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(54) SYSTEM OF ELECTRONIC DEVICES FOR PROTECTION AND SECURITY OF PLACES, PERSONS AND GOODS

SYSTEM MIT ELEKTRONISCHEN VORRICHTUNGEN FÜR SCHUTZ UND SICHERHEIT VON PLÄTZEN, PERSONEN UND WAREN

SYSTÈME DE DISPOSITIFS ÉLECTRONIQUES PERMETTANT D'ASSURER LA PROTECTION ET LA SÉCURITÉ DE LIEUX, DE PERSONNES ET DE BIENS

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- **SEBE ET AL: "3D video surveillance with Augmented Virtual Environments", INTERNATIONAL MULTIMEDIA CONFERENCE - FIRST ACM SIGMM INTERNATIONAL WORKSHOP ON VIDEO SURVEILLANCE; BERKELEY, CALIFORNIA, NOVEMBER 02 - 08, 2003 (IWVS'03), ACM, NEW YORK, NY, US, 2 November 2003 (2003-11-02), pages 107-112, XP007911819, DOI: 10.1145/982452.982466 ISBN: 978-1-58113-780-4**

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Description

OBJECT OF THE INVENTION

[0001] System of electronic devices to detect and locate changes in a predetermined space for protection and security of places, persons, and goods.

STATE OF THE ART

[0002] Many place, person, and goods security and protection systems are realized by using of sensors of different types including, for example, thermal sensors, anti-intrusion sensors, chemical sensors, environmental microphones, and cameras. In order to provide the information necessary to protect and secure places, persons, and goods, it is necessary to use the information concerning any changes that occur in the space to be monitored. For example, and for the sake of clearness, a change that occurs in the monitored space might be the opening of a door or the presence of a person in a room who doesn't own an electronic identification paper.

[0003] The security and protection system known so far activate an alarm whenever a change occurs in the space monitored by the security and protection system including, for example, the opening of a door or the appearance of a presence on the video display unit of a camera, which could be interpreted by video-analysis algorithms as an intrusion.

[0004] A relevant background of the present invention is the document WO 2012/153805. It teaches a system for monitoring a predetermined space, in particular by three - dimensional server and image process server. An other relevant document is Sebe et Al "3D video surveillance with Augmented Virtual Environments", International Multimedia Conference - First ACM SIGMM International Workshop on Video Surveillance; Berkeley, California, November 2-8, 2003 (IWVS'03), ACM, New York, NY, US, 2 November 2003, pages 107-112, XP007911819. Said document explains the visualization system for video surveillance based on an Augmented Virtual Environment (AVE) that fuses dynamic imagery with 3D models in a real-time display to help observers comprehend multiple streams of temporal data and imagery from arbitrary views of the scene. Unfortunately, said systems are not capable of selecting when a change in the monitored space represents a threat for the security and/or protection of that space without generating a high number of false alarms. Specifically, said systems are not capable of correlating to each other the signals coming from a variety of general sensors, i.e. sensors not having special characteristics and currently available on the market, to analyze all changes that could be potentially identified by all general sensors, even of different technologies, which monitor a given portion of the space to be monitored. A number of tests demonstrated that correlating the sensors results in substantially decreasing the number of false alarms, while increasing the selectivity of the protection and security system, by discriminating events pre-qualified by the user as relevant events from those non-relevant. An accurate location of every individual change in the space represents a fundamental element to correlate the changes detected by the sensors to each other correctly.

[0005] Such a lack of selective capability of the security and protection systems known so far is partially counteracted by the adoption of a GPS for the geographical location, for instance, of the foreign body that caused a change in the monitored space. Unfortunately the adoption of a GPS system has a number of drawbacks:

- The intrinsic inaccuracy in the GPS technology.
- The fact that seldom is a GPS system capable of locating a change: the foreign body that generated the change, as mentioned above as an example, is not provided with a GPS detector and cannot be located by means of said detector, which, at most, might locate the sensor that detected the change, not certainly the change itself. Such a shortcoming is evidently a major drawback in the protection and security systems known so far.
- A GPS system cannot be used in all places. For instance, it cannot be used indoor, especially if such place, for instance the vault of a bank, is protected.
- The GPSs used in the protection and security systems known so far use a system of bi-dimensional coordinates that don't allow the location of a change in the three-dimensional space: consider, for instance, the protection requirements of operators who perform their own activities in a suspended position, for instance on pylons or scaffolds. The accidental displacement of an operator toward a dangerous area cannot be detected by the protection and security systems known so far, which use a GPS system, with the consequent risks of accidents.
- The adoption of sensors equipped with a GPS equipment is an additional cost for the system.

SUMMARY OF THE INVENTION

[0006] The drawbacks of the art known so far are overcome by a system of electronic devices for the detection, location, and correlation of changes in a space to be monitored for the protection and the security of that space, persons, and goods present in said space, which will be described below.

[0007] The system according to the present invention also identifies further improvements of the place, person, and goods protection and security system, also described below. The system according to the present invention is capable of correlating in an innovative and advantageous manner the changes of the signals coming from the sensors on the basis of criteria related to their coincidence in the space, thus allowing an accurate evaluation of the events and their classification either as relevant or non-relevant events on the basis of security rules

pre-set by the user. This characteristic will be more widely illustrated in the description of figure 2, which illustrates, by way of an example, the operating modes of the system according to the present invention, and in particular with reference to the characteristic of said correlation.

[0008] The system of electronic devices for the detection and location of changes in a predetermined space for the protection and security of places, persons, and goods according to the present invention is based on an architecture including at least two sensors, a first data processing electronic device, which is the user interface, and at least one second data processing device.

[0009] It is here pointed out that by sensor or sensors we mean a sensor or several sensors, as defined above, commonly available on the market, i.e. without any specific characteristics for being used in the frame of the present invention.

[0010] Said first data processing device is connected to the second data processing device. In a preferred embodiment, said first device is separate from the remaining components of the said system and is preferably a personal computer, a smart phone, a tablet, or a terminal equipped with a user interface.

[0011] The second device, more complex than the first device, is equipped with first electronic means that reproduce the place to be monitored in a three-dimensional virtual reality with an appropriate fidelity on the basis of the mentioned place to be monitored. Let's point out that the degree of fidelity according to which the place to be monitored is reproduced in a three-dimensional virtual reality by the first electronic means depends on the monitoring requirements set by the user. For this reason, the words "appropriate fidelity" have been used to illustrate how the first electronic means reproduce the place to be monitored into a three-dimensional virtual reality.

[0012] If the place to be monitored is a square, the fidelity degree required to reproduce the square into the three-dimensional virtual reality is lower than in the case when the place to be monitored is a room. In a square the objects and the elements in general to be monitored have a greater dimension with respect to the objects and the elements in general to be monitored in a room: in a square, for instance, cars or persons have to be monitored, whereas in a room, for instance, paintings, vases, papers, persons have to be monitored. The fidelity degree required to reproduce a square into the three-dimensional virtual reality, in the example mentioned above, is lower than that required for the room according to the above mentioned example, the objects and the elements in general to be monitored in the square having greater dimensions than those present in the room.

[0013] Said second data processing device is adequately preset:

to acquire from the first device and store the security rules set by the system user for the place to be monitored;

to receive from the sensors data and/or signals, both referred to as "signals" here below;

to three-dimensionally map, continually as time goes by, the changes of the values that represent the signals received from the sensors in the mentioned three-dimensional virtual reality; to process, for every portion of the three-dimensional virtual reality, all changes of the signals mapped thereon to take out the data suitable for the application of the security rules set by the user for said place to be monitored;

to correlate to each other the changes of the signals received from different sensors and referred to the same portion of space; to apply the security rules set by the user for said place to be monitored on the basis of the processing of the changes of the mapped signals;

to activate the alarm signals specified by said rules on the first electronic device and/or on other external devices.

[0014] As mentioned above, the second data processing device maps the changes of the signals coming from the sensors as time goes by into the three-dimensional virtual reality. Such a mapping is carried out on the basis of: the subdivision of said virtual reality according to a cell-based three-dimensional grid; the association of the three-dimensional grid of every sensor and its respective signals with said cells.

[0015] In order to process the signals coming from the sensors appropriately, the second data processing device comprises one or several third data processing devices independent from and intercommunicating with each other. Each of said devices will be referred to as "Agent device" below.

[0016] Each Agent device is connected to at least one sensor and is capable of processing the signals of every sensor that it is connected to.

[0017] In order to process the signals coming from the sensors adequately, the second data processing device also comprises a fourth data processing device, referred to as Gateway below, capable of: identifying those Agent devices whose sensors have their signals associated with in sets of cells of the three-dimensional grid featuring a non-null intersection, referred to as "correlated Agents" below;

to activate a correlation between said thus identified Agent devices.

[0018] Every Agent device is capable of autonomously analyzing the signals coming from the sensors.

[0019] From the analysis of the changes of the said signals, every Agent device:

extrapolates the appearance of objects or events;

classifies said objects or events by type;

places said objects or events in the cells of the grid of the virtual reality;

alternatively calculates the probabilities of error or the reliability of correctness of the analysis made, in short referred to as "reliability" below.

[0020] By means of said features, every Agent device is capable of continually communicating to the remaining Agent devices correlated thereto its own results of the analysis and its respective reliability.

[0021] Therefore, every Agent device is capable of processing the results of the analysis and the reliability received from every correlated Agent together with its own results of the analysis and reliability, to get overall analysis results and an overall reliability. In the system according to the present invention, the overall analysis and the overall reliability are performed by an Agent device automatically identified on the basis of predetermined criteria and said Agent device communicates the results of the overall analysis and the overall reliability to the Gateway. Said communication takes place continually and, likewise, continually is identified, on the basis of the preset criteria, the Agent device that communicates the results of the overall analysis and the overall reliability to the Gateway.

[0022] Finally, the Gateway applies the security rules set by the user for said place to be secured and protected on the basis of the mentioned results of overall analysis and overall reliability, by activating the specified notification and/or alarm communications, for instance it activates a visual alarm, for instance a blinking light, or sends a signal to the first data processing device, for instance an audible signal or a message.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Figure 1 shows the assembly of the system according to the present invention.

Figure 2 shows a schematic example of operation of the system according to the present invention.

[0024] Figure 1 shows a system of electronic devices (1) for the detection and location of changes in a predetermined space for the protection and the security of places, persons, and goods. Said figure 1 shows four sensors (2) and a first data processing electronic device (3). Said device (3) might be a personal computer, like that shown in the figure, but it also might be a tablet, a smart phone, or any other terminal equipped with a user interface.

[0025] A second data processing device (4) is shown in dotted lines. Said second device (4) might be implemented on any hardware suitable for processing data, for instance a server.

[0026] The device (4) is connected to the first data processing device (3) and comprises first electronic means (5), not shown in the figure, which reproduce with an appropriate fidelity the place (A) to be monitored, not shown in the figure, into a three-dimensional virtual reality, not shown in the figure. In said second device (4) there are also second electronic means (6), not shown in the figure, capable of acquiring, storing the security rules set by the user for said place (A), receiving from the sensors (2) data and/or signals, three-dimensionally mapping in a continual manner as time goes by in said three-dimensional virtual reality the values that represent the signals coming from the sensors and the changes, processing, for each portion of the three-dimensional virtual reality, all signals mapped thereon to take out the data suitable for the application of the security rules set by the user for said place (A), applying the security rules set by the user for said place (A) on the basis of the processing of the mapped signals and activating the alarm signals specified by it on the first data processing device (3) and/or on other external devices.

[0027] The mapping into the three-dimensional virtual reality of the values that represent the signals coming from the sensors (2) as time goes by is performed by the second data processing device (4) on the basis of the subdivision of said virtual reality according to a cell-based three-dimensional grid, of the association with said cells of the three-dimensional grid of every sensor (2) and of its respective signal. Such a mapping is not shown in the figure because of evident difficulties of representation.

[0028] Figure 1 also shows the presence, in the second data processing device (4), of third data processing devices (7), referred to as Agent devices. Said Agent devices (7) are graphically represented as four devices. They are suitable for processing the signals coming from the sensors. They are independent of and intercommunicating with each other. Each of said Agent devices (7) is connected to a sensor (2). According to the present invention, the Agent devices can in any case be connected to one or several sensors (2).

[0029] Each of said Agent devices (7) is suitable for autonomously analyzing the signals continually coming from the sensors, so as:

- to identify the appearance of objects or events (change);
- to classify said objects or events by type (classification);
- to position said objects or events with reference to the cells of the grid of the virtual reality (positioning);
- to alternatively calculate the probability of error or the reliability of correctness of the analysis made (reliability).

[0030] Each of said Agent devices (7) is also capable of continually communicating with the remaining Agent devices (7) correlated thereto every change, classification, positioning, all together referred to as "results of the analysis", and its respective reliability, by processing the results of the analysis made received from every Agent device (7) correlated to its own results of analysis and reliability, all together referred to as "overall analysis and overall reliability", and of continually communicating to the Gateway device (8), already mentioned in the summary of the invention, the overall analysis and the overall reliability. Said communication is implemented by an agent automatically identified on the basis of predeter-

mined criteria.

[0031] Figure 1 also shows the presence in the second data processing device (4) of a fourth data processing device (8), referred to as Gateway. Said fourth device is capable of identifying the Agent devices (7) having the signals of the sensors that every Agent device (7) is connected to that are associated with in sets of cells of the three-dimensional grid featuring a non-null intersection, referred to as "correlated agents", and of activating a correlation between said thus identified Agent devices (7).

[0032] The Gateway (8) is also capable of applying the security rules set by the user for said place (A) on the basis of the above defined overall analysis and overall reliability, by activating the notifications or alarms predetermined by the user.

[0033] Figure 2 shows an example of operation of the system according to the present invention for the classification of the changes.

[0034] Two sensors (2^1 and 2^2), which are two cameras in this example, monitor a common area of the place to be monitored (A). The Agent devices (7^1 and 7^2) are correlated to each other, being connected to the sensors (2^1 and 2^2) which, as already said, monitor a common area.

[0035] In the example shown in figure 2, each of the sensors (2^1 and 2^2) detects a change. The changes detected by every sensor (2^1 and 2^2) are located on the basis of the mapping of the second electronic means (6), by determining that both sensors (2^1 and 2^2) detected a change in the same position.

[0036] As a matter of fact, each of said sensors detected a change and communicated its respective signal to the Agent device (7^1 or 7^2) that it is connected to.

[0037] Said Agent devices (7^1 and 7^2) identify that the appearance of objects or events did take place, in other words there was a change, as defined above in the summary of the invention. The change is positioned with reference to the cells of the virtual reality and is classified: in this example, it would be the presence of one person as shown in the graphical representation of figure 2. The system according to the present invention determines that it is matter of one person, in that each of the two Agent devices (7^1 and 7^2), correlated to each other, communicates to the other the detected change, its type and its position. In the example shown in figure 2, each of said Agent devices (7^1 and 7^2) communicates to the other having identified a change due to an object that can be classified, with a certain reliability, as a person in a precise position of the virtual reality. Being the position identical for both changes, each Agent (7^1) and (7^2) recognizes that the two changes coincide in the same change. Said change is synthetically classified by the Agent devices (7^1 and 7^2) on the basis of the classifications and their respective reliabilities, provided by the two said Agent devices.

Claims

1. A system of electronic devices (1) for the detection and location of changes in a predetermined space for the protection and the security of places, persons, and goods including at least two sensors (2), a first data processing electronic device (3) and at least one second data processing device (4) connected to the first data processing device (3), the second data processing device (4) comprising:

(a) first electronic means (5) reproducing the place (A) to be monitored with a fidelity appropriate to the place into a three-dimensional virtual reality;
(b) second electronic means (6) arranged for:

(b^1) acquiring and storing the security rules set by the user for said place;
(b^2) receiving data and/or signals from the sensors;
(b^3) three-dimensionally mapping in said three-dimensional virtual reality, continually as time goes by, the values that represent the signals;
(b^4) processing, for each portion of the three-dimensional virtual reality, all signals mapped thereon to take out the data suitable for the application of the security rules set by the user for said place;
(b^5) applying the security rules set by the user for said place on the basis of the processing of the mapped signals and activating the alarm signaling foreseen by it on the first data processing device and/or other external devices and mapping in the three-dimensional virtual reality the values that represent the signals coming from the sensors as time goes by, on the basis of:

(a) the subdivision of said virtual reality according to a cell-based three-dimensional grid;
(b) the association with said cells of the three-dimensional grid of every sensor and its respective signal **characterized by** the fact that the second data processing device (4) comprises:

(a) several third data processing devices (7), which are agent devices independent of and intercommunicating with each other, each agent device being connected to at least one sensor (2) and capable of processing signals,
(b) a fourth data processing device (8), which is a gateway device ar-

ranged for identifying the agent devices whose sensors have their signals associated with in sets of cells of the three-dimensional grid featuring a non-null intersection which are correlated agents and activating their correlation.

2. A system according to claim 1, **characterized by the fact that** every Agent device is capable of autonomously analyzing the signals continually coming from the sensors (2), so as:

- to identify the appearance of at least one object or at least one event (change);
- to classify said objects or events by type (classification);
- to position every object or event with reference to the cells of the grid of the virtual reality (positioning);
- to alternatively calculate the probability of error or the reliability of correctness of the analysis made (reliability).

3. A system according to claim 2 , where every Agent device:

(a) continually communicates to the remaining Agent devices correlated thereto every change, classification, positioning (results of the analysis) and its respective reliability;
(b) processes the results of the analysis received from every correlated Agent device with its own results of analysis and reliability (overall analysis and overall reliability);
(c) continually communicates to the Gateway device the overall analysis and overall reliability.

4. A system according to claim 3 , where the communication of the overall analysis and the overall reliability to the Gateway device is implemented by at least one Agent device automatically identified on the basis of predetermined criteria.

5. A system according to claim 3, **characterized by the fact that** the Gateway device applies the security rules set by the user for said place on the basis of the overall analysis and overall reliability.

Patentansprüche

1. Ein System elektronischer Vorrichtungen (1) für die Erkennung und Ortung von Veränderungen in einem vorher festgelegten Raum zum Schutz und zur Sicherheit von Orten, Personen und Gütern, das mindestens zwei Sensoren (2), ein erstes elektronisches Datenverarbeitungsgerät (3) und mindestens ein zweites Datenverarbeitungsgerät (4), das mit dem ersten Datenverarbeitungsgerät (3) verbunden ist, einschließt, wobei das zweite Datenverarbeitungsgerät (4) Folgendes umfasst:

(a) erste elektronische Mittel (5), die den zu überwachenden Ort (A) mit einer dem Ort angemessenen Wiedergabetreue als dreidimensionale virtuelle Realität reproduzieren;
(b) zweite elektronische Mittel (6), angeordnet um:

(b^1) die vom Nutzer für den genannten Ort festgelegten Sicherheitsregeln zu erfassen und zu speichern;
(b^2) Daten und/oder Signale von den Sensoren zu empfangen;
(b^3) die die Signale repräsentierenden Werte im Verlauf der Zeit kontinuierlich in genannter dreidimensionaler virtueller Realität dreidimensional darzustellen;
(b^4) für jeden Abschnitt der dreidimensionalen virtuellen Realität alle darin dargestellten Signale zu verarbeiten, um diejenigen Daten aufzunehmen, die für die Anwendung der vom Nutzer für genannten Ort festgelegten Sicherheitsregeln geeignet sind;
(b^5) die vom Nutzer für genannten Ort festgelegten Sicherheitsregeln auf Grundlage der Verarbeitung der dargestellten Signale anzuwenden und das von ihm vorgesehene Alarmsignal bei dem ersten datenverarbeitenden Gerät und/oder anderen externen Geräten auszulösen und in der dreidimensionalen virtuellen Realität im Verlauf der Zeit die Werte darzustellen, die die von den Sensoren eingehenden Signale darstellen, auf Grundlage:

(a) der Unterteilung der genannten virtuellen Realität gemäß einem zellbasierten dreidimensionalen Raster;
(b) der Verknüpfung mit genannten Zellen des dreidimensionalen Rasters von jedem Sensor und dem ihm zugehörigen Signal, **dadurch gekennzeichnet, dass** das zweite datenverarbeitende Gerät (4) Folgendes umfasst:

(a) mehrere dritte datenverarbeitende Geräte (7), welche Agent-Geräte sind, unabhängig voneinander und miteinander kommunizierend, wobei jedes Agent-Gerät mit mindestens einem Sensor (2) verbunden und in der Lage ist, Signale zu verarbeiten,
(b) ein viertes datenverarbeiten-

des Gerät (8), welches ein Gateway-Gerät ist, das so angeordnet ist, dass es die Agent-Geräte identifiziert, bei denen die von den Sensoren eingehenden Signale innerhalb von Zellsätzen des dreidimensionalen Rasters, mit dem Merkmal einer Ungleich-Null-Überschneidung, verknüpft sind und die korrelierte Agenten sind und ihre Korrelation aktivieren.

2. Ein System nach Anspruch 1, **dadurch gekennzeichnet, dass** jedes Agent-Gerät in der Lage ist, die von den Sensoren (2) kontinuierlich eingehenden Signale selbstständig zu analysieren, um somit:

- das Auftreten von mindestens einem Objekt oder mindestens einem Ereignis zu identifizieren (Veränderung);
- genannte Objekte oder Ereignisse nach Typen zu klassifizieren (Klassifizierung);
- jedes Objekt oder Ereignis mit Bezug auf die Rasterzellen der virtuellen Realität zu positionieren (Positionierung);
- alternativ die Fehlerwahrscheinlichkeit oder die Reliabilität der Richtigkeit der ausgeführten Analyse zu berechnen (Reliabilität).

3. Ein System nach Anspruch 2, bei dem jedes Agent-Gerät:

(a) kontinuierlich den damit verbundenen übrigen Agent-Geräten jede Veränderung, Klassifizierung, Positionierung (Ergebnisse der Analyse) und betreffende Reliabilität übermittelt;
(b) die Analyse-Ergebnisse, die von jedem, mit ihm verbundenen, Agent-Gerät erhalten werden, mit den eigenen Ergebnissen von Analyse und Reliabilität verarbeitet (Gesamtanalyse und Gesamt-Reliabilität);
(c) die Gesamtanalyse und Gesamt-Reliabilität kontinuierlich dem Gateway-Gerät übermittelt.

4. Ein System nach Anspruch 3, bei dem die Übermittlung der Gesamtanalyse und Gesamt-Reliabilität an das Gateway-Gerät durch mindestens ein, nach vorher festgelegten Kriterien, automatisch identifiziertes Agent-Gerät ausgeführt wird.

5. Ein System nach Anspruch 3, **dadurch gekennzeichnet, dass** das Gateway-Gerät die vom Nutzer für genannten Ort festgelegten Sicherheitsregeln auf Grundlage der Gesamtanalyse und Gesamt-Reliabilität anwendet.

Revendications

1. Un système de dispositif électronique (1) pour la détection et la localisation de changements dans un espace prédéterminé, visant à la protection et à la sécurité des lieux, des personnes et des biens, comprenant au moins deux capteurs (2), un premier dispositif électronique de traitement de données (3) et au moins un second dispositif de traitement de données (4) connecté au premier dispositif de traitement de données (3). Le second dispositif de traitement de données (4) comprenant :

(a) un premier dispositif électronique (5) reproduisant l'endroit à surveiller en réalité virtuelle tridimensionnelle, avec une fidélité appropriée au lieu ;
(b) un second dispositif électronique (6) conçu pour :

(b^1) l'acquisition et le stockage des règles de sécurité définies par l'utilisateur pour le lieu déterminé ;
(b^2) la réception des données et/ou des signaux provenant des capteurs ;
(b^3) la création en réalité virtuelle tridimensionnelle d'une carte, continuellement à jour, des valeurs que représentent les signaux ;
(b□) le traitement, pour chaque partie en réalité virtuelle tridimensionnelle, de tous les signaux cartographiés sur celle-ci pour extraire les données appropriées pour l'application des règles de sécurité définies par l'utilisateur pour le lieu déterminé ;
(b□) l'application des règles de sécurité définies par l'utilisateur pour le lieu déterminé, sur la base du traitement des signaux cartographiés et l'activation de la signalisation d'alarme prévue par celui-ci sur le premier dispositif de traitement de données et/ou d'autres dispositifs externes ainsi que la cartographie en réalité virtuelle dimensionnelle des valeurs que représentent les signaux émis, au fil du temps, par les capteurs sur la base de :

(a) la subdivision de ladite réalité virtuelle selon une grille tridimensionnelle basée sur des cellules ;
(b) l'association desdites cellules de la grille tridimensionnelle avec chaque capteur et avec son signal respectif **caractérisée par le fait que** le second dispositif de traitement de données (4) comprend :

(a) plusieurs dispositifs de traite-

ment de données de troisième rang (7), qui sont des dispositifs agents indépendants communicant entre eux, chaque dispositif agent étant connecté à au moins un capteur (2) et capable d'en traiter les signaux,
(b) un quatrième dispositif de traitement de données (8), qui est un dispositif passerelle conçu pour identifier les dispositifs agents dont les signaux des capteurs sont associés dans des ensembles de cellules de la grille tridimensionnelle présentant une intersection non nulle, lesquels sont des agents corrélés et activent leur corrélation.

2. Système, conformément à la revendication 1, **caractérisé par le fait que** chaque dispositif agent est capable d'analyser de manière autonome les signaux provenant en continu des capteurs (2), de la manière **suivante :**

- pour identifier l'apparition d'au moins un objet ou d'au moins un événement (changement) ;
- pour classer lesdits objets ou événements par type (classification) ;
- pour positionner chaque objet ou événement en référence aux cellules de la grille de réalité virtuelle (positionnement) ;
- pour calculer autrement la probabilité d'erreur ou la fiabilité quant à l'exactitude de l'analyse effectuée (fiabilité).

3. Un système, conformément à la revendication 2, où chaque dispositif agent :

(a) communique continuellement avec les autres dispositifs agents corrélés pour chaque changement, classification, positionnement (résultats de l'analyse) et leur fiabilité respective ;
(b) traite les résultats de l'analyse reçue de chaque dispositif agent corrélé avec ses propres résultats d'analyse et de fiabilité (analyse globale et fiabilité globale) ;
(c) communique en continu l'analyse globale et la fiabilité globale au dispositif passerelle.

4. Un système, conformément à la revendication 3, où la communication de l'analyse globale et de la fiabilité globale vers le dispositif passerelle est mise en oeuvre par au moins un dispositif agent, lui-même automatiquement identifié sur la base d'un critère prédéterminé.

5. Système, conformément à la revendication 3, **caractérisé par le fait que** le dispositif passerelle applique les règles de sécurité définies par l'utilisateur pour le lieu déterminé sur la base de l'analyse globale et de la fiabilité globale.

Fig. 1

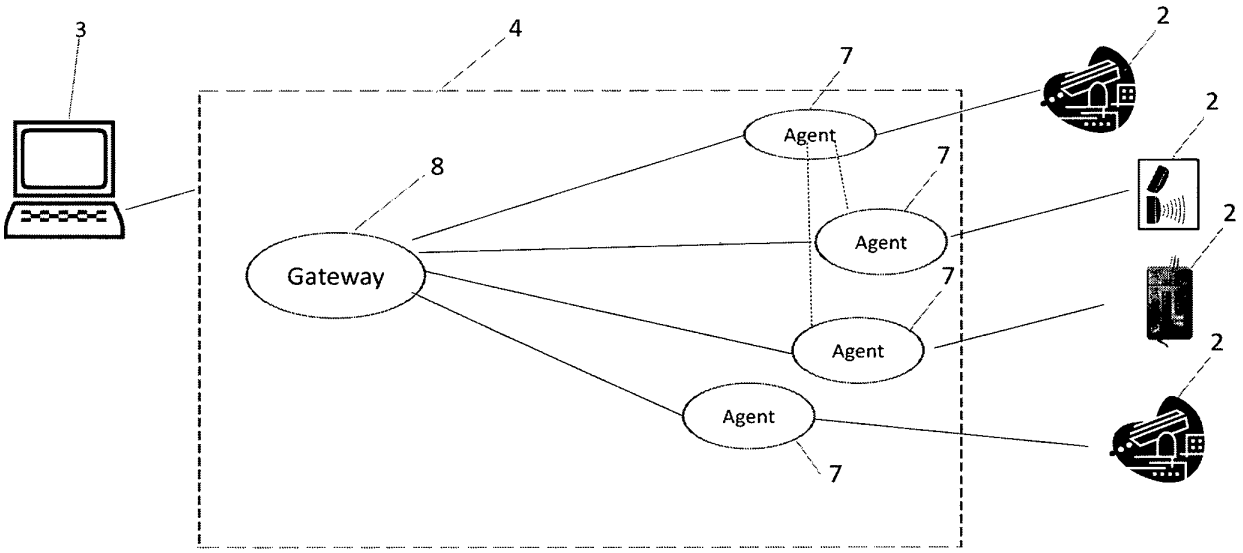
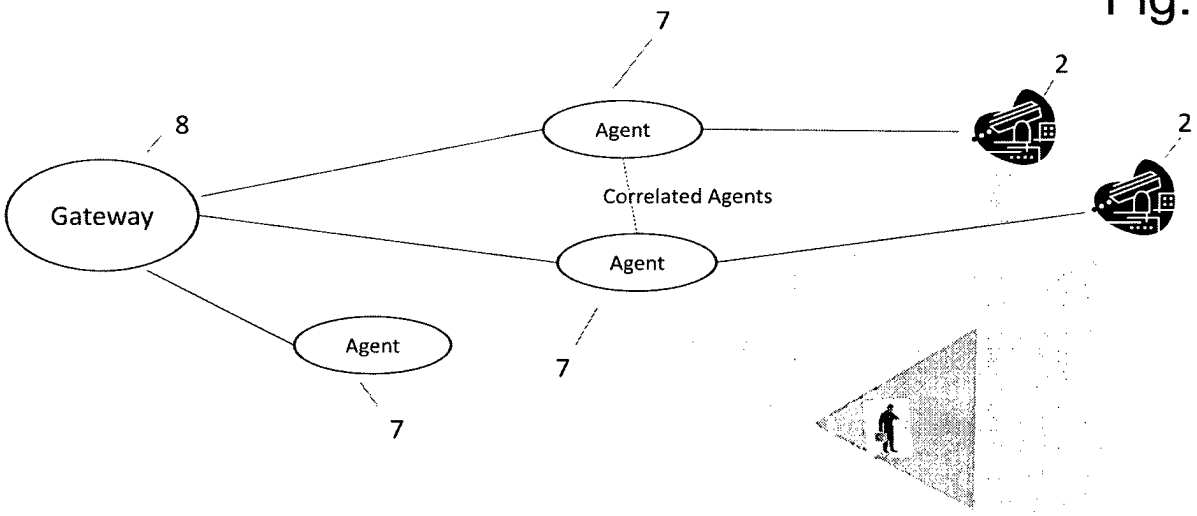


Fig. 2



REFERENCES CITED IN THE DESCRIPTION

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