



(51) International Patent Classification:
H04N 7/18 (2006.01)

(21) International Application Number:
PCT/MY2014/000137

(22) International Filing Date:
29 May 2014 (29.05.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PI2013702289 28 November 2013 (28.11.2013) MY

(71) Applicant: MIMOS BERHAD [MY/MY]; Technology Park Malaysia, 57000 Kuala Lumpur (MY).

(72) Inventors: NG, Seh Chun; c/o MIMOS Berhad, Technology Park Malaysia, 57000 Kuala Lumpur (MY). CHI-ENG, Heng Tze; c/o MIMOS Berhad, Technology Park Malaysia, 57000 Kuala Lumpur (MY). TING, Kee Ngoh; c/o MIMOS Berhad, Technology Park Malaysia, 57000 Kuala Lumpur (MY). CHOONG, Khong Neng; Mimos

Berhad, Technology Park Malaysia, 57000 Kuala Lumpur (MY).

(74) Agent: TAY, Wee Chao; c/o Author IP, No. 2-3, Taman Arosa, Jalan Haji Jaib, 84000 Muar, Johor (MY).

(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, LT, 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, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

[Continued on next page]

(54) Title: VIDEO SURVEILLANCE SYSTEM AND METHOD

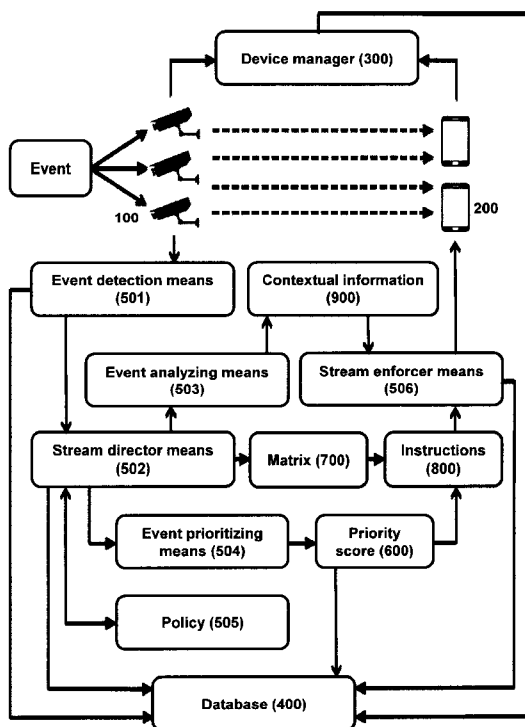


FIGURE 1

(57) Abstract: Disclosed herein is a video surveillance system that analyzes an event captured by at least one camera (100), and intelligently pairs the at least one camera (100) with at least one client device (200) and therefore allowing the at least one client device (200) to stream at least one live video from the at least one camera (100). The pairing is based on a number of factors comprising event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), location of the at least one client device (200), how the at least one client device (200) is registered to the device manager (300), network conditions, or a combination thereof. The system is also able to intelligently couple the at least one live video stream with useful contextual information based on the analyzed results. A video surveillance method for the same is also disclosed herein.



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).

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

Declarations under Rule 4.17:

- *as to the identity of the inventor (Rule 4.17(i))*

Published:

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

VIDEO SURVEILLANCE SYSTEM AND METHOD

TECHNICAL FIELD OF THE INVENTION

- 5 The present invention relates generally to a video surveillance system and a method for the same, and more particularly to an intelligent video surveillance system and a method for the same.

10 BACKGROUND OF THE INVENTION

- Surveillance system has been widely implemented nowadays for the purpose of monitoring activities and events that may or may not involve people. It is normally utilized to allow end users to justify and take appropriate actions based on the activities and events. For instance, surveillance system allows law
15 enforcers to identify a criminal activity such as burglary activity, and take appropriate actions in order to prevent the criminal activity or to capture the criminals that are responsible for the criminal activity.

- There are many ways to do so, and one of the most common ways is by means
20 of imagery/electronic equipment such as closed-circuit television (CCTV), cameras, video cameras, etc. Surveillance system that uses such imagery/electronic equipment is normally termed video surveillance system, and is connected to a recording device or a wired or wireless IP network. This particularly system normally requires handling and management by human
25 personnel, which is the cause for a number of disadvantages.

- For one disadvantage, a security guard may not be swift enough to analyze a particular event, and therefore would not be able to take appropriate actions such as informing a right party, or streaming a live video stream to a right party.
30 For another disadvantage, an event may occur in a very short time, allowing no time for a security guard to fully comprehend and analyse the short event, thus once again appropriate actions could not be taken. Additionally, as such video surveillance system involves human personnel, human errors are bound to

happen. For instance, a security guard may misinterpret an event, and therefore a wrong party is being informed, or a live video stream is forwarded to a wrong party. For another instance, a security guard may miss an occurrence of an event, and therefore is totally unaware of it, resulting in no action being taken at all.

Apart from the above, human personnel would not be able to provide accurate contextual information to end users of video surveillance system. In addition to the video footages and images conveyed to end users, contextual information is additional information that is equally important and useful for the end users to make a better decision, and take the most appropriate action.

Therefore, it has become an aim of the present invention to introduce a video surveillance system and a video surveillance method that overcome the discussed disadvantages, specifically, a video surveillance system and a video surveillance method that analyze an event, intelligently and accurately pair and stream live video streams from cameras to client devices, and coupling the live video streams with useful and accurate contextual information, all without human intervention.

SUMMARY OF THE INVENTION

The first technical aspect of the present invention is directed to a video surveillance system. The system is able to analyze an event captured by at least one camera, and thereafter intelligently pair the at least one camera with at least one client device based on several factors. The pairing allows the at least one client device to stream at least one live video stream from the at least one camera. In addition to the above, the system is also capable of coupling the at least one live video stream with useful contextual information based on the analyzed results.

According to an embodiment of the present invention, the video surveillance system comprises at least one camera that is continuously monitoring an area;

at least one client device that is in standby mode to be paired with and stream at least one live video stream from the at least one camera; a device manager for managing the at least one camera and the at least one client device; and a database for storing information of the at least one camera and information of the at least one client device; characterized in that the system further comprises an event detection means for detecting an occurrence of an event via the at least one camera; an event analyzing means for extracting and analyzing information of the event; a stream director means for determining pairing configurations of the at least one camera and the at least one client device based on a number of factors comprising event type, event conditions, event severity, degree of informative contents captured by the at least one camera, location of the at least one client device, how the at least one client device is registered to the device manager, network conditions, or a combination thereof, wherein the pairing configurations can be one camera to one client device, one camera to many client devices, many cameras to one client device, or many cameras to many client devices; an event prioritizing means for determining a priority score for the event based on event type, event conditions, event severity, network conditions, number of active live video streams, priority score of active live video streams, number of new live video streams, or a combination thereof; and a stream enforcer means for pairing the at least one camera and the at least one client device according to the pairing configurations determined by the stream director means and the priority score determined by the event prioritizing means, thus allowing the at least one client device to stream the at least one video stream from the at least one camera, and coupling the at least one live video stream with contextual information based on the analyzed results produced by the event analyzing means.

The second technical aspect of the present invention is directed to a video surveillance method. The method allows an event captured by at least one camera to be analyzed, and thereafter intelligently pairs the at least one camera with at least one client device based on several factors. The pairing allows the at least one client device to stream at least one live video stream from the at least one camera. In addition to the above, the method allows the at least one video

stream to be coupled with useful contextual information based on the analyzed results.

According to an embodiment of the present invention, the video surveillance method comprises the steps of having at least one camera to continuously monitor an area; having at least one client device in standby mode to be paired with and stream at least one live video stream from the at least one camera; managing the at least one camera and at least one client device; and storing information of the at least one camera and information of the at least one client device in a database; characterized in that the method further comprises the steps of detecting an occurrence of an event via the at least one camera; extracting and analyzing information of the event; determining pairing configurations of the at least one camera and the at least one client device based on a number of factors comprising event type, event conditions, event severity, degree of informative contents captured by the at least one camera, location of the at least one client device, how the at least one client device is registered to the device manager, network conditions, or a combination thereof, wherein the pairing configurations can be one camera to one client device, one camera to many client devices, many cameras to one client device, or many cameras to many client devices; determining a priority score for the event based on event type, event conditions, event severity, network conditions, number of active live video streams, priority score of active live video streams, number of new live video streams, or a combination thereof; pairing the at least one camera and the at least one client device according to the determined pairing configurations and the determined priority score; streaming the at least one video stream from the at least one camera to the at least one client device; and coupling the at least one live video stream with contextual information based on the analyzed results.

30

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates the video surveillance system of the present invention and the involved elements;

Figure 2 illustrates an example of graphical user interface (GUI) of a client device; and

- 5 Figure 3 is a flow chart depicting the video surveillance method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

- 10 The above mentioned and other features and objects of this invention will become more apparent and better understood by reference to the following detailed description. It should be understood that the detailed description made known below is not intended to be exhaustive or limit the invention to the precise disclosed form as the invention may assume various alternative forms. On the
15 contrary, the detailed description covers all the relevant modifications and alterations made to the present invention, unless the claims expressly state otherwise.

- The term “event” used herein means dynamic events, which may comprise fire
20 event, flood event, burglary event, thievery event, traffic accident event, traffic violation event, and other emergency or non-emergency events that are determined by an administrator of the system and method of the present invention.

- 25 The term “camera” used herein means video cameras, closed-circuit television (CCTV) cameras, and other cameras that have the capability to capture and record images or videos.

- The term “client device” used herein means mobile or non-mobile devices that
30 have image viewing capability, or live or non-live video playback capability.

The present invention comprises two fundamental technical aspects, which will be fully described herein with the aid of accompanying figures. The first

fundamental technical aspect relates to a video surveillance system, whereas the second fundamental technical aspect relates to a video surveillance method.

We now refer to the first fundamental technical aspect and Figure 1. The video surveillance system of the present invention is a system that enables an event captured by at least one camera (100) to be thoroughly analysed, intelligently pairs the at least one camera (100) with at least one client device (200) via wired or wireless network based on several factors therefore allowing streaming of at least one live video stream from the at least one camera (100) to the at least one client device (200), and couples the at least one live video stream with contextual information (900) based on the analysed results.

The aforesaid system comprises at least one camera (100); at least one client device (200); a device manager (300); a database (400); an event detection means (501); an event analyzing means (503); a stream director means (502); an event prioritizing means (504); and a stream enforcer means (506).

All of the aforesaid elements will now be elaborated in details.

The at least one camera (100) of the present system is always in operation. In other words, the at least one camera (100) is always capturing and recording images or videos, continuously monitoring an area.

The at least one client device (200) of the present system is always in standby mode. In other words, the at least one client device (200) is always ready to be paired with the at least one camera (100), and thereafter to stream at least one live video stream from the at least one camera (100).

The device manager (300) of the present system is introduced generally to manage the at least one camera (100) and the at least one client device (200). In other words, the main responsibility of the device manager (300) is to gather as much information as it can in order for the present system to intelligently pair the at least one camera (100) and the at least one client device (200) during an

occurrence of an event, of which will become more apparent at a later part of this document.

The device manager (300) is capable to discover the at least one camera (100) and other cameras (100) that may or may not be in the vicinity. The locations of all those discovered cameras (100) will subsequently be identified as well. Further, the device manager (300) allows an administrator of the present system to name and group all the discovered cameras (100).

10 The device manager (300) is also capable to discover the at least one client device (200) and other client devices (200) that may or may not be in the vicinity. Those discovered client devices (200) will subsequently be registered to the device manager (300). The registration of the discovered client devices (200) can be done based on event type. For example, one of the discovered client devices (200) may be registered to the device manager (300) to receive notification relating to fire event. The registration of the discovered client devices (200) can also be done based on department of which they belong to. For example, one of the discovered client devices (200) belongs to personnel of traffic department, and therefore it may be registered to the device manager (300) to receive notification on traffic accident event, traffic violation event, and other events that relate to traffic. The locations of those discovered client devices (200), in terms of which access points they are associated with, will also be identified, and regularly updated. This is prudent as only the discovered devices (200) that are in the vicinity of an event will be notified. For example, two of the discovered client devices (200), namely Client Device A and Client Device B, are registered to the device manager (300) to receive notification relating to thievery event, wherein the location of Client Device A is in a town, and the location of Client Device B is out of the town. During a thievery event in the town, only Client Device A will be notified of the thievery event, whereas Client Device B will not be notified. Further, the device manager (300) allows the administrator of the present system to name and group all the discovered client devices (200) based on how they are registered to the device manager (300).

The database (400) of the present system is introduced generally to store any information of the at least one camera (100) and any information of the at least one client device (200) that are presented by the device manager (300). Therefore, all the aforesaid information such as name, grouping, location, and
5 any other information of the at least one camera (100) and the at least one client device (200) that are gathered by the device manager (300) are stored in the database (400). All event histories are stored in the database (400) as well.

The event detection means (501) of the present system is introduced to detect
10 an occurrence of an event via the at least one camera (100). Once the event is detected, the event detection means (501) generates an event notification, which is then forwarded to the stream director means (502) to inform about the occurrence of the event. The event notification may comprise any information relating to the event and/or the at least one camera (100) that captures and
15 records the occurrence of the event, such as event identity, event type, event timestamp, camera identity of the at least one camera (100) that captures and records the occurrence of the event, at least one event snapshot captured by the at least one camera (100), or a combination thereof. Such event notification contains important information, and therefore it is stored in the database (400).

20

The stream director means (502), which upon receiving the event notification will initially check if there is more than one similar event notification. If yes, the stream director means (502) will consolidate all those similar event notifications, and store such consolidation in the database (400).

25

Thereafter, the stream director means (502) forwards the event notification to the event analyzing means (503) for analysis. In other words, the event analyzing means (503) extracts information from the event notification, and analyzes it. This is crucial as the extracted and analyzed information will be converted to
30 contextual information (900), which will be coupled with the at least one live video stream at a later stage. The coupling of the contextual information (900) to the at least one live video stream will be discussed at a later part of this document. The analysis can be carried out in many ways. One of the ways is to

have the event analyzing means (503) extracts the at least one event snapshot captured by the at least one camera (100) from the event notification and analyzes it. For example, the event snapshot depicts a car that violates a traffic regulation. In this case, the event analyzing means (503) will extract and analyze
5 any information that relates to the car such as the car registration number, the car model, the car colour, number of passengers, etc., and present the analyzed results as contextual information (900).

Soon after the stream director means (502) forwards the event notification to the
10 event analyzing means (503), the stream director means (502) determines pairing configurations of the at least one camera (100) and the at least one client device (200), which can be one camera (100) to one client device (200), one camera (100) to many client devices (200), many cameras (100) to one client device (200), or many cameras (100) to many client devices (200). The selection
15 of the at least one camera (100) and the at least one client device (200), and to pair them together are done based on several factors such as event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), location of the at least one client device (200), how the at least one client device (200) is registered to the device manager (300),
20 network conditions, or a combination thereof. To be more specific, the stream director means (502) identifies the at least one camera (100) that detects the occurrence of the event, a camera group that the at least one camera (100) belongs to, and all other cameras (100) that belong to the just identified camera group. Subsequently, the stream director means (502) selects the at least one
25 camera (100) and any other cameras (100) from the just identified cameras based on event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), network conditions, or a combination thereof. The stream director means (502) also identifies the at least one client device (200), a client device group that the at least one client device
30 (200) belongs to, and all other client devices (200) that belong to the just identified client device group. Subsequently, the stream director means (502) selects the at least one client device (200) and any other client devices (200) from the just identified client devices (200) to be paired with the at least one

selected camera (100) based on event type, event conditions, event severity, location of the at least one client device (200), how the at least one client device (200) is registered to the device manager (300), network conditions, or a combination thereof.

5

After the pairing configurations are determined, the stream director means (502) presents the pairing configurations in a form of matrix (700) based on a policy (505), which determines how the matrix (700) is formed. Examples of the pairing configurations in the form of matrix (700) are as below:

10

- one camera (100) to one client device (200)
[CAM(x1),Device(y1)]
- one camera (100) to many client devices (200)
[CAM(x1),Device{y1,y2,...,yn}]
- 15 • many cameras (100) to one client device (200)
[CAM{x1,x2,...,xn},Device(y1)]
- many cameras (100) to many client devices (200)
[CAM{x1,x2,...,n},Device{y1,y2,...,yn}]

20 Then, the stream director means (502) proceeds to generate at least one instruction (800) based on the matrix (700), which may comprise the matrix (700), the event identity, and any other information that may be necessary for the stream enforcer means (506) to perform the pairing of the at least one camera (100) and the at least one client device (200).

25

Additionally, the instruction (800) is tagged with a priority score (600), which is determined by the event prioritizing means (504) based on event type, event conditions, event severity, network conditions, number of active live video streams, priority score of active live video streams, number of new live video streams, or a combination thereof. In general, less critical event will be given a lower priority score (600), whereas more critical event will be given a higher priority score (600). For example, a fire event will have a higher priority score (600) than a traffic violation event (600). For another example, a fire event

30

involving three buildings will have a higher priority score (600) than a fire event involving only one building (600). Therefore, when the network is congested, the event with higher priority score (600) will be prioritized and streamed from the at least one camera (100) to the at least one client device (200). Each priority score (600) contain a pre-defined stream configuration such as frame rate and resolution. Hence, the event with higher priority score (600) will be streamed from the at least one camera (100) to the at least one client device (200) with higher frame rate and resolution. Such priority score (600) contains important information, and therefore it is stored in the database (400).

10

The stream enforcer means (506), upon receiving the instructions (800), pairs the at least one camera (100) with the at least one client device (200) according to the pairing configurations determined by the stream director means (502) and the priority score (600) determined by the event prioritizing means (504), which ultimately allows the at least one client device (200) to stream the at least one video stream from the at least one camera (100). Specifically, the pairing is executed by having the stream enforcer means (506) to interact with and provide the at least one client device (200) with any information necessary for the at least one client device (200) to interact with and request the at least one live video stream from the at least one camera (100), wherein the information may comprise IP address of the at least one camera (100), the analyzed results produced by the event analyzing means (503), event timestamp, or a combination thereof. All the aforesaid information can be packed into a message for easy delivery and interaction between the stream enforcer means (506) and the at least one client device (200). Once the at least client device (200) receives the message, it is then able to request and stream the at least one live video stream from the at least one camera (200).

Thereafter, the at least one client device (200) informs the stream enforcer means (506) about the streaming. Then, the stream enforcer means (506) enters this information into the database (400) and starts to couple the at least one live video stream with contextual information (900) based on the analyzed results produced by the event analyzing means (503). The contextual information (900)

30

can be presented in the forms of images, texts, audio, augmented live video streams, or a combination thereof. Referring now to Figure 2, it is shown an example of graphical user interface (GUI) of a client device (200). As it can be seen here, the client device (200) is streaming from six cameras (100), therefore
5 having six live video streams. The first and fifth live video streams consist of contextual information (900), which is in the form of augmentation. The augmentation can be in many ways such as highlighting of a particular detail in the live video stream with a box, a colour, or a combination thereof. The live video streams are also accompanied by other contextual information (900) in the
10 forms of images, texts, and audio, all of which may be presented in a separate window.

Once the streaming has ended, the at least one client device (200) will inform the stream enforcer means (506), which subsequently enters this information
15 into the database (400).

We now refer to the second fundamental technical aspect, Figure 1, and Figure 3. The video surveillance method of the present invention is a method that enables an event captured by at least one camera (100) to be thoroughly
20 analysed, intelligently pairs the at least one camera (100) with at least one client device (200) via wired or wireless network based on several factors therefore allowing streaming of at least one live video stream from the at least one camera (100) to the at least one client device (200), and couples the at least one live video stream with contextual information (900) based on the analysed results.

25

The aforesaid method comprises the first step of having at least one camera (100) to continuously monitor an area. The at least one camera (100) should always be in an operation mode, capturing and recording images or videos.

30 The second step is to have at least one client device (200) to be always in standby mode. In other words, the at least one client device (200) is always ready to be paired with the at least one camera (100), and thereafter to stream at least one live video stream from the at least one camera (100).

The third step is to manage the at least one camera (100) and the at least one client device (200) (11). At this point, information relating to the at least one camera (100) and the at least one client device (200) is gathered as much as possible in order to allow the present method to intelligently pair the at least one camera (100) and the at least one client device (200) during an occurrence of an event, of which will become more apparent at a later part of this document.

Specifically, the management of the at least one camera (11) comprises discovering the at least one camera (100) and other cameras (100) that may or may not be in the vicinity, identifying the locations of all those discovered cameras (100), and naming and grouping all the discovered cameras (100).

Specifically, the management of the at least one client device (11) comprises discovering the at least one client device (200) and other client devices (200) that may or may not be in the vicinity, registering those discovered client devices (200), and naming and grouping all the discovered client devices (200) based on how they are registered.

The registration of the discovered client devices (200) can be done based on event type. For example, one of the discovered client devices (200) may be registered to the device manager (300) to receive notification relating to fire event. The registration of the discovered client devices (200) can also be done based on department of which they belong to. For example, one of the discovered client devices (200) belongs to personnel of traffic department, and therefore it may be registered to the device manager (300) to receive notification on traffic accident event, traffic violation event, and other events that relate to traffic. The locations of those discovered client devices (200), in terms of which access points they are associated with, will also be identified, and regularly updated. This is prudent as only the discovered devices (200) that are in the vicinity of an event will be notified. For example, two of the discovered client devices (200), namely Client Device A and Client Device B, are registered to the device manager (300) to receive notification relating to thievery event, wherein

the location of Client Device A is in a town, and the location of Client Device B is out of the town. During a thievery event in the town, only Client Device A will be notified of the thievery event, whereas Client Device B will not be notified.

- 5 The subsequent step involves storing information of the at least one camera (100) and information of the at least one client device (200), which are gathered in the prior step, in a database (400) (12). Therefore, all the aforesaid information such as name, grouping, location, and any other information of the at least one camera (100) and the at least one client device (200) are stored in the
10 database (400). All event histories are stored in the database (400) as well.

- The next step involves detecting an occurrence of an event via the at least one camera (100) (13). Once the event is detected, an event notification is generated to inform about the occurrence of the event. The event notification may comprise
15 any information relating to the event and/or the at least one camera (100) that captures and records the occurrence of the event, such as event identity, event type, event timestamp, camera identity of the at least one camera (100) that captures and records the occurrence of the event, at least one event snapshot captured by the at least one camera (100), or a combination thereof. Such event
20 notification contains important information, and therefore it is stored in the database (400). If there is more than one similar event notification, those similar event notifications will be consolidated and such action will be entered into the database (400).

- 25 Thereafter, the event notification is subjected to analysis. In other words, information from the event notification is extracted and analyzed (14). This is a crucial step as the extracted and analyzed information will be converted to contextual information (900), which will be coupled with the at least one live video stream at a later stage. The coupling of the contextual information (900) to
30 the at least one live video stream will be discussed at a later part of this document. The analysis can be carried out in many ways. One of the ways is to extract the at least one event snapshot captured by the at least one camera (100) from the event notification and analyzes it. For example, the event snapshot

depicts a car that violates a traffic regulation. In this case, any information that relates to the car such as the car registration number, the car model, the car colour, number of passengers, etc. will be extracted, analyzed, and presented as contextual information (900).

5

Soon after that, pairing configurations of the at least one camera (100) and the at least one client device (200) are determined (15). The pairing configurations can be one camera (100) to one client device (200), one camera (100) to many client devices (200), many cameras (100) to one client device (200), or many cameras (100) to many client devices (200). The selection of the at least one camera (100) and the at least one client device (200), and to pair them together are done based on several factors such as event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), location of the at least one client device (200), how the at least one client device (200) is registered to the device manager (300), network conditions, or a combination thereof. To be more specific, the step of determining pairing configurations further comprises a first step of identifying the at least one camera (100) that detects the occurrence of the event, a camera group that the at least one camera (100) belongs to, and all other cameras (100) that belong to the just identified camera group; a second step of selecting the at least one camera (100) and any other cameras (100) from the just identified cameras based on event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), network conditions, or a combination thereof; a third step of identifying the at least one client device (200), a client device group that the at least one client device (200) belongs to, and all other client devices (200) that belong to the just identified client device group; and a fourth step of selecting the at least one client device (200) and any other client devices (200) from the just identified client devices (200) to be paired with the at least one selected camera (100) based on event type, event conditions, event severity, location of the at least one client device (200), how the at least one client device (200) is registered to the device manager (300), network conditions, or a combination thereof.

After the pairing configurations are determined (15), the pairing configurations are presented in a form of matrix (700) based on a policy (505), which determines how the matrix (700) is formed. Examples of the pairing configurations in the form of matrix (700) are as below:

- 5
 - one camera (100) to one client device (200)
[CAM(x1),Device(y1)]
 - one camera (100) to many client devices (200)
[CAM(x1),Device{y1,y2,...,yn}]
- 10
 - many cameras (100) to one client device (200)
[CAM{x1,x2,...,xn},Device(y1)]
 - many cameras (100) to many client devices (200)
[CAM{x1,x2,...,n},Device{y1,y2,...,yn}]
- 15 Subsequently, at least one instruction (800) is generated based on the matrix (700), which may comprise the matrix (700), the event identity, and any other information that may be necessary for performing the pairing of the at least one camera (100) and the at least one client device (200).
- 20 Additionally, the instruction (800) is tagged with a priority score (600), which is determined based on event type, event conditions, event severity, network conditions, number of active live video streams, priority score (600) of active live video streams, number of new live video streams, or a combination thereof (16). In general, less critical event will be given a lower priority score (600), whereas
- 25 more critical event will be given a higher priority score (600). For example, a fire event will have a higher priority score (600) than a traffic violation event (600). For another example, a fire event involving three buildings will have a higher priority score (600) than a fire event involving only one building (600). Therefore, when the network is congested, the event with higher priority score (600) will be
- 30 prioritized and streamed from the at least one camera (100) to the at least one client device (200). Each priority score (600) contain a pre-defined stream configuration such as frame rate and resolution. Hence, the event with higher priority score (600) will be streamed from the at least one camera (100) to the at

least one client device (200) with higher frame rate and resolution. Such priority score (600) contains important information, and therefore it is stored in the database (400).

5 The subsequent step involves pairing the at least one camera (100) with the at least one client device (200) according to the pairing configurations determined by the stream director means (502) and the priority score (600) determined by the event prioritizing means (504) (17), both of which are embedded within the instructions (800). This pairing ultimately allows the at least one client device
10 (200) to stream the at least one video stream from the at least one camera (100) (18). Specifically, the pairing is executed by interacting with and provide the at least one client device (200) with any information necessary for the at least one client device (200) to interact with and request the at least one live video stream from the at least one camera (100), wherein the information may comprise IP
15 address of the at least one camera (100), the analyzed results, event timestamp, or a combination thereof. All the aforesaid information can be packed into a message for easy delivery to the at least one client device (200). Once the at least client device (200) receives the message, it is then able to request and stream the at least one live video stream from the at least one camera (200) (18).

20

Thereafter, the at least one live video stream is coupled with contextual information (900) based on the analyzed results (19). The contextual information (900) can be presented in the forms of images, texts, audio, augmented live video streams, or a combination thereof. Referring now to Figure 2, it is shown
25 an example of graphical user interface (GUI) of a client device (200). As it can be seen here, the client device (200) is streaming from six cameras (100), therefore having six live video streams. The first and fifth live video streams consist of contextual information (900), which is in the form of augmentation. The augmentation can be in many ways such as highlighting of a particular detail in
30 the live video stream with a box, a colour, or a combination thereof. The live video streams are also accompanied by other contextual information (900) in the forms of images, texts, and audio, all of which may be presented in a separate window.

CLAIMS

- 1) A video surveillance system comprises:
- a) at least one camera (100) that is continuously monitoring an area;
 - 5 b) at least one client device (200) that is in standby mode to be paired with and stream at least one live video stream from the at least one camera (100);
 - c) a device manager (300) for managing the at least one camera (100) and the at least one client device (200); and
 - 10 d) a database (400) for storing information of the at least one camera (100) and information of the at least one client device (200);
- characterized in that the system further comprises;
- e) an event detection means (501) for detecting an occurrence of an event via the at least one camera (100);
 - 15 f) an event analyzing means (503) for extracting and analyzing information of the event;
 - g) a stream director means (502) for determining pairing configurations of the at least one camera (100) and the at least one client device (200) based on event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), location of the at least one client device (200), how the at least one client device (200) is registered to the device manager (300), network conditions, or a combination thereof, wherein the pairing configurations can be one camera (100) to one client device (200), one camera (100) to many client devices (200), many cameras (100) to one client device (200), or many cameras (100) to many client devices (200);
 - 20 25 30 h) an event prioritizing means (504) for determining a priority score (600) for the event based on event type, event conditions, event severity, network conditions, number of active live video streams, priority score (600) of active live video streams, number of new live video streams, or a combination thereof; and

- 5 i) a stream enforcer means (506) for pairing the at least one camera (100) and the at least one client device (200) according to the pairing configurations determined by the stream director means (502) and the priority score (600) determined by the event prioritizing means (504), thus allowing the at least one client device (200) to stream the at least one video stream from the at least one camera (100), and coupling the at least one live video stream with contextual information (900) based on the analyzed results produced by the event analyzing means (503).
- 10 2) A video surveillance system in accordance with claim 1, wherein the event detection means (501) generates an event notification to inform the stream director means (502) about the occurrence of the event, wherein the event notification comprises event identity, event type, camera identity
- 15 of the at least one camera (100) that detects the occurrence of the event, event timestamp, at least one event snapshot captured by the at least one camera (100), or a combination thereof.
- 20 3) A video surveillance system in accordance with claim 1, wherein the stream director means (502) presents the pairing configurations in a form of matrix (700) based on a policy (505) that determines how the matrix (700) is formed, and thereafter generates at least one instruction (800) based on the matrix (700) to instruct the stream enforcer means (506) to perform the pairing, wherein the at least one instruction (800) is tagged
- 25 with the priority score (600) determined by the event prioritizing means (504).
- 4) A video surveillance system in accordance with claim 1, wherein the stream director means (502) determines the pairing configurations by:
- 30 a) identifying the at least one camera (100) that detects the occurrence of the event, a camera group that the at least one camera (100) belongs to, and all other cameras (100) that belong to the just identified camera group;

- 5 b) selecting the at least one camera (100) and any other cameras (100) from the just identified cameras (100) based on event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), network conditions, or a combination thereof;
- c) identifying the at least one client device (200), a client device group that the at least one client device (200) belongs to, and all other client devices (200) that belong to the just identified client device group; and
- 10 d) selecting the at least one client device (200) and any other client devices (200) from the just identified client devices (200) to be paired with the at least one selected camera (100) based on event type, event conditions, event severity, location of the at least one client device (200), how the at least one client device (200) is
- 15 registered to the device manager (300), network conditions, or a combination thereof.
- 5) A video surveillance system in accordance with claim 1, wherein the stream enforcer means (506) pairs the at least one camera (100) and the
- 20 at least one client device (200) according to the pairing configurations determined by the stream director means (502) and the priority score (600) determined by the event prioritizing means (504) by interacting with and providing the at least one client device (200) with IP address of the at least one camera (100), the analyzed results produced by the event
- 25 analyzing means (503), event timestamp, or a combination thereof, in order to enable the at least one client device (200) to request the at least one live video stream from the at least one camera (100).
- 6) A video surveillance method comprises the steps of:
- 30 a) having at least one camera (100) to continuously monitor an area;
- b) having at least one client device (200) in standby mode to be paired with and stream at least one live video stream from the at least one camera (100);

- 5 c) managing the at least one camera (100) and at least one client device (200) (11); and
- d) storing information of the at least one camera (100) and information of the at least one client device (200) in a database (400) (12);
- characterized in that the method further comprises the steps of:
- e) detecting an occurrence of an event via the at least one camera (100) (13);
- f) extracting and analyzing information of the event (14);
- 10 g) determining pairing configurations of the at least one camera (100) and the at least one client device (200) (15) based on event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), location of the at least one client device (200), how the at least one client device (200) is
- 15 registered to the device manager (300), network conditions, or a combination thereof, wherein the pairing configurations can be one camera (100) to one client device (200), one camera (100) to many client devices (200), many cameras (100) to one client device (200), or many cameras (100) to many client devices (200);
- 20 h) determining a priority score for the event (16) based on event type, event conditions, event severity, network conditions, number of active live video streams, priority score (600) of active live video streams, number of new live video streams, or a combination thereof;
- 25 i) pairing the at least one camera (100) and the at least one client device (200) according to the determined pairing configurations and the determined priority score (600) (17);
- j) streaming the at least one video stream from the at least one camera (100) to the at least one client device (200) (18); and
- 30 k) coupling the at least one live video stream with contextual information (900) based on the analyzed results (19).

- 7) A video surveillance method in accordance with claim 6 further comprises the step of generating an event notification to inform about the occurrence of the event, wherein the event notification comprises event identity, event type, camera identity of the at least one camera (100) that detects the occurrence of the event, event timestamp, at least one event snapshot captured by the at least one camera (100), or a combination thereof.
- 8) A video surveillance method in accordance with claim 6, wherein the pairing configurations are presented in a form of matrix (700) based on a policy (505) that determines how the matrix (700) is formed, and at least one instruction (800) is generated based on the matrix (700), wherein the at least one instruction (800) is tagged with the determined priority score (600).
- 9) A video surveillance method in accordance with claim 6, wherein the step of determining the pairing configurations further comprises the steps of:
- a) identifying the at least one camera (100) that detects the occurrence of the event, a camera group that the at least one camera (100) belongs to, and all other cameras (100) that belong to the just identified camera group;
 - b) selecting the at least one camera (100) and any other cameras (100) from the just identified cameras (100) based on event type, event conditions, event severity, degree of informative contents captured by the at least one camera (100), network conditions, or a combination thereof;
 - c) identifying the at least one client device (200), a client device group that the at least one client device (200) belongs to, and all other client devices (200) that belong to the just identified client device group; and
 - d) selecting the at least one client device (200) and any other client devices (200) from the just identified client devices (200) to be paired with the at least one selected camera (100) based on event type, event conditions, event severity, location of the at least one

client device (200), how the at least one client device (200) is registered to the device manager (300), network conditions, or a combination thereof.

- 5 10) A video surveillance method in accordance with claim 6, wherein the step
of pairing the at least one camera (100) and the at least one client device
(200) according to the determined pairing configurations and determined
priority score (600) further comprises the step of interacting with and
10 providing the at least one client device (200) with IP address of the at
least one camera (100), the analyzed results, event timestamp, or a
combination thereof, in order to enable the at least one client device (200)
to request the at least one live video stream from the at least one camera
(100).

1/3

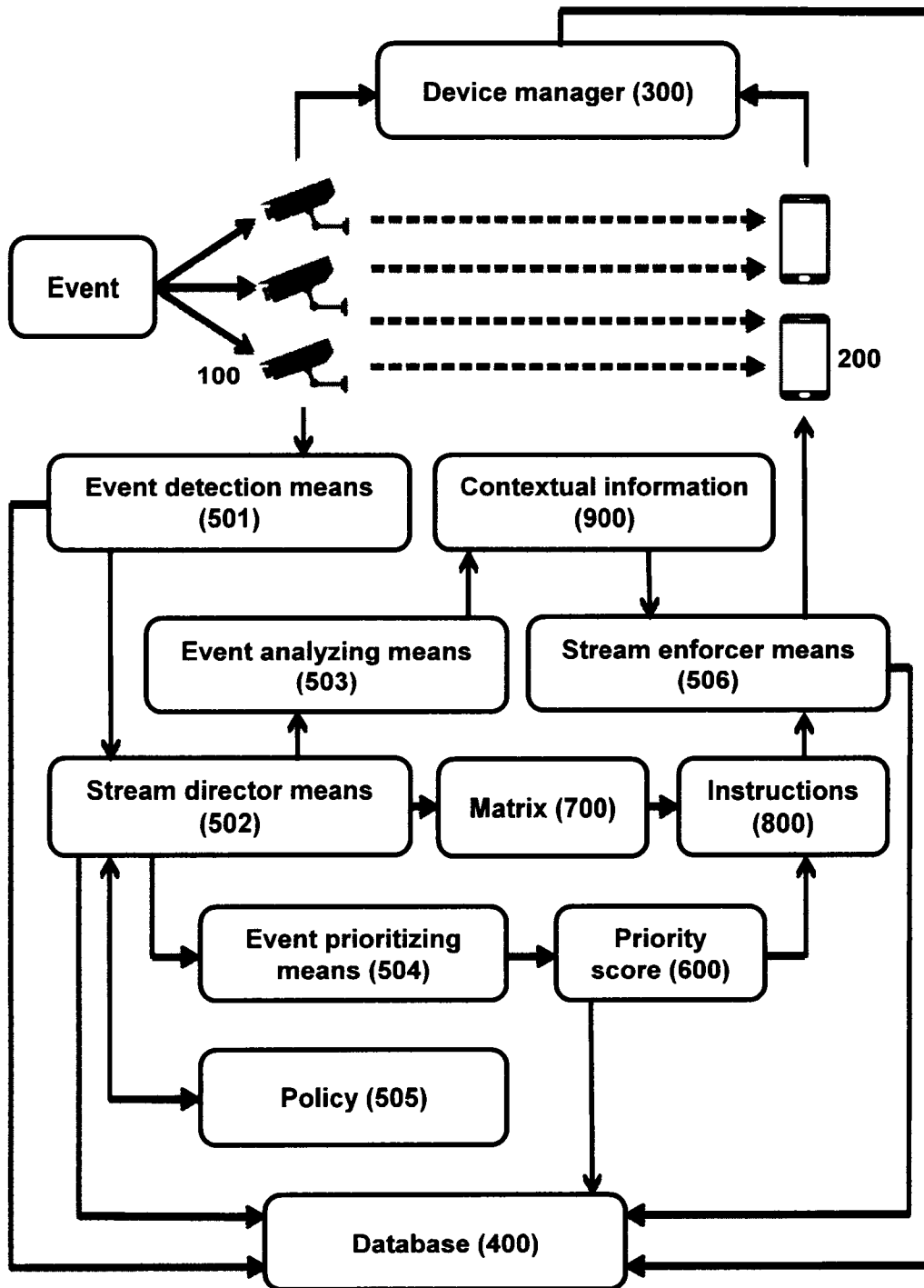
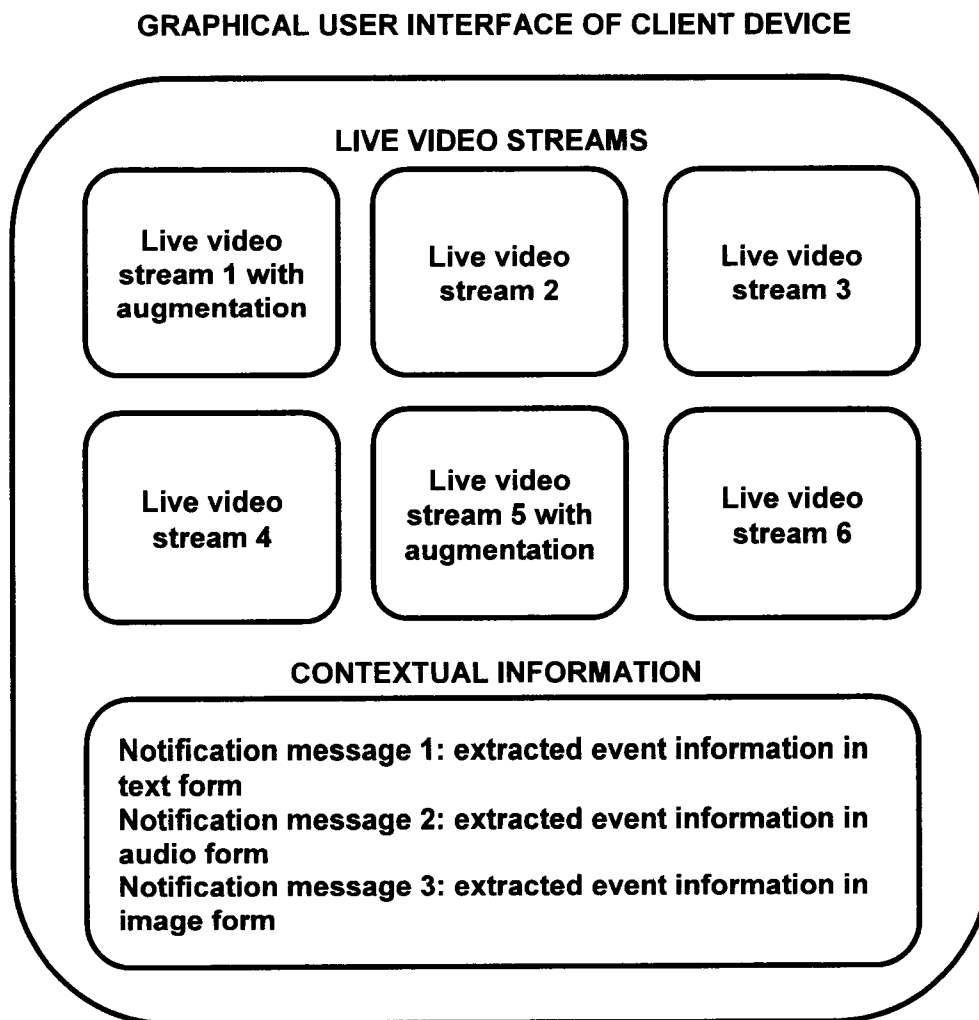


FIGURE 1

**FIGURE 2**

3/3

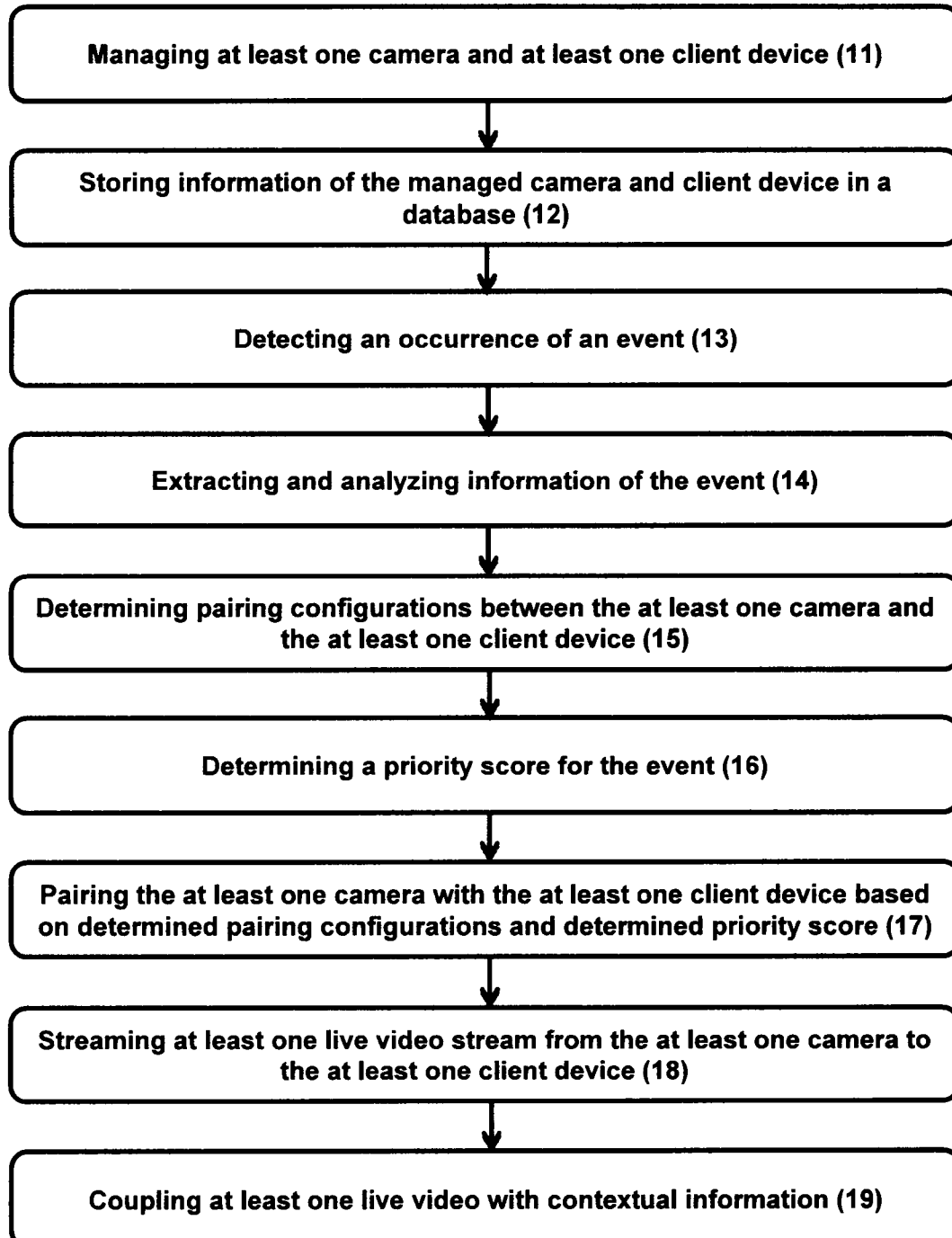


FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2014/000137

A. CLASSIFICATION OF SUBJECT MATTER
INV. 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 G08B

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.
Y	US 2011/242317 A1 (WENGROVITZ MICHAEL S [US]) 6 October 2011 (2011-10-06) abstract figure 1 paragraph [0025] - paragraph [0027] paragraph [0030] - paragraph [0033] paragraph [0037] paragraph [0042] - paragraph [0043] paragraph [0061]; figure 6	1-10
Y	US 2003/025599 A1 (MONROE DAVID A [US]) 6 February 2003 (2003-02-06) abstract paragraph [0025] - paragraph [0026] paragraph [0162] - paragraph [0164] paragraph [0177] - paragraph [0197] paragraph [0244] ----- -/-	1-10



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

28 November 2014

Date of mailing of the international search report

11/12/2014

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Sery, Franck

INTERNATIONAL SEARCH REPORT

International application No

PCT/MY2014/000137

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/261202 A1 (GOLDSTEIN BORIS [US]) 27 October 2011 (2011-10-27) abstract paragraph [0005] paragraph [0051] - paragraph [0058]; figure 1 -----	1-10
A	WO 01/57787 A1 (ROSS & BARUZZINI [US]; GAROUTTE MAURICE [US]) 9 August 2001 (2001-08-09) abstract page 45, line 28 - page 48, line 12 -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/MY2014/000137

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011242317	A1	06-10-2011	NONE
US 2003025599	A1	06-02-2003	NONE
US 2011261202	A1	27-10-2011	NONE
WO 0157787	A1	09-08-2001	AT 381073 T 15-12-2007
		AU 3802401 A 14-08-2001	
		AU 2001238024 B2 26-10-2006	
		CA 2399106 A1 09-08-2001	
		DE 60131840 T2 27-11-2008	
		EP 1266345 A1 18-12-2002	
		IL 151004 A 30-11-2010	
		JP 4618965 B2 26-01-2011	
		JP 2003521860 A 15-07-2003	
		US 2001033330 A1 25-10-2001	
		US 2005259848 A1 24-11-2005	
		US 2010074472 A1 25-03-2010	
		US 2013293708 A1 07-11-2013	
		WO 0157787 A1 09-08-2001	