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(54) Title: METHOD, DEVICE AND A COMPUTER PROGRAM FOR PROCESSING IMAGES IN A CONFERENCE BETWEEN A PLURALITY OF VIDEO CONFERENCING TERMINALS

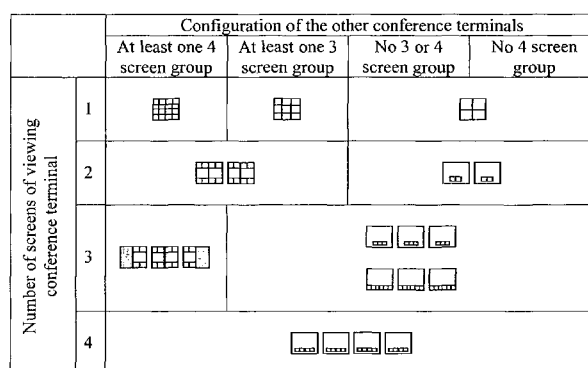


Fig. 4

(57) **Abstract:** A method is disclosed for processing images in conference between a plurality of video conferencing terminal. The method comprising first providing properties of at least two video conferencing terminals, then define a number of groups based on the properties of the at least two video conferencing terminals, then subsequently, for each of the video conferencing terminal, determining an ordered list of the a number of groups, determining a pane layout for displaying images from the video conferencing terminals, the pane layout being determined based on the properties of the video conferencing terminal the layout is to be displayed on and the properties of the other video conferencing terminals in the conference, mapping the ordered list of the number of groups to the respective determined pane layout, and finally providing at least one composite image stream to each of the video conferencing terminals according to the selected pane layout and mapping of the a number of groups. The method allow different types of telepresence endpoints, (e.g. different manufacturers, different numbers of screens/cameras, etc.) to work well together in the same video conference.

METHOD, DEVICE AND A COMPUTER PROGRAM FOR PROCESSING IMAGES IN A CONFERENCE BETWEEN A PLURALITY OF VIDEO CONFERENCING TERMINALS

TECHNICAL FIELD

- 5 The present invention relates in general to the field of video conferencing and telepresence systems. More specifically, the invention relates to a method, a device and a computer program for processing images in a conference between a plurality of video conferencing terminals.

BACKGROUND

- 10 Conventional video conferencing systems comprise a number of video conferencing terminals (endpoints) communicating real-time video, audio and/or data (often referred to as duo video) streams over and between various networks such as WAN, LAN and circuit switched networks.

- 15 A number of video conference systems residing at different sites may participate in the same conference, most often, through one or more MCU's (Multipoint Control Unit) performing i.a. switching and mixing functions to allow the audiovisual terminals to intercommunicate properly.

- 20 Video conferencing systems presently provide communication between at least two locations for allowing a video conference among participants situated at each station. Telepresence systems are enhanced video conference systems. Typically, terminals in telepresence systems have a plurality of large scaled displays for life-sized video, often installed in rooms with interior dedicated and tailored for video conferencing, all to create a conference as close to personal meetings as possible. The terminals in telepresence systems are provided with one or more cameras. The
- 25 outputs of those cameras are transmitted along with audio signals to a corresponding plurality of displays at a second location such that the participants at the first location are perceived to be present or face-to-face with participants at the second location.

- 30 Fig. 1 is a schematic view illustrating background art aspects of telepresence video conferencing.

- A display device of a video conferencing device, in particular a video conferencing terminal of the telepresence type, is arranged in front of a plurality of (four illustrated) local conference participants. The local participants are located along a table, facing the display device which includes a plurality of display screens. In the
- 35 illustrated example, four display screens are included in the display device. A first,

a second and a third display screens are arranged adjacent to each other. The first, second and third display screens are used for displaying images captured at one or more remote conference sites of a corresponding telepresence type.

5 A fourth display screen is arranged at a central position below the second display screen. In a typical use, the fourth screen may be used for computer-generated presentations or other secondary conference information. Alternatively, the fourth screen is replaced by several table mounted displays as shown in fig 2. Video
10 cameras are arranged on top of the upper display screens in order to capture images of the local participants, which are transmitted to corresponding remote video conference sites.

A purpose of the setup shown in fig. 1 and fig. 2 is to give the local participants a feeling of actually being present in the same meeting-room as the remote participants that are shown on the respective display screens.

15 Key factors in achieving a feeling of presence are the ability to see at whom the remote participants are looking, that all the participants are displayed in real life size and that all displayed participants appear equally sized relatively to each other. Another provision for achieving high quality telepresence is that the images of the remote participants are presented to each local participant as undistorted as possible.

20 In order to obtain this feeling of presence, a special set of rules, or a proprietary protocol, is used by the telepresence systems. Therefore, a telepresence system such as the one shown in fig. 1 and fig. 2, will operate properly only with other telepresence systems supporting that set of rules (or protocol). This is further
25 complicated by the fact that different telepresence systems might employ different numbers of display screens, e.g. one, two, three or four display screens. Finally, more than two telepresence systems might participate in a conference, and all the participants will still expect the same feeling of presence as with a two systems conference.

30 Further, since there has not been defined a standard protocol for telepresence systems, only telepresence systems from the same manufacturer may interoperate in a satisfactory way.

In many situations there is also a need to call, or receive a call from, a telepresence system from a, regular video conferencing terminal even though the regular video conferencing terminal does not provide the same feeling of presence.

35 US 7,034,860, incorporated herein by reference in its entirety, describes an apparatus and method for dynamically determining the image layout based on the numbers of participants or video sources connected to a conference. The system

combines each video source into a composite video signal according to the defined composite image layout, and transmits this composite signal to the connected sites. This works well with single screen systems, but a problem arises when two multi-screen telepresence systems with different numbers of screens are connected, more
5 than two multi-screen telepresence systems are connected, or/and when single screen systems are connected to one or more multi-screen systems.

Thus, there is a need in the art to allow different types of telepresence endpoints, (e.g. different manufacturers, different numbers of screens/cameras, etc.) working well together in the same video conference.

10 SUMMARY OF THE INVENTION

The invention provides a method, a computer program portion, and a video conferencing device as set forth in the appended claims.

In particular, the invention provides a method for processing images in a conference between a plurality of video conferencing terminals, comprising first providing
15 properties of at least two video conferencing terminals, then defining a number of groups based on the properties of the at least two video conferencing terminals, then subsequently, for each of the video conferencing terminals, determining an ordered list of the number of groups, determining a pane layout for displaying images from the video conferencing terminals, the pane layout being determined based on the
20 properties of the video conferencing terminal the layout is to be displayed on and the properties of the other video conferencing terminals in the conference, mapping the ordered list of the number of groups to the respective determined pane layout, and finally providing at least one composite image stream to each of the video conferencing terminals according to the selected pane layout and mapping of the a
25 number of groups.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to make the invention more readily understandable, the discussion that follows will refer to the accompanying drawings, wherein

Fig. 1 is a schematic view illustrating background art aspects of telepresence video
30 conferencing,

Fig. 2 is a schematic view illustrating background art aspects of telepresence video conferencing,

Fig. 3 is a schematic flow chart illustrating the principles of a method for processing video conference video streams,

Fig. 4 is an exemplary overview of video conference terminal screens layouts according to the present invention,

Fig. 5a and 5b show exemplary mappings of ordered groups to screen layouts,

5 Fig. 6a and 6b show exemplary modes of operation according to the present invention,

Fig. 7 is a schematic diagram of an exemplary configuration of telepresence terminals, and

Fig. 8 is a picture illustrating a telepresence terminal in an exemplary embodiment according to the present invention.

10 DETAILED DESCRIPTION OF EMBODIMENTS

In the following, the present invention will be discussed by describing various embodiments, and by referring to the accompanying drawings. However, people skilled in the art will realize other applications and modifications within the scope of the invention as defined in the enclosed independent claims.

15 Fig. 3 is a schematic flow chart illustrating the principles of a method for processing video streams in a conference between a plurality of video conferencing terminals.

The method starts at the initiating step 300.

20 First, in step 310, a first and a second video conference terminal provides an image processing device with the properties of the respective video conference terminal. Preferably, the properties comprise the number of screens of the video conference terminal, and the number of video streams provided from the video conference terminal. The properties of the respective video conference terminals preferably also allow the image processing device to determine whether a video stream is
25 allowed to be shown full screen or only to be shown in smaller panes as described below, e.g. the video resolution of the endpoint.

30 Next, in step 320, if the image processing device determines that there are more connected video conference terminals to provide the image processing device with their respective properties, the method continues to step 330, if not the method continues at step 340.

In step 330 the connected terminals provide the image processing device with the properties of the respective video conference terminal as described in step 310.

In step 340, the image processing device groups the video conference terminals based on the properties provided from the video conference terminals. In particular

would a group typically have two, three or four members according to the number of screens of the video conference terminal and/or the number of video streams provided from the video conference terminal. A single screen/video stream endpoint will typically not be placed in a group, but could in an alternative implementation be placed in a group of one. In the following is a group of screens or video streams is referred to as a group.

Next, in step 350, the image processing device determines an ordered list of the groups and single screen endpoints for each of the video conference terminals. The ordered list of groups is preferably based on the voice switching order of the video conferencing terminals, excluding the terminal on which the view is to be displayed. Optionally, in an alternative embodiment, the ordered list includes the terminal on which the view is to be displayed at the end of the list, provided that self-view for that terminal is enabled. In yet another alternative embodiment, the image processing device allows, for each conference, an "important" participant to be nominated. If there is an important participant nominated for a conference, the group of that participant is moved to the top of the ordered list for each of the ordered list, excluding the ordered list of the terminal including the group of the important participant.

In step 360, the image processing device determines a pane layout for each of the video conference terminals based on the properties of the video conference terminal itself and the properties of the other video conference terminals in the conference. Exemplary pane layouts according to the present invention are described below with reference to Fig. 4.

All the layouts used by the image processing device follow a similar format; each has a number (which can be 0) of big rows and/or some number of small rows. The big rows are either full screen panes or a row of large panes across the centre of one or more screens. The small rows are either continuous presence (CP) panes overlaid near the base of full screen panes or separate small panes above and/or below the centre row of big panes. For layouts where all panes are the same size (for instance a 3 x 3 arrangement on a single screen) all rows are considered small rows.

If the layout has full screen big rows the presence of overlaid small CP panes will be controlled by a "show CP" flag for each individual view (i.e. the "show CP" flag for the group's constituent endpoints). If the layout's big-rows are not full screen panes, the smaller CP panes above and below the centre row of larger panes will always be present.

In step 370, the image processing device maps the ordered groups into the rows of the selected pane layout for each of the video conference terminals. If the layout comprises a big row, the big row is filled first, and then the smaller rows are filled. The process of mapping the ordered groups is further described with reference to

Fig. 5a, wherein eight different groups are mapped to a five row layout. First assuming that all groups are allowed to be shown full screen and that row 510 is a full screen row, the highest priority group, 501, is mapped to row 510. As only one screen is now available in row 510, the second priority group, 502, is mapped to row 520. The third priority group, or single screen, 503, is then mapped to the available screen in the first row, 510. Following the same process, group 504 fills row 530, group 505 and group 508 are mapped to row 540; group 506 fills the available screens in row 520, and finally group 507 fills row 550. The result of this mapping is identical to the mapping of the groups in the case all the rows were small rows.

Now, assuming that row 510 is a full screen row and groups 503 and 508 are not allowed to be shown full screen. In this case, as shown in Fig. 5b, the highest priority group, 501, is mapped to the big row, 510, the second priority group, 502, is mapped to row 520. The third priority group, or single screen, 503, is not allowed to be mapped to the available screen in the first row, 510, and is waiting for an available screen. Group 504 fills row 530 and group 505 is mapped to row 540. Row 540 now has one available screen, to which group 503 is mapped. Group 506 fills the available screens in row 520, and finally group 507 fills row 550. In this case the available screen in row 510 will be blank, and group 508 will not be shown. However, in an alternative embodiment groups 506 and 508 might be voice-switched by methods known by a person skilled in the art.

When the ordered groups are mapped to the selected layouts for each of the video conference terminals, the method continues to step 380, wherein the video processing device is receiving video streams from each of the groups. The video processing device processing the video streams is providing a separate composite video stream to each of the screens of the terminals according to the determined layouts.

Now returning to step 360, exemplary pane layouts according to the present invention are described with reference to Fig. 4. As disclosed above the selected pane layout is determined based on the properties of the video conference terminal itself and the properties of the other video conference terminals in the conference. In Fig. 4, the number of screens of the terminal on which the view is to be displayed is shown on the left side of the table and the properties of the other video conference terminals in the conference is shown on the upper side of the table.

In a first exemplary layout, the terminal on which the view is to be displayed is a one screen terminal. If least one of the other video conference terminals is a four screen group, the layout is effectively constructed on a 4 x 4 grid, wherein each row of four can contain a group of four, a three plus a one, etc. The filling order of the

rows is typically: the second from the top, the third row from the top, the top row and finally the lowest row.

If there are no three screen terminals in the conference, but at least one of the other video conference terminals is a three screen group, the layout is effectively
5 constructed on a 3 x 3 grid, wherein each row of three can contain a group of three, a two plus one, etc. The filling order of the rows is typically: the middle row, the lowest row, and finally the top row.

If there are no three or four screen groups in the conference, the layout is constructed on a 2 x 2 grid with single screen endpoints and two screen groups. The
10 filling order of the rows is typically: the top row and finally the bottom row.

In a second exemplary layout, the terminal on which the view is to be displayed is a two screen terminal. If least one of the other video conference terminals is a four screen group or a three screen group, the layout is constructed on four big panes across the centre, i.e. two panes on each screen, plus four groups of four panes, i.e.
15 one group above and one below each set of the two big panes per screen. The four big panes in the middle are filled with as many of the groups in the ordered list as fit, i.e. if the group at the top of the list is a four screen terminal, the group is displayed across all four panes. If the group at the top is not a four screen group, more than one group may be displayed full screen. The filling order of the rows is
20 typically: the big row, the bottom small rows and finally the top small rows.

If there are no three or four screen groups in the conference, the layout is constructed on two full screen panes plus up to two continuous presence (CP) panes shown near the bottom of each screen. The two full screen panes can either be populated by a single two screen group or two single screen groups. The up to two
25 CP panes typically each comprise two or four screens. The filling order of the rows is typically: the big row, then the small bottom rows.

In a third exemplary layout, the terminal on which the view is to be displayed is a three screen terminal. If at least one of the other video conference terminals is a four screen group, the layout is constructed on four big panes across the centre, i.e.
30 one big pane on the respective right and left screen, two panes on the middle screen, plus four groups of four panes, i.e. one group above and one below each set of the four big panes. The outer half screen of the respective right and left screen is left blank. The four big panes in the middle are filled with as many of the groups in the ordered list as fit, i.e. if the group at the top of the list is a four screen terminal, the
35 group is displayed across all four panes. If the group at the top is not a four screen group, more than one group may be displayed full screen. The filling order of the rows is typically: the big row, the bottom small rows and finally the top small rows.

If there are no four screen systems in the conference, the layout is constructed on three full screen panes plus up to six CP panes at the bottom of each screen. The filling order of the rows is typically: the big row, then the small bottom rows.

5 In a fourth exemplary layout, the terminal on which the view is to be displayed is a four screen terminal. In this configuration the layout is always constructed on four full screen panes plus up to four CP panes per screen, the CP panes being at the bottom of the screens. The filling order of the rows is typically; the big row, then the small bottom rows.

10 The four exemplary layouts described above are exemplary layouts of normal mode telepresence. An alternative telepresence mode is referred to as "round table mode" as incorporated in TANDBERG T3®, wherein the feeling of presence is further enhanced by creating a virtual round table meeting. The T3® terminal has three screens and three video streams, i.e. one video stream from a camera positioned over each screen. In normal mode (Fig. 6a) each camera is capturing the image of
15 two seat positions situated directly in front of the camera and the screen, totaling to six seat positions, and is presented on other telepresence terminals as described above. In round table mode (Fig. 6b), each of the three cameras captures the image of the four centre seat positions, essentially capturing a left view image, a centre view image, and a right view image of the four seat positions. Fig. 7 shows four
20 terminals in round table mode, the arrows indicating which image being shown on which screen, e.g. centre screen (701C) of terminal 701 shows the image the centre camera of terminal 703, right screen (701R) shows the image of the left side camera of terminal 702, left screen (701L) shows the image of the right side camera of terminal 704, etc. Thus, as shown in Fig. 8, all terminals view a "round" table where
25 the participants are shown from the correct angle aligning the curvature of the table.

The round table layout described above is the default mode, and is working perfectly for three screen systems. Described below are exemplary layouts for one, two and four screen terminals respectively in a round table mode conference.

30 In a first exemplary round table layout, the terminal on which the view is to be displayed is a one screen terminal. The layout is effectively constructed on a 2 x 2 grid, each pane displaying the four seat positions. The filling order of the panes is typically: the top left, the top right, the left bottom and finally the bottom right pane. If only three round table terminals participate in the call, one pane is left blank. Alternatively the available pane is filled with a single screen endpoint.
35 Optionally, up to three small CP panes might be displayed at the bottom of the screen; these CP panes are filled with the next three groups.

In a second exemplary round table layout, the terminal on which the view is to be displayed is a two screen terminal. The layout are effectively constructed on four panes in a row across the centre of both screens, the panes showing the four round

table groups in their correct positions (i.e. the first round table group of the conference is in the leftmost pane). Empty panes in this row of four can hold other single screen endpoints or potentially a two or three screen group if there are enough unused panes. Optionally, there are up to four groups of four panes, i.e. one group above and one below each set of the two big panes per screen available for showing single screen endpoints or other groups.

In a third exemplary round table layout, the terminal on which the view is to be displayed is a four screen terminal. The layout is effectively constructed on four full screen panes, each pane showing the appropriate round table participant full screen, with eventual spare screens being used to show single screen endpoints. There are also up to four CP panes overlaid at the bottom of each screen if there are sufficient other conference participants.

According to an aspect of the present invention, an image processing device configured to perform the method described in the present disclosure could be embodied as a video conferencing terminal, e.g. a telepresence terminal.

According to another aspect of the present invention, an image processing device configured to perform the method described in the present invent could preferably be embodied as a multipoint control unit, e.g. a telepresence server.

Further disclosed is a computer program, or at least a computer program portion, which comprises processing instructions that causes a processing device in a video conferencing device to perform a method as described in the present disclosure. The computer program portion may be tangibly stored in a memory, such as a RAM, ROM, or Flash memory, or it may be stored in a computer-readable medium, such as a magnetic or optical disk. Alternatively, the computer program or computer program portion may be embodied as a propagated signal which carries information representing the processing instructions, e.g. a communication signal transferred between network elements in a local, regional or global computer network.

As readily understandable by a person skilled in the art with access to the teachings of this disclosure, several combinations and modifications of the present invention can be envisaged without leaving the scope of the present invention encompassed by the appended claims.

CLAIMS

1. A method for processing images in a conference between a plurality of video conferencing terminals, the method comprising
 - providing properties of at least two video conferencing terminals,
 - 5 - defining a number of groups based on the properties of the at least two video conferencing terminals,
 - for each of the video conferencing terminals, determining an ordered list of the number of groups,
 - for each of the video conferencing terminals, determining a pane layout for
10 displaying images from the video conferencing terminals, the pane layout being determined based on the properties of the video conferencing terminal on which the layout is to be displayed, and the properties of the other video conferencing terminals in the conference,
 - for each of the video conferencing terminals, mapping the ordered list of the
15 number of groups to the respective determined pane layout, and
 - providing at least one composite image stream to each of the video conferencing terminals according to the selected pane layout and the mapping of the number of groups.
2. A method according to claim 1, wherein the properties of the video
20 conference terminal comprise the number of screens of the video conference terminal and the number of video streams provided from the video conference terminal.
3. A method according to claim 1 or 2, wherein the properties of the video
25 conferencing terminal comprise information to determine whether or not a video stream is allowed to be shown full screen.
4. A method according to claim 2, wherein the number of groups is defined according to the number of screens of the video conferencing terminal and/or the number of video streams provided from the video conferencing terminal.
5. A method according to claim 1, wherein the ordered list of the number of
30 groups is determined based on the voice switching order of the video conferencing terminals.
6. A method according to claim 1 or 5, wherein the ordered list of the number of groups is excluding the video conferencing terminal on which the layout is to be displayed.

7. A method according to claims 1 or 5, wherein the ordered list of number of groups is including the video conferencing terminal on which the layout is to be displayed at the end of the ordered list.
8. A method according to claim 1, wherein one of the video conference
5 terminals is nominated an important participant, thereby moving the nominated video conference terminal to the top of each of the ordered list of number of groups.
9. A video conferencing device for processing images in a conference between a plurality of video conferencing terminals,
configured to perform a method as set forth in one of the claims 1-8.
10. A video conferencing device according to claim 9,
10 embodied as a video conferencing terminal.
11. A video conferencing device according to claim 9, ,
embodied as a telepresence terminal.
12. A video conferencing device according to claim 9,
15 embodied as a multipoint control unit, or telepresence server.
13. A computer program portion, tangibly stored in a memory or a computer-readable medium, or carried by a propagated signal,
comprising processing instructions that when executed on a processing device in a video conferencing device causes the processing device to perform a method as set
20 forth in one of the claims 1-8.

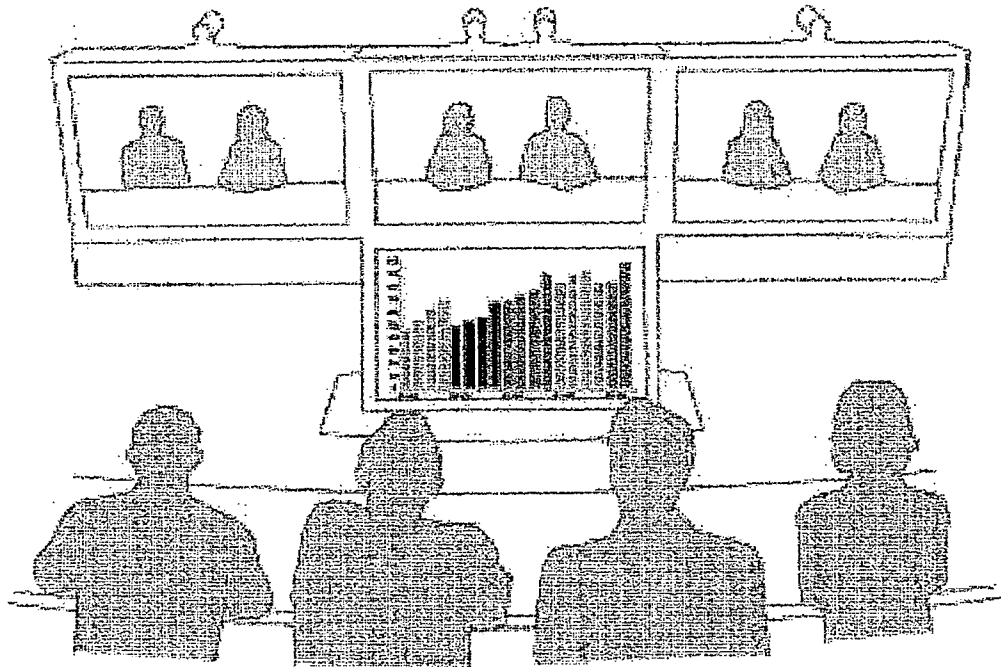


Fig. 1

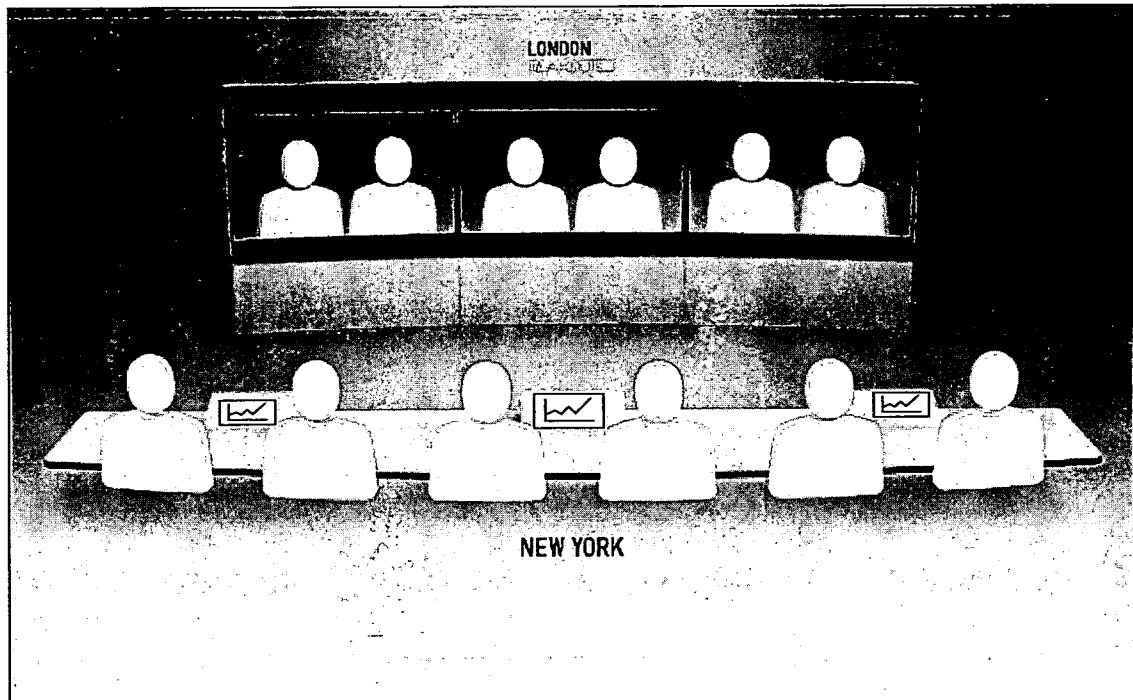


Fig. 2

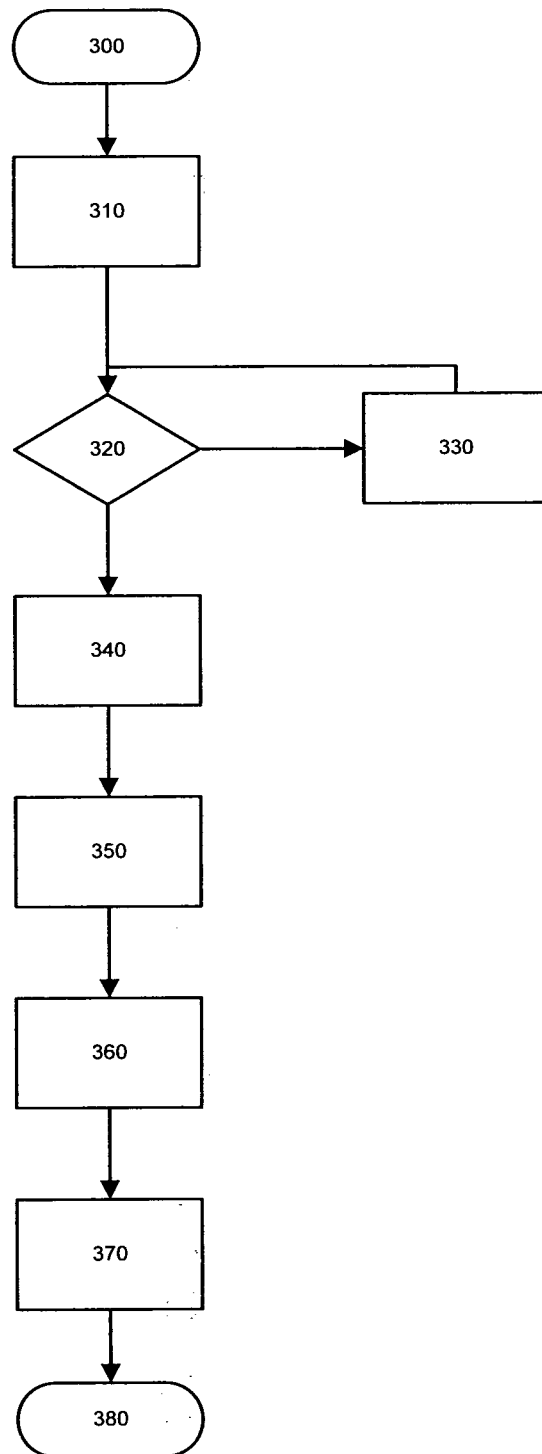


Fig. 3

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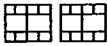
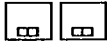
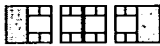
		Configuration of the other conference terminals			
		At least one 4 screen group	At least one 3 screen group	No 3 or 4 screen group	No 4 screen group
Number of screens of viewing conference terminal	1				
	2				
	3		 		
	4				

Fig. 4

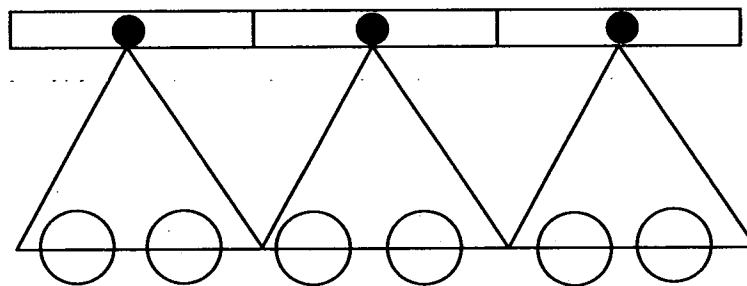


Fig. 6a

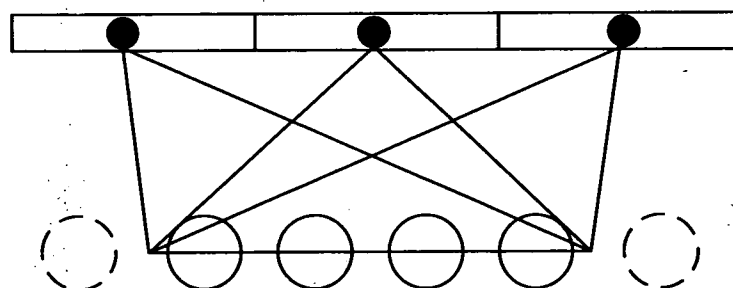


Fig. 6b

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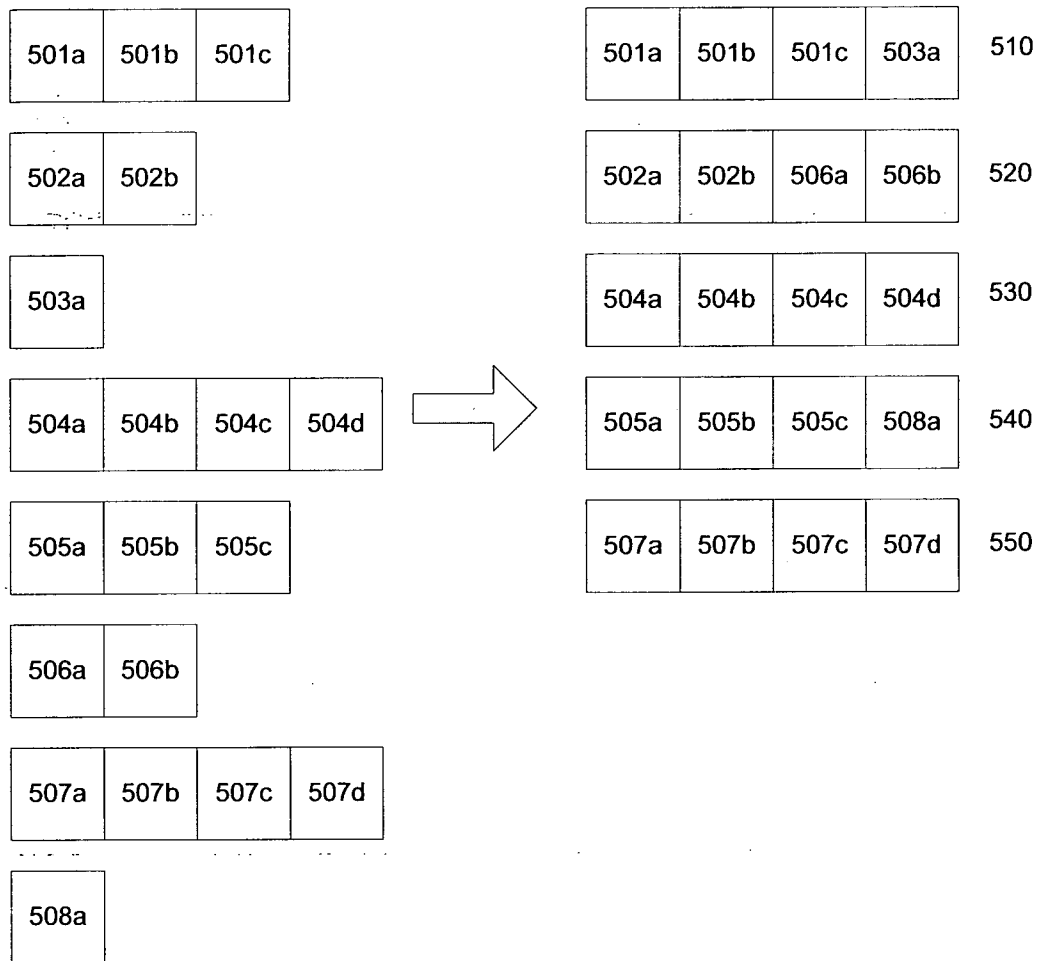


Fig. 5a

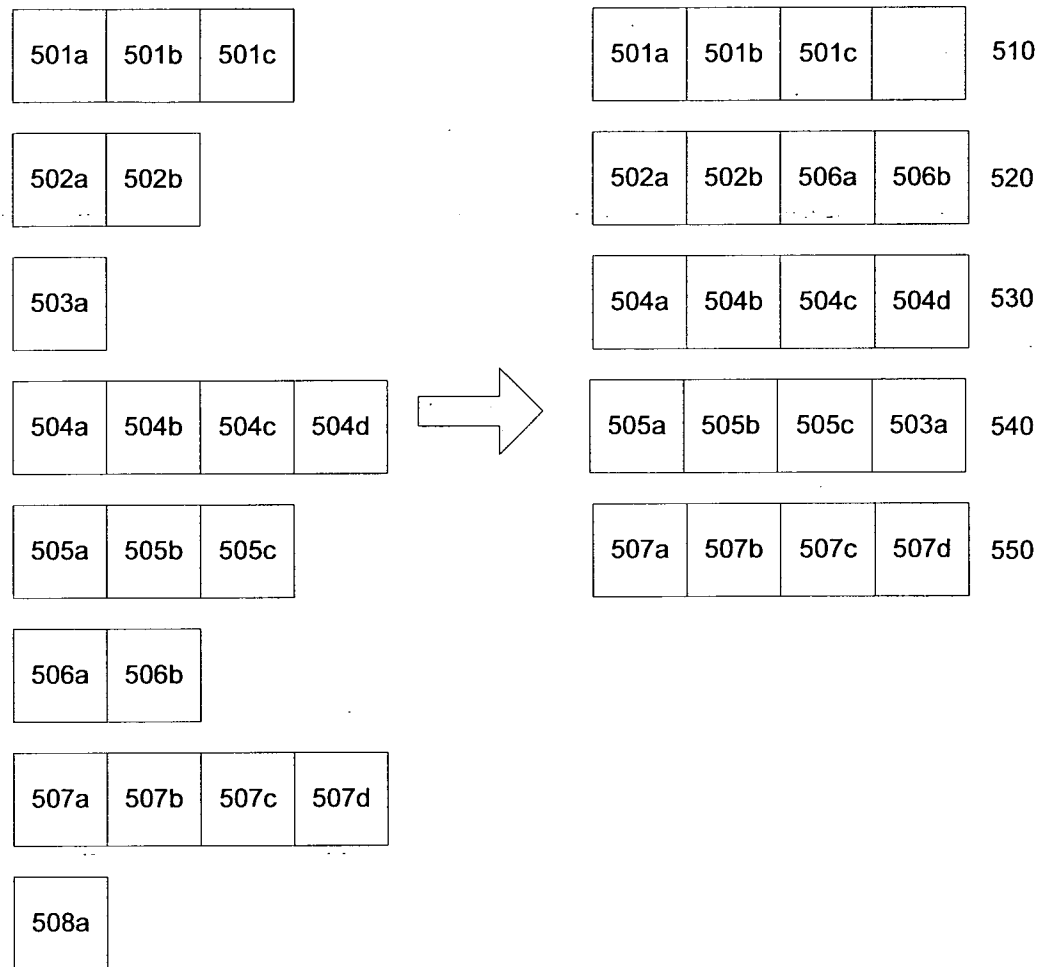


Fig. 5b

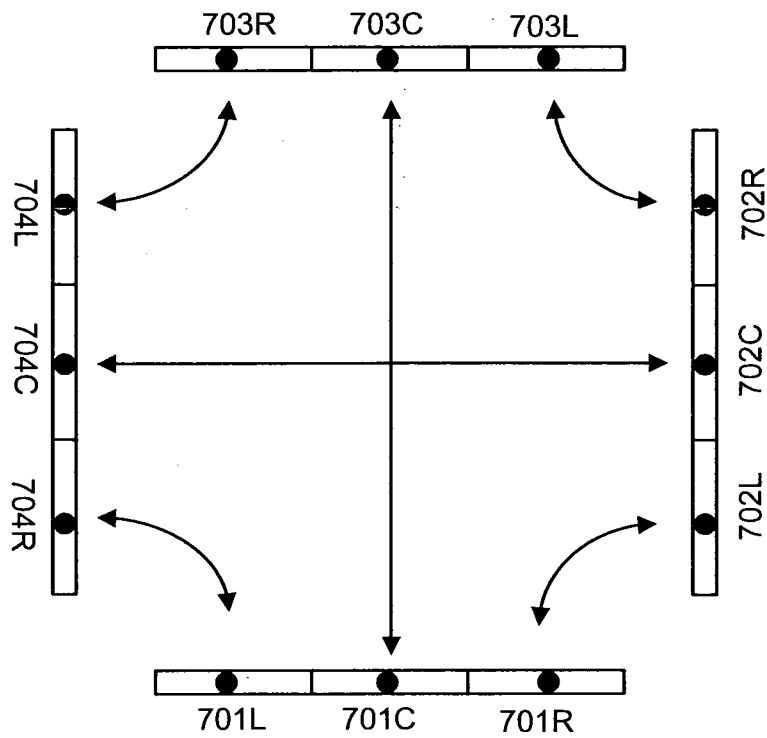


Fig. 7

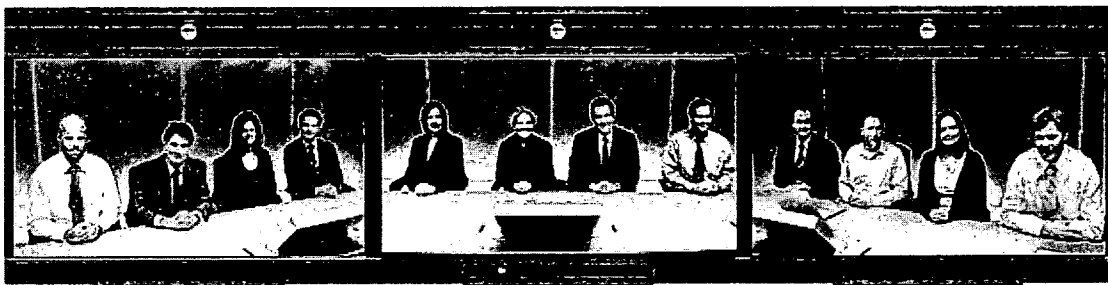


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2009/000434

A. CLASSIFICATION OF SUBJECT MATTER
H04N 7/15, H04N 5/265

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
SE, FI, DK, NO

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2008/101117 A TELIRIS INC, 21 August 2008 (21-08-2008) Abstract page 7, line 20 – page 8 line 2 page 11, line 16 – page 14 line 14 page 17, line 24 – page 18 last line, page 24, line 1 - 18	1 - 13
A	EP 1830568 A POLYCOM INC, 5. September 2007 (05-09-2007) The whole document	1 - 13
A	US 2008/0117285 A TANAKA S., 22 May 2008 (22-05-2008) Abstract paragraph [0059] – [0084]	1 - 13
A	US 2008/0100696 A SCHIRDEWAHN J. C., 1 May 2008 (01-05-2008) Paragraphs [0001], [0007] – [0008] og [0048] – [0064] claim 1	1 - 13

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO2009/000434**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

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A	US 5953050 A KAMATA H. et al., 14 September 1999 (14-09-1999) The whole document	
A	JP 2000-023131 A MITSUBISHI ELECTRIC CORP, 21 January 2000 (21-01-2000) Abstract figures	

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