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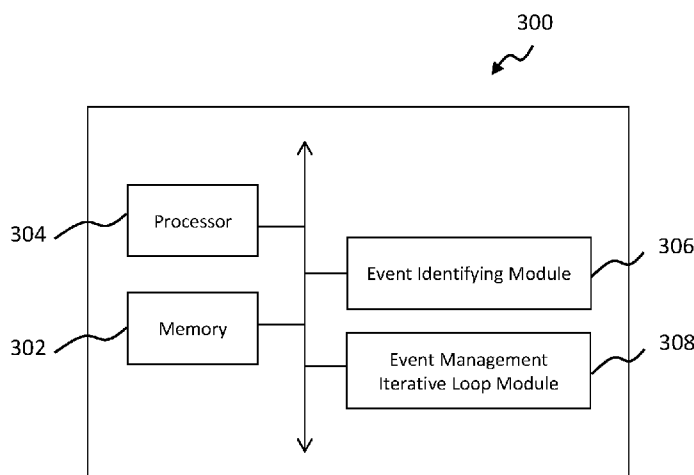


FIG. 3

(57) Abstract: A method of event management is provided. The method includes: identifying an actionable event based on sensor data; and performing an event management iterative loop with respect to the actionable event identified. Each iteration of the event management iterative loop includes: determining event status information associated with the actionable event based on event-related data associated with the actionable event; determining task assignment information for handling the actionable event based on one or more first event status parameters of the event status information; and updating the event-related data associated with the actionable event. A corresponding system for event management is also provided.

METHOD AND SYSTEM FOR EVENT MANAGEMENT

TECHNICAL FIELD

[0001] The present invention generally relates to a method and a system for event management, and more particularly, in relation to identifying and handling an actionable event.

BACKGROUND

[0002] In various conventional event management systems, an actionable event (e.g., any event that may require or be desirable for action(s) or task(s) to be performed in an attempt to address or resolve it, which may simply be herein referred to as an event) is manually reported by a person to an operator or administrator. The operator receiving the report may check or determine details of the event reported and may then manually dispatch a suitable person (e.g., a ground staff such as a security officer) to handle (e.g., resolve) the event. In such a conventional system, the reporting or detection of the event and the resource dispatching are carried out manually, which may result in a long response time and high operation cost.

[0003] As an example conventional event management system, Amis in US Patent No. 8,630,820 B2 (hereinafter referred to as the Amis reference) proposed a system for threat assessment, safety management and monitoring of individuals and groups. For example, when a user's health or well-being is at risk because of a (potential) threat, the user may manually seek help from the system. The system may then assign an operator to help the user. For illustration purpose, FIG. 1 shows an example illustration of how an event relating to a security issue involving a suspicious person in a shopping mall may be handled according to the system proposed in the Amis reference. A user (i.e., the victim shown in FIG. 1) reports an event using the system (being carried by the user) when the suspicious person hurts the user. The system may then assign a remote operator to communicate with the user to manually collect information relating to the event. The operator may then manually decide on appropriate action(s) in an attempt to resolve the event reported, such as dispatching a resource (e.g., a security officer) to arrest the attacker. However, the cost for resolving the event using such a conventional system is relatively high, for example, because a human operator is required to speak to each user in order to manually collect information relating to the event. In addition, the action(s) decided by the operator in an attempt to resolve the event may not be optimal, for example, since the operator makes the decision manually (e.g., manually assign task(s) to one or more persons) and under a tense or an urgent situation. Furthermore, according to such a

conventional system, even though the operator may accurately inform the location of the attacker at the time of incident when dispatching a security officer to attend to the event, the attacker may no longer be at the same location where the incident occurred when the security officer arrives at the scene. Accordingly, such conventional event management systems are inefficient and ineffective.

[0004] As another example conventional event management system, Bondareva *et al.* in US Publication No. 2021/0117835 A1 (hereinafter referred to as the Bondareva reference) proposed a system for enhancing strategic patrol planning and dispatch decision making based on gone on arrival prediction. In particular, the system is configured to generate a crime prediction map based on the historical crimes in a certain geographic area and optimize a police patrol schedule with respect to the geographic area based on an estimated crime probability according to the crime prediction map. However, in such a conventional system, the likelihood of a potential event in an area is predicted based on historical data associated with the area, and thus does not actually identify any actionable event occurring in real time. In this regard, although the police patrol schedule may be generated or optimized once for an area based on historical data associated with the area, the police patrol schedule generated or optimized is not affected by or is indifferent to any events occurring in real time. Accordingly, unless a police happens to be at an area where an actionable event in occurring, such an event occurring in real time would still require to be manually reported by a victim to an operator who may then manually assign a police to attend to the event.

[0005] A need therefore exists to provide a method and a system for event management, that seek to overcome, or at least ameliorate, one or more problems associated with conventional methods and systems for event management, and in particular, enhancing or improving efficiency and effectiveness in event management. It is against this background that the present invention has been developed.

SUMMARY

[0006] According to a first aspect of the present invention, there is provided a method of event management using at least one processor, the method comprising:

identifying an actionable event based on sensor data; and
performing an event management iterative loop with respect to the actionable event identified, each iteration of the event management iterative loop comprising:

determining event status information associated with the actionable event based on event-related data associated with the actionable event;

determining task assignment information for handling the actionable event based on one or more first event status parameters of the event status information; and

5 updating the event-related data associated with the actionable event.

[0007] According to a second aspect of the present invention, there is provided a system for event management, the system comprising:

at least one memory; and

10 at least one processor communicatively coupled to the at least one memory and configured to perform the method of event management according to the above-mentioned first aspect of the present invention.

[0008] According to a third aspect of the present invention, there is provided a computer program product, embodied in one or more non-transitory computer-readable storage mediums, comprising instructions executable by at least one processor to perform the method of event
15 management according to the above-mentioned first aspect of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Embodiments of the present invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way
20 of example only, and in conjunction with the drawings, in which:

FIG. 1 shows an example illustration of how an event relating to a security issue involving a suspicious person in a shopping mall may be handled according to a convention event management system;

25 FIG. 2 depicts a schematic flow diagram of a method of event management, according to various embodiments of the present invention;

FIG. 3 depicts a schematic block diagram of a system for event management, according to various embodiments of the present invention;

30 FIG. 4 depicts a schematic block diagram of an exemplary computer system which may be used to realize or implement the system for event management, according to various embodiments of the present invention;

FIG. 5 depicts a schematic drawing illustrating a method of event management, according to various example embodiments of the present invention;

FIG. 6 shows an example illustration of how an event relating to a security issue involving a suspicious person may be handled by the method of event management according to various example embodiments of the present invention;

FIGs. 7A and 7B depict schematic diagrams of an example manner of determining the event status information associated with the event, according to various example embodiments of the present invention;

FIG. 8 shows an example event status mapping information, according to various example embodiments of the present invention;

FIGs. 9A and 9B depict schematic diagrams of an example manner of determining a task set for handling the event, according to various example embodiments of the present invention;

FIG. 10 depicts an example task mapping information, according to various example embodiments of the present invention;

FIG. 11 shows example task update conditions, according to various example embodiments of the present invention;

FIGs. 12A and 12B depict schematic diagrams of an example manner of determining the task assignment information for handling the event, according to various example embodiments of the present invention;

FIG. 13 shows example task assignment conditions, according to various example embodiments of the present invention;

FIG. 14 depicts an example user interface displaying various event-related information for an event identified, according to various example embodiments of the present invention;

FIG. 15 depicts an example user interface for configuring task mapping information, according to various example embodiments of the present invention;

FIG. 16 depicts an example user interface for configuring resource information, according to various example embodiments of the present invention;

FIG. 17 depicts an example user interface for allowing a system administrator to approve or decline task(s) determined for the task set, according to various example embodiments of the present invention; and

FIG. 18 depicts a schematic drawing of an example system architecture for event management, according to various example embodiments of the present invention.

DETAILED DESCRIPTION

[0010] Various embodiments of the present invention provide a method and a system for event management, and more particularly, in relation to identifying and handling an actionable event. In this regard, the actionable event may refer to any event that may require or be desirable for action(s) or task(s) to be performed in an attempt to address or resolve it. It will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific actionable event, as long as action(s) or task(s) (e.g., involving resources such as human and/or machine resources) may be required or desired to be performed in an attempt to address or resolve it, such as but not limited to, an incident or an unusual, unexpected or undesired observation or condition detected based on the sensor data. It will also be appreciated by a person skilled in the art that the actionable event is not limited to any particular or specific situation or purpose, as long as action(s) or task(s) may be required or desired to be performed in an attempt to address or resolve it. For example and without limitation, the actionable event may be in relation to an activity of a target person (e.g., a suspicious person or an attacker), a cleanliness of a target area, a condition of a target area of a building or a traffic flow (e.g., human and/or vehicle traffic flow) in a target area.

[0011] As described in the background, conventional event management systems may be inefficient and ineffective. Therefore, various embodiments of the present invention provide a method and a system for event management, that seek to overcome, or at least ameliorate, one or more problems associated with conventional methods and systems for event management, and in particular, enhancing or improving efficiency and effectiveness in event management.

[0012] FIG. 2 depicts a schematic flow diagram of a method 200 of event management using at least one processor, according to various embodiments of the present invention. The method 200 comprises: identifying (at 202) an actionable event based on sensor data; and performing (at 204) an event management iterative loop with respect to the actionable event identified. In this regard, each iteration of the event management iterative loop comprises: determining event status information associated with the actionable event based on event-related data associated with the actionable event; determining task assignment information for handling the actionable event based on one or more first event status parameters of the event status information; and updating the event-related data associated with the actionable event.

[0013] In various embodiments, the event management iterative loop may be performed until a loop end condition is satisfied, such as when the event is deemed to be resolved or closed.

[0014] Accordingly, the method 200 of event management has advantageously been found to enhance or improve efficiency and effectiveness in event management. In particular, not only is the actionable event automatically identified based on sensor data using the at least one processor, an event management iterative loop is also performed with respect to the actionable event identified for dynamically handling the actionable event. As a result, changes or developments in the actionable event are automatically captured by the event management iterative loop and task assignment for handling the actionable event are dynamically determined (e.g., updated in real time) taking into account such changes or developments in the actionable event. Accordingly, the method 200 of event management is not only automated, but is also advantageously dynamic in handling the actionable event, thereby is dynamically optimized in real time for handling the actionable event, resulting in enhanced or improved efficiency and effectiveness in event management. These advantages or technical effects, and/or other advantages or technical effects, will become more apparent to a person skilled in the art as the method 200 of event management, as well as the corresponding system for event management, is described in more detail according to various embodiments and example embodiments of the present invention.

[0015] In various embodiments, the event status information is determined based on the event-related data and one or more event attribute parameters of event attribute information associated with the actionable event. In various embodiments, the event-related data comprises sensor data and/or manual feedback data obtained in relation to the actionable event. In this regard, the sensor data may be captured by one or more sensors and the manual feedback data may be manual input data obtained as a feedback from a person (e.g., a dispatched person) attending to the event. In various embodiments, at each iteration, the event-related data may comprise at least sensor data and may further comprise manual feedback data if any.

[0016] In various embodiments, the one or more first event status parameters are one or more representative event status parameters for the actionable event based on which the task assignment information for handling the actionable event is determined. For example, the one or more representative event status parameters may be key or main event status parameters predetermined to be utilized for subsequently determining the task assignment information for handling the actionable event, and may thus be key or main event status parameters representing or reflective of the state of the actionable event. In various embodiments, amongst event status parameters in the event status information, at least the one or more representative status parameters are to be utilized determining the task assignment information. In other words, one

or more other event status parameters in the event status information may also be utilized together with the one or more representative status parameters for determining the task assignment information. Accordingly, the event status information may comprise one or more first event status parameters (or one or more representative status parameters) and one or more other event status parameters. In various embodiments, at least one of the one or more other event status parameters may be utilized for determining the task assignment information and at least one of the one or more other event status parameters may be displayed on a user interface for showing latest event status(es).

[0017] In various embodiments, at least one of the one or more first event status parameters is determined based on a mapping of one or more other event status parameters of the event status information to the first event status parameter.

[0018] In various embodiments, the above-mentioned determining the task assignment information comprises determining a task set for handling the actionable event. In this regard, determining the task set comprises determining one or more tasks for handling the actionable event based on the one or more first event status parameters and one or more event attribute parameters of the event attribute information associated with the actionable event. Accordingly, the task set may comprise one or more tasks for handling the actionable event.

[0019] In various embodiments, at least one of the one or more tasks for handling the actionable event is determined based on a mapping of at least one of the one or more first event status parameters and at least one of the one or more event attribute parameters of the event attribute information to the task. In various embodiments, such a mapping may be performed based on event status mapping information (which may also be herein referred to as event status definition information).

[0020] In various embodiments, the above-mentioned determining the task set is based on one or more task update conditions. In this regard, the task set is updated based on the one or more tasks based on determining that the one or more task update conditions is satisfied. In other words, in various embodiments, at each iteration of the event management iterative loop, the task set is only updated if the one or more task update conditions is satisfied. Otherwise, the task set is not updated at a current iteration. Accordingly, by providing one or more task update conditions, various embodiments advantageously enable control over how the task set is updated for improving effectiveness and practicality in event management, such as avoiding frequent or unnecessary changes in the task set as the event management iterative loop is being performed.

[0021] In various embodiments, the task assignment information is determined based on the task set determined and resource information. In various embodiments, the resource information may include human resource information and/or machine/robotic resource information.

5 [0022] In various embodiments, the task assignment information is determined further based on one or more task assignment conditions. Accordingly, by providing one or more task assignment conditions, various embodiments advantageously enable control over how task or resource assignment is determined or updated for optimizing task or resource assignment for handling the event dynamically as the event management iterative loop is being performed.

10 [0023] In various embodiments, the actionable event is in relation to an activity of a target person, a cleanliness of a target area, a condition of a target area of a building or a traffic flow (e.g., human and/or traffic flow) in a target area.

[0024] In various embodiments, the actionable event is in relation to the activity of the target person, and the one or more first event status parameters of the event status information
15 comprises a severity level parameter for the actionable event.

[0025] In various embodiments, the above-mentioned performing the event management iterative loop further comprises outputting one or more event status parameters of the event status information and one or more event attribute parameters of the event attribute information to a user interface for display thereat.

20 [0026] FIG. 3 depicts a schematic block diagram of a system 300 for event management, according to various embodiments of the present invention, corresponding to the method 200 of event management as described hereinbefore with reference to FIG. 2 according to various embodiments of the present invention. The system 300 comprises: at least one memory 302; and at least one processor 304 communicatively coupled to the at least one memory 302 and
25 configured to perform the above-mentioned identifying (at 202) an actionable event based on sensor data; and the above-mentioned performing (at 204) an event management iterative loop with respect to the actionable event identified.

[0027] It will be appreciated by a person skilled in the art that the at least one processor 304 may be configured to perform various functions or operations through set(s) of instructions
30 (e.g., software modules) executable by the at least one processor 304 to perform various functions or operations. Accordingly, as shown in FIG. 3, the system 300 may comprise an event identifying module (or an event identifying circuit) 306 configured to perform the above-mentioned identifying (at 202) an actionable event based on sensor data; and an event

management iterative loop module (or an event management iterative loop circuit) 308 configured to perform the above-mentioned performing (at 204) an event management iterative loop with respect to the actionable event identified, such as until a loop end condition is satisfied.

5 [0028] It will be appreciated by a person skilled in the art that the above-mentioned modules are not necessarily separate modules, and two or more modules may be realized by or implemented as one functional module (e.g., a circuit or a software program) as desired or as appropriate without deviating from the scope of the present invention. For example, the event identifying module 306 and the event management iterative loop module 308 may be realized
10 (e.g., compiled together) as one executable software program (e.g., software application or simply referred to as an “app”), which for example may be stored in the at least one memory 302 and executable by the at least one processor 304 to perform various functions/operations as described herein according to various embodiments of the present invention.

[0029] In various embodiments, the system 300 for event management corresponds to the
15 method 200 of event management as described hereinbefore with reference to FIG. 2 according to various embodiments, therefore, various functions or operations configured to be performed by the least one processor 304 may correspond to various steps or operations of the method 200 of event management as described hereinbefore according to various embodiments, and thus need not be repeated with respect to the system 300 for event management for clarity and
20 conciseness. In other words, various embodiments described herein in context of the methods are analogously valid for the corresponding systems, and vice versa.

[0030] For example, in various embodiments, the at least one memory 302 may have stored therein the event identifying module 306 and/or the event management iterative loop module 308, which respectively correspond to various steps (or operations or functions) of the method
25 200 of event management as described herein according to various embodiments, which are executable by the at least one processor 304 to perform the corresponding functions or operations as described herein.

[0031] A computing system, a controller, a microcontroller or any other system providing a processing capability may be provided according to various embodiments in the present
30 disclosure. Such a system may be taken to include one or more processors and one or more computer-readable storage mediums. For example, the system 300 for event management described hereinbefore may include at least one processor (or controller) 304 and at least one computer-readable storage medium (or memory) 302 which are for example used in various

processing carried out therein as described herein. A memory or computer-readable storage medium used in various embodiments may be a volatile memory, for example a DRAM (Dynamic Random Access Memory) or a non-volatile memory, for example a PROM (Programmable Read Only Memory), an EPROM (Erasable PROM), EEPROM (Electrically Erasable PROM), or a flash memory, e.g., a floating gate memory, a charge trapping memory, an MRAM (Magnetoresistive Random Access Memory) or a PCRAM (Phase Change Random Access Memory).

[0032] In various embodiments, a “circuit” may be understood as any kind of a logic implementing entity, which may be special purpose circuitry or a processor executing software stored in a memory, firmware, or any combination thereof. Thus, in an embodiment, a “circuit” may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g., a microprocessor (e.g., a Complex Instruction Set Computer (CISC) processor or a Reduced Instruction Set Computer (RISC) processor). A “circuit” may also be a processor executing software, e.g., any kind of computer program, e.g., a computer program using a virtual machine code, e.g., Java. Any other kind of implementation of the respective functions may also be understood as a “circuit” in accordance with various embodiments. Similarly, a “module” may be a portion of a system according to various embodiments and may encompass a “circuit” as described above, or may be understood to be any kind of a logic-implementing entity.

[0033] Some portions of the present disclosure are explicitly or implicitly presented in terms of algorithms and functional or symbolic representations of operations on data within a computer memory. These algorithmic descriptions and functional or symbolic representations are the means used by those skilled in the data processing arts to convey most effectively the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities, such as electrical, magnetic or optical signals capable of being stored, transferred, combined, compared, and otherwise manipulated.

[0034] Unless specifically stated otherwise, and as apparent from the following, it will be appreciated that throughout the present specification, description or discussions utilizing terms such as “identifying”, “performing”, “determining”, “updating”, “mapping”, “determining” or the like, refer to the actions and processes of a computer system, or similar electronic device, that manipulates and transforms data represented as physical quantities within the computer

system into other data similarly represented as physical quantities within the computer system or other information storage, transmission or display devices.

[0035] The present specification also discloses a system (e.g., which may also be embodied as a device or an apparatus), such as the system 300 for event management, for performing various operations/functions of various methods described herein. Such a system may be specially constructed for the required purposes, or may comprise a general purpose computer or other device selectively activated or reconfigured by a computer program stored in the computer. The algorithms presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose machines may be used with computer programs in accordance with the teachings herein. Alternatively, the construction of more specialized apparatus to perform various method steps may be appropriate.

[0036] In addition, the present specification also at least implicitly discloses a computer program or software/functional module, in that it would be apparent to the person skilled in the art that individual steps of various methods described herein may be put into effect by computer code. The computer program is not intended to be limited to any particular programming language and implementation thereof. It will be appreciated that a variety of programming languages and coding thereof may be used to implement the teachings of the disclosure contained herein. Moreover, the computer program is not intended to be limited to any particular control flow. There are many other variants of the computer program, which can use different control flows without departing from the scope of the invention. It will be appreciated by a person skilled in the art that various modules described herein (e.g., the event identifying module 306 and/or the event management iterative loop module 308) may be software module(s) realized by computer program(s) or set(s) of instructions executable by a computer processor to perform the required functions, or may be hardware module(s) being functional hardware unit(s) designed to perform the required functions. It will also be appreciated that a combination of hardware and software modules may be implemented.

[0037] Furthermore, one or more of the steps of a computer program/module or method described herein may be performed in parallel rather than sequentially. Such a computer program may be stored on any computer readable medium. The computer readable medium may include storage devices such as magnetic or optical disks, memory chips, or other storage devices suitable for interfacing with a general purpose computer. The computer program when loaded and executed on such a general-purpose computer effectively results in an apparatus that implements the steps of the methods described herein.

[0038] In various embodiments, there is provided a computer program product, embodied in one or more computer-readable storage mediums (non-transitory computer-readable storage medium(s)), comprising instructions (e.g., the event identifying module 306 and/or the event management iterative loop module 308) executable by one or more computer processors to perform the method 200 of event management, as described herein with reference to FIG. 2 according to various embodiments. Accordingly, various computer programs or modules described herein may be stored in a computer program product receivable by a system therein, such as the system 300 for event management as shown in FIG. 3, for execution by at least one processor 304 of the system 300 to perform various functions.

[0039] Software or functional modules described herein may also be implemented as hardware modules. More particularly, in the hardware sense, a module is a functional hardware unit designed for use with other components or modules. For example, a module may be implemented using discrete electronic components, or it can form a portion of an entire electronic circuit such as an Application Specific Integrated Circuit (ASIC). Numerous other possibilities exist. Those skilled in the art will appreciate that the software or functional module(s) described herein can also be implemented as a combination of hardware and software modules.

[0040] In various embodiments, the system 300 for event management may be realized by any computer system (e.g., desktop or portable/mobile computer system) including at least one processor and at least one memory, such as an example computer system 400 as schematically shown in FIG. 4 as an example only and without limitation. Various methods/steps or functional modules may be implemented as software, such as a computer program being executed within the computer system 400, and instructing the computer system 400 (in particular, one or more processors therein) to conduct various functions or operations as described herein according to various embodiments. The computer system 400 may comprise a system unit 402, input devices such as a keyboard and/or a touchscreen 404 and a mouse 406, and a plurality of output devices such as a display 408. The system unit 402 may be connected to a computer network 412 via a suitable transceiver device 414, to enable access to e.g., the Internet or other network systems such as Local Area Network (LAN) or Wide Area Network (WAN). The system unit 402 may include a processor 418 for executing various instructions, a Random Access Memory (RAM) 420 and a Read Only Memory (ROM) 422. The system unit 402 may further include a number of Input/Output (I/O) interfaces, for example I/O interface 424 to the display device 408 and I/O interface 426 to the keyboard 404. The components of the system unit 402 typically

communicate via an interconnected bus 428 and in a manner known to the person skilled in the art.

[0041] It will be appreciated by a person skilled in the art that the terminology used herein is for the purpose of describing various embodiments only and is not intended to be limiting of the present invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" 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.

[0042] Any reference to an element or a feature herein using a designation such as "first", "second" and so forth does not limit the quantity or order of such elements or features, unless stated or the context requires otherwise. For example, such designations may be used herein as a convenient way of distinguishing between two or more elements or instances of an element. Thus, a reference to first and second elements does not necessarily mean that only two elements can be employed, or that the first element must precede the second element. In addition, a phrase referring to "at least one of" a list of items refers to any single item therein or any combination of two or more items therein.

[0043] In order that the present invention may be readily understood and put into practical effect, various example embodiments of the present invention will be described hereinafter by way of examples only and not limitations. It will be appreciated by a person skilled in the art that the present invention may, however, be embodied in various different forms or configurations and should not be construed as limited to the example embodiments set forth hereinafter. Rather, these example embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art.

[0044] In particular, for better understanding of the present invention and without limitation or loss of generality, unless stated or the context requires otherwise, various example embodiments of the present invention will be described below with respect to the actionable event being in relation to an activity of a target person (e.g., a suspicious person or an attacker). However, as described hereinbefore, the present invention is not limited to any particular or specific actionable event, as long as action(s) or task(s) (e.g., involving resources such as human and/or machine resources) may be required or desired to be performed in an attempt to address

or resolve it, such as but not limited to, an incident or an unusual, unexpected or undesired observation or condition detected based on the sensor data. The actionable event is also not limited to any particular or specific situation or purpose, as long as action(s) or task(s) may be required or desired to be performed in an attempt to address or resolve it. For example and
5 without limitation, other types of actionable event may be in relation to a cleanliness of a target area, a condition (e.g., temperature, noise and/or air quality) of a target area of a building or a traffic flow (e.g., human and/or vehicle flow) in a target area.

[0045] Various example embodiments provide an event management system configured to automatically identify (e.g., detect or predict) an actionable event (which may simply be herein
10 referred to as an event) and dispatch resources to handle the event dynamically and optimally. In contrast, as described in the background, various conventional event management systems do not identify an actionable event and/or dispatch resources to handle the event automatically. Furthermore, even in cases whereby a dispatch decision to handle the event is made automatically, such an automatic dispatch decision once made is not affected by or is indifferent
15 to changes or developments in the event occurring in real time, and thus, does not dynamically and optimally handle the event in practice (e.g., in real time). Therefore, such conventional event management systems have been found to be inefficient and ineffective in event management. In contrast, according to the event management system according to various example embodiments of the present invention, not only is the actionable event automatically
20 identified based on sensor data using the at least one processor, an event management iterative loop (which may also be herein referred to as an event evaluation loop) is performed with respect to the event identified for dynamically handling the event. As a result, changes or developments in the event are automatically captured by the event management iterative loop and task assignment for handling the event are dynamically determined (e.g., updated in real
25 time) taking into account such changes or developments in the event. Accordingly, the event management is not only automated, but is also advantageously dynamic in handling the event, thereby is dynamically optimized in real time for handling the event, resulting in enhanced or improved efficiency and effectiveness in event management.

[0046] FIG. 5 depicts a schematic drawing illustrating a method 500 of event management
30 according to various example embodiments of the present invention, such as corresponding to the method 200 of event management as described hereinbefore according to various embodiments. As shown in FIG. 5, the method 500 comprises identifying (e.g., detecting or predicting) (at 504) an event (i.e., actionable event) based on sensor data; and performing (at

510) an event evaluation loop with respect to the event identified (e.g., until a loop end condition is satisfied). Each iteration of the event evaluation loop comprising: determining (at 512) event status information associated with the event based on event-related data associated with the event; determining (at 514 and 516) task assignment information for handling the actionable event based on one or more first event status parameters (e.g., corresponding to representative event status parameters) of the event status information; and updating (at 518) the event-related data associated with the actionable event. Accordingly, the method 500 automatically identifies (e.g., detect or predict) an event (i.e., actionable event) based on sensor data. Once the event has been identified, an event evaluation loop is initiated to continuously collect (e.g., at each iteration) event-related data (e.g., sensor data captured by sensor(s) and/or manual feedback data inputted by a dispatched resource (e.g., a ground staff) in relation to the event), evaluate latest event status and update/re-optimize dispatching decisions (e.g., task assignment or schedule) for handling the event accordingly. Therefore, according to the method 500, not only is the event identification (e.g., detection or prediction) automatic, but the resource dispatch optimization is also dynamic for dynamically handling the event, including taking into account such changes or developments in the event occurring in real time.

[0047] As shown in FIG. 5, the method 500 may further comprise obtaining (at 502) sensor data, which may then be stored in a sensor data database 506. It will be understood by a person skilled in the art that the sensor data may be captured by one or more sensors in relation to one or more objects and/or areas for the intended purpose or application, such as but not limited to, vision or imaging sensors, temperature sensors, sound sensors, motion sensors and so on. For example, in the case of the event being in relation to an activity of a target person (e.g., a suspicious person or an attacker) and detecting the event being based on video and/or image analysis, the sensor data captured may thus include video and/or image data captured in relation to the target person and related area(s) associated with the event. As another example, in the case of the event being in relation to a condition of a target area of a building and detecting the event being based on target area condition analysis, the sensor data captured may thus include temperature data, noise data and/or air quality data as deemed appropriate for the intended purpose.

[0048] As described above, the method 500 comprises identifying (at 504) an event based on sensor data. In this regard, the event may be identified by analyzing the sensor data based on various detection or prediction technologies or techniques known in the art for the intended purpose as appropriate or as desired and thus need not be described herein for clarity and

conciseness. For example, if the sensor data fulfill or violate one or more predefined rules, such as a sensor value being out of a predefined range, an actionable event may be identified or triggered. Alternatively, various machine learning techniques known in the art may be utilized to automatically identify (e.g., detect or predict) an event without any predefined rules. For example, it is possible to use unsupervised method to build a model/pattern based on historical sensor data and determine how far the current sensor data captured has deviated based on the model/pattern. Accordingly, it will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific technique for identifying an event based on sensor data, as long as an event is identified (e.g., detected or predicted) based on sensor data for the intended purpose or application.

[0049] In various example embodiments, once an event is identified or triggered at 504, event attribute information (e.g., event meta information or metadata) associated with the event may be stored in an event attribute database 508 (or event meta information database) and a corresponding event evaluation loop may be initiated. For example, the event attribute information may include various attributes (e.g., event attribute parameters) of the event identified, such as but not limited to, location, time, target object information (e.g., in relation to a target person, a target vehicle, a target device, etc), an event record or evidence (e.g., a video clip showing the event identified), a response or progress status (e.g., initiated, waiting for response, handling, resolved, etc). In various example embodiments, the event evaluation loop may perform the steps or operations therein iteratively in a loop (e.g., 512 → 514 → 516 → 518 and repeat iteratively) until a loop end condition is satisfied. In various example embodiments, each event identified is associated with a corresponding and dedicated event evaluation loop. In other words, a corresponding and dedicated event evaluation loop may be provided or triggered for each event identified. In various example embodiments, the loop end condition may be satisfied (and thus the event evaluation loop may end) when the event has been resolved or closed (e.g., once the response status has been updated to be resolved or closed). In various example, when the event evaluation loop is being performed or executed, various event-related information may be displayed (at 520) on a user interface (e.g., on a display screen) for facilitating a better understanding and monitoring of the event. For example, a system administrator or operator may request that the latest task-related information (e.g., task description and assignment information) of the event be displayed in order to monitor the progress of the event handling.

[0050] Accordingly, the event evaluation loop according to various example embodiments of the present invention advantageously collects and analyzes latest event-related data (e.g., sensor data captured by sensor(s) or manual input data obtained as a feedback from a dispatched resource (e.g., a ground staff)) and update/re-optimize dispatching decisions (e.g., task assignment or schedule) for handling the event accordingly. As a result, the method 500 of event management according to various example embodiments of the present invention is advantageously aware of dynamic changes or developments in the event and is able to dispatch resources optimally and dynamically, thereby facilitating to reduce response time and operation cost. In other words, changes or developments in the event are automatically captured by the event evaluation loop and task assignment for handling the actionable event are dynamically determined (e.g., updated in real time) taking into account such changes or developments in the event. Accordingly, the event management is not only automated, but is also advantageously dynamic in handling the actionable event, thereby is dynamically optimized in real time for handling the actionable event, resulting in enhanced or improved efficiency and effectiveness in event management.

[0051] As mentioned above, for better understanding of the present invention, various example embodiments of the present invention will now be described with respect to the example actionable event being in relation to an activity of a target person (e.g., a suspicious person or an attacker). For illustration purpose, an example illustration of how an event relating to a security issue involving a suspicious person may be handled by the method 500 of event management according to various example embodiments of the present invention is shown in FIG. 6, as an example comparison to the example illustration shown in FIG. 1 according to a conventional event management system. According to various example embodiments, once an event relating to a suspicious person is identified (e.g., detected), the method 500 may perform (e.g., initiate) the event evaluation loop including: continuously tracking the suspicious person, and for example, if it is detected that the suspicious person carried out a dangerous action (e.g., hurting a victim as shown in FIG. 6) based on updated event-related sensor data obtained, the method 500 may determine and assign a task to a nearby officer so as to dispatch the officer to arrest the attacker (i.e., previously the suspicious person) based on the updated location (e.g., as an updated event status parameter) of the attacker determined in the event evaluation loop. Accordingly, it can be seen that the officer is able to obtain up-to-date event status information (e.g., the updated or latest location of the attacker derived by the event evaluation loop based on updated event-related data), and thus, is able to be dispatch to the latest location of the

attacker if the attacker has since moved to a different location after the attack, instead of still being dispatched to the original location of the attack according to conventional event management methods whereby the attacker is no longer present there. Therefore, as shown, according to the method 500 of event management, changes or developments in the event are automatically captured by the event evaluation loop and task assignment for handling the event is dynamically determined (e.g., updated in real time) taking into account changes or developments in the event. Accordingly, the method 500 of event management is not only automated, but is also advantageously dynamic in handling the actionable event, thereby is dynamically optimized in real time for handling the actionable event, resulting in enhanced or improved efficiency and effectiveness in event management.

[0052] The method 500 of event management will now be described in further details according to various example embodiments of the present invention, with respect to the event being in relation to an activity of a target person (e.g., tracking a suspicious person or an attacker).

[0053] As described hereinbefore, the event evaluation loop comprises determining (e.g., evaluating or updating) (at 512) event status information associated with the event based on event-related data associated with the event. FIGs. 7A and 7B depict schematic diagrams of an example manner of determining the event status information associated with the event, according to various example embodiments of the present invention. The event status information may be determined based on the event-related data and one or more event attribute parameters of event attribute information (e.g., event meta information or metadata) associated with the event. In this regard, the event-related data may comprise sensor data (e.g., updated sensor data) and/or manual feedback data (e.g., manual input data as a feedback from a dispatched person) obtained (e.g., at 518) in relation to the event. The event attribute information may comprise a plurality of event attribute parameters relating to the event, such as but not limited to, an identity (ID) (e.g., name or number) assigned to the event, a type of the event, a location of the event, a time of the event and so on. For example, the event attribute information may be generated when the event was identified and stored in the event attribute database 508. It will be appreciated by a person skilled in the art that the event attribute information may include various event attribute parameters (or various event meta information or metadata) as appropriate or as desired for the intended purpose or application and the present invention is not limited to any particular or specific event attribute parameters.

[0054] In various example embodiments, the above-mentioned one or more first event status parameters may be one or more representative (or key) event status parameters for the event based on which the task assignment information for handling the event is determined.

[0055] In various example embodiments, at least one of the representative event status parameters is determined based on a mapping of one or more other event status parameters of the event status information to the representative event status parameter. Accordingly, in various example embodiments, one or more event status parameters of the event status information may be determined based on event status mapping information (which may also be herein referred to as event status definition information). In various example embodiments, the event status mapping information defines a plurality of mapping relationship, each mapping relationship defined to map one or more event statuses determined by analyzing event-related data to another event status. For example, the event status mapping information may be stored in an event status mapping information database 702.

[0056] For illustration purpose, FIG. 8 shows an example event status mapping information according to various example embodiments of the present invention. In this example event status mapping information, mapping relationships are defined for mapping various event status parameters (e.g., wandering duration and behavior of the target person) to a representative event status parameter (e.g., severity level of the event). Accordingly, in this example, the severity level in the event status information may be determined or updated at 512b based on one or more other event status parameters (e.g., wandering duration and the behavior of the target person) determined based on the analysis results of the event-related data at 512a. Accordingly, in the event status information, one or more event status parameters may be determined using a detection or prediction technique and one or more event status parameters (e.g., representative event status parameters) may be determined based on one or more other event status parameters in the event status information by referring to the event status mapping information.

[0057] For example, in the example event being in relation to an activity of a target person, an event with a higher severity level (e.g., representative event status parameter for the event) determined may represent or indicate a higher level of urgency and/or a higher amount of resources to handle the event. By way of an example only and without limitation, referring to the example event status mapping information shown in FIG. 8, if a behavior status of the target person is detected based on event-related data to be arguing with another person, such a behavior status may map to a severity level of 5. For example, based on such a severity level for the event determined, an example task assignment for handling the event may be to dispatch

one ground officer to attend to the issue. However, while the event evaluation loop is being executed, if the severity level determined escalates a higher level, such as level 50 (e.g., a belonging status of the target person determined to be holding a knife), the task assignment may be updated to immediately dispatch additional officers to attend to the event. Accordingly, in this example event, the event evaluation loop advantageously continuously evaluates (until a loop end condition is satisfied) the latest event status (including the severity level) and update the task assignment dynamically to optimally handle the event as it evolves. For example, in this case, the change of severity of the event was captured and task assignment (e.g., resource dispatching) were updated dynamically to better handle the event.

[0058] In various example embodiments, the event status information may comprise one or more event status parameters (e.g., an event status set) relating to the event, which may be updated at 512 based on updated (e.g., latest) event-related data updated at 518. For example, the event status information may be stored in an event status information database 704. By way of an example only and without limitation, in the example event relating to an activity of a target person, an example event status information may comprise a plurality of event status parameters, such as but not limited to, a location of a target person, item(s) worn by the target person, belonging(s) of the target person, activity (e.g., behaviour) of the target person, wandering duration of the target person, a severity (or seriousness) level of the event, and so on. It will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific event status parameter or set of event status parameters, and various event status parameters may be included in the event status information as appropriate or as desired for the intended purpose or application, such as based on the type of event being handled.

[0059] In various example embodiments, as shown in FIG. 7B, determining (e.g., evaluating or updating) the event status information associated with the event may include analyzing, at 512a, event-related data (e.g., the initial event-related captured at 502 at a first or beginning iteration of the event evaluation loop or the updated event-related data updated at 518 at subsequent iterations of the event evaluation loop) associated with the event, and determining (e.g., updating), at 512b, the event status information based on the analysis results. At 512a, for example, the latest location of a target person may be obtained by analyzing event-related data using various existing object (e.g., target person) detection techniques known in the art and thus need not be described herein for clarity and conciseness. For example, the location of the target person (e.g., bounded by a bounding box) in a camera view may be

derived. For example, the location of the target person in a camera view may be converted to a real-world location by applying various mapping techniques known in the art configured to map a region in a camera view to a location or position in the real-world. Similarly, various other event status parameters may be obtained by analyzing event-related data using various detection or prediction techniques known in the art, such as but not limited to, machine learning models. For example, item(s) worn by the target person (e.g., color and/or type of an outfit, whether wearing a hat, whether wearing glasses), belonging(s) of the target person (e.g., holding a suitcase, holding a shopping bag), behavior of the target person (e.g., fighting, using a knife or gun) and wandering duration (e.g., wandering duration in a small area) may be determined (e.g., detected or predicted) by using various detection or prediction techniques known in the art, such as but not limited to, machine learning models. Accordingly, it will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific manner of analyzing event-related data for determining the event status information.

[0060] As described hereinbefore, the event evaluation loop further comprises determining (e.g., updating) task assignment information (at 514 and 516) for handling the event based on one or more representative event status parameters (corresponding to the one or more first event status parameters described hereinbefore) of the event status information. FIGs. 9A and 9B depict schematic diagrams of an example manner of determining (e.g., updating) a task set (including one or more tasks) (at 514) for handling the event, according to various example embodiments of the present invention. In this regard, determining (at 514) the task assignment information comprises determining (at 514a) a task set for handling the actionable event. In this regard, determining (at 514a) the task set comprises determining one or more tasks for handling the actionable event based on the one or more representative event status parameters and one or more event attribute parameters of the event attribute information associated with the actionable event.

[0061] In various example embodiments, at least one of the one or more tasks for handling the actionable event is determined based on a mapping of at least one of the one or more representative event status parameters and at least one of the one or more event attribute parameters of the event attribute information to the task. In this regard, the mapping may be performed based on a task mapping information configured to define a plurality of mapping relationships, each mapping relationship defined to map one or more event status parameters and one or more event attribute parameters to one or more tasks. For example, the task mapping information may be stored in a task mapping information database 904. For illustration purpose

and without limitations, FIG. 10 depicts an example task mapping information according to various example embodiments of the present invention. As shown, in the example task mapping information, a task may be determined based on an event attribute parameter (e.g., event type (suspicious person)) and a representative event status parameter (e.g., the severity level). It will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific mapping relationships and various mapping relationships may be configured based on any one or more event status parameters and any one or more event attribute parameters as appropriate or as desired based on the intended purpose or application. It will also be appreciated by a person skilled in the art that each mapping relationship may map to one or more tasks. For example, referring to the example task mapping information shown in FIG. 10, an event type relating to a suspicious person and a severity level of 50 or more may map to two tasks to handle the event, namely, a first task of dispatching three security officers and a second task of dispatching one medical officer to attend to the event.

[0062] In various example embodiments, the task set comprises one or more tasks determined or selected for handling the event and may be stored in a task set database 906. In other words, the task set indicates which task(s) has been selected for handling the event.

[0063] In various example embodiments, determining (at 514a) the task set is based on one or more task update conditions (or one or more task update policies), and the task set is updated based on the one or more tasks based on determining that the one or more task update conditions is satisfied (i.e., if the one or more task update conditions is satisfied). In various example embodiments, if one or more task update conditions are not satisfied, the task set is not updated or the above-mentioned one or more tasks is not determined. Accordingly, based on the latest event status information determined or updated at 512 and the event attribute information, a task set may be determined at 514 for handling the event.

[0064] For example, there may be provided a task update condition relating to whether the representative event status parameter(s) satisfies a predefined threshold or range condition. In this regard, the task set is updated based on the one or more tasks if the task update condition is satisfied. For example, the task update condition may be satisfied if the representative event status parameter has changed by at least a predefined amount compared to its previous status at the immediately previous iteration (if any) of the event evaluation loop. As a result, by providing task update condition(s) according to various example embodiments, while the event evaluation loop is being executed, frequent changes of tasks in the task set (based on which the task assignment is to be determined) can be avoided unless it is deemed necessary at each

iteration (e.g., if the representative event status parameter (e.g., severity level) has changed by at least a predefined amount (e.g., changed by at least 5 levels)).

[0065] By way of an example only and without limitation, FIG. 11 shows example task update conditions (or task update policies), including a first example task update condition (e.g., Policy 1), a second example task update condition (e.g., Policy 2) and a third example task update condition (e.g., Policy 3). In the first example task update condition, the task set may be updated according to the one or more tasks determined at 514a. The second example task update condition may be updated based on the one or more tasks determined at 514a, whereby any new task(s) (i.e., not already existing in the task set) in the one or more tasks determined are added to the task set while any existing task(s) in the task set that are not any of the one or more tasks determined are maintained in the task set. The third example task update condition corresponds to the above-mentioned task update condition relating to whether one or more event status parameters satisfies a predefined threshold or range condition. For example, in the case of the event status parameter being the severity level, as shown in FIG. 11, the task set may not be updated at a current iteration if the change in severity level determined at the current iteration compared to that determined at the immediately previous iteration is less than 5 levels. If so, existing task(s) in the task set may be maintained. On the other hand, the task set may be updated at the current iteration based on the one or more tasks determined at the current iteration if the change in severity level determined at the current iteration is 5 levels or higher. Accordingly, by providing task update condition(s), various example embodiments advantageously enable control over how the task set is updated for improving effectiveness and practicality in event management. It will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific task update conditions and various task update conditions may be configured as appropriate or as desired for the intended purpose or application. For example, the task update conditions may be stored in a task update condition database 902.

[0066] In various example embodiments, determining the task assignment information further comprise determining (at 514b) a task difference between the task set determined at the current iteration and the task set determined at an immediately previous iteration (if any) of the event evaluation loop. In various example embodiments, the task assignment information at the current iteration may be determined (e.g., updated) based on such a task difference. Accordingly, for example, if a task update condition is provided for avoiding frequent or unnecessary changes in the task set, it may be often that the task set determined at the current

iteration is the same as that determined at the immediately previous iteration (if any), and thus, the task difference may be no task difference. If no task difference, the task assignment at the current iteration may then be determined to be the same as that at the immediately previous iteration (if any).

5 **[0067]** Accordingly, in various example embodiments, the task assignment information may be determined based on the task set determined (e.g., based on the above-mentioned task difference) and resource information. FIGs. 12A and 12B depict schematic diagrams of an example manner of determining (e.g., updating) (at 516) the task assignment information for handling the event, according to various example embodiments of the present invention. In
10 various example embodiments, as shown in FIG. 12B, determining (at 516) the task assignment information comprises determining (e.g., updating) (at 516a) the task assignment information based on the above-mentioned task difference. In various example embodiments, the task assignment information may comprise one or more tasks (task information) currently assigned, along with the corresponding resource assignment information for each task. For example, the
15 task assignment information may be stored in a task assignment database 1202 (which may also be referred to as a task schedule database). For example, based on the above-mentioned task difference, one or more tasks may be added or removed from the task assignment information, such as removing existing task(s) that is no longer required for handling the event. As shown in FIG. 12B, determining (at 516) the task assignment information may further comprise
20 determining (at 516b) resource assignment information (e.g., assigning one or more resources (e.g., staff) to perform the task, along with schedule or workflow of the one or more resources) for each new task added to the task assignment information.

[0068] In various example embodiments, the task assignment information is determined further based on one or more task assignment conditions (which may also be herein referred to
25 as task assignment policies). In various example embodiments, the one or more task assignment conditions may be configured for optimizing the assignment of resources for performing the task(s). For example, the task assignment condition(s) may be stored in a task assignment condition database 1204. By way of an example only and without limitation, FIG. 13 shows example task assignment conditions (or task assignment policies), including a first example
30 task assignment condition (e.g., Policy 1), a second example task assignment condition (e.g., Policy 2) and a third example task assignment condition (e.g., Policy 3). In the first example task assignment condition, nearest one or more staff may be selected or assigned to perform the task. In the second example task assignment condition, one or more staff with most suitable

expertise or skills may be selected or assigned to perform the task. In the third example task assignment condition, one or more staff with the shortest response time may be selected or assigned to perform the task. It will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific task assignment conditions and various task assignment conditions may be configured as appropriate or as desired based on the intended purpose (e.g., to optimize the assignment of resources) or application. In various example embodiments, the assignment of resources for performing the task(s) is configurable (e.g., for optimization) by configuring and/or selecting task assignment condition(s) accordingly. Accordingly, it will be also appreciated by a person skilled in the art that the present invention is not limited to any particular or specific technique for assigning resource(s) to perform a task, and for example, various task assignment techniques that have been disclosed (e.g., the method of workflow assignment disclosed in International Publication No. WO 2020/204811 A1) in the art may be applied accordingly. For example, resource information based on which resource assignment for a task may be determined at 516b may be stored in a resource information database 1206. Accordingly, determining (at 514 and 516) task assignment information for handling the event may function as workflow management.

[0069] As described hereinbefore, in various example embodiments, the event evaluation loop may comprise updating (at 518) the event-related data associated with the event. As also described hereinbefore, the event-related data may comprise sensor data (e.g., updated sensor data captured by one or more sensors) and/or manual feedback data (e.g., manual input data from a person assigned to attend to the event) obtained. Accordingly, while the event evaluation loop is being executed, event-related data associated with the event may be updated at each iteration of the event evaluation loop such that, at the next iteration (if any), the event status information is determined at 512 based on the updated event-related data and the task assignment information is determined at 514 and 516 based on one or more event status parameters in the event status information determined at 512. In other words, the event-related data associated with the event may be automatically collected and updated at each iteration of the event evaluation loop for the next iteration (if any) of the event evaluation loop.

[0070] For example, one or more sensors may be communicatively coupled to the system for event management based on various communication protocols or networks known in the art, including wired or wireless communication networks, such as but not limited to, Ethernet, cellular or mobile communication network (e.g., 3G, 4G, 5G or higher generation mobile communication network), Wi-Fi, Bluetooth, wired or wireless sensor network, satellite

communication network, wired or wireless personal or local area network and so on. In various example embodiments, the one or more sensors may continuously or periodically upload or transmit sensor data captured to the system, and the system may then store sensor data received in a sensor data database 506. As described above, at 518, in addition to the sensor data captured by sensor(s), the event-related data may further comprise manual input data from a person (a dispatched officer) assigned to attend to the event as feedback in relation to the event. For example, the officer may send a message to the system stating that the target person being tracked is located at a specific new location. In various example embodiments, as will be described later below, a dispatched person may provide the manual input data via a user interface on a mobile device being carried by the dispatched person. Accordingly, in various example embodiments, such manual input data from the officer is also considered as part of the event-related data, which is then utilized when determining the event status information at 512 at the next iteration of the event evaluation loop.

[0071] In various example embodiments, the event evaluation loop may further comprise outputting, at 520, one or more event status parameters of the event status information (e.g., determined at 512) and one or more event attribute parameters of the event attribute information (e.g., determined at 504) to a user interface (e.g., a display screen) for display thereat, such as for facilitating a better understanding of the event. For example, a system administrator and/or a dispatched person may request the system to show, or the system may automatically show, the latest situation of the event, and the system may then output various event-related information to a user interface (e.g., to a display screen viewable by the system administrator and/or the dispatched person) for display thereat. By way of an example only and without limitation, FIG. 14 depicts an example user interface displaying various event-related information for an event identified. For example, the event attribute information and the event status information may be displayed at a top portion of the user interface. The middle-left portion of the user interface may display the last video clip of a target person of interest. For example, it may be useful to highlight the target person's location in the camera view, e.g., showing a bounding box around the target person in highlighted color. The middle-right portion of the user interface may show the target person information, such as various event status parameters relating to the target person. The bottom portion of the user interface may show the current task set for the event, along with the corresponding resource assignment information and the progress of each task. Accordingly, the event-related information shown in the FIG. 14 are helpful for a system administrator and/or a dispatched person to have a better understanding

and awareness of the current situation of the event. It will be appreciated by a person skilled in the art that the present invention is not limited to any particular or specific configuration of the user interface and the user interface may be configured for displaying various event-related information as appropriate or as desired, such as for facilitating a better understanding of the event. In various example embodiments, the user interface may further include a user input function or module configured to allow a user to manually provide manual input data relating to the event.

[0072] FIG. 15 depicts an example user interface for configuring task mapping information, such as the example task mapping information as described hereinbefore with reference to FIG.

10 according to various example embodiments of the present invention. As described hereinbefore, the task mapping information may be utilized for determining the task set at 514. For example, the task mapping information may be configured by a system administrator. As described hereinbefore, the task mapping information may be configured to define a plurality of mapping relationships, each mapping relationship defined to map one or more event status parameters and one or more event attribute parameters to one or more tasks for handling the event. For example, for each task, the system administrator may configure the operation(s) to be performed, the type of personnel required and the number of personnel required.

[0073] FIG. 16 depicts an example user interface for configuring resource information (e.g., personnel information) according to various example embodiments of the present invention. As described hereinbefore, the resource information may be utilized for determining the task assignment information at 516. For example, resource information may comprise various profile information (e.g., particulars and skills) of each resource (e.g., each personnel) and may be stored at the resource information database 1206. In various example embodiments, the system for event management may be connected or connectable to an existing resource management system comprising resource information and may retrieve resource information therefrom (e.g., by downloading).

[0074] FIG. 17 depicts an example user interface for allowing a system administrator to approve or decline task(s) determined for the task set. For example, one or more tasks determined for the task set may require an approval from the system administrator before being utilized or implemented. For example, various tasks may be very time consuming and/or incur significant cost. Therefore, for such task(s), approval from the system administrator may be required and may only be implemented if the system administrator approves the task(s).

[0075] As mentioned hereinbefore, various example embodiments of the present invention have been described with respect to the event being in relation to an activity of a target person (e.g., a suspicious person or an attacker). However, as described hereinbefore, the present invention is not limited to any particular or specific event, as long as action(s) or task(s) may be required or desired to be performed in an attempt to address or resolve it, such as but not limited to, an incident or an unusual, unexpected or undesired observation or condition detected based on the sensor data. The event is also not limited to any particular or specific situation or purpose, as long as action(s) or task(s) may be required or desired to be performed in an attempt to address or resolve it. In various example embodiments, other types of actionable event may be in relation to an activity of a target person, a cleanliness of a target area, a condition of a target area of a building or a traffic flow (e.g., human and/or traffic flow) in a target area.

[0076] For example, in relation to the cleanliness of a target area, the target area may be a surface area. In this regard, at 502, sensor data in relation to the surface area may be captured (video and/or image data); at 504, an event may be identified or triggered based on the sensor data captured (e.g., the number of people that were around or came in contact with the surface area exceeded a predefined threshold); and at 510, an event evaluation loop may be performed with respect to the event for dynamically handling the event in the same, similar or corresponding manner as described hereinbefore according to various example embodiments (e.g., example event status information may include the number of people that were around or came in contact with the surface area and the size of the surface area that has been touched, and example task assignment information may include schedules of a number of cleaning staff and/or robot for cleaning the surface area).

[0077] For example, in relation to the condition of a target area of a building, for example, the building may be a manufacturing or chemical facility. In this regard, at 502, sensor data in relation to the target area of the manufacturing facility may be captured (e.g., temperature data, noise data, air quality data and so on); at 504, an event may be identified or triggered based on the sensor data captured (e.g., an abnormality detected, such as any one of the temperature level, noise level and air quality level exceeding a predefined threshold); and at 510, an event evaluation loop may be performed with respect to the event for dynamically handling the actionable event in the same, similar or corresponding manner as described hereinbefore according to various example embodiments (e.g., example event status information may include temperature level, noise level and air quality level, and example task assignment information may include schedules of a number of maintenance staff for inspecting or repairing

corresponding devices or machines that may require attention). For example, each device or machine of the target area of the manufacturing facility may have a corresponding digital representation in a building information database (e.g., digital twin database). Accordingly, the health status of various devices or machines in the building information database may be monitored based on sensor data, and an event may be identified or triggered based on the sensor data captured for detecting an abnormality, and the event identified may then be handled based on the event evaluation loop in the same, similar or corresponding manner as described hereinbefore according to various example embodiments of the present invention.

[0078] For example, in relation to a traffic flow in a target area, the traffic flow may be a human traffic flow in a building (e.g., shopping mall, airport or sport center) for performing human traffic flow analysis or a vehicle traffic flow for performing vehicle traffic volume analysis. In this regard, at 502, sensor data in relation to the vehicle traffic flow in the target area may be captured (e.g., video and/or image data); at 504, an event may be identified or triggered based on the sensor data captured (e.g., e.g., an abnormality detected, such as vehicle movement lower than a predefined threshold or number of vehicles exceed a predefined threshold); at 510, an event evaluation loop may be performed with respect to the event for dynamically handling the actionable event in the same, similar or corresponding manner as described hereinbefore according to various example embodiments (e.g., example event status information may include the number of vehicles that passed through the area over a predefined duration, average speed of vehicles passing through the area and/or a traffic congestion level (e.g., a representative event status parameter), and example task assignment information may include schedules of a number of traffic officers for attending to the event such as to resolve traffic congestion).

[0079] Accordingly, it can be understood by a person skilled in the art that depending on the particular use case, event status parameters in the event status information may be set or configured as appropriate or as desired for the intended purpose. For example, in the use case of tracking a suspicious person, an event status parameter denoting the severity level may be provided for determining the task assignment information. On the other hand, in the use case of monitoring traffic flow along a road, an event status parameter denoting the traffic congestion level may be provided for determining the task assignment information. In various example embodiments, event status parameters in the event status information are configured to facilitate the determination of the task assignment information.

[0080] FIG. 18 depicts a schematic drawing of an example system architecture 1800 for event management according to various example embodiments of the present invention. The example system architecture 1800 comprises an event management system 1802 configured to perform the method 500 of event management as described hereinbefore according to various example embodiments of the present invention (e.g., corresponding to the system 300 for event management as described hereinbefore with reference to FIG. 3 according to various embodiments) and a plurality of sensors 1804 configured to obtain sensor data. As shown in FIG. 18, the event management system 1802 may be communicative coupled to the plurality of sensors 1804 for obtaining the sensor data captured in relation to an event. The event management system 1802 is also able to communicate with one or more mobile devices 1806 of one or more personnel for exchanging data therebetween such as various event-related information and the manual feedback data as described hereinbefore according to various example embodiments.

[0081] Accordingly, the event management system 1802 for event management according to various example embodiments can advantageously be applied in a large variety of use cases. As described hereinbefore, for example, a user can easily define corresponding tasks to handle various possible events. By utilizing the event evaluation loop according to various example embodiments, the event management system 1802 is able to detect situation changes of the event and taking corresponding actions (e.g., task determination and resource assignment) dynamically and optimally. In addition, the event management system 1802 can transmit the event-related information to a person attending to the event for easy and better understanding of the event. Accordingly, various example embodiments may be applied in advanced event management systems. It will be appreciated by a person skilled in the art that the ability of detecting dynamic change of the event situation and automatically taking corresponding actions to handle the event can facilitate to shorten the response time and reduce the operation cost, which are highly desirable in event management.

[0082] While embodiments of the invention have been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

What is claimed is:

- 5 1. A method of event management using at least one processor, the method comprising:
identifying an actionable event based on sensor data; and
performing an event management iterative loop with respect to the actionable event
identified, each iteration of the event management iterative loop comprising:
determining event status information associated with the actionable event based
10 on event-related data associated with the actionable event;
determining task assignment information for handling the actionable event based
on one or more first event status parameters of the event status information; and
updating the event-related data associated with the actionable event.
- 15 2. The method according to claim 1, wherein
the event status information is determined based on the event-related data and one or
more event attribute parameters of event attribute information associated with the actionable
event, and
the event-related data comprises sensor data and/or manual feedback data obtained in
20 relation to the actionable event.
3. The method according to claim 2, wherein the one or more first event status parameters
are one or more representative event status parameters for the actionable event based on which
the task assignment information for handling the actionable event is determined.
- 25 4. The method according to claim 3, wherein at least one of the one or more first event
status parameters is determined based on a mapping of one or more other event status
parameters of the event status information to the first event status parameter.
- 30 5. The method according to any one of claims 2 to 4, wherein
said determining the task assignment information comprises determining a task set for
handling the actionable event, and

said determining the task set comprises determining one or more tasks for handling the actionable event based on the one or more first event status parameters and one or more event attribute parameters of the event attribute information associated with the actionable event.

5 6. The method according to claim 5, wherein at least one of the one or more tasks for handling the actionable event is determined based on a mapping of at least one of the one or more first event status parameters and at least one of the one or more event attribute parameters of the event attribute information to the task.

10 7. The method according to claim 5 or 6, wherein
said determining the task set is based on one or more task update conditions, and
the task set is updated based on the one or more tasks based on determining that the one or more task update conditions is satisfied.

15 8. The method according to any one of claims 5 to 7, wherein the task assignment information is determined based on the task set determined and resource information.

9. The method according to claim 8, wherein the task assignment information is determined further based on one or more task assignment conditions.

20

10. The method according to any one of claims 1 to 9, wherein the actionable event is in relation to an activity of a target person, a cleanliness of a target area, a condition of a target area of a building or a traffic flow in a target area.

25 11. The method according to claim 10, wherein
the actionable event is in relation to the activity of the target person, and
the one or more first event status parameters of the event status information comprises a severity level parameter for the actionable event.

30 12. A system for event management, the system comprising:
at least one memory; and
at least one processor communicatively coupled to the at least one memory and configured to:

identify an actionable event based on sensor data; and
perform an event management iterative loop with respect to the actionable event identified, each iteration of the event management iterative loop comprising:

- 5 determining event status information associated with the actionable event based on event-related data associated with the actionable event;
- determining task assignment information for handling the actionable event based on one or more first event status parameters of the event status information; and
- updating the event-related data associated with the actionable event.

- 10 13. The system according to claim 12, wherein
the event status information is determined based on the event-related data and one or more event attribute parameters of event attribute information associated with the actionable event, and
the event-related data comprises sensor data and/or manual feedback data obtained in
15 relation to the actionable event.

- 14. The system according to claim 13, wherein the one or more first event status parameters are one or more representative event status parameters for the actionable event based on which the task assignment information for handling the actionable event is determined.

20

- 15. The system according to claim 14, wherein at least one of the one or more first event status parameters is determined based on a mapping of one or more other event status parameters of the event status information to the first event status parameter.

- 25 16. The system according to any one of claims 13 to 15, wherein
said determine the task assignment information comprises determining a task set for handling the actionable event, and
said determining the task set comprises determining one or more tasks for handling the actionable event based on the one or more first event status parameters and one or more event
30 attribute parameters of the event attribute information associated with the actionable event.

- 17. The system according to claim 16, wherein at least one of the one or more tasks for handling the actionable event is determined based on a mapping of at least one of the one or

more first event status parameters and at least one of the one or more event attribute parameters of the event attribute information to the task.

18. The system according to claim 16 or 17, wherein

5 said determining the task set is based on one or more task update conditions, and
 the task set is updated based on the one or more tasks based on determining that the one or more task update conditions is satisfied.

19. The system according to any one of claims 16 to 18, wherein the task assignment
10 information is determined based on the task set determined and resource information.

20. The system according to claim 19, wherein the task assignment information is determined further based on one or more task assignment conditions.

15 21. The system according to any one of claims 12 to 20, wherein the actionable event is in relation to an activity of a target person, a cleanliness of a target area, a condition of a target area of a building or a traffic flow in a target area.

22. A computer program product, embodied in one or more non-transitory computer-
20 readable storage mediums, comprising instructions executable by at least one processor to perform a method of event management according to any one of claims 1 to 11.

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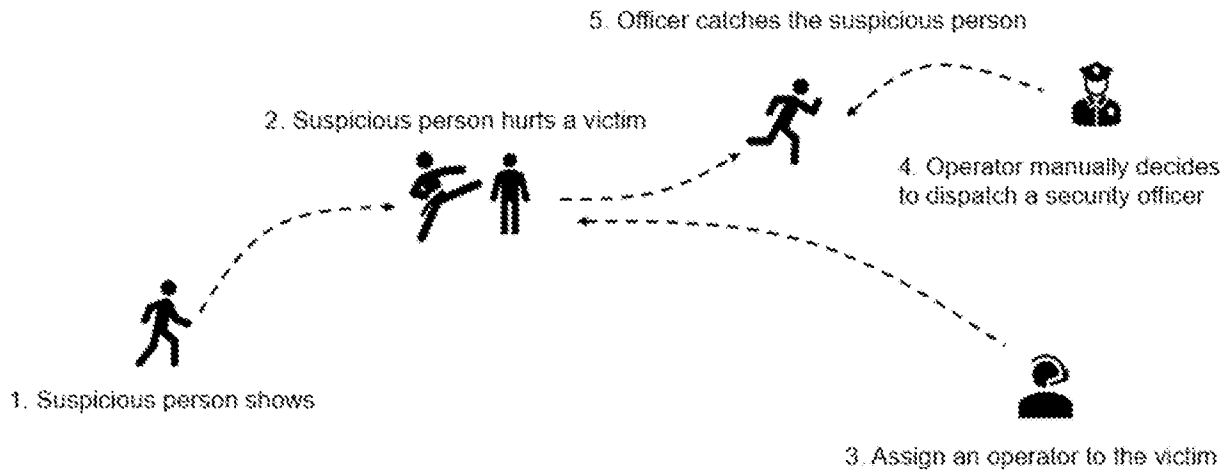


FIG. 1

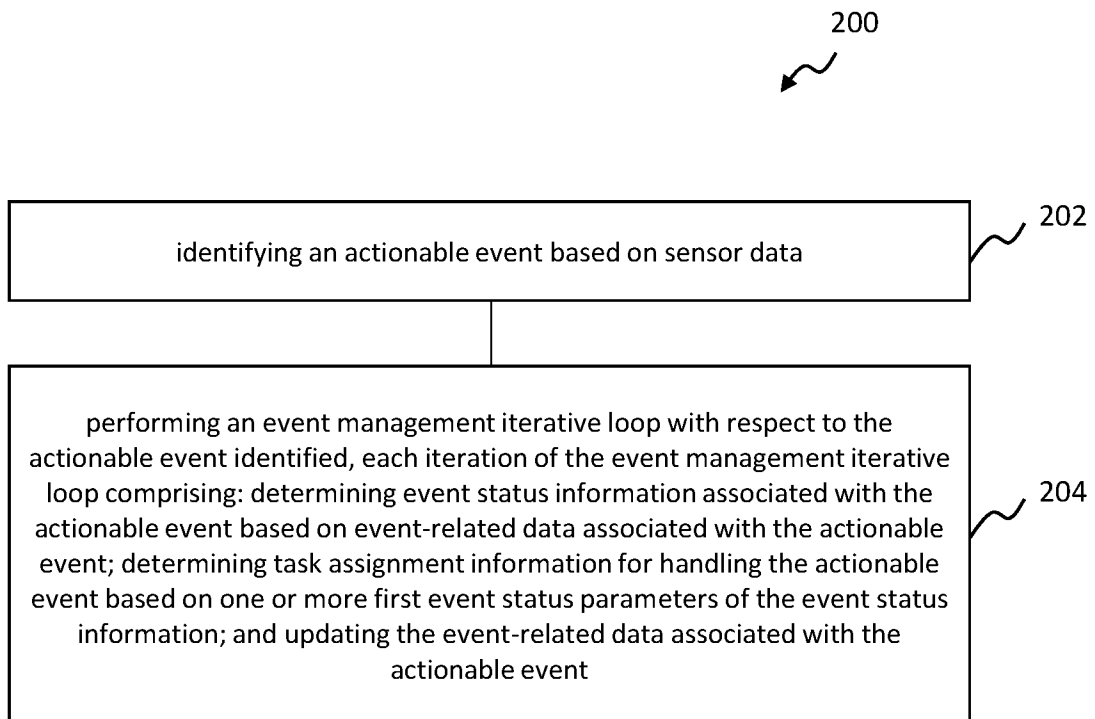


FIG. 2

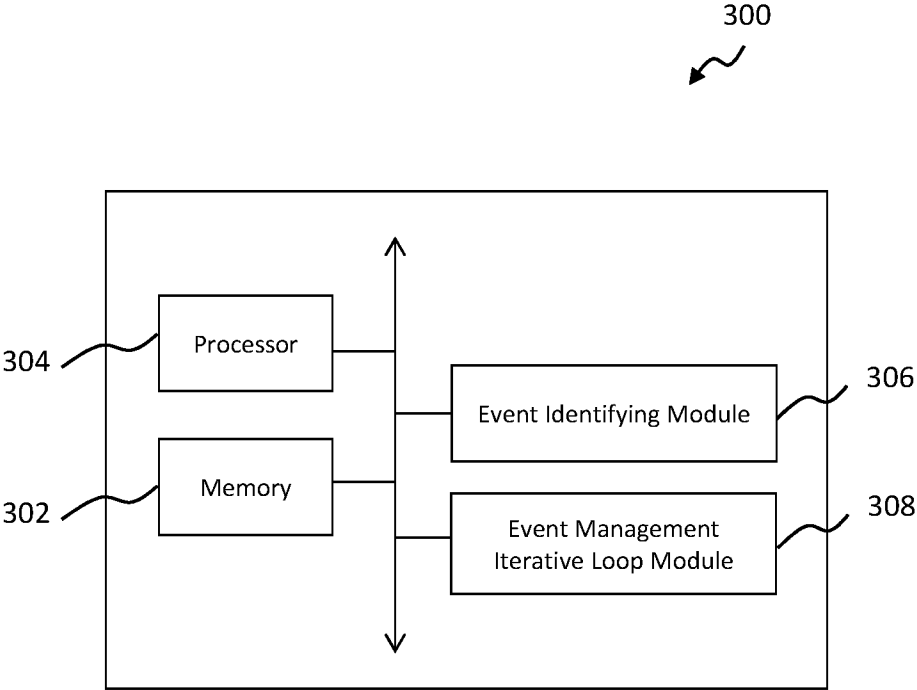


FIG. 3

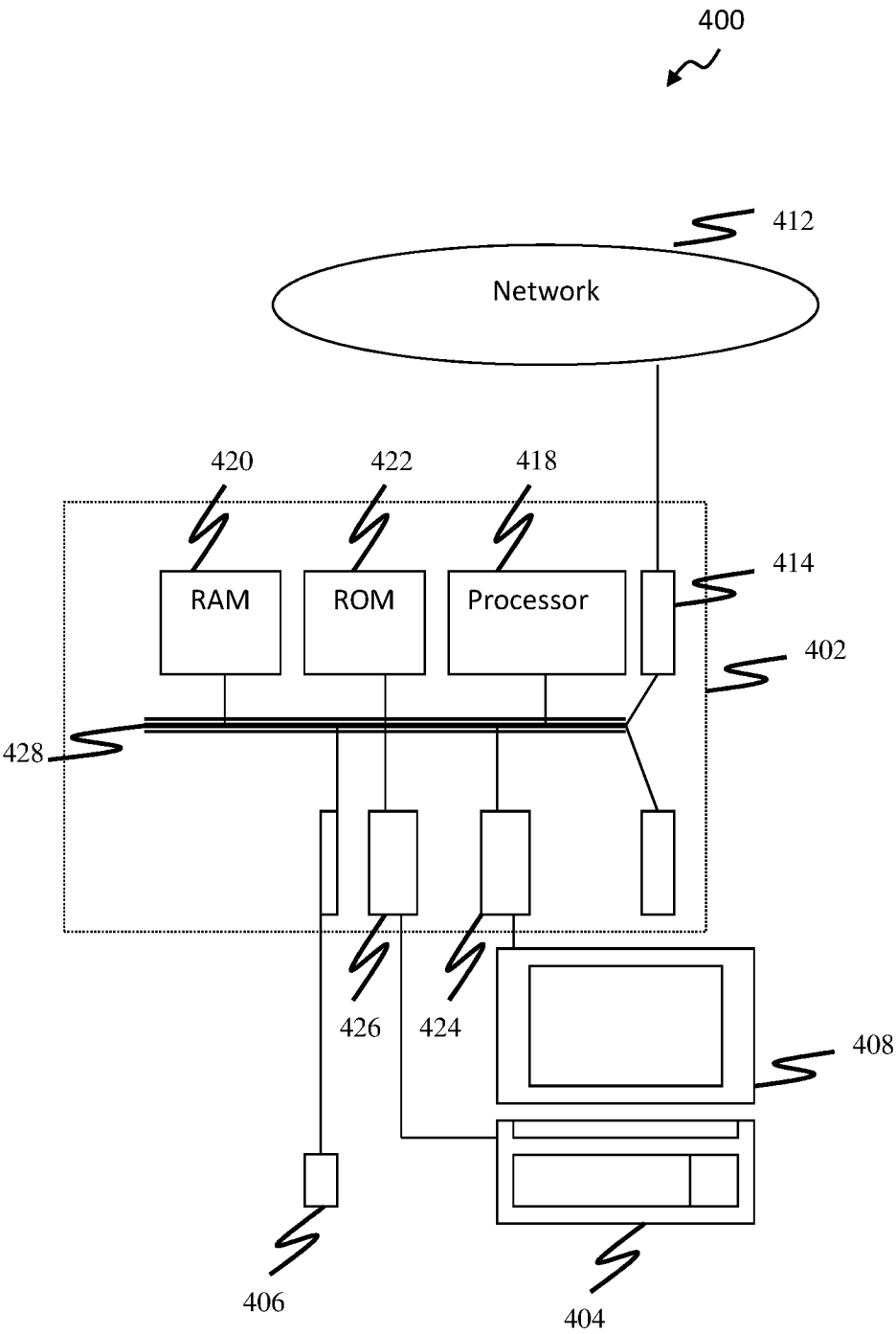


FIG. 4

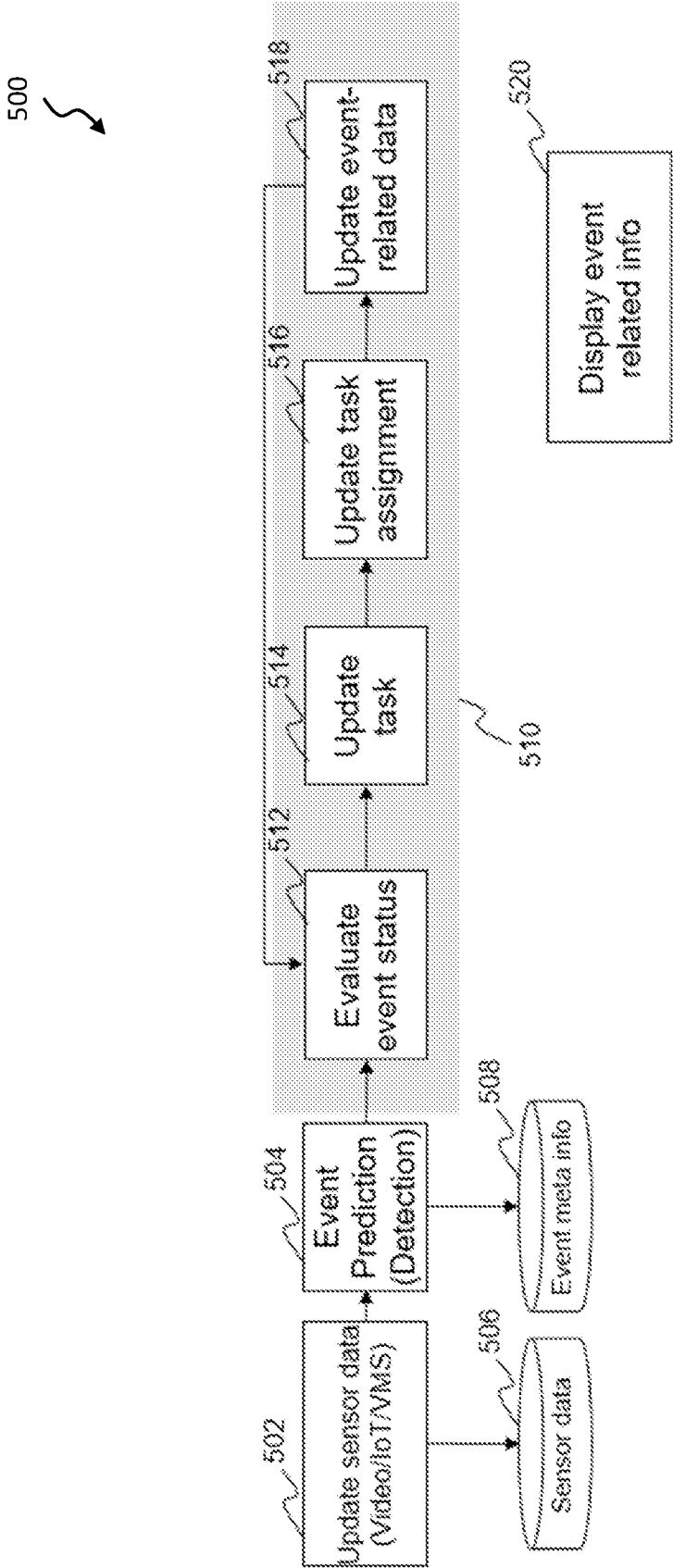


FIG. 5

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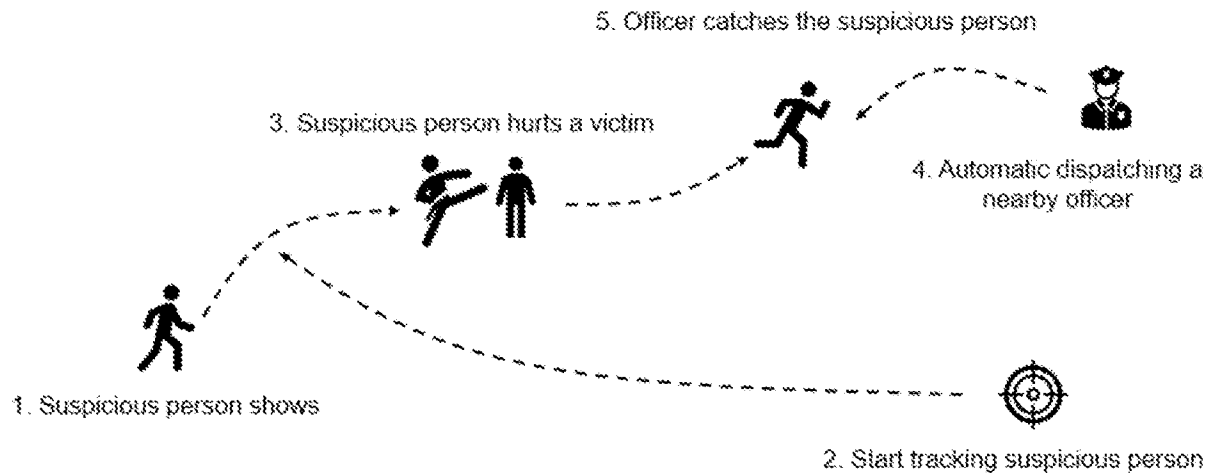


FIG. 6

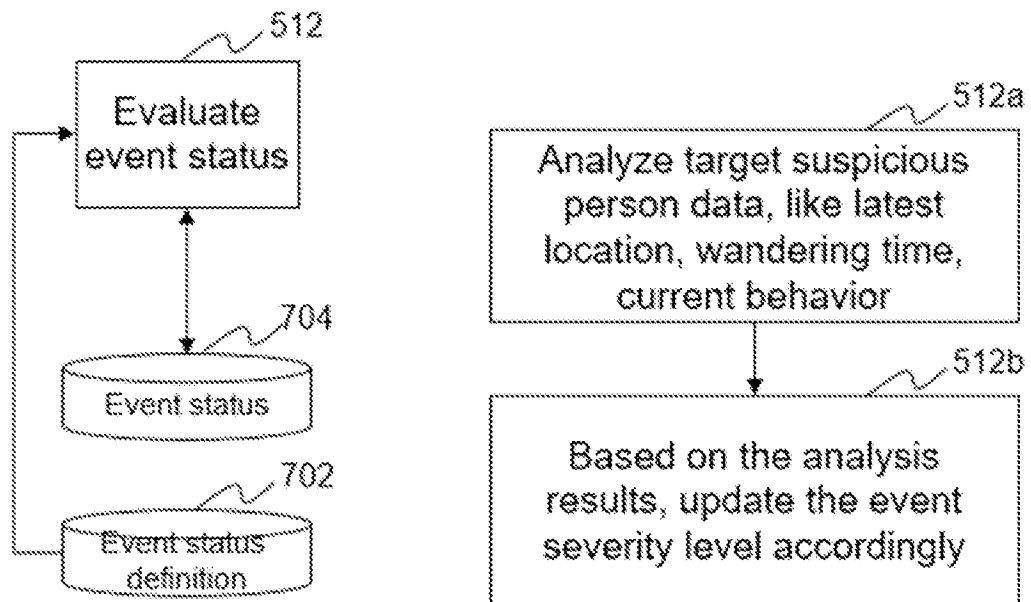


FIG. 7A

FIG. 7B

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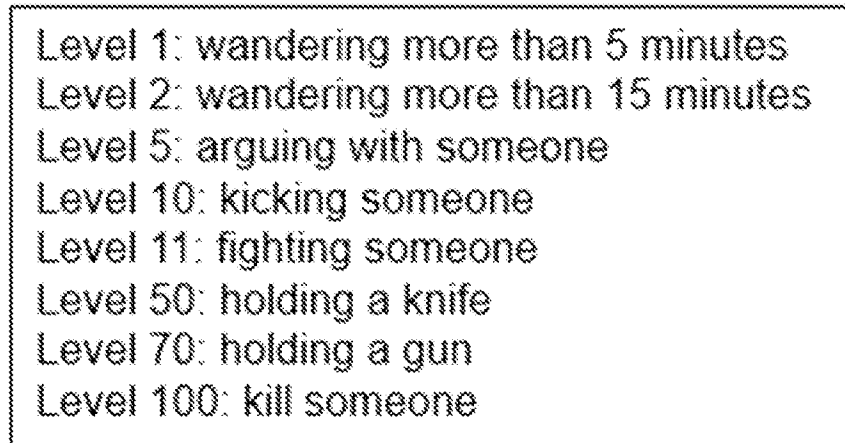


FIG. 8

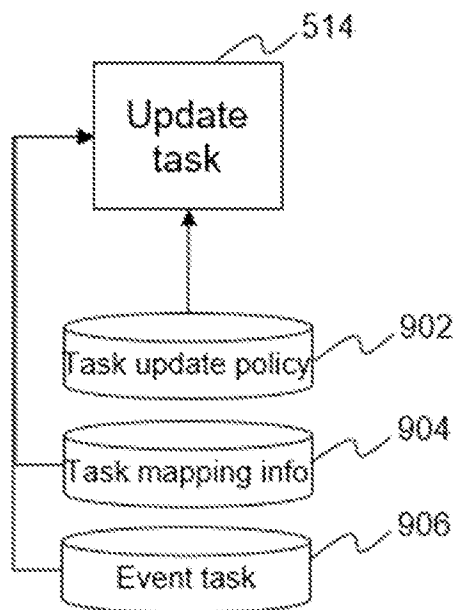


FIG. 9A

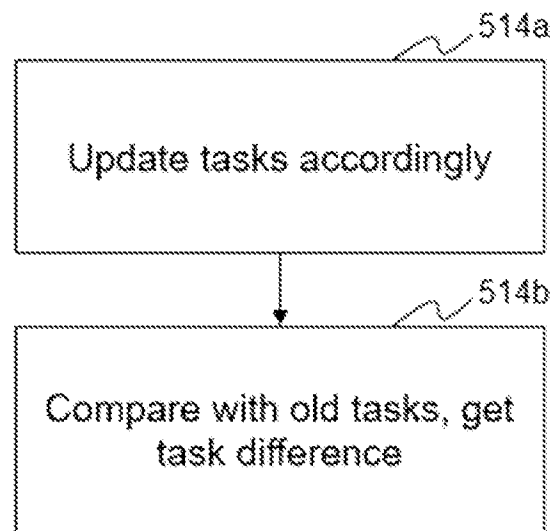


FIG. 9B

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Task mapping info example:
Event type(suspicious person):
Level1-9: do nothing
Level10-49: dispatch 1 security officer
Level50+: dispatch 3 security officers (nearby)

FIG. 10

Task update policy example:
Policy1:
 update tasks changes accordingly
Policy2:
 similar as Policy1, but only create new tasks
 without deleting old tasks
Policy3:
 if level change < 5, do nothing
 if level change $\geq$ 5, update tasks accordingly

FIG. 11

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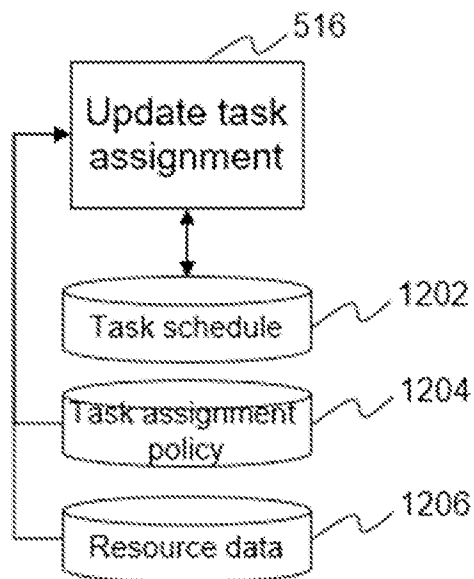


FIG. 12A

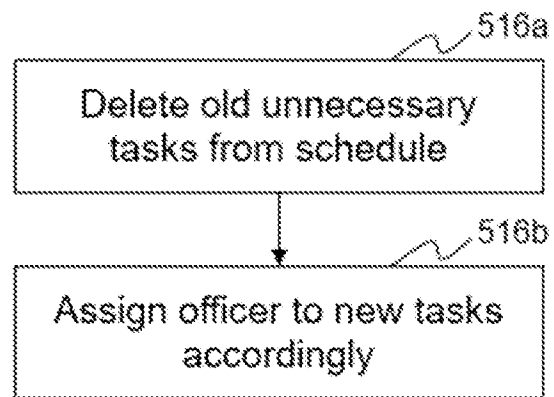


FIG. 12B

Task assignment policy example:

Policy1:

choose nearest officer

Policy2:

choose most skillful officer

Policy3:

choose officer with shortest response time

FIG. 13

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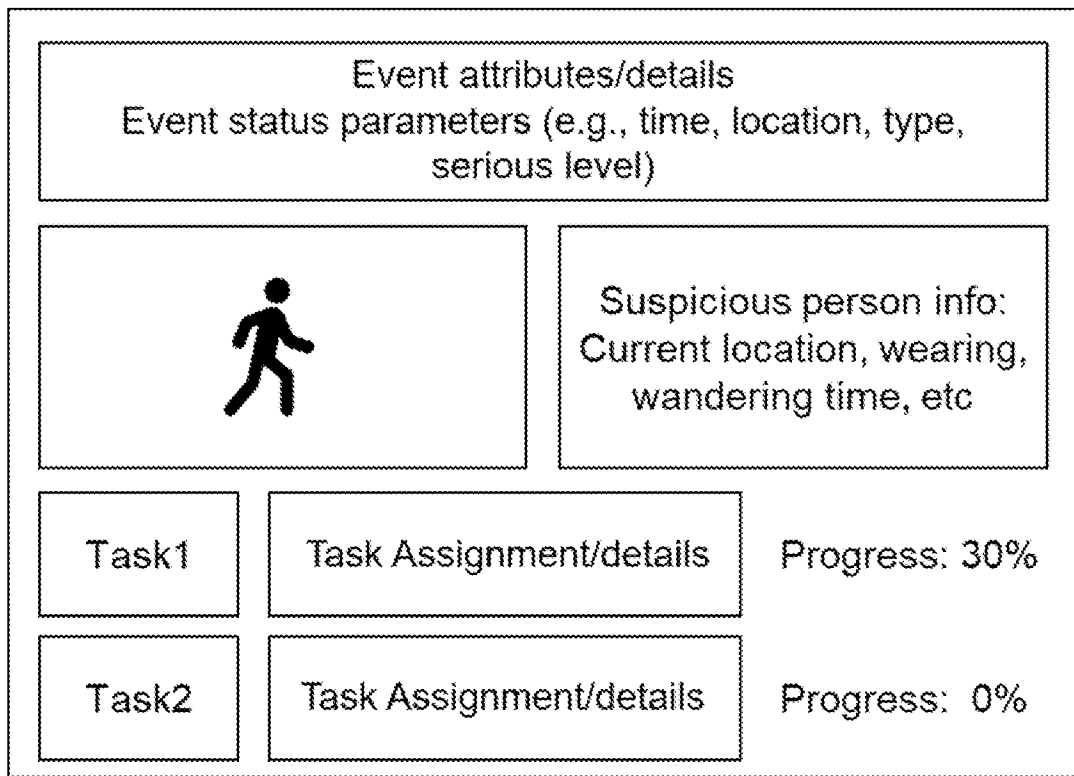


FIG. 14

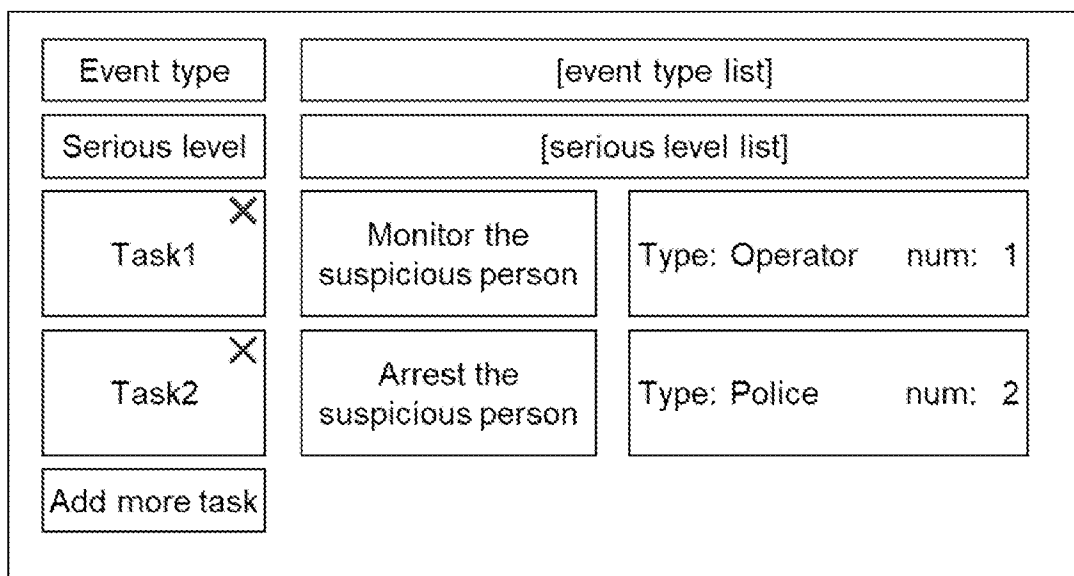


FIG. 15

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Name	John
Gender	Male
Profession type	Police
Skill level	3

FIG. 16

Event attributes/details				
Task1	Monitor the suspicious person	Operator	1	Already dispatched
Task2	Arrest the suspicious person	Health	1	Will be deleted
Task3	Arrest the suspicious person	Police	2	Approve Decline

FIG. 17

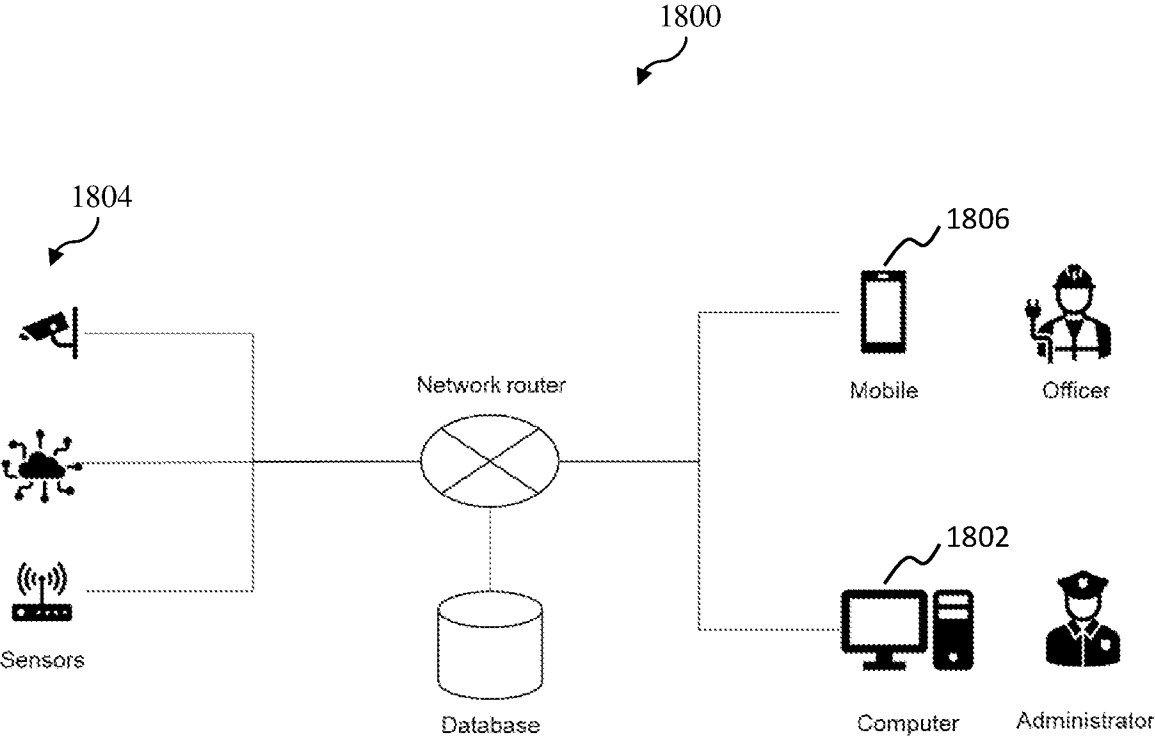


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2022/050827

A. CLASSIFICATION OF SUBJECT MATTER

G06Q 10/0631 (2023.01) G06Q 50/26 (2012.01) G08B 29/02 (2006.01)

According to International Patent Classification (IPC)

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06Q

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)

FAMPAT: sense, detect, supervise, cctv, camera, identify, measure, diagnose, predict, event, incident, instance, matter, fault, abnormal, danger, hazardous, suspicious, risk, accident, malfunction, assign, assemble, dispatch, allocate, plan, schedule, arrange, notify, distribute, staff, officer, serviceman, task, job, person, member, employee, worker, iterate, repeat, continue, replicate, circular, loop, periodic, update, renew, 更新, 重复, 继续, 持续, 工作人员, 派遣, 分配, 调度, 事件, 故障, 事故, 检测, 感测, 监测 and other related items

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 115018261 A (JIANGSU LANCHUANG INTELLIGENT TECH CO LTD) 6 September 2022 Paras. [0002], [0006]-[0013], [0019]-[0023], [0025], [0033], [0049]-[0064], [0067]-[0070], [0074]-[0075], [0078], [0088], [0111], [0162]-[0165] of the original non-English language document (a machine translation is enclosed only for your reference)	1-22
X	CN 113643520 A (NANJING JIWU INTELLIGENT TECH CO LTD) 12 November 2021 Para. [0001], [0007]-[0010], [0031], [0051], [0059]-[0060], [0074]-[0076], [0082] of the original non-English language document (a machine translation is enclosed only for your reference)	1-22
X	US 2020/0151641 A1 (AVEGLIANO, P.B. ET AL.) 14 May 2020 Paras. [0044], [0049]-[0052], [0054], [0062]-[0067], Fig.s 2A-2B	1-22

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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"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

27/07/2023

(day/month/year)

Date of mailing of the international search report

11/08/2023

(day/month/year)

Name and mailing address of the ISA/SG



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2022/050827**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 10037637 B1 (YAMADA, A.) 31 July 2018 Whole document particularly Para. [0070]-[0071]	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SG2022/050827

Note: This Annex lists known patent family members relating to the patent documents cited in this International Search Report. This Authority is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 115018261 A	06/09/2022	NONE	
CN 113643520 A	12/11/2021	NONE	
US 2020/0151641 A1	14/05/2020	NONE	
US 10037637 B1		JP 2018124958 A US 2018/0218550 A1	09/08/2018 02/08/2018