

SYSTEM AND METHOD FOR CONFIGURING SURVEILLANCE CAMERAS
USING MOBILE COMPUTING DEVICES

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Patent Application No. 15/076,713 filed on March 22, 2016, which is incorporated herein by reference in its entirety.

[0002] This application is related to:

[0003] U.S. Application number 15/076,701, filed on March 22, 2016, entitled “Method and system for surveillance camera arbitration of uplink consumption,” attorney docket number 0340.0001US1;

[0004] U.S. Application number 15/076,703, filed on March 22, 2016, entitled “Method and system for pooled local storage by surveillance cameras,” attorney docket number 0340.0002US1;

[0005] U.S. Application number 15/076,704 filed on March 22, 2016, entitled “System and method for designating surveillance camera regions of interest,” attorney docket number 0340.0003US1;

[0006] U.S. Application number 15/076,705, filed on March 22, 2016, entitled “System and method for deadzone detection in surveillance camera network,” attorney docket number 0340.0004US1;

[0007] U.S. Application number 15/076,706 filed on March 22, 2016, entitled “System and method for overlap detection in surveillance camera network,” attorney docket number 0340.0005US1;

[0008] U.S. Application number 15/076,708, filed on March 22, 2016, entitled “System and method for retail customer tracking in surveillance camera network,” attorney docket number 0340.0006US1;

[0009] U.S. Application number 15/076,709, filed on March 22, 2016, entitled “Method and system for modeling image of interest to users,” attorney docket number 0340.0007US1;

[0010] U.S. Application number 15/076,710, filed on March 22, 2016, entitled “System and method for using mobile device of zone and correlated motion detection,” attorney docket number 0340.0008US1;

[0011] U.S. Application number 15/076,712, filed on March 22, 2016, entitled "Method and system for conveying data from monitored scene via surveillance cameras," attorney docket number 0340.0009US1;

[0012] and

[0013] U.S. Application number 15/076,717, filed on March 22, 2016, entitled "System and method for controlling surveillance cameras," attorney docket number 0340.0011US1.

[0014] All of the afore-mentioned applications are incorporated herein by this reference in their entirety.

BACKGROUND OF THE INVENTION

[0015] Video surveillance systems are often deployed in schools, government buildings, small businesses, retail stores and corporate offices, and even many residences. These surveillance systems are typically comprised of surveillance cameras that capture image data, image data storage systems that store the image data along with possibly metadata, and increasingly analytics systems that analyze the image data and possibly generate the metadata.

[0016] The installation of surveillance systems is often complex and time consuming. First, an installer has to identify and select locations throughout the building, for example, to install the surveillance cameras. Next, the installer has to physically mount the surveillance cameras in the building and supply them with power. Data connections between the surveillance cameras and the image data storage systems and possibly the analytics systems must then be established. In many cases, this requires running data cables from data transmission devices (e.g., routers, switches, and hubs) to all of the devices, although wireless systems are becoming increasingly common.

[0017] After the physical installation, the installer must then configure the systems. Generally, configuration of the surveillance camera systems is tedious, requiring the installer to repeatedly enter configuration information such as device names, Internet Protocol (IP) addresses, media access control (MAC) addresses, device locations, and/or port settings for devices. In many cases, the installer has to travel between different locations throughout the building to configure the various components, the network, and any monitoring station.

[0018] Recently, the surveillance camera systems have begun using open standards. Among other advantages, this enables users to more easily access the image data from the surveillance cameras. On user devices such as computer workstations and mobile computing devices such as tablets, smart phones and laptop computers, users can access and select image data from specific surveillance cameras for real-time viewing upon and downloading to the user devices. In addition, the users on the user devices can also access previously recorded image data stored on the image data storage systems.

[0019] Another trend concerns the analytics systems, which are becoming increasingly powerful. Often, the analytics systems will track moving objects against fixed background models. More sophisticated functions include object detection to determine the presence of an object or classify the type of object or event. The analytics systems generate video primitives or metadata for the detected objects and events, which the analytics systems can further process or send over the data networks to other systems for storage and incorporation into the image data as metadata, for example.

[0020] While analytics systems have historically been separate systems apart from the surveillance cameras, the surveillance cameras themselves are increasingly providing this functionality. Integrating the analytics functionality within the cameras themselves has advantages. It eliminates the cost and maintenance associated with deploying a separate analytics system to accomplish the same objective, and enables more efficient analysis by eliminating the messaging overhead associated with sending the image data over the data network for analysis by the separate analytics systems, in examples.

[0021] Similar trends have emerged in the case of image data storage systems. Surveillance cameras are being offered that include image data storage on the camera itself. Such surveillance cameras are especially attractive to smaller organizations such as stores, small companies, and local offices that want to reduce installation and maintenance expenses. Each camera can function as a stand-alone unit, and as a result there is no need to have a specialized image data storage system. With the advent of improved image compression on one hand, and the decreasing costs of data storage on the other hand, each surveillance camera is often able to store substantially larger amounts of image data than it generates.

[0022] At the same time, remote cloud image data storage systems are also available. These systems can offer a number of advantages over local image data storage systems.

The organizations have fewer components to buy and install, which lowers both purchase and depreciation cost. Organizations can also pay on a per usage basis for infrequently used value-added services. Finally, the service providers of the cloud storage systems bear the responsibility of maintaining and upgrading the storage systems and their capabilities, the cost of which the service providers can share across their managed clients.

SUMMARY OF THE INVENTION

[0023] The present invention concerns a method and system for configuring surveillance cameras. It can be used to leverage many of the previously discussed trends, while also enabling the configuration of cameras to operate in such systems.

[0024] In general, according to one aspect, the invention features a method for configuring surveillance cameras. The method comprises displaying configuration images on user devices, deriving the configuration images from image data from the surveillance cameras, and pairing configuration information from the user devices with corresponding surveillance cameras by reference to the configuration images.

[0025] The step of displaying the configuration images could comprise displaying QR codes, for example.

[0026] Typically, image data from the surveillance cameras is sent to a registration server that derives the configuration images from the image data and pairs the configuration information from the user devices with the surveillance cameras. In examples, the user device configuration information includes location information for the surveillance cameras or user account information for owners of the surveillance cameras. The configuration images are derived from image data from the surveillance cameras using a remote analytics system or an analytics system integrated within the surveillance cameras.

[0027] In another example, the camera configuration information includes camera type information. Moreover, unregistered surveillance cameras can periodically sending image data to a registration server, which is used to pair the configuration information from the user device with the corresponding surveillance cameras. The method can also additionally store image data from the surveillance cameras to a cloud storage system after registration of the surveillance cameras.

[0028] In general, according to another aspect, the invention features a surveillance camera system. The surveillance camera system includes user devices on which configuration images are displayed, surveillance cameras, and a registration server. The surveillance cameras generate image data of the user devices on which the configuration images are displayed, and the registration server pairs configuration information from the user devices with corresponding surveillance cameras by reference to the configuration images. In one example, the configuration images are test patterns.

[0029] The above and other features of the invention including various novel details of construction and combinations of parts, and other advantages, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular method and device embodying the invention are shown by way of illustration and not as a limitation of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] In the accompanying drawings, reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale; emphasis has instead been placed upon illustrating the principles of the invention. Of the drawings:

[0031] Fig. 1 is a schematic diagram showing surveillance cameras along with a technician with a mobile computing device in a registration process in which a registration server supplies configuration images to the mobile computing device and analyzes the image data from the surveillance cameras;

[0032] Fig. 2 is a sequence diagram showing a process for registering a surveillance camera by deriving the configuration images from the image data to pair the surveillance camera with configuration information entered via mobile computing devices; and

[0033] Fig. 3 is a schematic diagram illustrating the organization of information in the registration database.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] The invention now will be described more fully hereinafter with reference to the accompanying drawings, in which illustrative embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be

construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0035] As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. Further, the singular forms including the articles "a", "an" and "the" are intended to include the plural forms as well, unless expressly stated otherwise. It will be further understood that the terms: includes, comprises, including and/or comprising, when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. Further, it will be understood that when an element, including component or subsystem, is referred to and/or shown as being connected or coupled to another element, it can be directly connected or coupled to the other element or intervening elements may be present.

[0036] Fig. 1 shows an exemplary surveillance camera and image data storage system 10 to which the present invention is applicable.

[0037] The system 10 includes surveillance cameras 103 along with possibly other security devices installed at a premises 52 of an organization. The surveillance cameras 103 generate image data 250 and communicate with each other and with other security devices over a local (enterprise) network 210 which may be wired, wireless, or a hybrid of wired and wireless links.

[0038] A number of approaches may be employed in the alternative or in a hybrid fashion to store the image data 250 generated by the surveillance cameras 103-1, 103-2, 103-3. A local image data storage system 212 is shown, deployed on the local network 210. In other examples, each or some of the cameras 103 includes a camera image data storage system 174. Further, streams of image data 250 can be transferred over a network cloud 50 to a cloud or remote image data storage system 310.

[0039] The image data 250 can then be accessed over the network cloud 50 by user mobile computing devices 400 such as smartphones, tablet computing devices, laptop computer running operating systems such as Windows, Android, Linux, or IOS, in examples. User mobile computing devices 400 are also referred to as user devices. Each

user device 400 includes a display screen or touch screen 402 and one or more applications 412, or "apps." The apps 412 execute upon the operating systems of the user devices 400.

[0040] A specific example showing how the cameras might be deployed is illustrated. Within the premises 52, camera1 103-1 focuses upon person 60 located within an aisle. Camera2 103-2 detects motion of individuals 60 near a door 62 providing entry to or exit from the premises 52. Finally, camera3 103-3 detects motion near a safe 64.

[0041] Other components of the system 10 are the video analytics systems. A cloud video analytics system is shown 312 that receives the image data from the surveillance cameras 103 via the network cloud 50. Here, the cloud video analytics system 312 might be managed by a third party hosting company and is presented to the enterprise local network 210 as a single virtual entity, in one example. In other examples, the analytics system is installed on the local network 210 and may be owned by the same business entity as the surveillance camera system 10. Further, an optional camera analytics system 176 integrated within one or more of the surveillance cameras 103 is another option.

[0042] Also shown is a registration server 314 and a registration database 316 on the network 318 of the cloud system. In one example, the registration server 314 is used to maintain user accounts for organizations that own surveillance camera systems 10. As a result, this registration server 314 is used, in one example, as part of a service that enables access to dedicated storage in the cloud image data storage system 310 for various organizations that subscribe to the service. In one embodiment, the registration server 314 includes a web server.

[0043] The registration server 314 could further be used to provide access to other services. It could provide subscribing organizations with remote analytics of the image data generated by the surveillance cameras 103 in the cloud video analytics system 312. In still other examples, the registration server 314 would use the cloud system to distribute image data 250 from the surveillance cameras 103 such as to user devices 400.

[0044] As part of a registration process, as the surveillance cameras 103 are installed by an installer 60, for example, it is necessary to associate those surveillance cameras 103 with configuration information such as the account for the organization owning the premises 52 and/or subscribing to services available on the cloud network 318. Further, configuration information such as where are the surveillance cameras are installed, names for each of the surveillance cameras, the type and model of surveillance cameras 103

should also be stored to the registration database 316 in various examples. Still further, device data such as Internet Protocol (IP) addresses, media access control (MAC) addresses is also typically stored in connection with each of the surveillance cameras 103 and in connection with the account of the organization that owns or manages the surveillance cameras 103.

[0045] In the illustrated example, the pairing between the surveillance cameras 103 and the configuration information is achieved by using a user device 400 typically operated by the installer 60.

[0046] In more detail, the installer 60 places the user device 400 such that the surveillance camera is able to capture an image of the display 402 of the user device. That is, the display 402 of the user device 400 is placed within the field of view 105 of the surveillance camera 103-1 by the installer 60.

[0047] Displayed on display 402 is a configuration image 410. In one example, this configuration image is a Quick Response (QR) code. Moreover, this configuration image 410 is preferably supplied by the registration server 314. In one example, the registration server 314 downloads the image when the installer 60 invokes a camera registration web page supplied by the registration server 314. In other examples, the configuration image 410 is included in or accessed by or generated by an app 412 that is installed on the user device 400.

[0048] The image data 250 collected by the surveillance camera 103-1 is then processed on an analytics system. This could be the integrated analytic system 176, a local analytics system 212 installed on the local network 210 or the cloud video analytics system 312.

[0049] Wherever the image data is processed, the configuration image 410 is extracted and passed to the registration server 314 or otherwise compared to the configuration image 410 provided to the user device. This allows the registration server 314 to pair configuration information entered, for example, at the user device 400 with the specific surveillance camera 103-1 that captured the configuration image displayed by the user device 400.

[0050] Fig. 2 shows the process for pairing a surveillance camera with configuration information entered at a user device 400, for example.

[0051] In more detail, upon startup, the surveillance camera 103-1 sends a request to the registration server 314 for an IP address in step 608. In one example, the request references a preconfigured Universal Resource Locator (URL) of the registration server 314 for this purpose. After receiving an IP address 264 (in the example, "10.10.10.1") from the registration server 314, the process transitions to step 610.

[0052] During normal operation, the surveillance camera 103-1 stores image data to image data storage in step 610. In one example, a discrete local image data storage system 212 is used. In other examples, integrated image data storage 174 located on the surveillance camera receives the image data 250. In still other examples, the image data could be stored in the cloud image data storage system 310.

[0053] The surveillance camera 103-1 begins sending image data 250 to the registration server 314 in step 612. In one example, the surveillance camera 103-1 sends the image data periodically, such as once a minute or when the surveillance camera is triggered to enter into a configuration mode. The surveillance camera can be triggered to enter the configuration mode in response to an installer pressing an associated button on the surveillance camera, in response to the installer selecting a configuration mode setting within the app 412 executing on the user device 400, or when the surveillance camera 103-1 is first powered-on and has never been configured before, in examples.

[0054] At the same time or in a generally contemporaneous fashion, the app 412 installed on the user device 400 is controlled by the installer 60 to send a "request to register" message to the registration server 314 in step 614.

[0055] In one example, a configuration image 410 is then sent by the registration server 314 to the app 412 executing on the user device 400 in step 616. The app could also generate this image and send it to the server 314. In one example, the configuration image 410 is a QR code. The image type, however, is not critical. The configuration image might be any random or predefined image or pattern, such as a test pattern.

[0056] The app 412 displays the configuration image 410 on the display 402 of the user device 400. In this way, in step 618, the configuration image is presented to the surveillance camera 103-1 so that the surveillance camera 103-1 can include the configuration image 410 within image data 250-1 of the scene that the surveillance camera 103-1 captures.

[0057] In this process, the user device 400 and specifically the app 412 executing on the user device sends configuration information to the registration server 314 in step 620. As discussed previously, this configuration information includes possibly a user account for the owner of the surveillance camera 103. Additional information, such as where the surveillance camera 103-1 is installed is also sometimes entered at the user device 400 and sent to the registration server 314. Other information such as a name for the surveillance camera, the type and model of surveillance camera 103 should also be passed to the registration server 314 and stored to the registration database 316, in various examples.

[0058] In step 622, the configuration image is sent to the registration server 314 by the surveillance camera 103-1 in conjunction with surveillance camera information obtained from the surveillance camera 103-1. In one example, the configuration image 410 is included in image data 250-1 captured by the surveillance camera 103-1.

[0059] Configuration information can include information such as the assigned Internet Protocol (IP) address 264, media access control (MAC) address, camera type and serial number, in examples. The configuration information can then be sent to the registration server 314 and stored in connection with the surveillance camera 103-1 and in connection with the account of the organization that owns or manages the surveillance cameras 103 in the registration database 316.

[0060] In step 624, the registration server 314 extracts the configuration image 410 (e.g. QR code) sent by the surveillance camera 103 in step 622. In this case, the registration server 314 derives the configuration image 410 from the image data 250-1 sent by the surveillance camera 103-1. To accomplish this, the registration server 314 sends the image data 250-1 to the cloud video analytics system 312, which then extracts the configuration image from the image data 250-1. In other examples, the configuration image 410 is extracted from the image data 250-1 using the local analytics system or an integrated analytic system 176 of the surveillance camera. In any event, the registration server 314 extracts and matches the configuration image 410 (e.g. QR code) with the user device 400 and probably with configuration information such as the user account that was typically entered at the user device 400.

[0061] In step 626, the registration server 314 associates the surveillance camera 103-1 with the user account and any other configuration information added at the user device 400

by the installer 60, for example, and/or provided by the surveillance camera 103-1. This information is stored in the registration database 316, in one example.

[0062] In one specific example, the registration database 316 or the registration server 314 allocates cloud storage in step 628 for the surveillance camera 103-1. Then, the registration server 314 sends path information for the cloud image data storage system to the local image data storage 212 in step 630. As a result, in step 632, image data 250-2 can now be stored to the cloud image data storage system 310 either directly by the surveillance camera 103-1 or by the local image data storage 212. In other examples, other services could be made available to the surveillance camera 103-1 such as image analytics provided by the cloud video analytics system 312.

[0063] Figure 3 schematically illustrates exemplary content of the registration database 316. Specifically, the registration database holds many user accounts 330, account #1 330-1...account #n, account #(n+1). For each of the accounts 330, configuration information 332-1, 332-2 is stored for each of the surveillance cameras 103 that have been associated with that account 330-1. This configuration information might include the location where each surveillance camera 103 is installed, the type of surveillance camera, and any image data storage profile information, such as the location within the cloud image data storage system 310 where the image data 250 from each surveillance camera is stored.

[0064] While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention encompassed by the appended claims.

CLAIMS

What is claimed is:

1. A method for configuring surveillance cameras, comprising:
displaying configuration images on user devices;
deriving the configuration images from image data from the surveillance cameras; and
pairing configuration information from the user devices with corresponding surveillance cameras by reference to the configuration images.
2. The method according to claim 1, wherein displaying the configuration images comprises displaying QR codes.
3. The method according to claim 1, wherein the image data from the surveillance cameras is sent to a registration server that derives the configuration images from the image data and pairs the configuration information from the user devices with the surveillance cameras.
4. The method according to claim 3, wherein the user device configuration information includes location information for the surveillance cameras.
5. The method according to claim 3, wherein the user device configuration information includes user account information for owners of the surveillance cameras.
6. The method according to claim 3, wherein the configuration images are derived from image data from the surveillance cameras using a remote analytics system or an analytics system integrated within the surveillance cameras.
7. The method according to claim 3, wherein the camera configuration information includes camera type information.
8. The method according to claim 1, further comprising unregistered surveillance cameras periodically sending image data to a registration server, which is used to

pair the configuration information from the user device with the corresponding surveillance cameras.

9. The method according to claim 1, further comprising storing image data from the surveillance cameras to a cloud storage system after registration of the surveillance cameras.

10. A surveillance camera system, comprising:

user devices on which configuration images are displayed;
surveillance cameras for generating image data of the user devices on which the configuration images are displayed; and
a registration server that pairs configuration information from the user devices with corresponding surveillance cameras by reference to the configuration images.

11. The system according to claim 10, wherein the configuration images are QR codes.

12. The system according to claim 10, wherein the registration server receives the image data from the surveillance cameras and pairs the configuration information from the user devices with the surveillance cameras using the configuration images.

13. The system according to claim 12, wherein the user device configuration information includes location information for the surveillance cameras.

14. The system according to claim 12, wherein the user device configuration information includes user account information for owners of the surveillance cameras.

15. The system according to claim 12, wherein the camera configuration information includes camera type information.

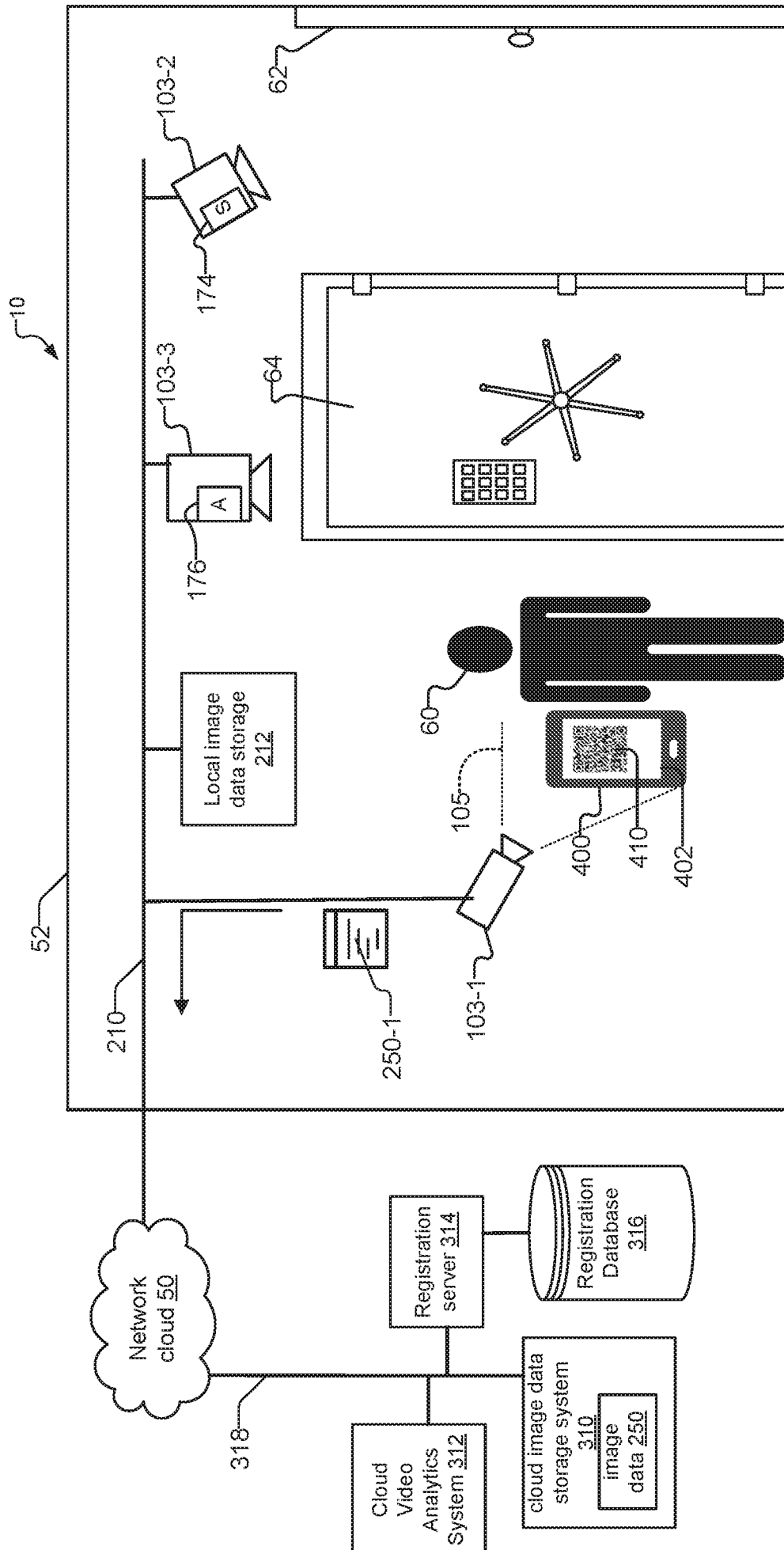
16. The system according to claim 10, wherein the surveillance cameras periodically send image data to the registration server, which is used to pair the configuration information from the mobile device with the corresponding surveillance cameras.

17. The system according to claim 10, further comprising a cloud storage system for storing image data from the surveillance cameras after registration of the surveillance cameras.

18. The system according to claim 10, further comprising a remote analytics system that derives the configuration images from the image data from the surveillance cameras.

19. The system according to claim 10, further comprising an analytics system integrated within the surveillance cameras that derives the configuration images from the image data.

20. The system according to claim 10, wherein the configuration images are test patterns.





 DEPARTMENT OF HEALTH AND HUMAN SERVICES

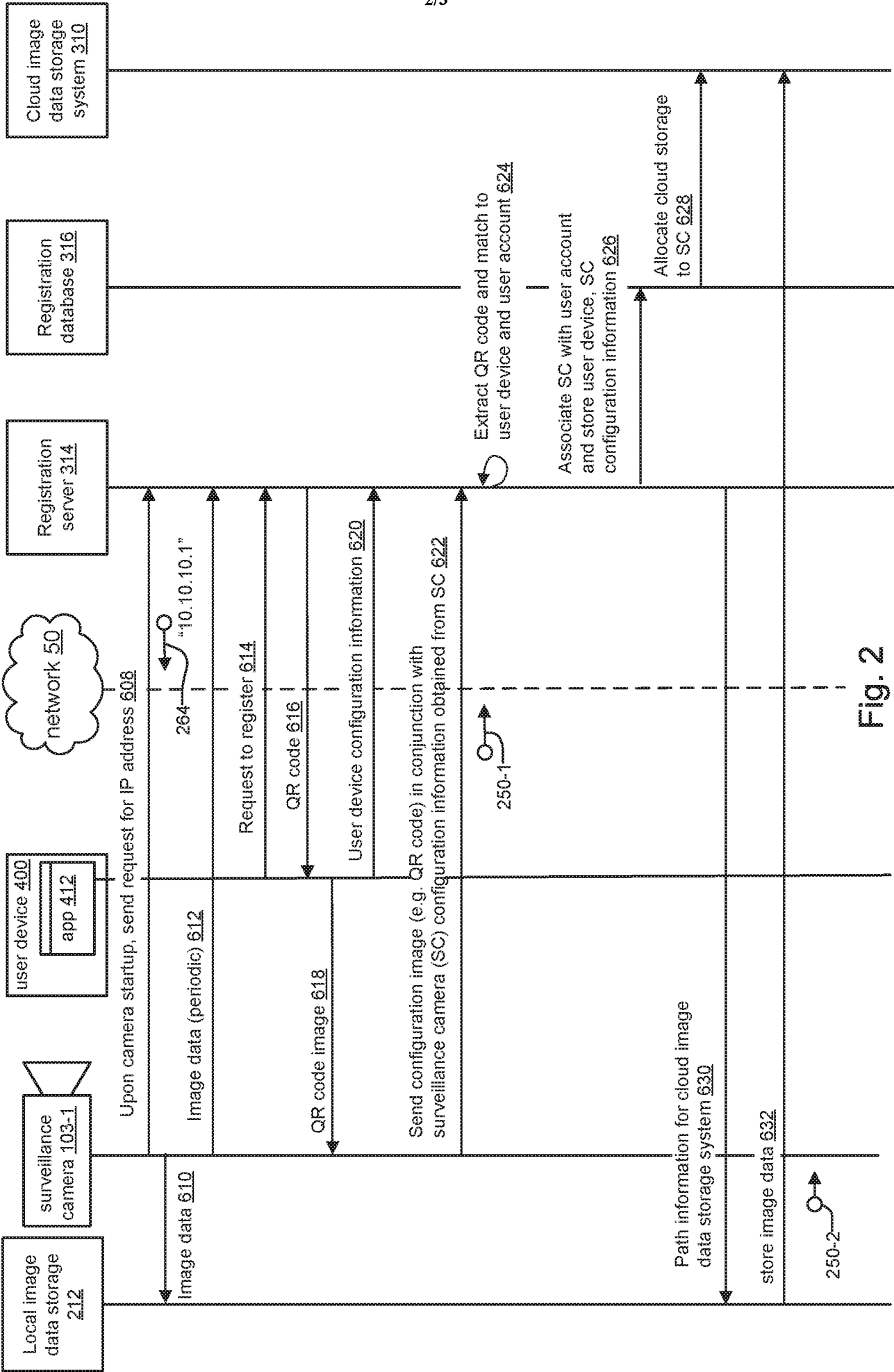


Fig. 2

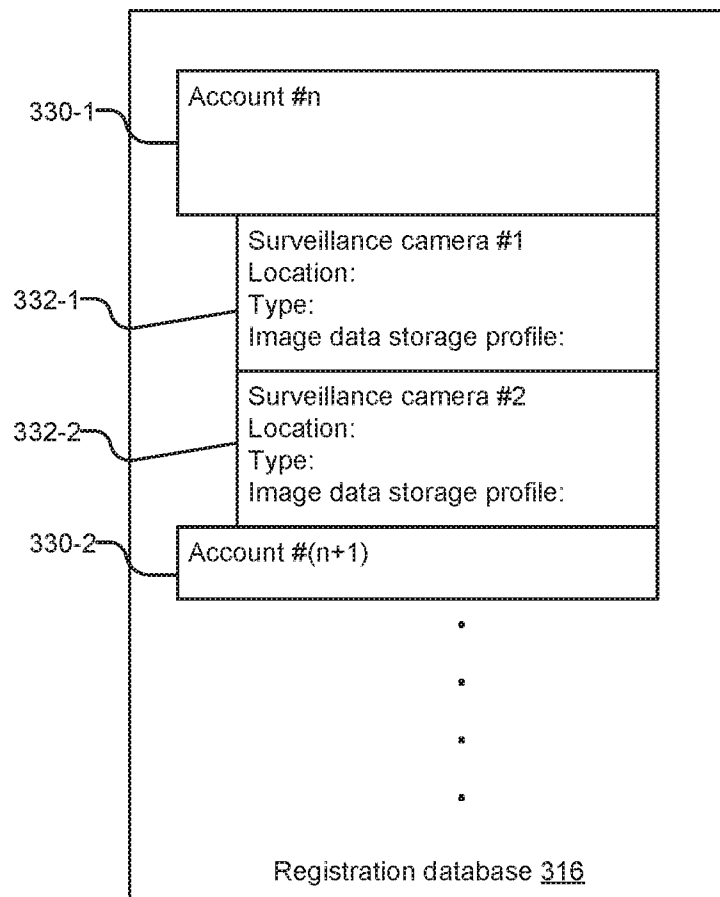


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/023444

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08B13/196 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)
G08B H04N

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 2014/211018 A1 (DE LIMA DIOGO STRUBE [BR] ET AL) 31 July 2014 (2014-07-31) paragraph [0009] - paragraph [0022]; figures 1-4	1-20
X	US 2013/169801 A1 (MARTIN STEVEN D [US] ET AL) 4 July 2013 (2013-07-04) paragraph [0056] - paragraph [0072] paragraph [0082] - paragraph [0085] paragraphs [0090], [0095]; figures 1-5	1-20
X	US 2010/110212 A1 (KUWAHARA NAOKI [JP] ET AL) 6 May 2010 (2010-05-06) paragraphs [0002] - [0004], [0032] - [0041]; figures 1,2	1,2,10, 11,19,20
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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 application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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

"&" document member of the same patent family

Date of the actual completion of the international search

13 June 2017

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21/06/2017

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2017/023444

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/223625 A1 (DE WAAL MENNO [NL] ET AL) 29 August 2013 (2013-08-29) claims 1-5 -----	1,2,10, 11,19,20
X	US 2013/278780 A1 (CAZIER ROBERT P [US] ET AL) 24 October 2013 (2013-10-24) paragraph [0049] - paragraph [0051]; figure 2 -----	1,2,10, 11,19,20
A	US 2003/169337 A1 (WILSON JEREMY CRAIG [NZ] ET AL) 11 September 2003 (2003-09-11) abstract -----	1-15
A	US 2015/215583 A1 (CHANG YEE-HSIANG SEAN [US]) 30 July 2015 (2015-07-30) paragraph [0041]; figure 5 -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/023444

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014211018 A1	31-07-2014	NONE	
US 2013169801 A1	04-07-2013	CN 105359516 A EP 2798840 A2 US 2013169801 A1 WO 2013101504 A2	24-02-2016 05-11-2014 04-07-2013 04-07-2013
US 2010110212 A1	06-05-2010	JP 2010114584 A US 2010110212 A1	20-05-2010 06-05-2010
US 2013223625 A1	29-08-2013	CA 2865550 A1 CN 104255024 A EP 2820839 A2 JP 5905976 B2 JP 2015509679 A US 2013223625 A1 WO 2013128287 A2	06-09-2013 31-12-2014 07-01-2015 20-04-2016 30-03-2015 29-08-2013 06-09-2013
US 2013278780 A1	24-10-2013	NONE	
US 2003169337 A1	11-09-2003	GB 2394341 A US 2003169337 A1	21-04-2004 11-09-2003
US 2015215583 A1	30-07-2015	NONE	