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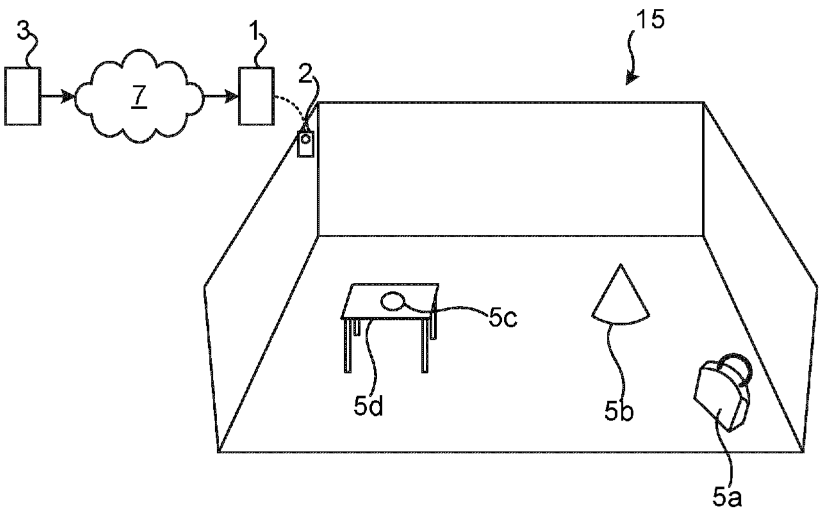

Fig. 1

(57) Abstract: It is provided a method for detecting changes in a physical space. The method is performed by an object detector and comprises : obtaining an image of at least part of the physical space; detecting and classifying at least one object in the image; determining a position of each detected object; storing, in an object map, the classification and position of each detected object; repeating the obtaining an image, detecting and classifying, determining a position and storing, respectively, for a plurality of images; and comparing the object map of an image with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

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DETECTING CHANGES IN A PHYSICAL SPACE

TECHNICAL FIELD

[0001] The present disclosure relates to the field of detection of one or more objects in a physical space and in particular to detecting changes to such one or more objects.

BACKGROUND

[0002] People are increasingly consuming services to be provided directly at a property, such as a home or commercial property. The service can e.g. be a delivery of a product, a cleaning service, a builder/plumber/electrician, assisted living, etc. The person providing the service is here denoted a service agent and the company providing the service is denoted service provider.

[0003] The services can sometimes be provided even when no person is present at the property. Access to the property can be provided e.g. using remote controlled locks.

[0004] However, consuming services in this way does present a risk, e.g. that the service agent could potentially steal one or more items from the premises.

[0005] This is not only an issue for the owner of the premises, who is worried that a theft may occur, but also for the service provider, who could be illegitimately accused of theft.

[0006] One way to reduce the risk of thefts and theft accusations is to deploy camera supervision of the property. However, camera supervision may require explicit consent from service providers, and it is time consuming and inefficient to examine a large amount of image material when a theft has occurred.

SUMMARY

[0007] One objective is to improve detection of objects in a physical space over time.

[0008] According to a first aspect, it is provided a method for detecting changes in a physical space. The method is performed by an object detector and comprises: obtaining an image of at least part of the physical space; detecting and classifying at least one object in the image; determining a position of each detected object; storing, in an object map, the classification and position of each detected object; repeating the obtaining an image, detecting and classifying, determining a position and storing, respectively, for a plurality of images; and comparing the object map of an image with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

[0009] The detecting and classifying may comprises classifying the at least one objects to be a certain type of object, such that the classification is an indication of the type of object. This indication can be a reference that corresponds to the type of object.

[0010] The classification may be based on a machine learning algorithm.

[0011] Each iteration of obtaining an image may comprise obtaining an image with essentially the same camera angle.

[0012] Each iteration of obtaining an image may comprise obtaining an image from a mobile camera. In this case, the determining a position of the object comprises determining the position based on a machine learning model.

[0013] The method may be triggered to begin when a person is detected in the physical space.

[0014] The method may be triggered by receiving a trigger signal from an external system.

[0015] The object map may be associated with a single image. In this case, the object map has a timestamp corresponding to a capturing time of the associated image.

[0016] The image may comprise depth information.

[0017] According to a second aspect, it is provided an object detector for detecting changes in a physical space. The object detector comprises: a processor; and a memory storing instructions that, when executed by the processor, cause the object detector to: obtain an image of at least part of the physical space; detect and classifying at least one object in the image; determine a position of each detected object; store, in an object map, the classification and position of each detected object; repeat the instructions to obtain an image, detect and classify, determine a position and store, respectively, for a plurality of images; and compare the object map of an image with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

[0018] The instructions to detect and classify may comprise instructions that, when executed by the processor, cause the object detector to classify the at least one objects to be a certain type of object, such that the classification is an indication of the type of object.

[0019] The classification may be based on a machine learning algorithm.

[0020] The instructions may be repeated and each iteration of the instructions to obtain an image comprise instructions that, when executed by the processor, cause the object detector to obtain an image with essentially the same camera angle.

[0021] The instructions may be repeated and each iteration of the instructions to obtain an image comprise instructions that, when executed by the processor, cause the object detector to obtain an image from a mobile camera. The instructions to determine a position of the object then comprise instructions that, when executed by the processor, cause the object detector to determine the position based on a machine learning model.

[0022] The instructions may be triggered to begin when a person is detected in the physical space.

[0023] The instructions may be triggered by receiving a trigger signal from an external system.

[0024] The object map may be associated with a single image, in which case the object map has a timestamp corresponding to a capturing time of the associated image.

[0025] The image may comprise depth information.

[0026] According to a third aspect, it is provided a computer program for detecting changes in a physical space. The computer program comprises computer program code which, when run on an object detector causes the object detector to: obtain an image of at least part of the physical space; detect and classifying at least one object in the image; determine a position of each detected object; store, in an object map, the classification and position of each detected object; repeat the computer program code to obtain an image, detect and classify, determine a position and store, respectively, for a plurality of images; and compare the object map with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

[0027] According to a fourth aspect, it is provided a computer program product comprising a computer program according to the third aspect and a computer readable means on which the computer program is stored.

[0028] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the element, apparatus, component, means, step, etc." are to be interpreted openly as referring to at least one instance of the element, apparatus, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Aspects and embodiments are now described, by way of example, with reference to the accompanying drawings, in which:

[0030] Fig 1 is a schematic diagram illustrating an environment in which embodiments presented herein can be applied;

[0031] Fig 2A-C are schematic diagrams illustrating different changes in objects which can occur, compared to the example of Fig 1;

[0032] Figs 3A-C are schematic diagrams illustrating embodiments of where the object detector can be implemented;

[0033] Fig 4 is a flow chart illustrating embodiments of methods for detecting changes in a physical space;

[0034] Fig 5 is a schematic diagram illustrating components of the object detector of Figs 3A-C; and

[0035] Fig 6 shows one example of a computer program product 90 comprising computer readable means.

DETAILED DESCRIPTION

[0036] The aspects of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which certain embodiments of the invention are shown. These aspects may, however, be embodied in many different forms and should not be construed as limiting; rather, these embodiments are provided by way of example so that this disclosure will be thorough and complete, and to fully convey the scope of all aspects of invention to those skilled in the art. Like numbers refer to like elements throughout the description.

[0037] Fig 1 is a schematic diagram illustrating an environment in which embodiments presented herein can be applied. A physical space 15 is here shown in the form of a room. It is be noted that the physical space can be any other type of physical space, e.g. house, garden, office, factory, storage space, etc.

[0038] In the physical space 15, objects 5a-d are provided. The objects 5a-d are physical objects. In this example, there is a first object 5a in the form of a bag, a second object 5b in the form of a cone-shaped toy. A third object 5c is in the form of a wallet, which lies on a fourth object 5d in the form of a table. There can be more or fewer objects in the physical space 15; the objects 5a-d shown in Fig 1 only form part of an example.

[0039] An imaging device 2 is positioned to capture images of at least part of the physical space 15. The imaging device 2 can be a traditional digital camera which captures images in two dimensions, or a three-dimensional image capturing device, e.g. based on Lidar, radar or stereo imaging (dual cameras). The imaging device 2 is connected to an object detector 1 which is configured to detect and classify objects in images captured by the imaging device, as described in more detail below. While the imaging device 2 is shown in a fixed position in Fig 1, the imaging device 2 could also be a portable device, such as a smartphone.

[0040] Optionally, the object detector 1 is connected to a wide-area network 7, such as the Internet. In this way, the object detector 1 can communicate with a server 3, which is also connected to the wide-area network 7. The server 3 can be implemented as a single device or over several devices. The server 3 can form part of what is commonly known as the cloud.

[0041] As explained in more detail below, images captured by the imaging device 2 are analysed by the object detector 1. Objects are identified and positioned, and this information is stored in an object map. The object map is implemented any suitable data structures which can hold information about objects for a particular point in time. Changes in any of the objects can be detected by comparing object maps from different images, relating to different points in time.

[0042] Fig 2A-C are schematic diagrams illustrating different changes in objects which can occur, compared to the scenario of Fig 1.

[0043] In Fig 2A, it is illustrated how, compared to the example of Fig 1, the third object 5c (the wallet) has been removed from the physical space 15. This can e.g. be due to someone having stolen the wallet or that the owner of the wallet has taken it out of the physical space 15.

[0044] In Fig 2B, it is illustrated how, compared to the example of Fig 1, the first object 5a (the bag) is in a different orientation. This can e.g. be due to a thief having picked the bag up and stolen items from within the bag and put the bag back, or that the owner of the bag has changed the orientation of the bag.

[0045] In Fig 2C, it is illustrated how, compared to the example of Fig 1, a fifth object 5e, in the form of a box, has been placed within the physical space 15. The fifth object 5e can e.g. be a delivery of an item from a courier firm. Using embodiments presented herein, it can also be detected if an object is removed and it is later provided back in the same place again, e.g. the third object in the form of a wallet.

[0046] Figs 3A-C are schematic diagrams illustrating embodiments of where the object detector 1 can be implemented.

[0047] In Fig 3A, the object detector 1 is shown as implemented in the imaging device 2. The imaging device 2 is thus the host device for the object detector 1 in this embodiment. In this embodiment, the communication between the imaging device 2 and the object detector is internal communication, whereby the reliance on network availability is reduced or even eliminated.

[0048] In Fig 3B, the object detector 1 is shown as implemented in the server 3. The server 3 is thus the host device for the object detector 1 in this embodiment. In this embodiment, the object detector 1 can be used for a large number of imaging devices and corresponding physical spaces.

[0049] In Fig 3C, the object detector 1 is shown as implemented as a stand-alone device. The object detector 1 thus does not have a host device in this embodiment.

[0050] Fig 4 is a flow chart illustrating embodiments of methods for detecting changes in a physical space. The method is performed in the object detector 1.

[0051] The method can be triggered to begin when a person is detected in the physical space. In this way, any changes to objects are likely to be captured using this method. Alternatively or additionally, the method is triggered when a previously detected person is not detectable anymore. In other words, a change in presence of people (either the entry or people or exit of people) in the physical space can trigger the method to be started. In this way, any changes to objects (e.g. moved, added, removed) can be detected and associated with the person coming or going. This provides a usable context in relation with which it may be very useful to detect objects. The detection of one or more people can be based e.g. on an infrared camera, a sensor detecting when a door is opened and/or closed, and/or when a lock is disengaged and/or engaged.

[0052] Alternatively or additionally, the method is triggered by receiving a trigger signal from an external system, e.g. an alarm system triggering the method when an alarm is triggered.

[0053] In an *obtain image* step 40, the object detector obtains an image of at least part of the physical space.

[0054] In a *detect & classify object(s)* step 42, the object detector detects and classifies at least one object in the image. For instance detected objects can be classified to be a certain type of object, e.g. chair, table, bag, wallet, set of keys, etc. This detection and classification can be based on machine learning algorithms. The classification is then an indication of the type of object and does not contain any image data. The since the classification is only a reference to an object type, the amount of data required for the classification is very small, much smaller than e.g. image data.

[0055] In a *determine position* step 44, the object detector determines a position of each detected object. The position can be a three-dimensional (3D) position or a two-dimensional (2D) position in the plane of the image. In order to obtain three-dimensional position information, the image can comprise depth information, obtained e.g. from a Lidar sensor, a radar sensor, a 3D camera sensor, using stereographic imaging, structure from motion, etc.

[0056] In a *store in object map* step 46, the object detector stores, in an object map, the classification and position of each detected object. For instance, it can be stored that a bag is located centred around a 3D position x, y and z. The object map is associated with a single image, the one currently being processed. The object map is a logical representation of objects that have been detected and classified in the image. The object map can have a timestamp corresponding to the capturing time of the associated image. Since the classification is only a reference to an object type, the data required for each object in the object map is very small. This allows efficient use, distribution and storage of the object map. Furthermore, the object map can contain a great number of objects.

[0057] In a conditional *more image(s)* step 48, the object detector determines if there are any more images to process. If this is the case, the method returns to the *obtain image* step 40. Otherwise, the method proceeds to a *compare object map* step 50.

[0058] In the *compare object map* step 50, the object detector compares the object map with an object map of a previous image of the physical space. In this way, the object detector can detect when there is a change in an object (or several objects) in the physical space, e.g. any one or more of the changes illustrated in Figs 2A-C. Optionally, step 50 is performed for every new image or for any few images.

[0059] The method is repeated and each iteration of obtaining an image can comprise obtaining an image with essentially the same camera angle.

[0060] Using the embodiments presented herein, changes to objects in the physical space are detected by analysing the object map. This can be used to detect when objects disappear, e.g. thefts, and when objects appear, e.g. deliveries. By associating the object map with a time of the image, a time window of when the object change occurred can also be determined. In this way, it can be deduced if a particular service provider agent was involved in the object change, when a time of when the service provider agent was in the physical space is known. This can clear suspicions of an innocent service provider agent and can pinpoint a guilty party.

[0061] By using classifications, rather than e.g. images for each object, changes of an object, e.g. rotations or small movements, that change its appearance but are not the result of significant movement, do not alter the classification. See e.g. the first object in Fig 2B compared with Fig 2A, where the classification and position are the same. In contrast, in non-classification based (e.g. based on image representations of objects) systems of the prior art, any significant visual changes, e.g. rotation of an object with different colours or shapes for different directions, can trigger an alarm. In contrast, according to embodiments presented herein, as long as the classification (and optionally position) is consistent, the alarm will not be triggered. This more robust method of detecting objects significantly reduces the risk of false alarms.

[0062] Fig 5 is a schematic diagram illustrating components of the object detector of Figs 3A-C. It is to be noted that one or more of the mentioned components can be shared with the host device, when present. A processor 60 is provided using any combination of one or more of a suitable central processing unit (CPU), multiprocessor, microcontroller, digital signal processor (DSP), etc., capable of executing software instructions 67 stored in a memory 64, which can thus be a computer program product. The processor 60 could alternatively be implemented using an application specific integrated circuit (ASIC), field programmable gate array (FPGA), etc. The processor 60 can be configured to execute the method described with reference to Fig 4 above.

[0063] The memory 64 can be any combination of random-access memory (RAM) and/or read-only memory (ROM). The memory 64 also comprises persistent storage, which, for example, can be any single one or combination of magnetic memory, optical memory, solid-state memory or even remotely mounted memory.

[0064] A data memory 66 is also provided for reading and/or storing data during execution of software instructions in the processor 60. The data memory 66 can be any combination of RAM and/or ROM.

[0065] The object detector further comprises an I/O interface 62 for communicating with external and/or internal entities. Optionally, the I/O interface 62 also includes a user interface.

[0066] Other components of the object detector 1 are omitted in order not to obscure the concepts presented herein.

[0067] Fig 6 shows one example of a computer program product 90 comprising computer readable means. On this computer readable means, a computer program 91 can be stored, which computer program can cause a processor to execute a method according to embodiments described herein. In this example, the computer program product is an optical disc, such as a CD (compact disc) or a DVD (digital versatile disc) or a Blu-Ray disc. As explained above, the computer program product could also be embodied in a memory of a device, such as the computer program product 64 of Fig 5. While the computer program 91 is here schematically shown as a track on the depicted optical disk, the computer program can be stored in any way which is suitable for the computer program product, such as a removable solid-state memory, e.g. a Universal Serial Bus (USB) drive.

[0068] Here now follows a list of embodiments, enumerated with roman numerals.

[0069] i. A method for detecting changes in a physical space, the method being performed by an object detector and comprising the steps of:

obtaining an image of at least part of the physical space;

detecting and classifying at least one object in the image;

determining a position of each detected object;

storing, in an object map, the classification and position of each detected object;

repeating the steps of obtaining an image, detecting and classifying, determining a position and storing, respectively, for a plurality of images; and

comparing the object map of an image with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

[0070] ii. The method according to embodiment i, wherein each iteration of obtaining an image comprises obtaining an image with essentially the same camera angle.

[0071] iii. The method according to embodiment i, wherein each iteration of obtaining an image comprises obtaining an image from a mobile camera; and wherein the step of determining a position of the object comprises determining the position based on a machine learning model.

[0072] iv. The method according to any one of embodiments i to iii, wherein the method is triggered to begin when a person is detected in the physical space.

[0073] v. The method according to any one of embodiments i to iii, wherein the method is triggered by receiving a trigger signal from an external system.

[0074] vi. The method according to any one of the preceding embodiments, wherein the object map is associated with a single image, and wherein the object map has a timestamp corresponding to a capturing time of the associated image.

[0075] vii. The method according to any one of the preceding embodiments, wherein the image comprises depth information.

[0076] viii. An object detector for detecting changes in a physical space, the object detector comprising:

a processor; and

a memory storing instructions that, when executed by the processor, cause the object detector to:

obtain an image of at least part of the physical space;

detect and classifying an object in the image;

determine a position of each detected object;

store, in an object map, the classification and position of each detected object;

repeat the instructions to obtain an image, detect and classify, determine a position and store, respectively, for a plurality of images; and

compare the object map of an image with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

[0077] ix. The object detector according to embodiment viii, wherein the instructions are repeated and each iteration of the instructions to obtain an image comprise instructions that, when executed by the processor, cause the object detector to obtain an image with essentially the same camera angle.

[0078] x. The object detector according to embodiment viii wherein the instructions are repeated and each iteration of the instructions to obtain an image comprise instructions that, when executed by the processor, cause the object detector to obtain an image from a mobile camera; and wherein the instructions to determine a position of the object comprise instructions that, when executed by the processor, cause the object detector to determine the position based on a machine learning model.

[0079] xi. The object detector according to embodiment viii or ix, wherein the instructions are triggered to begin when a person is detected in the physical space.

[0080] xii. The object detector according to embodiment viii or ix, wherein the instructions are triggered by receiving a trigger signal from an external system.

[0081] xiii. The object detector according to any one of embodiments viii to xii, wherein the object map is associated with a single image, and wherein the object map has a timestamp corresponding to a capturing time of the associated image.

[0082] xiv. The object detector according to any one of embodiments viii to xiii, wherein the image comprises depth information.

[0083] xv. A computer program for detecting changes in a physical space, the computer program comprising computer program code which, when run on an object detector causes the object detector to:

obtain an image of at least part of the physical space;

detect and classifying at least one object in the image;

determine a position of each detected object;

store, in an object map, the classification and position of each detected object;

repeat the computer program code to obtain an image, detect and classify, determine a position and store, respectively, for a plurality of images; and

compare the object map with an object map of a previous image of the physical space, to thereby detect when there is a change in an object in the physical space.

[0084] xvi. A computer program product comprising a computer program according to embodiment xv and a computer readable means on which the computer program is stored.

[0085] The aspects of the present disclosure have mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims. Thus, while various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

CLAIMS

1. A method for detecting changes in a physical space (15), the method being performed by an object detector (1) and comprising:

obtaining (40) an image of at least part of the physical space (15);

detecting (42) and classifying at least one object in the image;

determining (44) a position of each detected object;

storing (46), in an object map, the classification and position of each detected object;

repeating (48) the obtaining (40) an image, detecting (42) and classifying, determining (44) a position and storing (46), respectively, for a plurality of images; and

comparing (50) the object map of an image with an object map of a previous image of the physical space (15), to thereby detect when there is a change in an object in the physical space (15).

2. The method according to claim 1, wherein the detecting (42) and classifying comprises classifying the at least one objects to be a certain type of object, such that the classification is an indication of the type of object.

3. The method according to claim 2, wherein the classification is based on a machine learning algorithm.

4. The method according to any one of claims 1 to 3, wherein each iteration of obtaining (40) an image comprises obtaining an image with essentially the same camera angle.

5. The method according to any one of claims 1 to 3, wherein each iteration of obtaining (40) an image comprises obtaining an image from a mobile camera; and wherein the determining (44) a position of the object comprises determining the position based on a machine learning model.

6. The method according to any one of claims 1 to 5, wherein the method is triggered to begin when a person is detected in the physical space (15).

7. The method according to any one of claims 1 to 5, wherein the method is triggered by receiving a trigger signal from an external system.

8. The method according to any one of the preceding claims, wherein the object map is associated with a single image, and wherein the object map has a timestamp corresponding to a capturing time of the associated image.

9. The method according to any one of the preceding claims, wherein the image comprises depth information.

10. An object detector (1) for detecting changes in a physical space (15), the object detector (1) comprising:

a processor (60); and

a memory (64) storing instructions (67) that, when executed by the processor, cause the object detector to:

obtain an image of at least part of the physical space (15);

detect and classifying an object in the image;

determine a position of each detected object;

store, in an object map, the classification and position of each detected object;

repeat the instructions to obtain an image, detect and classify, determine a position and store, respectively, for a plurality of images; and

compare the object map of an image with an object map of a previous image of the physical space (15), to thereby detect when there is a change in an object in the physical space (15).

11. The object detector (1) according to claim 10, wherein the instructions to detect and classify comprise instructions (67) that, when executed by the processor, cause the object detector to classify the at least one objects to be a certain type of object, such that the classification is an indication of the type of object.

12. The object detector (1) according to claim 11, wherein the classification is based on a machine learning algorithm.

13. The object detector (1) according to any one of claims 10 to 12, wherein the instructions are repeated and each iteration of the instructions to obtain an image comprise instructions (67) that, when executed by the processor, cause the object detector to obtain an image with essentially the same camera angle.

14. The object detector (1) according to any one of claims 10 to 12 wherein the instructions are repeated and each iteration of the instructions to obtain an image

comprise instructions (67) that, when executed by the processor, cause the object detector to obtain an image from a mobile camera; and wherein the instructions to determine a position of the object comprise instructions (67) that, when executed by the processor, cause the object detector to determine the position based on a machine learning model.

15. The object detector (1) according to claim 10 or 13, wherein the instructions are triggered to begin when a person is detected in the physical space (15).

16. The object detector (1) according to claim 10 or 13, wherein the instructions are triggered by receiving a trigger signal from an external system.

17. The object detector (1) according to any one of claims 10 to 16, wherein the object map is associated with a single image, and wherein the object map has a timestamp corresponding to a capturing time of the associated image.

18. The object detector (1) according to any one of claims 10 to 17, wherein the image comprises depth information.

19. A computer program (67, 91) for detecting changes in a physical space (15), the computer program comprising computer program code which, when run on an object detector causes the object detector to:

obtain an image of at least part of the physical space (15);

detect and classifying at least one object in the image;

determine a position of each detected object;

store, in an object map, the classification and position of each detected object;

repeat the computer program code to obtain an image, detect and classify, determine a position and store, respectively, for a plurality of images; and

compare the object map with an object map of a previous image of the physical space (15), to thereby detect when there is a change in an object in the physical space (15).

20. A computer program product (64, 90) comprising a computer program according to claim 19 and a computer readable means on which the computer program is stored.

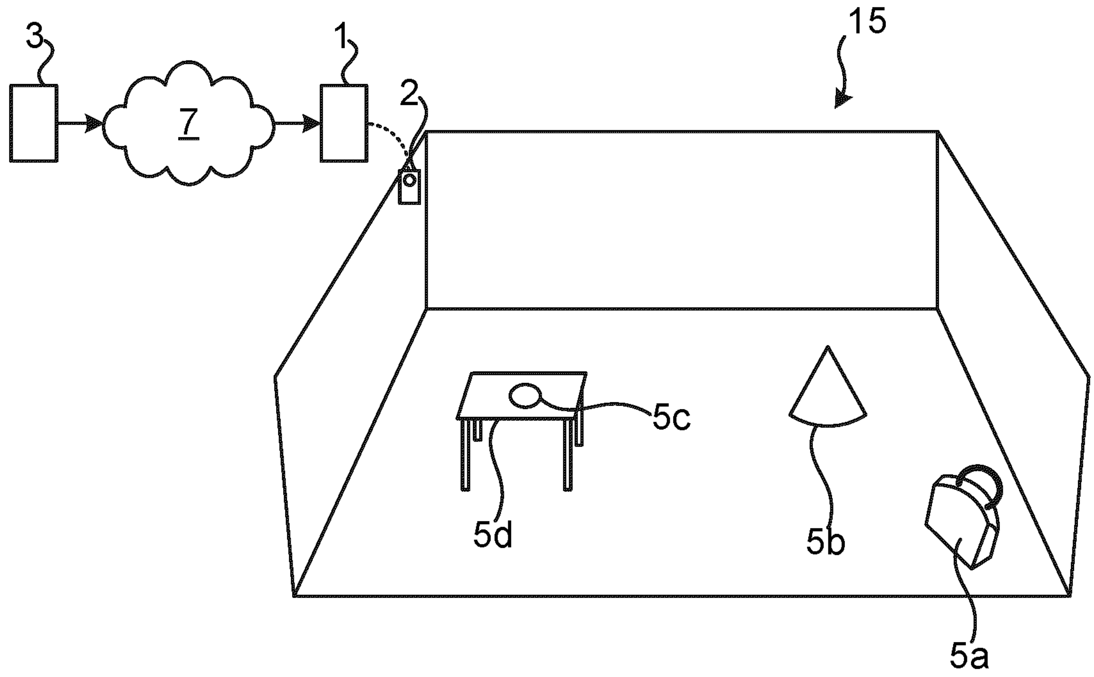

Fig. 1

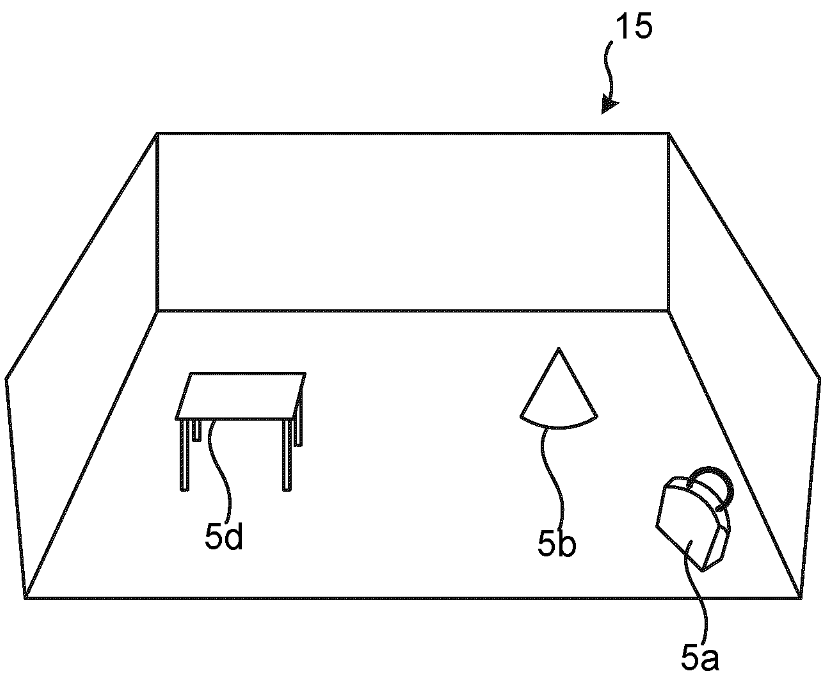

Fig. 2A

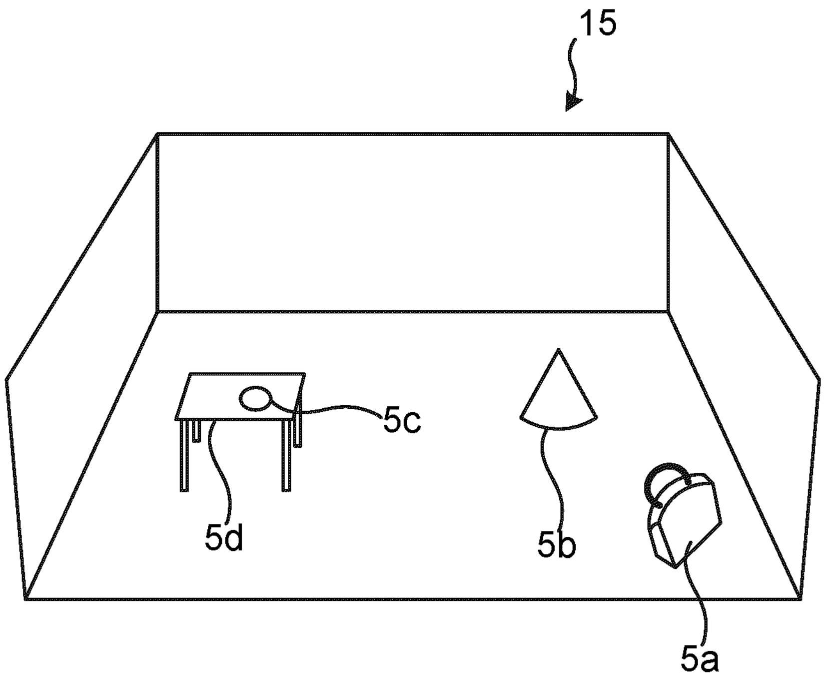

Fig. 2B

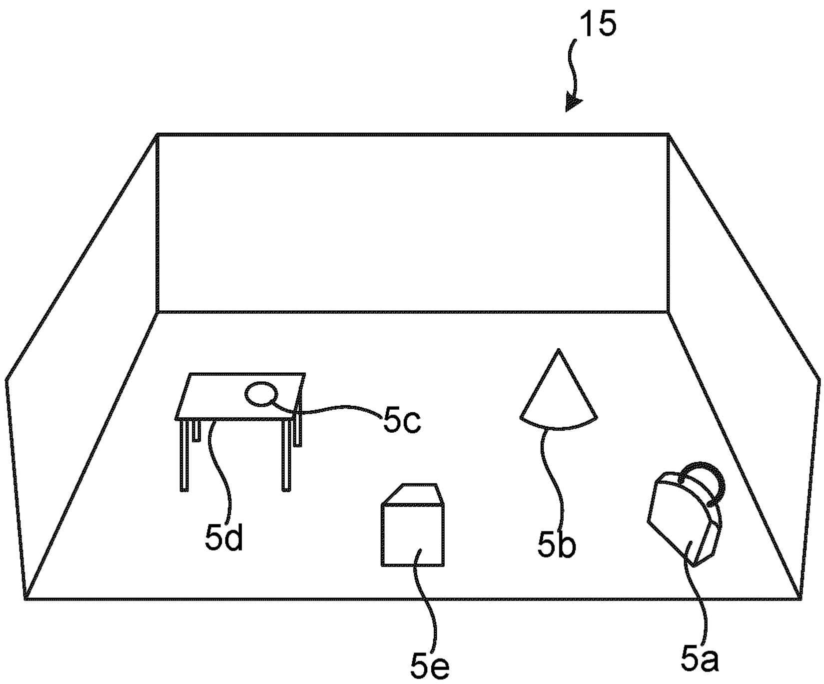

Fig. 2C

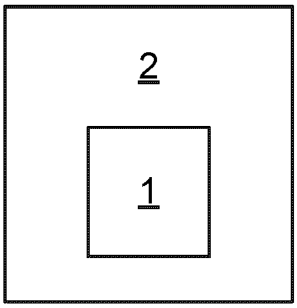

Fig. 3A

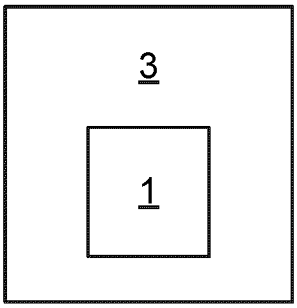

Fig. 3B

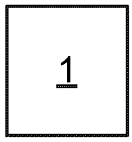

Fig. 3C

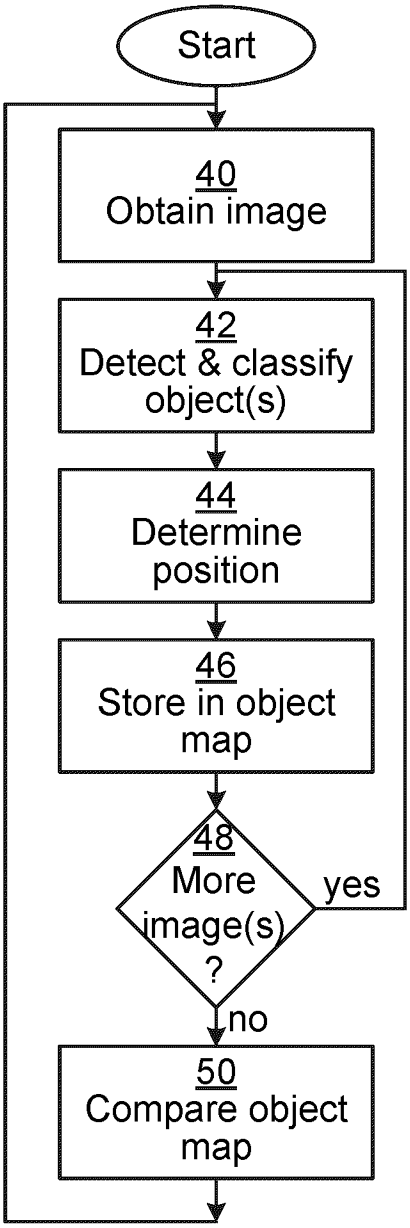

Fig. 4

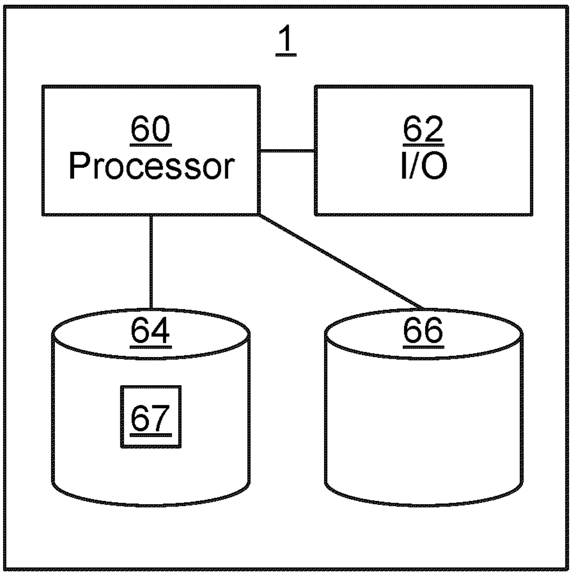

Fig. 5

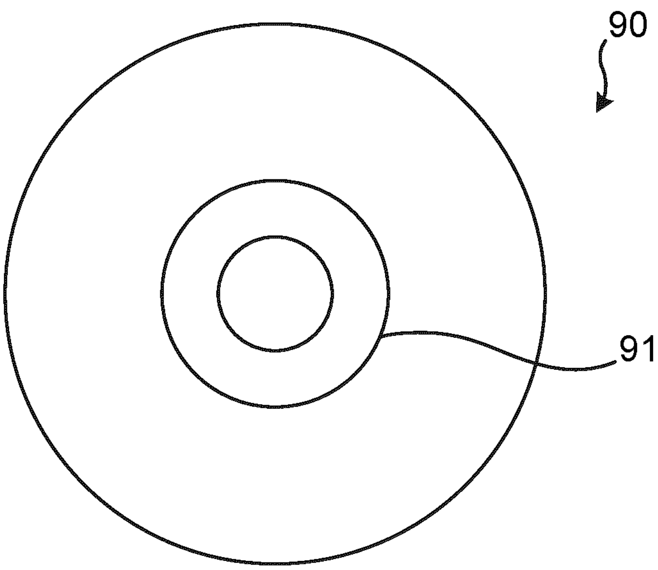

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/078385

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06K9/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 10 235 762 B1 (WYLIE STEPHEN MICHAEL [US] ET AL) 19 March 2019 (2019-03-19) figures 1-5 column 4, line 26 - line 31 column 7, line 22 - line 57 column 13, line 3 - column 17, line 53 -----	1-20
X	FR 2 941 317 A1 (ROCKWELL COLLINS FRANCE [FR]) 23 July 2010 (2010-07-23) page 8, line 28 - page 14, line 7; figures 1-5 -----	1-20

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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

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

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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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 February 2021	09/02/2021

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Chehade, Thomas

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	TRIPATHI RAJESH KUMAR ET AL: "Abandoned or removed object detection from visual surveillance: a review", MULTIMEDIA TOOLS AND APPLICATIONS, KLUWER ACADEMIC PUBLISHERS, BOSTON, US, vol. 78, no. 6, 14 August 2018 (2018-08-14), pages 7585-7620, XP036755939, ISSN: 1380-7501, DOI: 10.1007/S11042-018-6472-9 [retrieved on 2018-08-14] the whole document -----	1-20
A	ELENA LUNA ET AL: "Abandoned Object Detection in Video-Surveillance: Survey and Comparison", SENSORS, vol. 18, no. 12, 1 December 2018 (2018-12-01), page 4290, XP055770403, ISSN: 1424-8220, DOI: 10.3390/s18124290 the whole document -----	1-20

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2020/078385

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 10235762	B1	19-03-2019	US 10235762	B1	19-03-2019
			US 2020082545	A1	12-03-2020
FR 2941317	A1	23-07-2010	NONE		