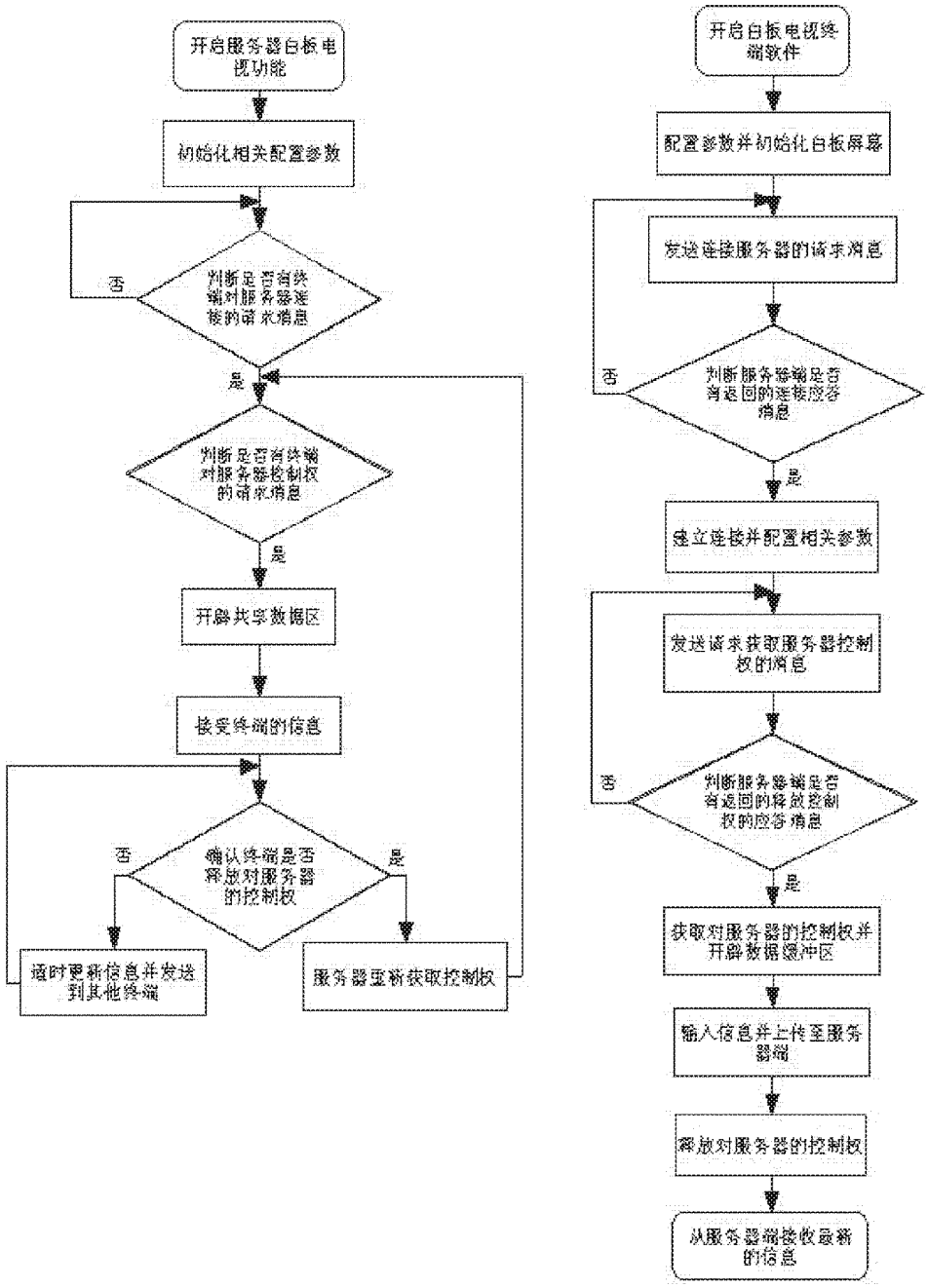

开启服务器白板电视功能
初始化相关配置参数
判断是否有终端对服务器连接的请求消息
否
是
判断是否有终端对服务器控制权的请求消息
是
开辟共享数据区
接受终端的信息
确认终端是否释放对服务器的控制权
否
是
适时更新信息并发送到其他终端
服务器重新获取控制权
开启白板电视终端软件
配置参数并初始化白板屏幕
发送连接服务器的请求消息
判断服务器端是否有返回的连接应答消息
否
是
建立连接并配置相关参数
发送请求获取服务器控制权的消息
判断服务器端是否有返回的释放控制权的应答消息
否
是
获取对服务器的控制权并开辟数据缓冲区
输入信息并上传至服务器端
释放对服务器的控制权
从服务器端接收最新的信息

图 2

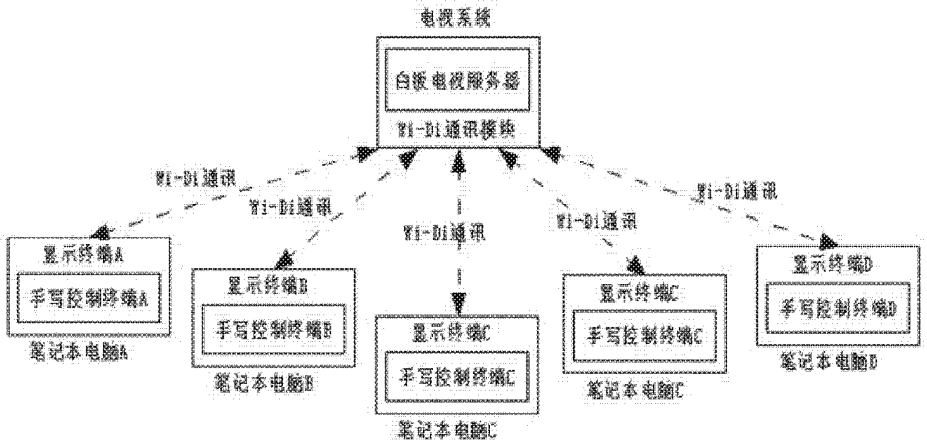

电视系统
白板电视服务器
Wi-Di通讯模块
Wi-Di通讯
Wi-Di通讯
Wi-Di通讯
Wi-Di通讯
Wi-Di通讯
显示终端A
手写控制终端A
笔记本电脑A
显示终端B
手写控制终端B
笔记本电脑B
显示终端C
手写控制终端C
笔记本电脑C
显示终端C
手写控制终端C
笔记本电脑C
显示终端D
手写控制终端D
笔记本电脑D

图 3

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DESCRIPTION CN102088593A

[10] The invention discloses a MPEG4 compressed video transmission communication system based on Bluetooth 3.0 specification, which mainly solves the problems of low communication fluency and single function mode of the existing video transmission system. The communication system includes a Bluetooth control module, a video acquisition module, an audio acquisition and playback module, an ARM-side processing control module, a DSP-side video codec module, an interface operation module, and an external storage module; the ARM-side processing control module receives the audio acquisition and playback module and The audio and video data collected by the video acquisition module, the DSP end video codec module encodes and decodes the data sent by the ARM end processing control module and stores the encoded video data in the external storage module, and sends the data to be transmitted through the Bluetooth control module Or receive, display video data and user graphical interface through the interface operation module. The invention has multiple functional modes, adapts to a variety of different environments, and can be used for medium and short distance self-organizing network video and voice transmission.

[22] MPEG4 compressed video transmission communication system and method based on Bluetooth 3.0 specification

[24] Technical field

[25] The invention belongs to the field of wireless communication technology, and relates to video compression technology and real-time video and voice transmission, in particular to a video transmission communication system using Bluetooth 3.0 wireless transmission technology, which can be used for medium and short distance self-organized network video and voice transmission.

[29] Background technique

[30] 2009 On April 21, 2005, the Bluetooth Technology Alliance officially promulgated version 3.0 of the Bluetooth Core Specification as a new generation of Bluetooth technology standard specifications. The core of Bluetooth 3.0 is a new alternate radio frequency technology AMP, which allows the Bluetooth protocol stack to dynamically select the correct radio frequency for any task. Bluetooth 3.0 has the advantage of high transmission speed. By integrating the "802.11PAL" protocol adaptation layer, Bluetooth 3.0 can call 802.11Wi-Fi to achieve high-speed data transmission when needed, and its data transmission rate can be increased to 24Mbps, which is Bluetooth 2.0 Eight times.

[37] In recent years, wireless information communication has become an indispensable part of people's lives, and