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(54) Title: AN INTEGRATED METHOD FOR CAMERA PLANNING AND POSITIONING

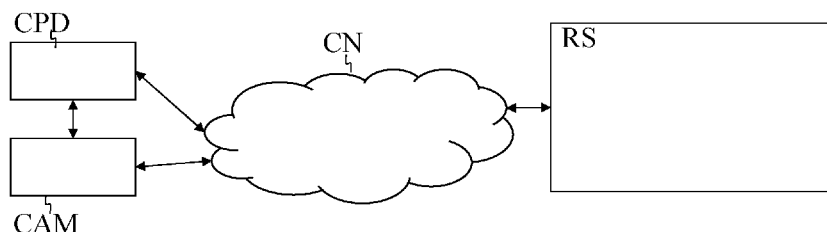


FIG. 1

(57) Abstract: The present invention relates to a method, a related system and related devices for calibrating a position of a Camera CAM for monitoring a predetermined area. The camera CAM being coupled to a remote server RS over a communications link where the remote server RS is able to receive media corresponding to said predetermined area to be monitored within an environment of said camera CAM. This media is recorded by the camera CAM and forwarded to said remote server RS over the communications link. The method comprises the step of determining camera position calibration instructions based on predefined camera position parameters defining said predetermined area to be monitored and actual camera position parameters identifying a current position of said camera as determined by a camera positioning device CPD.

AN INTEGRATED METHOD FOR CAMERA PLANNING AND POSITIONING

The present invention relates to a method for calibrating a position of a Camera according to the preamble of claim 1, a system for calibrating a position of a Camera according to the preamble of claim 4.

Such a method for calibrating a position of a Camera being well known in the art where such a method relates to the calibrating of a position of a Camera for monitoring a predetermined area in the environment of the camera. Such camera, typically is coupled to a remote server, for managing a plurality of such cameras over a communications link. The remote server is able to receive media corresponding to the predetermined area to be monitored within said surrounding/ environment of the camera, where this media is recorded by the camera and forwarded subsequently to the remote server over a communications link. The media received at the remote server may be displayed and inspected, together with media of a plurality of other cameras each monitoring a different area, at the site of the remote server.

When "Monitoring planning", "Installation & commissioning" and "Operation" phases are run by different entities, tools and processes, there is a significant risk of generating data mismatch and inefficiencies. Moreover additional inefficiencies are generated whenever camera installation is performed by different engineers depending on the type of activity; in a typical case is a cabling engineer does pull cables up to the desired location and terminates the cable (which typically supports Ethernet), an installation engineer installs the camera on the defined support and finally a configuration engineer needs to configure the camera, the network connections, positions the camera in the right direction and fastens the camera in order to have a predetermined view fully covering a predetermined area to be monitored as determined in an area monitoring plan.

This installation and calibration task could be combined in one profile, anyhow by doing so there would be a need to send highly skilled engineers and thus increase the overall implementation cost.

Furthermore, apart from the labour intensive approach, this installation approach is very error prone. Usually a large number of cameras are applied for monitoring a full area to be monitored in such a area monitoring plan where each camera monitors a predefined part of the full/entire area to be monitored, but wherein not the intended predetermined area to be monitored is not always covered by a camera. Hence there is overlap in area monitored by all of the cameras and/or parts of the full area to be monitored that are not covered by a camera. Alternatively, even a wrong cameras is addressed.

An objective of the present invention is to provide a method, system and related devices of the above known type but wherein the calibrating of a position of a Camera is performed in more efficient and less error prone manner.

According to the invention, this objective is achieved by the method described in claim 1, the system described in claim 4, the related position calibration device described in claim 7, the related remote server and the related calibration application as described in claim 11.

5 Indeed, by determining, by means of an application being executed by a calibrating device, camera position calibration instructions "(for a technician)" based on predefined camera position parameters defining/identifying the predetermined area to be monitored and actual camera position parameters determined by a said calibrating device. These camera position calibration instructions are instructions for a technician in order to adjust
10 the camera position in such that the predetermined area to be monitored by the camera in the surrounding/environment of the camera indeed is within the reach of the camera. In this way by following the generated instructions, a technician is able, in a fast, easy and reliable way to calibrate the position of the camera so that the predetermined area to be monitored by the camera is matched.

15 The predefined camera position parameters that characterize the predetermined area to be monitored by the camera, include at least one of the height of the camera the rotation angle of the camera, being the compass angle, the tilt of the camera (all related to a certain predefined X-Y-Z axis) and the viewing angle of the camera's lens in combination with possible variation in viewing angle, being the zoom value of the camera's lens .

20 Furthermore, these predefined parameters are matched with the actual parameters that are measured or determined by the calibration device by means of internal or coupled location sensors e.g. compass for determining the horizontal rotation angle being the compass angle, accelerometer for determining the actual tilt of the camera, image recognition module or digital zooming value for determining zoom.

25 Another characterizing embodiment of the present invention is described in claim 2 and claim 5.

 The predefined camera position parameters defining the predetermined area to be monitored include at least one of the height of the camera, the rotation angle of the camera, the tilt of the camera and the viewing angle of the camera's lens).

30 The actual camera position parameters determined by the calibrating device respectively include actual values of respectively the height of the camera, the rotation angle of the camera, the tilt of the camera and the viewing angle of the camera's lens. Then, the step of determining the camera position calibration instructions is performed based on the difference between the predefined camera position parameters defining the predetermined area to be
35 monitored and the by the calibration device measured actual camera position parameters.

A further advantageous characterizing embodiment of the present invention is described in claim 3.

Advantageously, by applying a coupling of the unique camera identification of the camera and the geographical location identifier can be used to uniquely identify the camera, preventing from the situation that media recorded at the camera and monitored by an operator the location is unknown or wrongly identified. Such coupling can be maintained in a storage device.

Such unique camera identification may be a communication address like MAC-address or any other unique identification like a serial number of the camera or another unique code preinstalled on the camera accessible through the Ethernet link and reported also on a label attached on the camera, label readable with barcode reader or even RFID could be applied.

The location identifier could be the GPS location of the camera or the location determined by localization means of the mobile communications network the camera positioning device is connected to or otherwise.

By initially coupling a camera communications address like a MAC address or an IP address with a geographical location the camera and its position can be identified uniquely when monitoring the media provide by a camera and furthermore any camera can be addressed uniquely using this coupling in case of installation or any maintenance activity.

Further characterizing embodiments of the present integrated method for Camera planning and positioning are mentioned in the appended claims.

It is to be noticed that the term 'comprising', used in the claims, should not be interpreted as being restricted to the means listed thereafter. Thus, the scope of the expression 'a device comprising means A and B' should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

Similarly, it is to be noticed that the term 'coupled', also used in the claims, should not be interpreted as being restricted to direct connections only. Thus, the scope of the expression 'a device A coupled to a device B' should not be limited to devices or systems wherein an output of device A is directly connected to an input of device B. It means that there exists a path between an output of A and an input of B which may be a path including other devices or means.

The above and other objects and features of the invention will become more apparent and the invention itself will be best understood by referring to the following description of an embodiment taken in conjunction with the accompanying drawings wherein:

Fig. 1 represents the system for calibrating a position of a Camera CAM for monitoring a predetermined area including a camera CAM and a remote server RS and a camera positioning device CPD,

Fig. 2 represents a functional representation of system calibrating a position of a Camera CAM including the functional representation of the camera positioning device CPD and a functional representation of the remote server RS as presented in Fig.1.

5 In the following paragraphs, referring to the drawing in FIG.1 and Fig. 2 an implementation of the system is described. In the second paragraph, all connections between mentioned elements are defined.

Subsequently all relevant functional means of the mentioned system as presented in FIG.2 are described followed by a description of all interconnections. In the succeeding paragraph the actual execution of the communication system is described.

10 A first essential element of system for calibrating a position of a Camera CAM for monitoring a predetermined area is a camera CAM, e.g. being a surveillance camera for monitoring an area in a certain town where the media recorded by the camera is being watched by an operator at a remote location. This camera may be mounted on wall a pole or otherwise being able to oversee the predetermined area to be monitored.

15 The operator, in addition may also monitor media recorded by a plurality of further surveillance cameras monitoring further other relevant parts of the town.

Although such a system for monitoring such an area usually comprises a plurality of surveillance cameras, for sake of clarity and simplicity only one such surveillance camera CAM is described in this embodiment.

20 A second relevant element is a remote server RS that is adapted to receive media corresponding to the predetermined area to be monitored within an environment of the camera CAM where this media is being recorded by said camera CAM and forwarded to the remote server RS over a communications link.

25 Furthermore, there is a Camera Positioning device CPD for assisting an technician in installing such camera. Such camera positioning device may be a smart phone having sensors for determining a compass angle a tilt of the smart phone, a height the smart phone is located, the GPS location of the device.

30 Alternatively the Camera Positioning device CPD may be any device with communications abilities and means for executing applications. Such device may have internal sensors for determining actual camera position parameters such as compass angle, a tilt of the smart phone, a height the smart phone is located, the GPS location of the device but may alternatively be coupled to external sensors for determining such actual camera position parameters.

35 The Camera Positioning device CPD is associated in such way that all measurements done with this Camera Positioning device CPD so that these are valid for the camera. The Camera Positioning device CPD can e.g. be mounted on the camera with a mold.

Both the camera CAM and the camera Positioning Device CPD are coupled to the remote server RS over a communications link. The coupling between the camera and the remote server may be an internet connection where the camera is identified by a MAC address and a IP address. The coupling between the camera positioning device and the remote server
5 RS may be supported by a mobile data connection such as UMTS.

The Camera Positioning device CPD comprises a Communications part CP, that is adapted to obtain predefined camera position parameters defining said predetermined area to be monitored. In this embodiment, this the communication part is adapted to obtain these predefined camera position parameters from the data storage in the or associated with the
10 remote server RS.

The Camera Positioning device CPD further comprises an Actual Camera position parameter obtaining part MPOP that is able to obtain the actual camera position parameters defining an area to currently being monitored and a Processing Part PP that is adapted to determine camera position calibration instructions based on the predefined camera position
15 parameters and the actual camera position parameters. The Actual Camera position parameter obtaining part MPOP may include sensors for determining the actual values of values of at least one of said height of the camera, the rotation angle of the camera, the tilt of the camera and the viewing angle of the camera's lens.

Furthermore the Camera Positioning device CPD, i.e. the Smartphone comprises
20 an Instruction presenting part IPP that is able to present the camera position calibration/adjusting instructions to a user of said Camera Positioning device. Such an Instruction presenting part IPP may be able to display the instructions on the screen using pictorials, written instructions or a combination thereof. Alternatively the Instruction presenting part IPP may be a speaker of the smart phone for providing the user with spoken instruction
25 solely or in addition to the instructions presented at the screen of the smart phone.

The communications part CP of the Camera Positioning device CPD, i.e. the smart phone is further adapted to provide the remote server at least with a location identifier of the camera CAM.

The location identifier may be the GPS location or the location of the camera
30 determined based on the mobile communications network of the smart phone CPD.

The Remote Server RS first comprises a communications part RCP that is able to communicate with the camera positioning device CPD i.e. the smart phone and a management part MP that is adapted to manage the predefined camera position parameters stored for the camera CAM in a data storage device DB. The data storage device may be internal or external
35 to the remote server RS.

The Remote Server RS further is adapted to store a camera communications address with a geographical location identifier of the camera, obtained from the camera

positioning device, together with the predefined camera position parameters in the data storage device DB.

The a Communications part CP has an input/output-terminal that is at the same time an input-output-terminal of the Camera Positioning device CPD. The Communications part CP further is coupled to the a Processing Part PP that in turn is coupled to the Instruction presenting part IPP. The Actual Camera position parameter obtaining part MPOP further is coupled with an a first output to an input of the Processing part and with a second output to an input of the communications part.

The Communications part RCP of the remote server RS has an input/output-terminal that is at the same time an input-output-terminal of the remote server RS. The Communications part RCP further is coupled to the management part MP that in turn is coupled to the data storage device DB that may be internal or external to the remote server RS.

In order to explain the execution of the present invention it is assumed that a surveillance camera needs to be installed at a certain location. In a initial planning phase the area to be monitored in a city map, landmark or private domain, defining the position of a camera, its video beam (direction or compass, tilt, zoom information) and attributes plus the capability to rollout data needed to efficiently configure and calibrate camera's are defined. This typically is done for the entire area to be monitored e.g. the city map wherefore a plurality of camera's are planned to cover the whole area to be monitored. For each camera the belonging position of the camera, its video beam (direction or compass, tilt, zoom information) and attributes plus capability to rollout data needed to efficiently configure and calibrate each camera are defined.

Subsequently, a camera needs to be placed at the predefined location in such way that the, in the camera coverage planning predefined area is covered indeed.

It is assumed that a the cabling for connecting the camera to the remote server is available already. The technician on location for installing this camera mounts the camera at the planned location directing at the predefined area to be monitored.

The meant camera first is connected and configured in the following way: First when the camera is connect to the remote server over a IP network, a Dynamic Host configuration Protocol module further referred to as a DHCP module, will detect the presence of a camera, query a MAC address and upon detection of a MAC address of the camera (being the unique identifier of the camera), the remote server, by means of the DHCP module it, will assign an Internet protocol Address, further referred to as an IP address, will query the camera for further information such as Camera Model, Manufacturer, optics mounted, technical parameters of the camera, version software installed on the camera etc. and will store this information together with the link between IP and MAC address in the data storage device DB

in a dedicated entry for this camera. The camera then is connected to the remote server and is known to the remote server.

At a certain moment the data storage device DB is populated with the planning data of the camera, i.e. the data for each camera defining the position and direction of the camera as defined in a planning phase wherein the coverage of an entire area e.g. the city is planned by applying a plurality of cameras where each camera monitors a predefined area of the whole city. For each camera the belonging position of the camera, its video beam (direction or compass, tilt, zoom information were defined and stored in the data storage device DB. This storing of this data is performed via the management part MP of the remote server.

Subsequently, the operator scans the MAC address indicated at the camera (using bar code and/or alphanumerical characters) or manually enters the indicated MAC address, where the MAC address is the unique identification of the camera using the Smartphone . The Smartphone will send to the server, the Identification of the camera, being the MAC address, the real GPS position. Advantageously this coupling of the unique identification of the camera and the location identifier being the GPS location can be used to uniquely identify the camera, preventing from the situation that media recorded at the camera and monitored by an operator the location is unknown or wrongly identified.

Now the server can built the complete information. The camera is installed, linked to the network and all camera data are stored on the data storage device DB.

Now, to further explain the execution of the present invention it is assumed that the coupling of the camera is performed as described above. The same technician start an application at the smart phone CPD that by means of the Communications part CP retrieves the predefined camera position parameters that define the predetermined area to be monitored. Here are the values for the compass angle, the camera tilt and zoom information retrieved from the data storage device DB using the MAC address of the camera. This retrieving from the data storage device DB and subsequent forwarding of this data is executed under control of the management part MP of the remote server RS. At the same time or subsequently, the Actual Camera position parameter obtaining part MPOP retrieves the actual camera position parameters defining an area to currently being monitored, being the actual values of the compass angle, the camera tilt and zoom information.

The processing Part PP, subsequently determines camera position calibration instructions by comparing each parameter of the predefined camera position parameters with the corresponding parameter of the actual camera position parameters. Based on the differences between each of the corresponding parameters an instruction for the technician is generated indicating the technician with an following action. These following actions could be

one or more of: change the compass angle, change the tilt of the camera, adapt the zooming, adjust focus.

Afterwards this process is repeated until all parameters of the predefined camera position parameters match substantially with the corresponding parameter of the actual camera position parameters.

Instructions can be provide via screen using spoken instructions or otherwise

The Media recorded by camera additionally may be forwarded to calibration device and displayed at display thereof.

The media e.g. may include discrete images or video.

It is to be noted that although the present invention is described in as client-server where the camera positioning device cooperates with the server for obtaining data with respect to the predefined area to be monitored, alternatively this data could be loaded immediately into the camera positioning device so that this device is able to position the camera on its own as standalone device where the data is obtained over a short range communications link like USB, Bluetooth or WIFI or even being entered manually.

. The recorded media still is to be forwarded to the camera positioning device directly over a further short range wired or wireless interface.

Another remark is that the camera height can be measured in different ways, also integrated, like a Bluetooth IR/ultrasonic device of the kind used in civil works industry to measure rooms volumes or windows measurements.

A final remark is that embodiments of the present invention are described above in terms of functional blocks. From the functional description of these blocks, given above, it will be apparent for a person skilled in the art of designing electronic devices how embodiments of these blocks can be manufactured with well-known electronic components. A detailed architecture of the contents of the functional blocks hence is not given.

While the principles of the invention have been described above in connection with specific apparatus, it is to be clearly understood that this description is merely made by way of example and not as a limitation on the scope of the invention, as defined in the appended claims.

CLAIMS

1. A method for calibrating a position of a Camera (CAM) for monitoring a predetermined area, said camera (CAM) being coupled to a remote server (RS) over a communications link, said remote server (RS) receiving media corresponding to said predetermined area to be monitored within an environment of said camera (CAM), being recorded by said camera (CAM) and forwarded to said remote server (RS) over said communications link, **CHARACTERIZED IN THAT** said method comprises the step of determining camera position calibration instructions based on predefined camera position parameters defining said predetermined area to be monitored and actual camera position parameters identifying a current position of said camera determined by a camera positioning device.

2. A method for calibrating a position of a Camera (CAM) according to claim 1, **CHARACTERIZED IN THAT** said predefined camera position parameters defining said predetermined area to be monitored include at least one of the height of the camera, the rotation angle of the camera, the tilt of the camera (and the viewing angle of the camera's lens); and

In that said actual camera position parameters determined respectively include actual values of at least one of said height of the camera, the rotation angle of the camera, the tilt of the camera and the viewing angle of the camera's lens; and

in that said step of determining, said camera position calibration instructions is performed based on the difference between said predefined camera position parameters and said actual camera position parameters.

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3 A method for calibrating a position of a Camera according to claim 2, **CHARACTERIZED IN THAT** said method further includes the step of coupling a a unique camera identifier with a geographical location identifier of aid camera.

4. A system for calibrating a position of a Camera (CAM) for monitoring a predetermined area, said system comprising said camera (CAM) and a remote server (RS), said camera (CAM) being coupled to said remote server (RS) over a communications link, said remote server (RS) being adapted to receive media corresponding to said predetermined area to be monitored within an environment of said camera (CAM), being recorded by said camera (CAM) and forwarded to said remote server (RS) over said communications link, **CHARACTERIZED IN THAT** said system further comprises a Processing Part (PP), adapted to determine camera position calibration instructions based on said predefined camera position

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parameters defining said predetermined area to be monitored and said actual camera position parameters defining said actual position of said camera (CAM).

5 5. A system for calibrating a position of a Camera (CAM) according to claim 4,
CHARACTERIZED IN THAT said predefined camera position parameters defining said
predetermined area to be monitored include at least one of the height of the camera, the
rotation angle of the camera, the tilt of the camera and the viewing angle of the camera's lens;
and

10 In that said actual camera position parameters determined respectively include
actual values of at least one of said height of the camera, the rotation angle of the camera, the
tilt of the camera and the viewing angle of the camera's lens; and

 in that said step of determining, said camera position calibration instructions is
performed based on the difference between said predefined camera position parameters and
said actual camera position parameters.

15

 6 A system for calibrating a position of a Camera (CAM) according to claim 4,
CHARACTERIZED IN THAT said system further includes localization part (LP) adapted to
couple a unique camera identifier with a geographical location identifier of said camera.

20 7. Camera Positioning device (CPD) for use in a system according to claim 4,
CHARACTERIZED IN THAT said camera positioning device (CPD) comprises;

 a. a Communications part (CP), adapted to obtain predefined camera position
parameters defining said predetermined area to be monitored;

25 b. an Actual Camera position parameter obtaining part (MPOP), adapted to obtain
actual camera position parameters defining an area to currently being monitored;

 c. a Processing Part (PP), adapted to determine camera position calibration
instructions based on said predefined camera position parameters and said actual camera
position parameters;

30 d. Instruction presenting part (IPP), adapted to present said camera position
calibration/adjusting instructions to a user of said Camera Positioning device.

 8. Camera Positioning device (CPD) according to claim 7, **CHARACTERIZED IN
THAT** said camera positioning device (CPD) comprises a communications part (CP) that is
further adapted to provide said remote server at least with a location identifier of said camera
35 (CAM).

9. Remote Server (RS) for use in system according to claim 4, **CHARACTERIZED IN THAT** said remote server (RS) comprises a management part (MP) adapted to manage said predefined camera position parameters stored for said camera (CAM) in a data storage device (DB).

5

10. Remote Server (RS) according to claim 9, **CHARACTERIZED IN THAT** said management part (MP) further is adapted to store a unique camera identifier with a geographical location identifier of said camera together with said predefined camera position parameters in said data storage device (DB).

10

11 Camera Positioning application for use in a system according to claim 4, **CHARACTERIZED IN THAT** said camera positioning application comprises;

a. a Communications part (CP), adapted to obtain predefined camera position parameters defining said predetermined area to be monitored; and

15

b. an Actual Camera position parameter obtaining part (MPOP), adapted to obtain actual camera position parameters defining an area to currently being monitored ?;

c. a Processing Part (PP), adapted to determine camera position calibration instructions based on said predefined camera position parameters and said actual camera position parameters.

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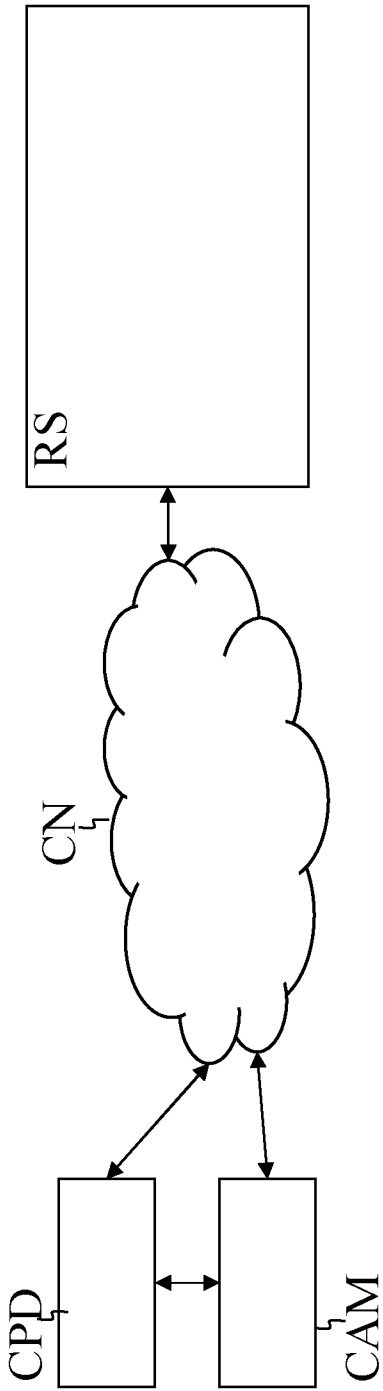


FIG. 1

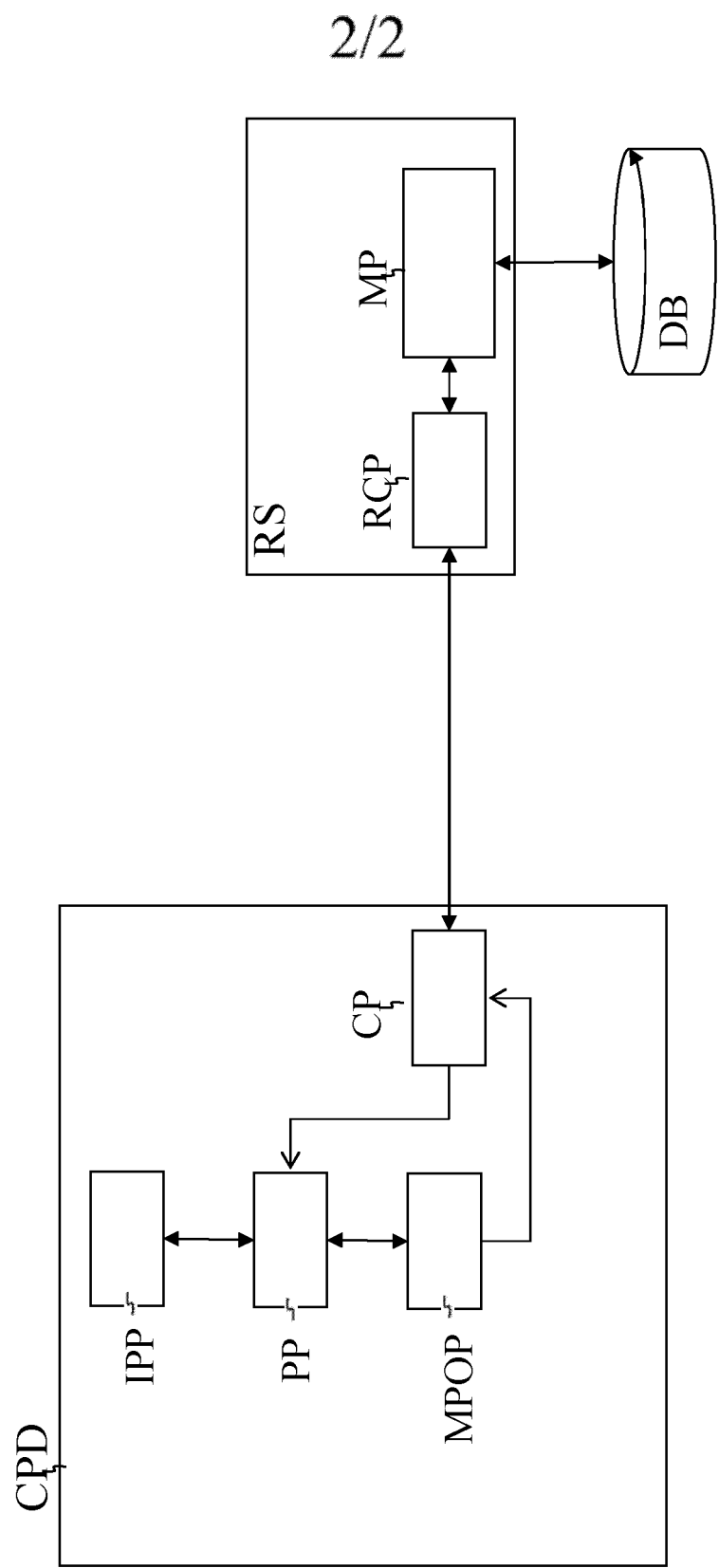


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/073600

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06T7/00 H04N5/232 H04N7/18
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)
H04N G06T

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 practical, 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 2005/140783 A1 (AKAMATSU KENJI [JP]) 30 June 2005 (2005-06-30) abstract paragraph [0004] - paragraph [0007] paragraph [0009] - paragraph [0013] paragraphs [0016], [0023] paragraph [0039] - paragraph [0047] paragraph [0055] - paragraph [0056] figures 3-5, 8,9 ----- -/--	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

28 February 2012

Date of mailing of the international search report

07/03/2012

Name and mailing address of the ISA/

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Katsoulas, Dimitrios

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2011/073600

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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