(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 April 2017 (13.04.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/059906 A1

(51) International Patent Classification:
G06F 3/14 (2006.01)

(21) International Application Number:
PCT/EP2015/073212

(22) International Filing Date:
8 October 2015 (08.10.2015)

(25) Filing Language: English

(26) Publication Language: English

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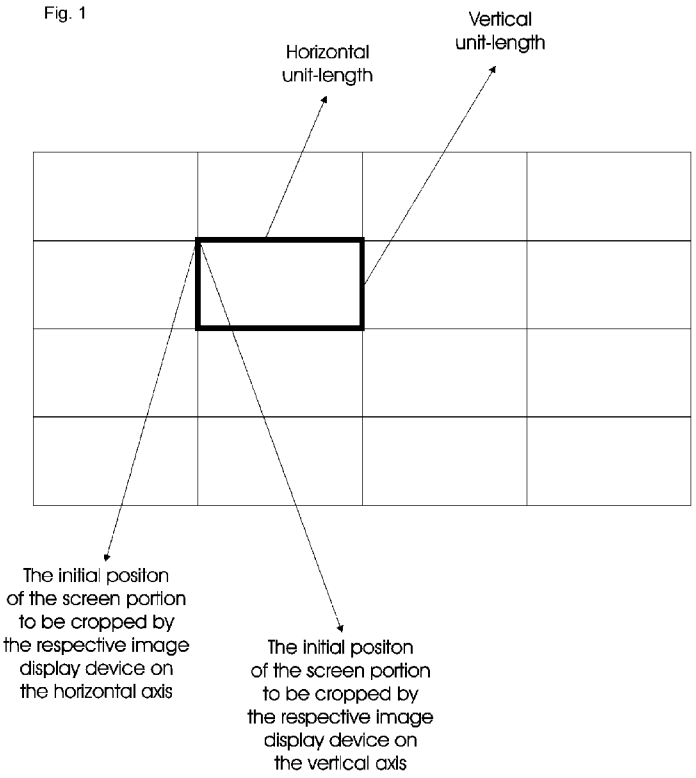
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR LOCATIONAL DEFINITION OF AN IMAGE DISPLAY DEVICE IN A VIDEO WALL DISPLAY SYSTEM

Fig. 1



(57) Abstract: The present invention relates to an image display device programmable for formation of a video wall system. The present invention more particularly relates to a video wall system having a multitude of image display devices in the form of a in a matrix-like web with each pair of image display devices being at least partially neighboring each other on a first axis as well as on a second axis different than the first axis, each image display device of the video wall system comprising a control unit.

WO 2017/059906 A1

Published:

— *with international search report (Art. 21(3))*

Description

SYSTEM AND METHOD FOR LOCATIONAL DEFINITION OF AN IMAGE DISPLAY DEVICE IN A VIDEO WALL DISPLAY SYSTEM

[0001] The present invention relates to an image display device programmable for formation of a video wall system.

[0002] Image display devices present images on screens thereof and combination of multiple display devices in order to form a large screen display environment called a video wall system is one of the functions achievable through combination and simultaneous operation of a plurality of individual image display devices. The term video wall generally refers to the generation of a combined image from the same video input by means of a plurality of image display devices as a single video wall image. The video wall may typically be arranged in the form of 1x4, 2x2, 3x3, 4x4 or much larger screen formats.

[0003] Video walls are basically preferred due to their capability to generate a very large screen whose tile layout can be customized by which a greater screen area and greater pixel density per unit cost can be achieved, which is advantageous due to manufacturing costs of single screens allowing an unusual resolution when combined.

[0004] Video walls are conventionally used in large public venues such as stadiums. Video walls are driven from multi-monitor video cards, but complex arrangements require special video processors capable to manage large video walls. Software based video wall controllers use PCs and networking equipment.

[0005] In video wall applications, each image display device of the system requires individual cable installation for effecting data communication with a central computer.

[0006] The video distribution is possible through different methods. One of the methods includes a central video distributor system and each image to be displayed on a single image display device is distributed by the central video distributor system. Video transmission lines are established by connection of all devices to the central video distributor system. Video transfer is typically effectuated by HDMI or DVI-D connections.

[0007] Another method uses serial connection between separate image display devices through which transfer of the whole video content to an adjacent image display device is performed. Appropriate divisioning of the video content by individual image display devices is conventionally ensured by an image processor of each image display device.

[0008] Among others, one of the prior art disclosures in the technical field of the present invention may be referred to as EP2328073, which discloses a video wall system which includes a plurality of display devices, each of the display devices including: a pair of input and output connectors comprising an input connector connected to a first neighboring display device among the plurality of display devices to input an image signal from the first neighboring display device, and an output connector connected to a second neighboring display device to output the input video signal; a signal processor which processes the input video signal; and a display which displays an image based on the processed video signal.

[0009] The present invention provides a system and method for programming of an image display device in a video wall system such that a plurality of image display devices are operated to create a combined screen area.

[0010] The present invention therefore provides an image display device operable as part of a video wall system as provided by the characterizing features defined in Claim 1.

[0011] Primary object of the present invention is hence to provide an image display device programmable for operating in a video wall system.

[0012] The invention proposes a video wall system having a plurality of image display devices, each one being individually set to zoom or enlarge a certain screen portion of the overall image or video content. Each image display device identifies and generates a particular dedicated screen portion based on its locational definition in a matrix-like web, such information containing the dimensions of the formed matrix-like web in which the location of each image display device is indexed to be identified by its row and column on two axes, initial positons of a screen portion on two axes to be cropped by each respective image display device of the video wall system and the unit lengths (X, Y) on the horizontal (x) and

vertical axis (y) of the video wall system.

[0013] The invention advantageously allows programming of each image display separately by end-users, thereby providing greater flexibility. The invention also allows simultaneous programming of a plurality of devices remotely, i.e. through appropriate control software simultaneously communicating with the respective control unit of each image display device to set operational parameters. This provides easy programming and practical setup for large video wall systems having many image display devices. A test and calibration step is performed to verify location of each mage display device in the video wall system.

[0014] Accompanying drawings are given solely for the purpose of exemplifying a video wall system whose advantages over prior art were outlined above and will be explained in brief hereinafter.

[0015] The drawings are not meant to delimit the scope of protection as identified in the claims nor should they be referred to alone in an effort to interpret the scope identified in the claims without recourse to the technical disclosure in the description of the present invention.

[0016] Fig. 1 demonstrates a general schematic view of a 4x4 video wall system according to the present invention.

[0017] The present invention proposes a video wall system with a multitude of image display devices, each device comprising at least one input connector. The video wall system's operation is effectuated such that each image display device is individually set to identify its particular enlarged screen portion of the overall screen as delineated below.

[0018] The video wall system of the invention is created by means of a plurality of image display devices, the latter together forming a combined very large screen in the form of a generally rectangular web. Each of the combined image display devices then generates and displays a certain dedicated portion of the video content so that the video content can be displayed on a combined large screen. Each of the image display devices comprises a control unit for identification and generation of the dedicated portion of the complete image or video content. Each image display device therefore processes the received image or video content to create a certain portion

of the overall screen area together with a plurality of neighboring or adjacent image display devices.

[0019] The video wall system therefore operates such that the image or video content is obtained in a much larger size than a single display device can display, by way of dividing the main image into a plurality of image portions for display on separate image display devices.

[0020] The image display devices may be connected to a video transmission line through respective input connectors. The connectors may typically be in the form of high definition multimedia interface (HDMI) or DVI-D type connectors. The source images are transferred to a plurality of image display devices while two neighboring image display devices can be placed vertically, horizontally or otherwise with respect to each other so that a generally rectangular shape large screen area is obtainable. Each image display device within the video wall system is configured to display a certain dedicated portion of the image or video content and accordingly divides the image or video content so as to generate a specially adapted portion thereof corresponding to the specific screen area of the overall combined screen size depending on the number of image display devices on the vertical and horizontal axes.

[0021] Therefore, each image display device dynamically process the received image or video content to identify its particular screen portion of the combined screen as will be delineated hereinafter.

[0022] The method of operation of the video wall system with a certain number of image display devices involves receiving of the video signal by all image display devices and displaying of a particular portion thereof as a processed video signal simultaneously and separately by each and every image display device.

[0023] Therefore, the present invention ensures that each image display device identifies the particular portion of the video to be displayed by setting the location of each image display device in a matrix-like web. Locational definition of the image display devices can be performed manually through a respective settings menu on the control interface of the image display device as will be delineated hereinafter.

[0024] The location information of each image display device is communicated to the respective control unit of the device through the settings menu thereof by way of indicating the size of the formed web as well as the specific position of a respective image display device in the web of the video wall system upon which each image display device can identify its particular video screen portion to be displayed. The dimension of the video wall is defined as the number of image display devices on horizontal and vertical axes. The location of each image display device is configured at the menu as a specific position on the horizontal and vertical axes of the video wall system. In a more specific manner, in a video wall system having six image display devices on the horizontal axis and five image display devices on the vertical axis, each image display device and the location thereof is indexed within the matrix and is identified by its row and column such as (1, 2), (5, 6) or the like.

[0025] The image display device, when analyzing the signal received from a video transmission line, identifies the particular video portion to be displayed based on the formula below, where "$A_{m,n}$" corresponds to the dimensions of the video wall system being formed and "a" identifies an image display device within the matrix of the video wall system.

[0026]

$$Am,n = \begin{matrix} a1,1 & \cdots & a1,n \\ \vdots & \ddots & \vdots \\ am,1 & \ldots & am,n \end{matrix}$$

[0027] In the formula below (X*(n-1)) and (Y*(m-1)) define the initial positons of a screen portion to be cropped by a respective image display device on the horizontal and vertical axes of the video wall system web. (X,Y) determines the unit length of the web on the horizontal and vertical axes.

[0028]

$$Am,n = \big(X*(n-1),Y*(m-1)\big)(X,Y)$$

[0029] In the formula below, X corresponds to the horizontal unit length of the web and n_{max} is the index number of the final element on the horizontal axis of the video wall web. The same analogy applies to Y as well. Y

corresponds to the vertical unit length of the matrix and m_{max} is the index number of the final element on the vertical axis of the web.

[0030]

$$X = \frac{\text{Resolution(x)}}{\text{nmax}}$$

[0031]

$$Y = \frac{\text{Resolution(y)}}{\text{mmax}}$$

[0032] Overall, the location of a respective image display device within the video wall matrix is determined based on the dimensions of the formed video wall, the unit lengths (X, Y) on the horizontal (x) and vertical axes (y) of the video wall and initial points of the respective device on horizontal and vertical axes.

[0033] In summary, the present invention proposes a video wall system having a multitude of image display devices in the form of a matrix-like web with each pair of image display devices being at least partially neighboring each other on a fist axis as well as on a second axis different than the first axis, each image display device of the video wall system comprising a control unit.

[0034] In one embodiment of the present invention, an image or video content is transferred to the multitude of image display devices and each image display device is individually set to process the image or video content identifying and generating a particular dedicated screen portion by way of dividing the overall image into a plurality of image portions corresponding to the specific screen area of an overall combined screen size depending on the number of image display devices on the first and second axes in the manner that the image or video content is displayed by the video wall system in a combined screen area of the multitude of image display devices.

[0035] In a further embodiment of the present invention, locational definition of the image display devices in the matrix-like web is performed such that information as to identification of the particular dedicated screen portion in

the form of the dimensions of the formed matrix-like web in which the location of each image display device is indexed to be identified by its row and column on two axes, initial positons of a screen portion on two axes to be cropped by each respective image display device of the video wall system and the unit lengths (X, Y) on the horizontal (x) and vertical axis (y) of the video wall system, is communicated to the control unit of the respective image display device.

[0036] In a further embodiment of the present invention, locational definition of an image display device in the matrix-like web is communicated to the control unit of the respective image display device through wired or wireless data communication links between a main control station and each image display device. The invention therefore allows simultaneous programming of a plurality of devices remotely, i.e. by a control software simultaneously communicating with the respective control unit of each image display device to set operational parameters. The software may typically require that each device connect to a local area network prior to the establishment of the video wall web. Simultaneous and wireless programming ensures practical setup for large video wall systems having many image display devices. A test and calibration step is typically performed to verify location of each mage display device in the video wall system.

[0037] In a further embodiment of the present invention, locational definition of an image display device in the matrix-like web is communicated to the control unit of the respective image display through inputting the dimensions of the formed matrix-like web, initial positons of the screen portion on two axes to be cropped by the image display device and the unit lengths (X, Y) on the horizontal (x) and vertical axis (y) of the video wall system through a respective settings menu of the image display device.

[0038] In a further embodiment of the present invention, each image display device comprises an image processor for identification and generation of an enlarged dedicated particular screen portion of a received overall image or video content.

[0039] In a further embodiment of the present invention, the fist axis is perpendicular to the second axis.

[0040] In a further embodiment of the present invention, an image display device for use in the video wall system is proposed.

[0041] In a further embodiment of the present invention, each image display device comprises input and output connectors by which a serial video transmission line is created in the manner that each image display device transfers the image or video signal to a neighboring image display device in the video wall system by means of respective input and output connectors through a unidirectional serial video transmission line established between a first and a final image display device.

[0042] In a further embodiment of the present invention, a method for operation of a video wall system with a certain number of image display devices forming a matrix-like web is proposed. The method comprises the steps of (a) transferring an image or video content to the certain number of image display devices, (b) individually setting each image display device of the video wall system to process the image or video content identifying and generating a particular dedicated screen portion by way of dividing the overall image into a plurality of image portions corresponding to the specific screen area of an overall combined screen size depending on the number of image display devices on a first and second axes in the manner that the image or video content is displayed by the video wall system in a combined screen area of the multitude of image display devices and (d) communicating to a control unit of each respective image display device locational information as to identification of the particular dedicated screen portion in the form of the dimensions of the formed matrix-like web in which the location of each image display device is indexed to be identified by its row and column on the first and second axes, initial positons of a screen portion on the axes to be cropped by each respective image display device of the video wall system and the unit lengths (X, Y) the axes of the video wall system.

[0043] The invention advantageously allows programming of each image display separately by end-users, thereby providing greater flexibility. The invention also allows simultaneous programming of a plurality of devices remotely by means of a control software simultaneously communicating with the

respective control unit of each image display device to set operational parameters. This latter system is particularly advantageous if the image display devices are equipped with network interface cards and can hence connect to a local network. Otherwise, they can still be manually set on an individual basis. As the operation of the video wall requires a simple and short-duration one-time setup, manual setting also affords great functionality.

Claims

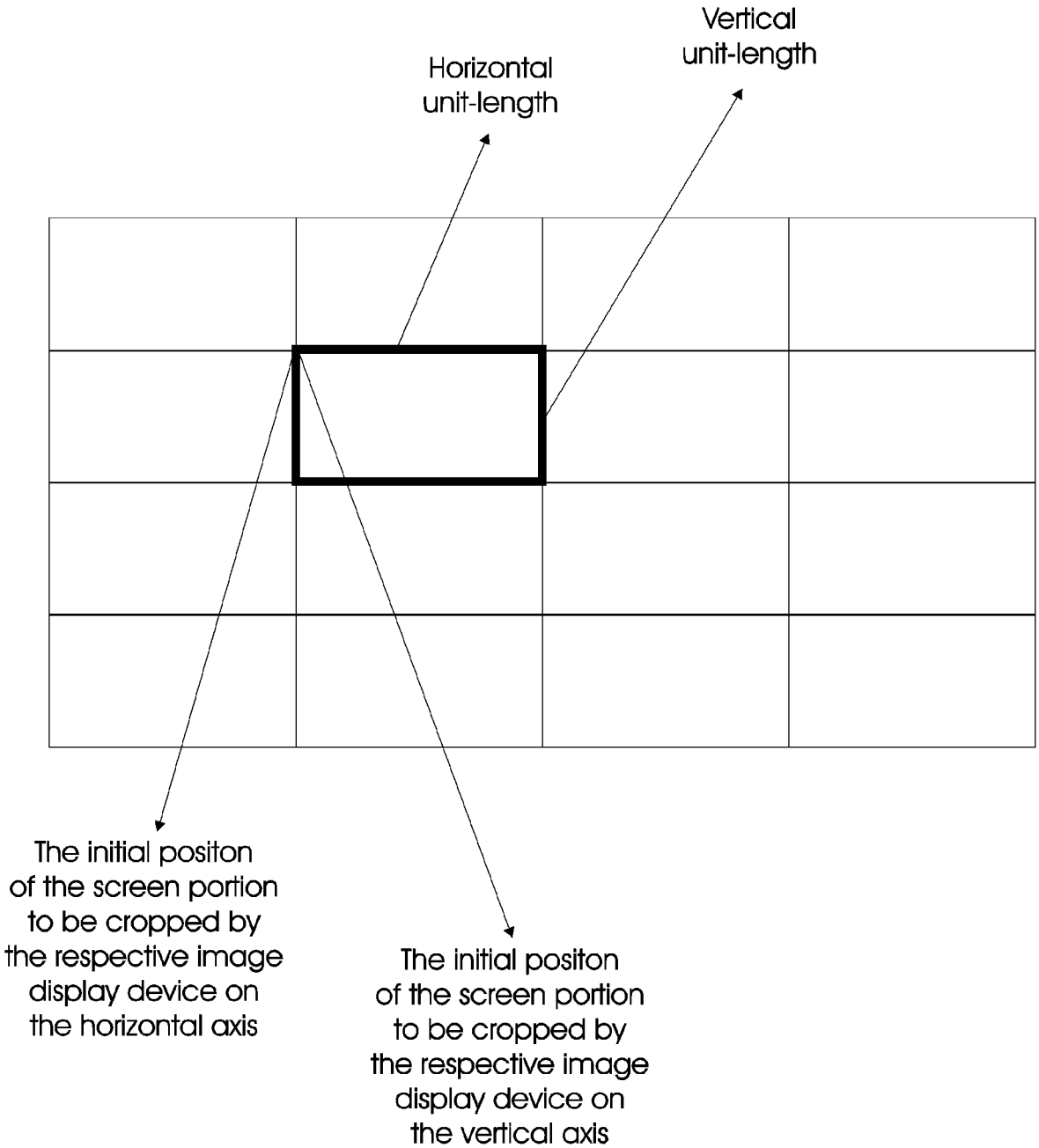
1. A video wall system having a multitude of image display devices in the form of a matrix-like web with each pair of image display devices being at least partially neighboring each other on a fist axis as well as on a second axis different than the first axis, each image display device of the video wall system comprising a control unit, **characterized in that**
an image or video content is transferred to the multitude of image display devices and each image display device is individually set to process the image or video content identifying and generating a particular dedicated screen portion by way of dividing the overall image into a plurality of image portions corresponding to the specific screen area of an overall combined screen size depending on the number of image display devices on the first and second axes in the manner that the image or video content is displayed by the video wall system in a combined screen area of the multitude of image display devices.
2. A video wall system as in Claim 1, **characterized in that** locational definition of the image display devices in the matrix-like web is performed such that information as to identification of the particular dedicated screen portion in the form of the dimensions of the formed matrix-like web in which the location of each image display device is indexed to be identified by its row and column on two axes, initial positons of a screen portion on two axes to be cropped by each respective image display device of the video wall system and the unit lengths (X, Y) on the horizontal (x) and vertical axis (y) of the video wall system, is communicated to the control unit of the respective image display device.
3. A video wall system as in Claim 2, **characterized in that** locational definition of an image display device in the matrix-like web is communicated to the control unit of the respective image display device through wired or wireless data communication links between a main control station and each image display device.
4. A video wall system as in Claim 2, **characterized in that** locational definition of an image display device in the matrix-like web is communicated to the control unit of the respective image display through inputting the dimensions of the

formed matrix-like web, initial positons of the screen portion on two axes to be cropped by the image display device and the unit lengths (X, Y) on the horizontal (x) and vertical axis (y) of the video wall system through a respective settings menu of the image display device.

5. A video wall system as in Claim 1, **characterized in that** each image display device comprises an image processor for identification and generation of an enlarged dedicated particular screen portion of a received overall image or video content.
6. A video wall system as in Claim 1, 2, 3 or 4, **characterized in that** the fist axis is perpendicular to the second axis.
7. An image display device used in the video wall system as explained in Claim 1, 2, 3 or 4.
8. A video wall system as in Claim 1, **characterized in that** each image display device comprises input and output connectors by which a serial video transmission line is created in the manner that each image display device transfers the image or video signal to a neighboring image display device in the video wall system by means of respective input and output connectors through a unidirectional serial video transmission line established between a first and a final image display device.
9. A method for operation of a video wall system with a certain number of image display devices forming a matrix-like web comprising the steps of (a) transferring an image or video content to the certain number of image display devices, (b) individually setting each image display device of the video wall system to process the image or video content identifying and generating a particular dedicated screen portion by way of dividing the overall image into a plurality of image portions corresponding to the specific screen area of an overall combined screen size depending on the number of image display devices on a first and second axes in the manner that the image or video content is displayed by the video wall system in a combined screen area of the multitude of image display devices and (d) communicating to a control unit of each respective image display device locational information as to identification of the particular dedicated screen portion in the form of the dimensions of the formed matrix-like web in which the location of each image display device is

indexed to be identified by its row and column on the first and second axes, initial positons of a screen portion on the axes to be cropped by each respective image display device of the video wall system and the unit lengths (X, Y) the axes of the video wall system.

Fig. 1


Vertical
unit-length
Horizontal
unit-length
The initial positon
of the screen portion
to be cropped by
the respective image
display device on
the horizontal axis
The initial positon
of the screen portion
to be cropped by
the respective image
display device on
the vertical axis

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/073212

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F3/14
ADD.

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)
G06F G09G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/271286 A1 (LI MIN [CN] ET AL) 28 October 2010 (2010-10-28) the whole document	1,5-7
X	US 2004/046772 A1 (OUCHI AKIHIRO [JP] ET AL) 11 March 2004 (2004-03-11) paragraphs [0080] - [0105]; figures 7-11 paragraphs [0002], [0011], [0020], [0044] - [0055]; figure 2	1-9

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

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 November 2015	14/12/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Demin, Stefan

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/073212

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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