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(54) Monitoring of objects to avoid their loosing with automatic selection thereof

(57) A solution is proposed for helping a person wearing a wearable device avoid loosing objects. A corresponding method (500) includes the steps of monitoring (532-564) a presence in an object area around the wearable device of each one of a set of selected objects, and outputting (550-552) an alarm in response to each selected object leaving the object area. In the solution according to an embodiment of the invention, the method further includes the steps of monitoring (504-512) a presence in a home area of the wearable device, selecting (514-520) the objects included in a further object area around the wearable device in response to the wearable device leaving the home area (the further object area being external to the home area), and unselecting (566-572) the selected objects in response to the wearable device entering the home area.

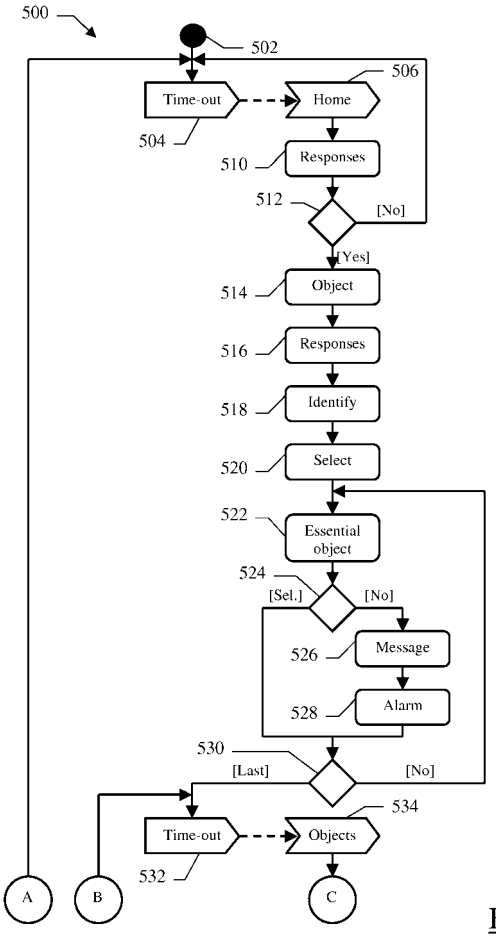


FIG.5A

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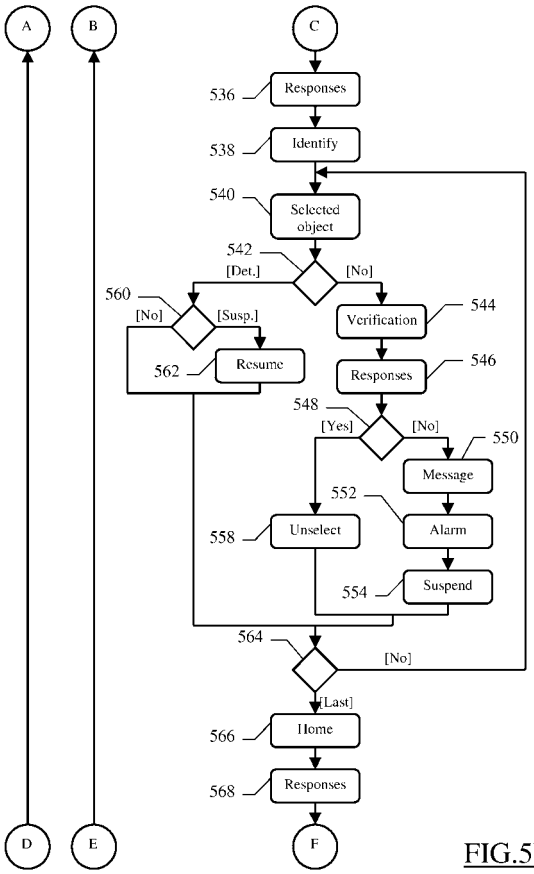
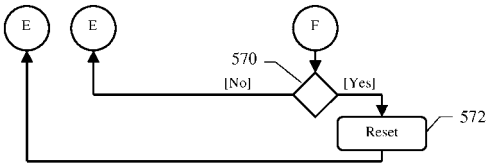

A
B
C
536
Responses
538
Identify
540
Selected object
542
[Det.]
[No]
560
[No]
[Susp.]
Verification
544
562
Resume
Responses
546
548
[Yes]
[No]
550
Message
552
Alarm
558
Unselect
554
Suspend
564
[No]
[Last]
566
Home
568
Responses
D
E
F

FIG.5B


E
E
F
570
[No]
[Yes]
572
Reset

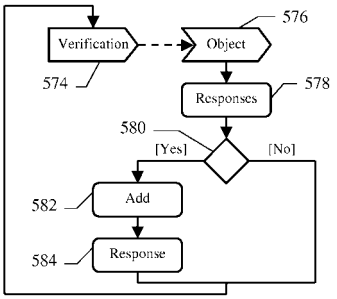

576
Verification
Object
574
578
Responses
580
[Yes]
[No]
582
Add
584
Response

FIG.5C

Description

[0001] The solution according to one or more embodiments of the present invention generally relates to the field of personal commodities, especially for helping a person avoid loosing objects.

[0002] Nowadays, every person commonly carries a number of different objects when s/he is outside home. For example, objects like home keys and wallets are normally indispensable; other objects (such as mobile telephones and PDAs) have become practically necessary. Further objects may be needed in specific situations (for example, car keys when driving, MP3 players when jogging, suite cases when traveling, cameras when sightseeing, and so on).

[0003] A problem with these objects is that they may be lost by the person. For example, the objects may slip out of a pocket when the person raises, of they may fall down from a bag while walking. In these cases, it is very difficult (if not impossible) to find the lost objects again.

[0004] The loss of these objects brings about several problems. For example, a significant economic damage is suffered when the objects are valuable (for example, the telephone or the PDA), a series of tiresome consequences may arise in specific situations (for example, the need of duplicating documents contained in the wallet), the person may be exposed to risks (for example, when the home keys are found by potential thieves), and the like.

[0005] Similar considerations apply when the objects are forgotten somewhere (outside home). For example, when the objects are left far way from home (such as in vacation) it is almost impossible to go back to take them, or when the objects are left in a public location (such as a train) it is very likely that they are taken by someone else. Similar problems may arise even if the objects are forgotten in a place from which they can still be recovered. For example, when valuable objects (such as the telephone or the camera) are left in the car, they may attract potential thieves; instead, when objects are left at work, they cannot usually be recovered until the next working day (leaving the person without these objects for a long period, up to the whole week-end if the event occurs on Friday).

[0006] In addition, the person may suffer a theft; however, the person often realizes that some objects have been stolen with a long delay (only when the objects are to be used). Therefore, no action can be taken at the moment to foil the theft.

[0007] Some solutions have been proposed in an attempt to mitigate the above-mentioned problems. For example, document IT-A-MI2006U00400 discloses a device that is formed by a sniffer and an RFID. The RFID is attached to an object to be monitored (for example, a mobile phone), whereas the sniffer is carried by the person (for example, by integrating it into a wristwatch). The sniffer monitors the presence of the RFID within a predefined action range by broadcasting an interrogation signal and listening for a corresponding response signal by the RFID. When no response signal is received (since the RFID exits the action range of the sniffer), a corresponding alarm is output, so as to inform the person that s/he is loosing the corresponding object.

[0008] However, the above-described technique is not completely satisfactory. For example, information about the objects to be monitored has to be stored in the sniffer before its use. However, this makes the application of the proposed technique quite complex and not user friendly. Another drawback may be due to the need of switching on the sniffer when leaving home and to the need of switching it off when coming back; those operations are relatively annoying and easy to be forgotten. All of the above hinders the use of this technique in practice.

[0009] Other related problems arise when the person forgets some (important) objects at home. For example, when the person does not pick up the telephone, s/he remains unreachable until returning to home.

[0010] In its general terms, the solution according to one or more embodiments of the present invention is based on the idea of automating the selection of the objects to be monitored.

[0011] Particularly, different aspects of the solution according to one or more embodiments of the invention are set out in the independent claims. Advantageous features of the same solution are set out in the dependent claims.

[0012] More specifically, an aspect of the solution according to an embodiment of the invention proposes a method for helping a person wearing a wearable device avoid loosing objects. The method starts with the step of monitoring a presence in an object area around the wearable device of each one of a set of selected objects; an alarm is output in response to each selected object leaving the object area. In the solution according to an embodiment of the invention, the method further includes the step of monitoring a presence in a home area of the wearable device. The objects included in a further object area around the wearable device are selected in response to the wearable device leaving the home area (with the further object area that is external to the home area); conversely, the selected objects are unselected in response to the wearable device entering the home area.

[0013] Another aspect of the solution according to an embodiment of the invention proposes a computer program per performing this method.

[0014] A further aspect of the solution according to an embodiment of the invention proposes a wearable device for performing the method (with the same advantageous features recited in the dependent claims for the method that apply *mutatis mutandi* to the wearable object).

[0015] A still further aspect of the solution according to an embodiment of the invention proposes a corresponding modification kit for a wearable device.

[0016] A different aspect of the solution according to an embodiment of the invention proposes a commodity kit including this wearable device.

[0017] The solution according to one or more embodiments of the invention, as well as further features and the advantages thereof, will be best understood with reference to the following detailed description, given purely by way of a non-restrictive indication, to be read in conjunction with the accompanying drawings (wherein corresponding elements are denoted with equal or similar references and their explanation is not repeated for the sake of brevity, and the name of each signal is generally used to denote both its type and its value for the sake of simplicity). In this respect, it is expressly intended that the figures are not necessary drawn to scale (with some details that may be exaggerated and/or simplified) and that, unless otherwise indicated, they are merely used to conceptually illustrate the structures and procedures described herein. Particularly:

FIG.1A-1N illustrate exemplary scenarios of application of the solution according to different embodiments of the invention;
FIG.2 is a pictorial representation of a commodity kit according to an embodiment of the invention;
FIG.3 is a block diagram of a watch according to an embodiment of the invention;
FIG.4 shows the main software components that can be used to implement the solution according to an embodiment of the invention; and
FIG.5A-5C is a diagram describing the flow of activities relating to an implementation of the solution according to an embodiment of the invention.

[0018] With reference in particular to FIG.1A-1N, exemplary scenarios of application of the solution according to different embodiments of the invention are illustrated.

[0019] Starting from FIG.1A, the described solution is based on the use of a wristwatch (or simply watch) 105, which may be worn by a person (not shown in the figure). The watch 105 helps the person avoid loosing personal objects when outside his/her home 110; for example, the figure shown a camera 115a, a mobile telephone 115b and a bunch of home keys 115c. In this way, no additional device (to be specifically used for helping the person avoid loosing the objects) is required; indeed, the watch 105 is a commonplace device that is owned practically by everybody. Moreover, almost every person wears the watch 105 when s/he outside home 110. Therefore, the risk of forgetting it at home 110 is very low; in any case, the person should not bother to remember to take any additional device when leaving home 110.

[0020] Particularly, the watch 105 is provided with a sniffer (not shown in the figure) for Radio Frequency Identification (RFID) tags. Each RFID tag consists of a transponder, which detects and automatically responds to a (low-power RF) interrogation signal, and returns a response signal including a corresponding identification code; the RFID tag is of the passive type - i.e., it does not require any power source but takes the energy for its operation from the same interrogation signal. The sniffer continually broadcasts the interrogation signal in a monitoring area around it (at a monitoring distance from the sniffer wherein the interrogation signal is effective), and it listens for the response signals that are returned by the RFID tags reached by the interrogation signal (within the monitoring area).

[0021] Particularly, each object to be monitored 115a-115c is provided with a corresponding (object) RFID tag, not shown in the figure; this RFID tag is very small (for example, of the order of 2-5 cm^2), since it is dimensioned to have a working range comparable with a typical maximum distance at which the objects 115a-115c are held by the person when outside home 110 (for example, 0.5-5m). Another (home) RFID tag 120 is kept at home 110 (for example, at its entrance); this RFID tag 120 is relatively large (for example, of the order of a 10-20 cm^2), since it is dimensioned to have a working range comparable with a typical extent of the home 110 (for example, 10-50m).

[0022] In a starting condition, the watch 105 continually broadcasts a (home) interrogation signal 125 for the RFID tag 120. This interrogation signal 125 is provided in a (home) monitoring area 130 around the watch 105; the monitoring area 130 has an extent, defined by a corresponding (home) monitoring distance from the watch 105, which corresponds to the typical size of the home 110 (i.e., 10-50m in the example at issue). When the RFID tag 120 is inside the monitoring area 130 (as in this case), it receives the interrogation signal 125 from the watch 105.

[0023] Therefore, as shown in FIG.1B, the RFID tag 120 returns a corresponding (home) response signal 137 to the watch 105. In this way, the watch 105 can determine the presence of the RFID tag 120 in the monitoring area 130 - meaning that the person wearing the watch 105 is at home 110 (or very close to it).

[0024] Moving to FIG.1C, let us suppose instead that the RFID tag 120 is outside the monitoring area 130; this occurs when the watch 105 has moved to a distance from the RFID tag 120 higher than the extent of the monitoring area 130. In this case, the RFID tag 120 does not receive the interrogation signal 125 that is broadcast by the watch 105 any longer, so that no corresponding response signal is returned thereto. In this way, the watch 105 can determine that the person wearing the watch 105 has left home 110. Therefore, the watch 105 starts monitoring the objects 110a-110c that the person has taken with him/her.

[0025] For this purpose, as shown in FIG.1D, first of all the watch 105 broadcasts an (object) interrogation signal 137 for the RFID tags of the objects 115a-115c. This interrogation signal 137 is provided in an (object) monitoring area 140 around the watch 105; the monitoring area 140 has an extent, defined by a corresponding (object) monitoring distance from the watch 105, which corresponds to the typical maximum distance at which the objects 115a-115c are held by the person when outside home 110 (i.e., 0.5-5m in the example at issue, and in any case lower than the home monitoring distance

defining the monitoring area 130). Each object inside the monitoring area 140 (the keys 115c in this case) then receives the interrogation signal 137 from the watch 105.

[0026] Therefore, as shown in FIG.1E, the RFID tag of the keys 115c returns a corresponding (object) response signal 145 to the watch 105. In this way, the watch 105 can determine the presence of the RFID tag of the keys 115c in the monitoring area 140. Since the extent of the monitoring area 140 is lower than the extent of the monitoring area 130, the keys 115c (inside the monitoring area 140) are at a distance from the RFID tag 120 (outside the monitoring area 130) at least equal to the difference between the home monitoring distance and the object monitoring distance (i.e., from 10-0.5=9.5m to 20-3=17m in the example at issue); this means that the person has taken the keys 115c when s/he has left home 110. Therefore, the watch 105 selects the keys 115c for their monitoring. On the contrary, the RFID tags of the other objects 115a,115b that have remained at home 110 do not receive the object interrogation signal that is broadcast by the watch 105 (since these objects 115a,115b are outside the monitoring area 140), so that no corresponding response signal is returned to the watch 105; therefore, the objects 115a,115b are not selected for monitoring by the watch 105.

[0027] The proposed solution automatically selects the objects 115a-115c to be monitored (by simply determining that they have been taken by the person when s/he has left home 110). Therefore, no action at all is required on the part of the person (neither for switching on/off the monitoring nor for specifying the objects 115a-115c to be monitored). This makes the above-described solution dramatically simple and user friendly. All of the above fosters the widespread use of the proposed solution.

[0028] Moving to FIG.1F, as a further improvement some objects are defined as essential; the essential objects (for example, the telephone 115b) should always be taken by the person when outside home 110. When the telephone 115b has been left at home 110 (as in this case), its RFID tag does not receive the object interrogation signal that is broadcast by the watch 105 (since the telephone 115b is outside the monitoring area 140); therefore, no corresponding response signal is returned by the telephone 115b to the watch 105. When this happens, the watch 105 outputs a corresponding alarm - schematically denoted with the reference 147 in the figure (for example, a ring that is emitted until the person stops it - such as by pushing a specific button of the watch 105). Therefore, the person is immediately informed of the event, and s/he can react accordingly (for example, by returning to home 110 for taking the telephone 115b, or by disregarding the warning if s/he can do without the telephone 115b in the specific situation).

[0029] Considering now FIG.1G, in any case the watch 105 now monitors the selected objects that have been taken by the person (i.e., the keys 115c in the example at issue). For this purpose, the watch 105 continually broadcasts the interrogation signal 137 (in the monitoring area 140 around the watch). When the keys 115c are inside the monitoring area 140 (as in this case), their RFID tag receives the interrogation signal 137 from the watch 105.

[0030] Therefore, as shown in FIG.1H, the RFID tag of the keys 115c returns the corresponding response signal 145 to the watch 105. In this way, the watch 105 can determine the presence of the RFID tag of the keys 115c in the monitoring area 140 - meaning that the keys 115c are sufficiently close to the person wearing the watch 105.

[0031] Moving to FIG.1I, let us suppose instead that the keys 115c are outside the monitoring area 140; for example, this may occur when the keys 115c have fallen down (while the person moves), they have been forgotten (in a place left by the person), or they have been stolen (by a theft that has then escaped from the person). In any case, the RFID tag of the keys 115c does not receive the interrogation signal 137 that is broadcast by the watch 105 (since it is too far away from it). Therefore, no response signal is returned to the watch 105 by the RFID tag of the keys 115c. When this happens, the watch 105 can determine that the keys 115c have left the monitoring area 140 (i.e., they are not close to the person wearing the watch 105 any longer). As a result, the watch 105 outputs a corresponding alarm - schematically denoted with the reference 148 in the figure (for example, again a ring that is emitted until the person stops it by pushing a specific button of the watch 105). Therefore, the person is immediately informed of the event, and s/he can react accordingly (trying to avoid loosing the keys 115c). For example, when the keys 115c have fallen down the person can search them immediately, when the keys 115c have been left somewhere the person can return to take them, or when the keys 115c have been stolen the person can call for help to catch the theft.

[0032] As a further improvement, as shown in FIG.1J, in this situation the watch 105 also verifies whether the keys 115c have been passed to another person, who wears a twin watch (denoted with the reference 105'). For this purpose, the watch 105 broadcasts a (verification) interrogation signal 150 for the keys 115c. This interrogation signal 150 is provided in a (verification) monitoring area 155 around the watch 105; the monitoring area 150 has an extent, defined by a corresponding (verification) monitoring distance from the watch 105, which is higher than the object monitoring distance defining the monitoring area 140 (for example, 2-4 times it - such as from 1-2m to 10-20m in the example at issue). When the watch 105' is inside the monitoring area 155 (as in this case), it receives the interrogation signal 150 from the watch 105.

[0033] In response thereto, as shown in FIG.1K, the watch 105' verifies whether the keys 115c are inside its monitoring area (denoted with the reference 140'). As above, for this purpose the watch 105' broadcasts the obj ect interrogation signal (in the monitoring area 140'); when the keys 115c are inside the monitoring area 140' (as in this case), their RFID tag receives the object inter-

rogation signal and then returns the corresponding response signal to the watch 105'. This means that the keys 115c have not been lost but they have been simply passed to the person wearing the watch 105'.

[0034] Therefore, the watch 105' starts monitoring the keys 115c. At the same time, the watch 105' returns a corresponding (verification) response signal 160 to the watch 105 (indicating that the keys 115c are inside its monitoring area 140'). In response thereto, the watch 105 stops monitoring the keys 115c (with no alarm that is output). This additional feature allows passing the objects among different persons (for example, the members of a family) without any problem.

[0035] With reference now to FIG.1L, in the meanwhile the watch 105 also monitors the position of the person with respect to the home 110. For this purpose, the watch 105 continually broadcasts the interrogation signal 125 (in the monitoring area 130 around the watch). When the RFID tag 120 is outside the monitoring area 130 (as in this case), it does not receive the interrogation signal 125 from the watch 105 so that no corresponding response signal is returned thereto. In this way, the watch 105 can determine that the person wearing the watch 105 is still outside home 110. Therefore, assuming that the keys 115a are still taken by the person wearing the watch 105, the monitoring of the keys 115c continues.

[0036] Moving to FIG.1M, let us instead suppose that the RFID tag 120 is inside the monitoring area 130; this occurs when the watch 105 has moved to a distance from the RFID tag 120 lower than the extent of the monitoring area 130. In this case, the RFID tag 120 receives the interrogation signal 125 that is broadcast by the watch 105.

[0037] Therefore, as shown in FIG.1N, the RFID tag 120 returns the corresponding response signal 137 to the watch 105. In this way, the watch 105 can determine the presence of the RFID tag 120 in the monitoring area 130 - meaning that the person wearing the watch 105 has returned to home 110 (or s/he is approaching it). In this condition, the keys 115c are unselected for the monitoring (going back to the same situation of FIG.1A).

[0038] With reference to FIG.2, a pictorial representation of a commodity kit 200 according to an embodiment of the invention is illustrated.

[0039] The kit 200 includes the above described watch 105 and a block of spare RFID tags (for example, some tens). Some smaller RFID tags (denoted with the reference 205) are adapted to be used as object RFID tags, while others larger RFID tags (denoted with the reference 210) are adapted to be used as home RFID tags. Preferably, the RFID tags 205 and 210 are implemented with stickers, which can be easily fastened to the objects to be monitored and to a fixed location at home, respectively.

[0040] Preferably, each RFID tag 205 is programmed so as to return a code that identifies a specific category of objects (for example, cameras, telephones, home keys, and the like); a description of the category of objects associated with the code of each RFID tag 205 is printed on a label 215 being provided on its front surface, so as to allow the identification of the corresponding category of objects by the person that uses the kit 200.

[0041] In this way, the kit 200 is ready to be used immediately. Indeed, it is enough to stick one or more of the RFID tags 210 at home (so as to ensure that their working ranges cover the whole extent of the home). An RFID tag 205 (of the corresponding category, as indicated in its label 215) is further stuck on each object to be monitored. The person then wears the watch 105 (after a corresponding power supply battery has been inserted), so as to start the above-described process. In this way, the proposed solution may be used promptly without any additional operation.

[0042] With reference now to FIG.3, there is shown a block diagram of the watch 105 according to an embodiment of the invention.

[0043] The watch 150 includes a control unit 305 that implements the above-described process. More in detail, the control unit 305 includes a processing unit 310 (for example, based on a micro-processor). The processing unit 310 accesses a RAM 315 (which is used as a working memory) and a flash E^2PROM 320 (which is used as a mass memory for storing information to be preserved even when a power supply is off - particularly, a control program of the processing unit 310). Moreover, the processing unit 310 is connected in a conventional way to one or more input units 325 (for example, including a set of buttons of the watch) and to one or more output units 330 (for example, including a display and a buzzer of the watch). The control unit 305 interfaces with the above-described sniffer for the RFID tags (denoted with the reference 335).

[0044] Considering now FIG.4, there are shown the main software components 400 that can be used to implement the solution according to an embodiment of the invention. These software components (i.e., programs and data) are typically stored on the mass memory of the control unit of the watch, and they are loaded (at least in part) into its working memory when the programs are running.

[0045] Particularly, a monitoring engine 405 controls the execution of the above-described process. For this purpose, the monitoring engine 405 interfaces with a drive 410 of the sniffer, and with a drive 412 of the output units of the watch.

[0046] The monitoring engine 405 accesses a (hard-coded) variable 415 that stores a unique identification code of the watch. The monitoring engine 405 also accesses a table 420 that stores information about any object that may be monitored by the watch 105 (for example, the identification code of its RFID tag together with a corresponding description), a table 425 that stores an (essential) list of the essential objects (by means of their codes), and a table 430 that stores a (twin) list of the associated twin watches (by means of their codes). A programming interface 435 may be used to update the

content of the table 420 (to remove objects that are not to be monitored any longer, to add new objects to be monitored, or to change the description of the objects to be monitored), of the table 425 (to remove or add essential objects), and of the table 430 (to remove or add twin watches). Preferably, this operation is performed by connecting the watch to an external computer wherein a dedicated customization program is installed (for example, by means of a wireless connection). In this way, it is always possible to customize the operation of the watch to adapt it to any contingent need (either by a retailer when the commodity kit is bought or by the person owning it later on). For example, the above-described commodity kit may include some general-purpose object RFID tags (with the corresponding labels that only indicate their codes); these object RFID tags can then be used for particular objects that are not of common use (i.e., they do not belong to the pre-defined categories of the other object RFID tags), by simply programming the corresponding description in the table 420. Likewise, it is possible to buy additional RFID tags (when the ones provided in the commodity kit have run out), and add their codes with the descriptions of corresponding objects to the table 420.

[0047] The monitoring engine 405 manages a table 440 that stores a (selection) list of the objects that are currently selected for the monitoring (by means of their codes). Particularly, the monitoring engine 405 fills in the table 440 when the watch leaves the home monitoring area and resets it when the watch enters the home monitoring area again; moreover, a specific selected object may be removed from the table 440 when it is passed to the person wearing a twin watch, or it may be added thereto vice-versa.

[0048] Moving to FIG.5A-FIG.5C, there is shown a diagram 500 describing the flow of activities relating to an implementation of the solution according to an embodiment of the invention. Particularly, the diagram 500 illustrates a control process of the watch, which is implemented by the monitoring engine running on its control unit.

[0049] The process begins at the black start circle 502, and then enters a continuous loop at block 504. As soon as a home time-out expires, the flow of activity passes from block 504 to block 506 to verify the presence of the person at home. The home time-out has a relatively high value (for example, 30-90s, such as 60s). Indeed, the verification of the presence at home may be performed with a relatively low frequency (since no problem occurs even if its leaving is discovered with some delay); as a result, it is possible to reduce the corresponding operations with a beneficial effect on the power consumption of the watch. In this phase, the sniffer of the watch broadcasts the home interrogation signal (in the home monitoring area around the watch). Proceeding to block 510, the sniffer of the watch listens for any corresponding home response signal (for example, for 2-5s). A test is then made at block 512 to verify whether a home response signal has been returned by any home RFID (inside the home monitoring area). If so (meaning that the person is still at home), the process returns to block 504 to repeat the same operations.

[0050] Conversely, as soon as no home response signal is received by the sniffer of the watch since no home RFID tag is inside the home monitoring area (meaning that the person has left home), the process descends from block 512 into block 514. In this phase, the sniffer of the watch broadcasts the object interrogation signal (in the object monitoring area around the watch). Proceeding to block 516, the sniffer of the watch listens for any corresponding object response signal (for example, for 2-5s). For each received object response signal (from the RFID tag of the corresponding object being inside the object monitoring area), the associated object is identified at block 518 (according to the code included in the object response signal). Continuing to block 520, the objects so identified (i.e., the ones that have been taken by the person when leaving home) are then selected for the monitoring, by adding their codes to the selection list.

[0051] A loop is then performed for each essential object. The loop begins at block 522, wherein a current essential object, starting from the first one (as indicated in the essential list) is identified. A test is then made at block 524 to verify whether the (current) essential object is included in the selection list. If not (meaning that the essential object has been left at home), a corresponding warning message is created at block 526 (for example, by adding the description of the essential object - extracted from the corresponding table - to a pre-defined phrase). Continuing to block 528, a corresponding alarm is output by the watch (for example, by emitting a ring and displaying the warning message, so as to inform the person that s/he has forgotten taking the essential object indicated in it). The process then descends into block 530; the same point is instead reached directly from block 524 when the essential object is included in the selection list (meaning that it has been taken by the person when leaving home). In any case, a test is made to determine whether a last essential object has been verified. If not, the process returns to block 522 to repeat the same operations on a next essential object. Conversely (once all the essential objects have been verified), the loop is exit descending from block 530 into block 532.

[0052] As soon as an object time-out expires, the flow of activity passes from block 532 to block 534 to start monitoring the selected objects. The object time-out is preferably lower than the home time-out (for example, 10-20s, such as 15s). Indeed, the monitoring of the selected objects should be performed with a high frequency (so as to detect their loss promptly); however, this is not a problem, since the corresponding operations require a relatively low power consumption (since the object monitoring area is small). Moreover, in this way the monitoring of the selected objects is performed only when it is necessary (i.e., when the person is outside home), with a beneficial effect on the power consumption of the watch. In this phase, the sniffer of the watch broadcasts the ob-

ject interrogation signal (in the object monitoring area around the watch). Proceeding to block 536, the sniffer of the watch listens for any corresponding object response signal (for example, for 2-5s). For each received object response signal (from the RFID tag of a corresponding object being inside the object monitoring area), the associated object is identified at block 538 according to the code included in the object response signal. The objects so identified (i.e., the ones close to the person) are then added to a (temporary) detection list.

[0053] A loop is then performed for each selected object. The loop begins at block 540, wherein a current selected object, starting from the first one (as indicated in the selection list) is identified. A test is then made at block 542 to verify whether the (current) selected object is included in the detection list. If not (meaning that the selected object is not close to the person any longer), the process continues to block 544. In this phase, the sniffer of the watch broadcasts the verification interrogation signal (in the verification monitoring area around the watch); the verification interrogation signal includes the code of the watch and the code of the selected object. Proceeding to block 546, the sniffer of the watch listens for any corresponding verification response signal (for example, for 2-5s). A test is then made at block 548 to determine whether a corresponding verification response signal has been returned by any twin watch, which is inside the verification monitoring area and has the selected object inside its object monitoring area; for this purpose, the verification response signal includes the code of the twin watch (to verify its inclusion in the twin list) and the code of the selected object (for associating it thereto). If no verification response signal has been received, because no other watch is inside the verification monitoring area, any other watch inside it is not a twin watch, or the selection object is not inside the object monitoring area of any twin watch in the verification monitoring area (meaning that the selected object has been lost), a corresponding warning message is created at block 550 (for example, by adding the description of the selected obj ect - extracted from the corresponding table - to a pre-defined phrase). Continuing to block 552, a corresponding alarm is output by the watch (for example, by emitting a ring and displaying the warning message, so as to inform the person that s/he has lost the selected object). The monitoring of the selected object is then suspended at block 554 (for example, by asserting a corresponding flag in the selection list). Returning to block 548, if the verification response signal has been returned by a twin watch (meaning that the selected object has been passed to the person wearing it), the process passes from block 548 to block 558; in this phase, the selected object is unselected (by removing it from the selection list), so as to stop its monitoring.

[0054] Returning to block 542, if the selected object is included in the detection list, the process continues to block 560; in this phase, a test is made to verify whether the monitoring of the selected object is suspended (as indicated by the corresponding flag in the selection list being asserted). If so (meaning that the selected object returned close to the person), the monitoring of the selected object is resumed at block 562 (by deasserting the corresponding flag in the selection list). In this way, it is possible to suspend the monitoring of the selected objects that have been left somewhere temporarily (for example, in a hotel room when the person goes to its restaurant), and to resume it as soon as the selected objects are taken again the person (for example, when s/he returns to the hotel room and exits again with them).

[0055] The flow of activity now passes to block 564 from block 554 (when the selected object has been lost), from block 558 (when the selected object has been passed to the person wearing a twin watch), from block 562 (when the monitoring of the selected object has been resumed) or from block 560 (when no operation has been performed for the selected object, since it is currently under monitoring and it is included in the detection list). In this phase, a test is made to determine whether a last selected object has been processed. If not, the process returns to block 540 to repeat the same operations on a next selected object. Conversely (once all the selected objects have been processed), the loop is exit descending from block 564 into block 566.

[0056] At this point, the sniffer of the watch again broadcasts the home interrogation signal (in the home monitoring area around the watch). Proceeding to block 568, the sniffer of the watch listens for any corresponding home response signal (for example, for 2-5s). A test is then made at block 570 to verify whether a home response signal has been returned by any home RFID tag (which is inside the home monitoring area). If so (meaning that the person has returned to home), the selection list is reset at block 572 (so as to unselect all its objects). The flow of activity then returns to block 504 (to monitor the presence at home of the person wearing the watch). Conversely, if no home response signal has been received by the sniffer of the watch since no home RFID tags is inside the home monitoring area (meaning that the person is still outside home), the flow of activity returns to block 532 (to continue monitoring the selected objects).

[0057] Concurrently, the watch is listening at block 574 for a verification interrogation signal from any other watch. As soon a verification interrogation signal is received from a twin watch (whose code provided in the verification interrogation signal is included in its twin list), the process passes to block 576. In this phase, the sniffer of the watch broadcasts the object interrogation signal (in the object monitoring area around the watch). Proceeding to block 578, the sniffer of the watch listens for the object response signal of the selected object (which left the object monitoring area of the twin watch), as indicated by the code included in the verification interrogation signal (for example, for 2-5s). A test is then made at block 580 to determine whether the object response signal of this selected object has been received (from the

corresponding object RFID tag in the object monitoring area). If so (meaning that the select object has been taken by the person wearing the watch), the selected object is added to the selection list of the watch, so as to start its monitoring. Continuing to block 584, a corresponding verification response signal (including the code of the watch and the code of the selected object) is returned to the twin watch. The process then returns to block 574 (listening for a further verification interrogation signal). The same point is also reached directly from block 580 when no verification response signal is received from the RFID tag of the selected object (meaning that it has not been taken by the person wearing the watch).

[0058] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations. More specifically, although this solution has been described with a certain degree of particularity with reference to one or more preferred embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible. Particularly, the same solution may even be practiced without the specific details (such as the numerical examples) set forth in the preceding description to provide a more thorough understanding thereof; conversely, well-known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars. Moreover, it is expressly intended that specific elements and/or method steps described in connection with any embodiment of the disclosed solution may be incorporated in any other embodiment as a matter of general design choice.

[0059] For example, similar considerations apply if the proposed solution is implemented with an equivalent method (by using similar steps, removing some steps being non-essential, or adding further optional steps); moreover, the steps may be performed in a different order, concurrently or in an interleaved way (at least in part).

[0060] Of course, the above-mentioned objects to be monitored are merely illustrative and they have not to be interpreted in a limitative manner. Likewise, the home monitoring area and/or the object monitoring area may have any other extent.

[0061] Alternatively, any other transponder (for example, based on ultrasonic, radiofrequency, or ultra-red waves) may be used to monitor the selected objects; in any case the use for this purpose of whatever wireless technique is contemplated.

[0062] Similar considerations apply to the monitoring of the presence of the watch in the home monitoring area; alternatively, this result may also be achieved with a dedicated infrastructure (for example, based on transceivers that are installed at home).

[0063] Nothing prevents using different time-outs for periodically monitoring the presence of the person at home and the selected objects (for example, equal to each other).

[0064] In a different embodiment of the invention, it is also possible to select the objects to be monitored with a different procedure (for example, by means of a specific selection interrogation signal that is broadcast in a selection monitoring area at a corresponding selection monitoring distance from the watch being lower than the object monitoring distance).

[0065] In any case, the possibility of monitoring the objects continuously (even when the watch is inside the home monitoring area) is not excluded; alternatively, it is also possible to provide additional RFID tags to be used in temporary home areas (for example, in a resort) so as to suspend the monitoring of the selected objects when the watch is inside the corresponding home monitoring area. However, nothing prevents switching off the above-described operation of the watch completely when it is not necessary - either manually or automatically (for example, when no movement of the watch is detected for more than a predefined period, such as 30-60s, meaning that the watch is not worn by anybody).

[0066] Similar considerations apply if the essential objects are defined in a different way (for example, by means of codes included in a dedicated range); however, this feature is not strictly necessary and it may be omitted in a simplified implementation of the invention.

[0067] As above, the verification of the essential objects may be performed with a different procedure (for example, by means of the above-mentioned selection interrogation signal).

[0068] In a different implementation of the proposed solution, each selected object that is lost is removed from the selection list (so as to stop its monitoring completely, and not only suspend it).

[0069] Any other protocol may be used to manage the passing of the selected objects among persons wearing twin watches (for example, by providing a warning message when this happens, by using a point-to-point communication scheme, and the like); in any case, this additional feature may be omitted in a simplified implementation of the proposed solution.

[0070] Moreover, it is possible to provide any equivalent alarm to the person when any selected object is lost or any essential object is forgotten at home, even without any associated warning message (for example, simply by means of a flashing light, a vibration, and the like).

[0071] Similar considerations apply if the program (which may be used to implement each embodiment of the invention) is structured in a different way, or if additional modules or functions are provided; likewise, the memory structures may be of other types, or may be replaced with equivalent entities (not necessarily consisting of physical storage media). In any case, the program may take any form suitable to be used by any data processing system or in connection therewith (for example, within a virtual machine); particularly, the program may be in the form of external or resident software, firmware, or microcode (either in object code or in source code - for example, to be compiled or interpreted). More-

over, it is possible to provide the program on any computer-usable medium; the medium can be any element suitable to contain, store, communicate, propagate, or transfer the program. For example, the medium may be of the electronic, magnetic, optical, electromagnetic, infrared, or semiconductor type; examples of such medium are fixed disks (where the program can be pre-loaded), removable disks, tapes, cards, wires, fibers, wireless connections, networks, broadcast waves, and the like. In any case, the solution according to an embodiment of the present invention lends itself to be implemented even with a hardware structure (for example, integrated in a chip of semiconductor material), or with a combination of software and hardware.

[0072] Likewise, the watch may have a different structure or it may include equivalent components (either separate to each other or combined together, in whole or in part). In any case, the proposed solution may be implemented in a bracelet, a necklace, a pendant, or any other wearable device.

[0073] It should be noted that the proposed solution is suitable to be implemented and put on the market even as a modification kit for application to standard watches (or equivalent wearable devices).

[0074] Alternatively, the proposed commodity kit may also include the customization program for managing the object RFID tags. Moreover, the (object and/or home) RFID tags may be provided with hooks, or any other fastening means. Alternatively, the commodity kit may include only pre-programmed object RFID tags, or vice-versa only general-purpose object RFID tags.

Claims

1. A method (500) for helping a person wearing a wearable device avoid loosing objects, the method including the steps of:

   monitoring (532-564) a presence in an object area around the wearable device of each one of a set of selected objects, and
   outputting (550-552) an alarm in response to each selected object leaving the object area,
   characterized by the steps of
   monitoring (504-512) a presence in a home area of the wearable device,
   selecting (514-520) the objects included in a further object area around the wearable device in response to the wearable device leaving the home area, the further object area being external to the home area, and
   unselecting (566-572) the selected objects in response to the wearable device entering the home area.

2. The method (500) according to claim 1, wherein an object transponder is associated with each object for emitting a corresponding object response signal indicative of the object in response to an object interrogation signal, the step of monitoring (532-564) the presence in the object area of each selected object including:

   broadcasting (534) the object interrogation signal by the wearable device at an object distance from the wearable device, and
   detecting (536-564) the leaving of the object area by each selected object when the corresponding object response signal in not sensed by the wearable device in response to the object interrogation signal.

3. The method (500) according to claim 2, wherein at least one home transponder is associated with the home area for emitting a home response signal indicative of the home area in response to a home interrogation signal, the step of monitoring (504-512) the presence in the home area of the wearable device including:

   broadcasting (506) the home interrogation signal by the wearable device at a home distance from the wearable device, the object distance being lower than the home distance, and
   detecting (510-512) the leaving of the home area by the wearable device when no home response signal is sensed by the wearable device in response to the home interrogation signal.

4. The method (500) according to claim 3, wherein the object interrogation signal is broadcast periodically with an object period and the home interrogation signal is broadcast periodically with a home period, the object period being lower than the home period.

5. The method (500) according to claim 3 or 4, wherein the step of selecting (514-520) the objects includes:

   broadcasting (514) a further object interrogation signal by the wearable device at a further object distance from the wearable device, the further object distance being lower than the home distance, and
   selecting (516-520) each object when the corresponding object response signal is sensed by the wearable device in response to the further object interrogation signal.

6. The method (500) according to any claim from 1 to 5, further including the steps of:

   enabling (512) the monitoring of the presence in the object area of each selected object in response to the wearable device leaving the home area, and

disabling (570) the monitoring of the presence in the object area of each selected object in response to the wearable device entering the home area.

7. The method (500) according to any claim from 1 to 6, wherein the objects include a set of essential objects, the method further including the steps of:

verifying (522-530) a presence in the further object area of each essential object in response to the wearable device leaving the home area, and outputting (526-528) a further alarm in response to each essential object being absent in the further object area.

8. The method (500) according to claim 7 when dependent directly or indirectly on claim 5, wherein the step of verifying (522-530) the presence in the further object area of each essential object includes:

detecting (524) the absence of each essential object in the further object area when the corresponding object response signal is not sensed by the wearable device in response to the further object interrogation signal

9. The method (500) according to any claim from 1 to 8, further including the steps of:

suspending (554) the monitoring of the presence in the object area of each selected object in response to the selected object leaving the object area, and
resuming (562) the monitoring of the presence in the object area of each selected object in response to the selected object entering the object area.

10. The method (500) according to any claim from 1 to 9, further including the steps of:

causing (544) a further wearable device, in a verification area around the watch, to verify the presence in a still further object area around the further wearable device of each selected object leaving the object area, and
in response to the presence in the still further object area of each selected object leaving the object area:

selecting (582) the selected object leaving the object area on the further wearable device, and
unselecting (558) the selected object leaving the object area on the wearable device.

11. The method (500) according to any claim from 1 to 10, wherein the step of outputting (550-552) an alarm and/or the step of outputting (526-528) a further alarm includes:

retrieving (550;526) a message associated with the corresponding selected and/or essential object, and
outputting (552;528) the message.

12. A computer program (400) including code means for causing a control unit (305) of a wearable device (105) to perform the steps of the method (500) according to any claim from 1 to 11 when the computer program is executed on the control unit.

13. A wearable device (105) for helping a person wearing the wearable device avoid loosing objects, the wearable device including means (400) for performing the steps of the method (500) according to any claim from 1 to 11.

14. A modification kit for a wearable device (105), the modification kit including means (400) for performing the steps of the method (500) according to any claim from 1 to 11.

15. A commodity kit (300) for helping a person avoid loosing objects, the commodity kit including the wearable device (105) according to claim 13 when including means (400) for performing the steps of the method (500) according to any claim from 3 to 11, a set of spare transponders (205) for use as object transponders, and a set of further spare transponders (210) for use as home transponders.

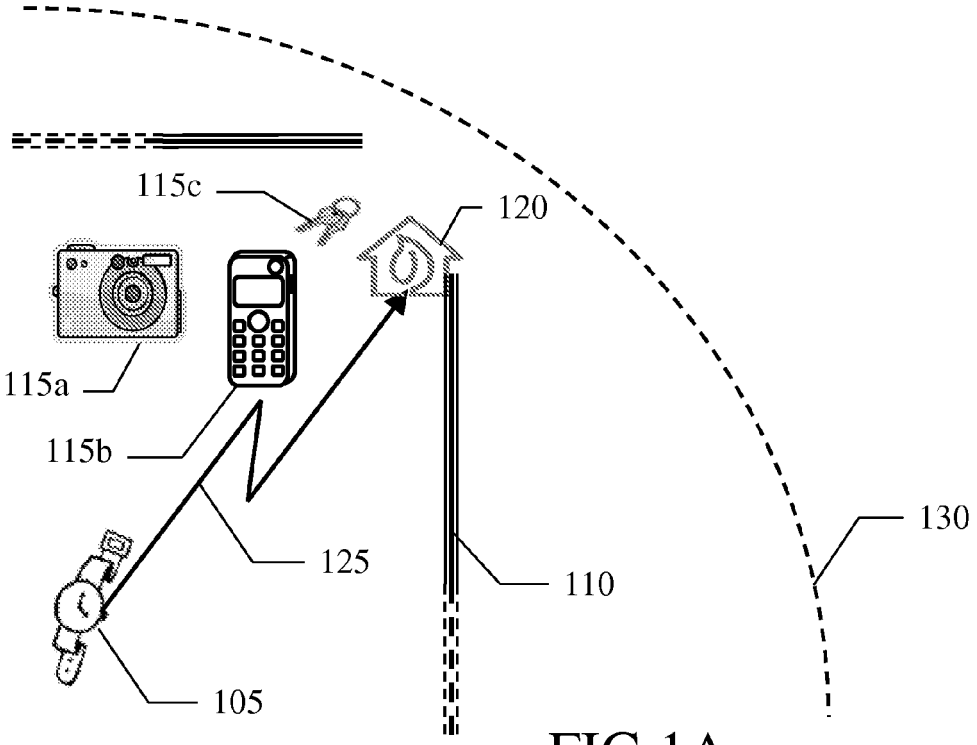

115c
120
115a
115b
125
130
110
105

FIG.1A

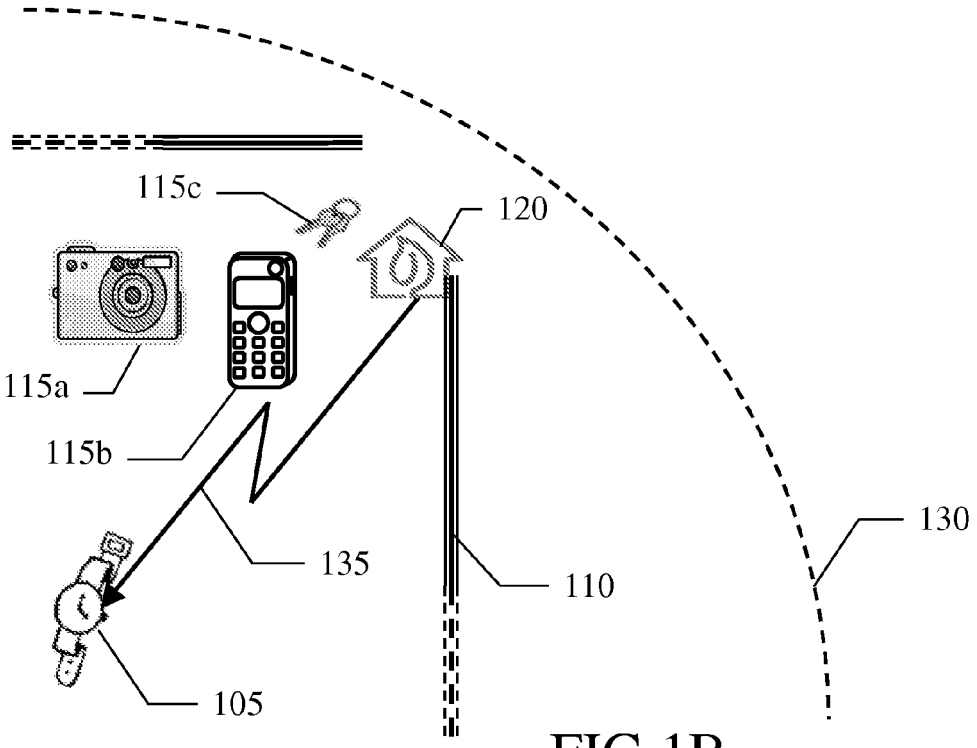

115c
120
115a
115b
135
130
110
105

FIG.1B

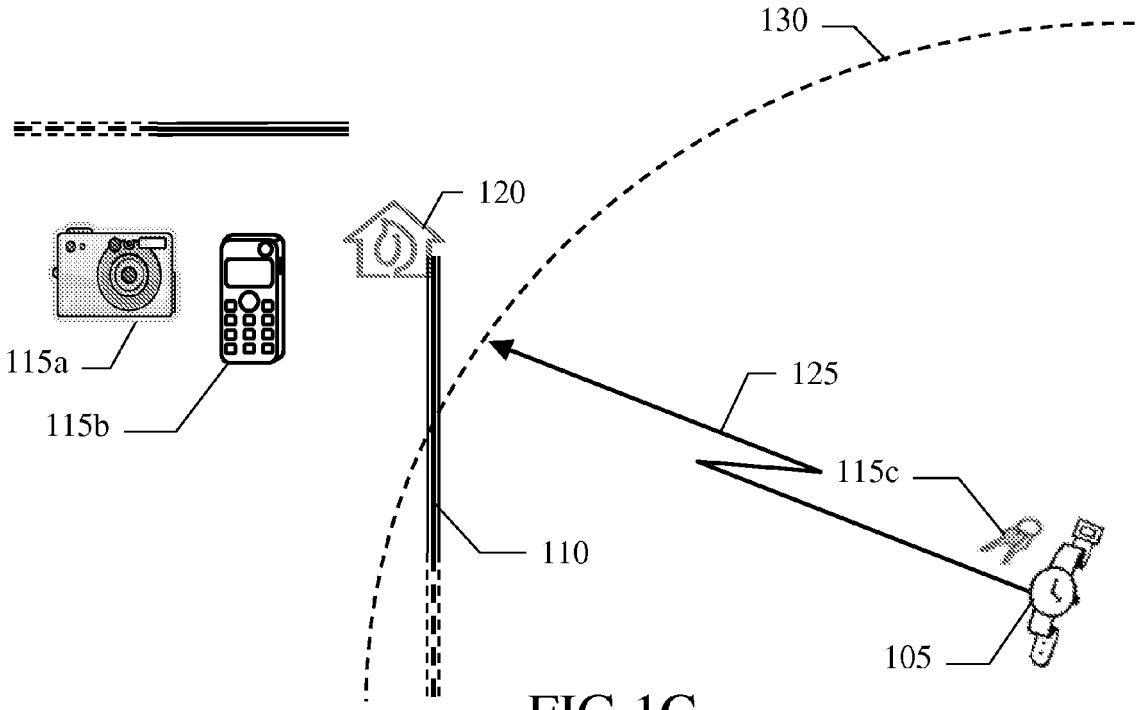

130
120
115a
115b
125
115c
110
105

FIG.1C

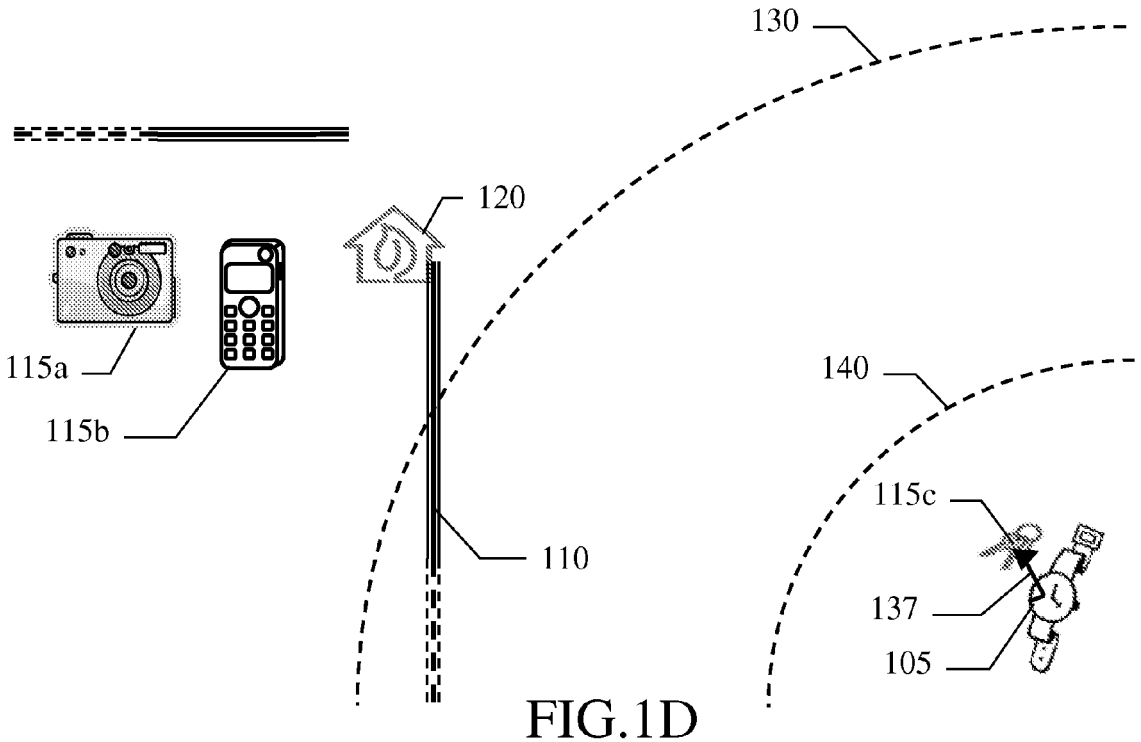

130
120
115a
115b
140
115c
110
137
105

FIG.1D

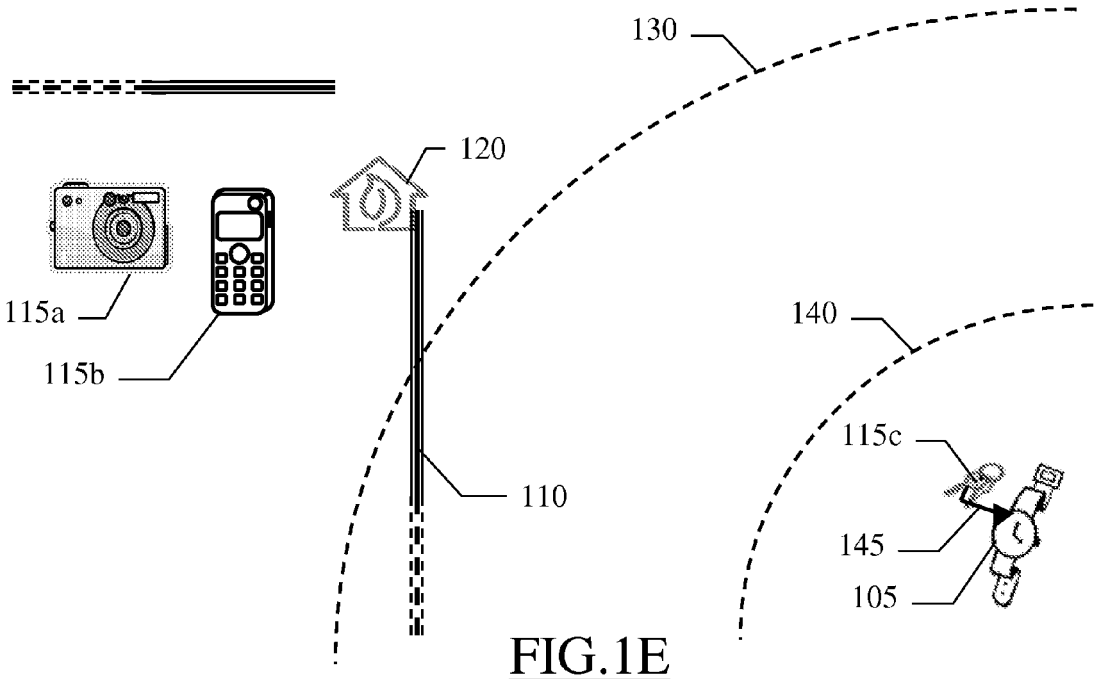

130
120
115a
115b
140
115c
110
145
105

FIG.1E

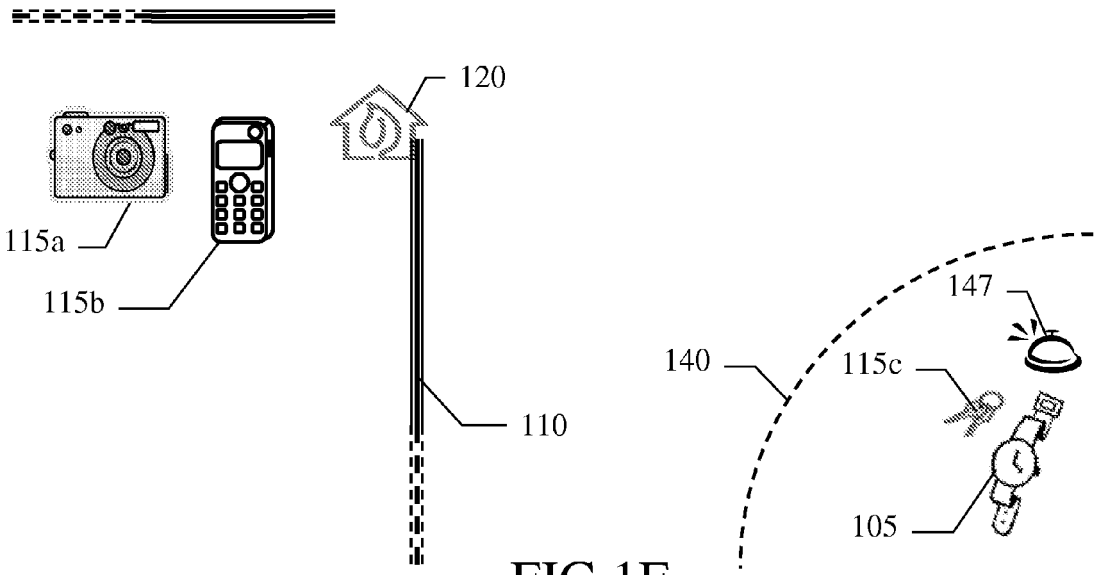

120
115a
115b
147
140
115c
110
105

FIG.1F

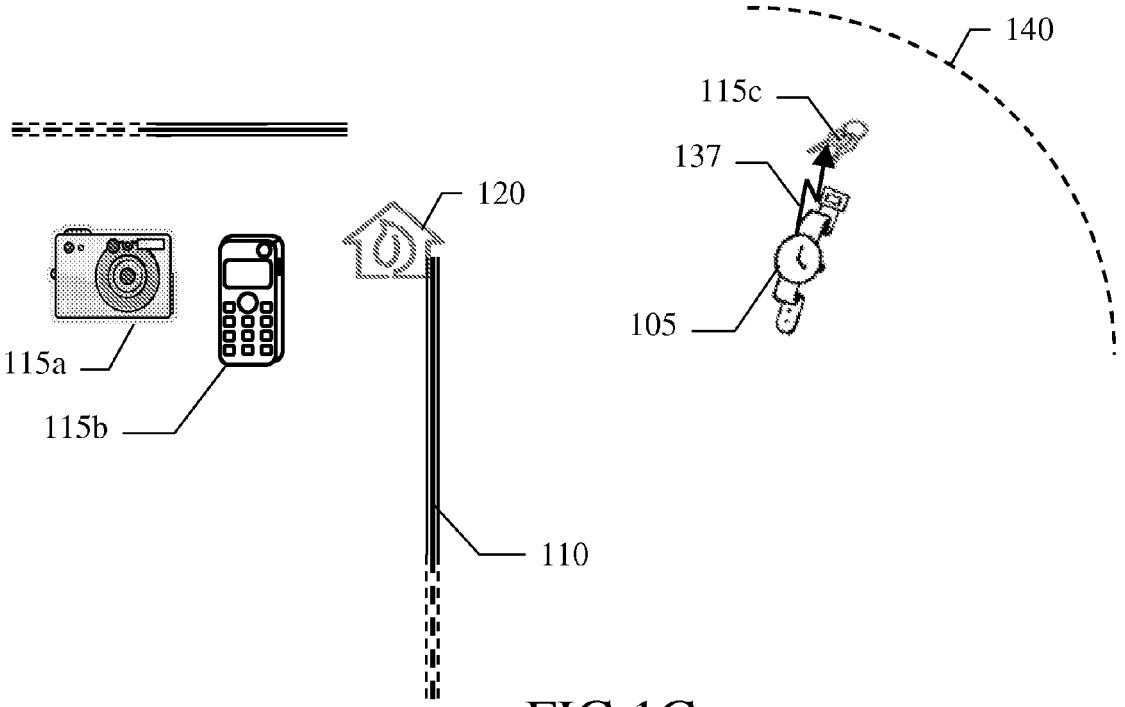

140
115c
137
120
105
115a
115b
110

FIG.1G

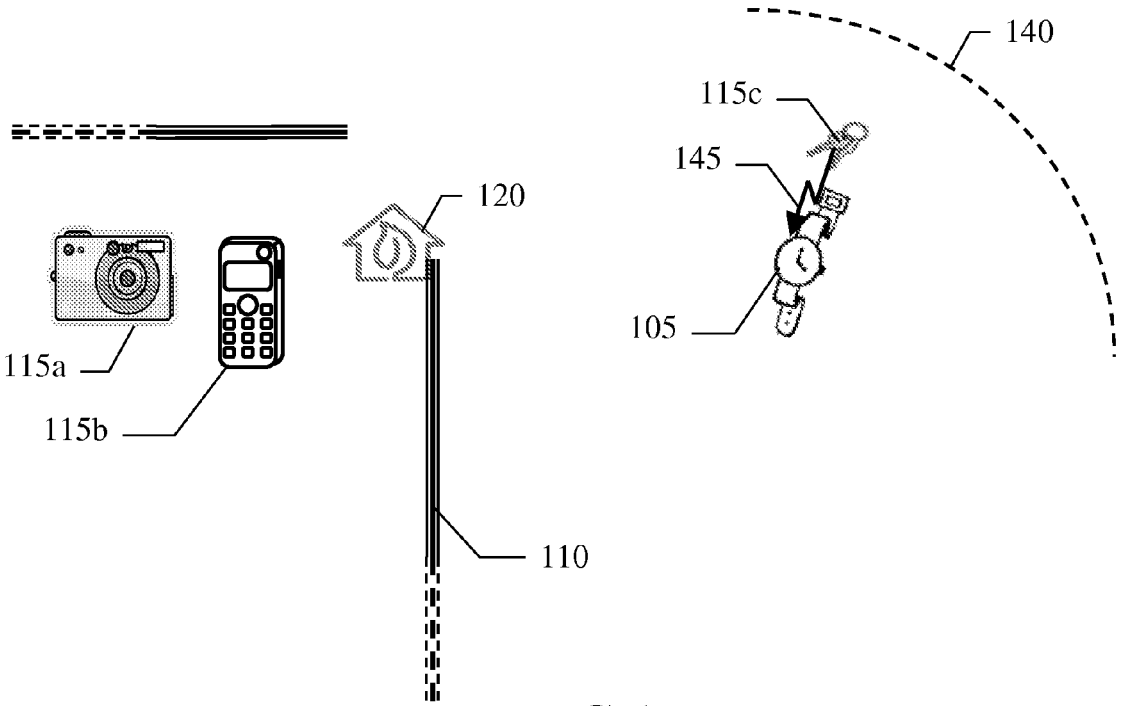

140
115c
145
120
105
115a
115b
110

FIG.1H

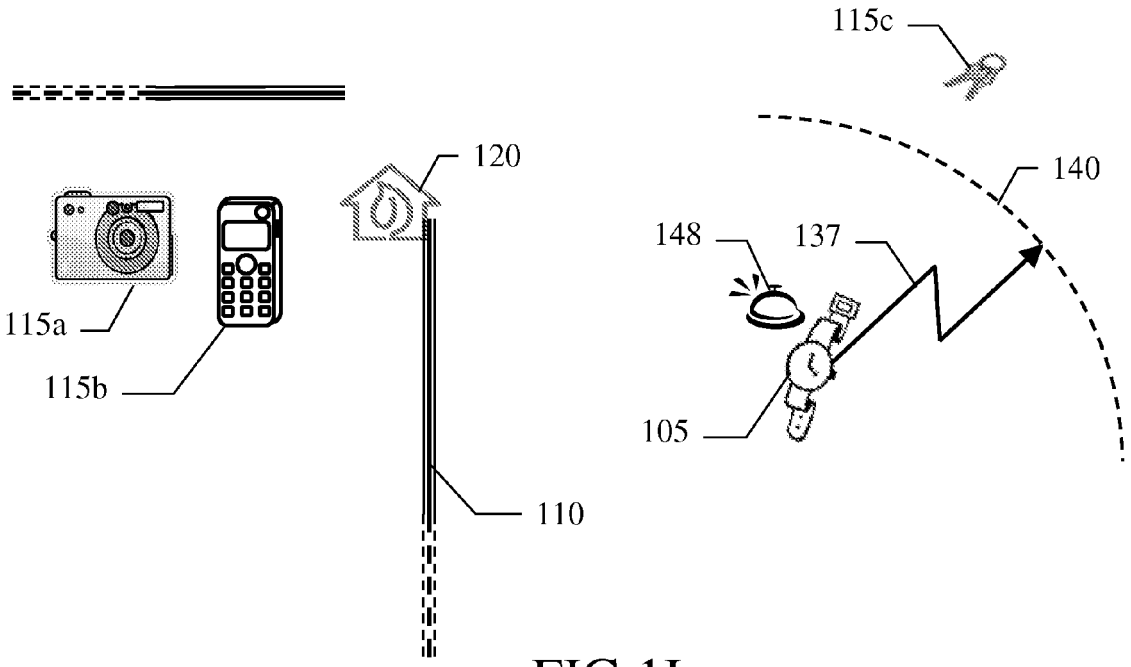


FIG.1I

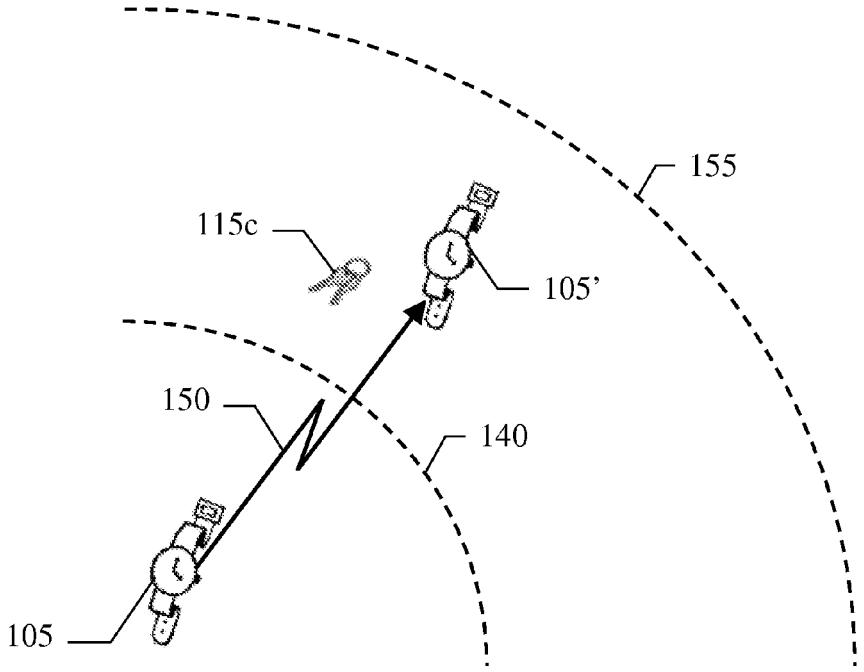


FIG.1J

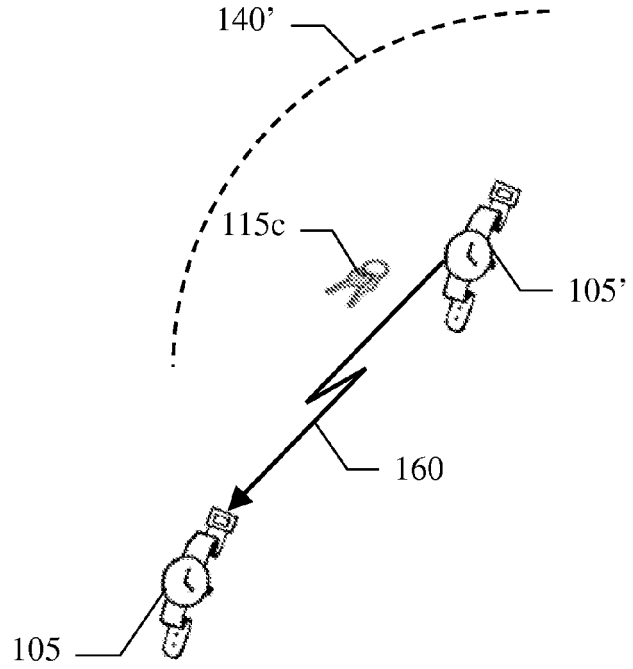


FIG.1K

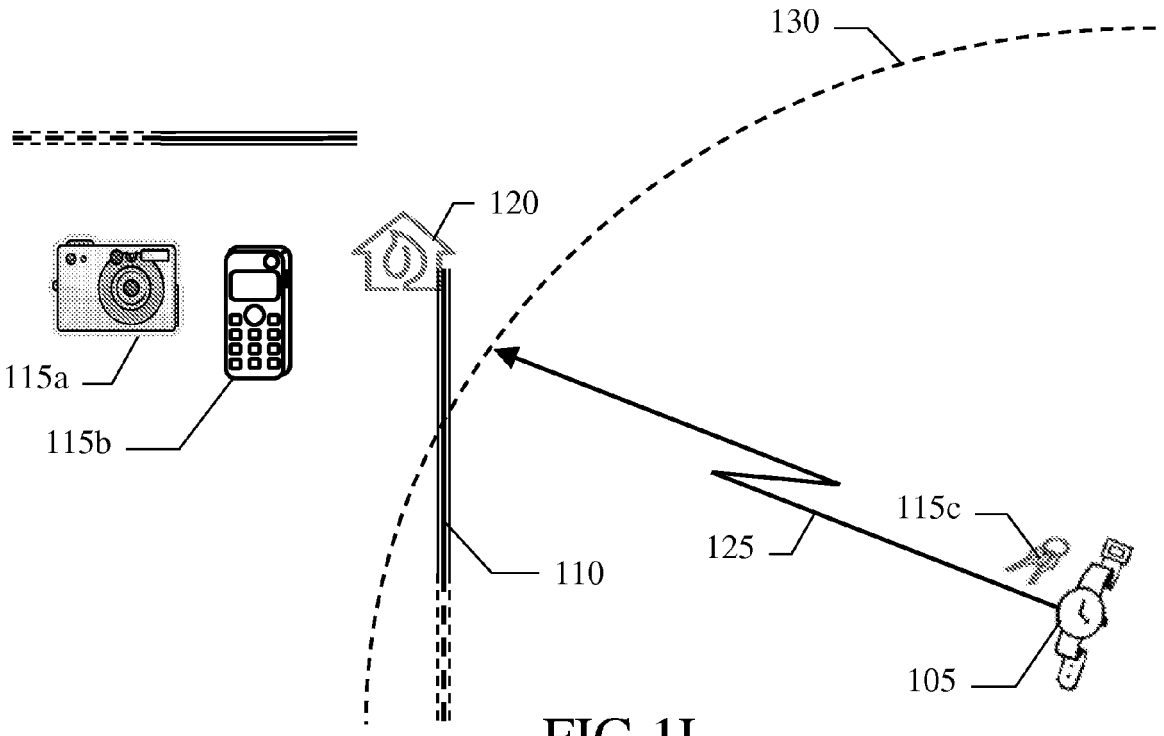


FIG.1L

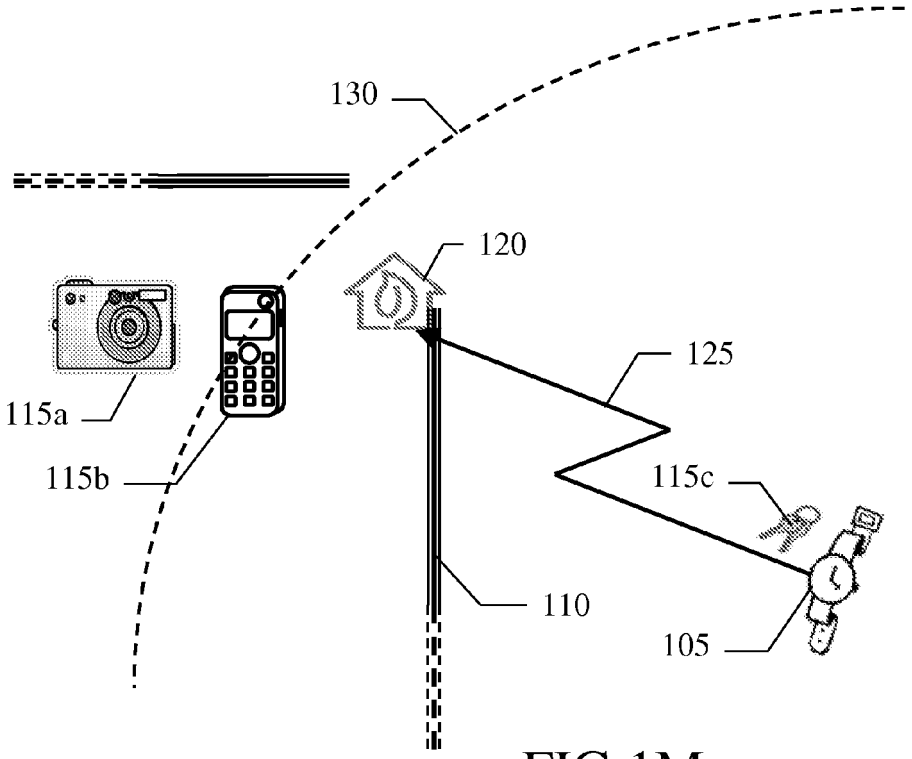

130
120
125
115a
115b
115c
110
105

FIG.1M

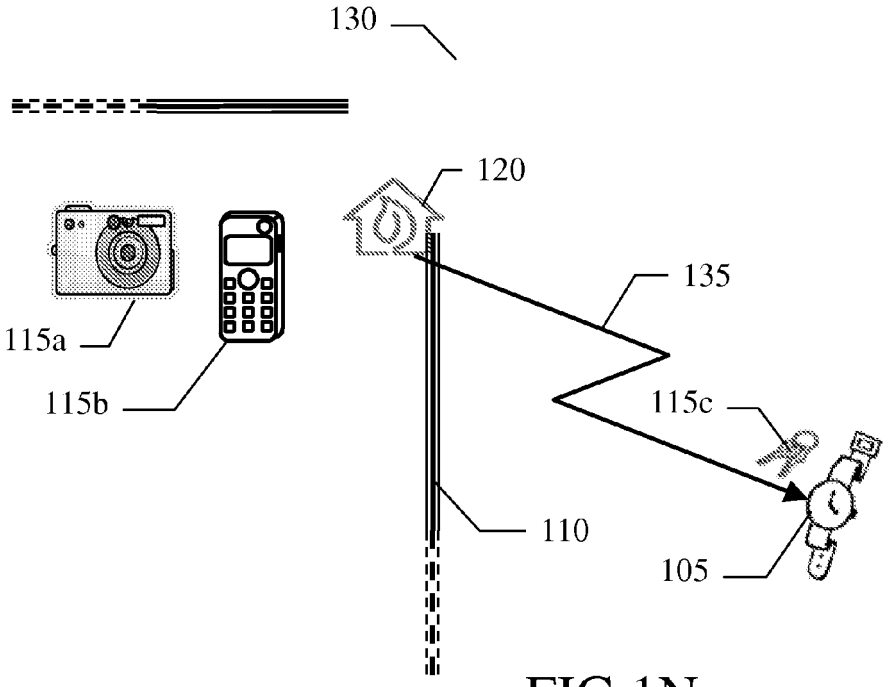

130
120
135
115a
115b
115c
110
105

FIG.1N

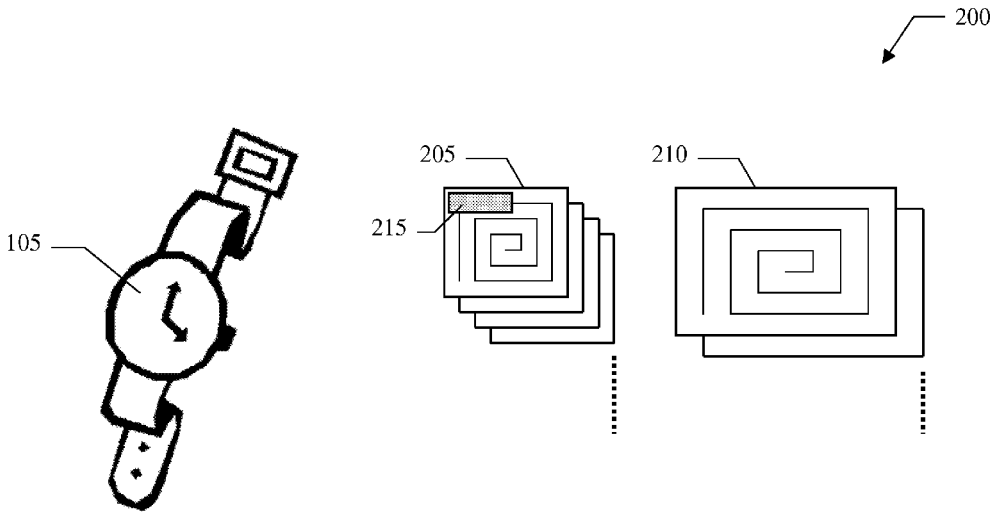


FIG.2

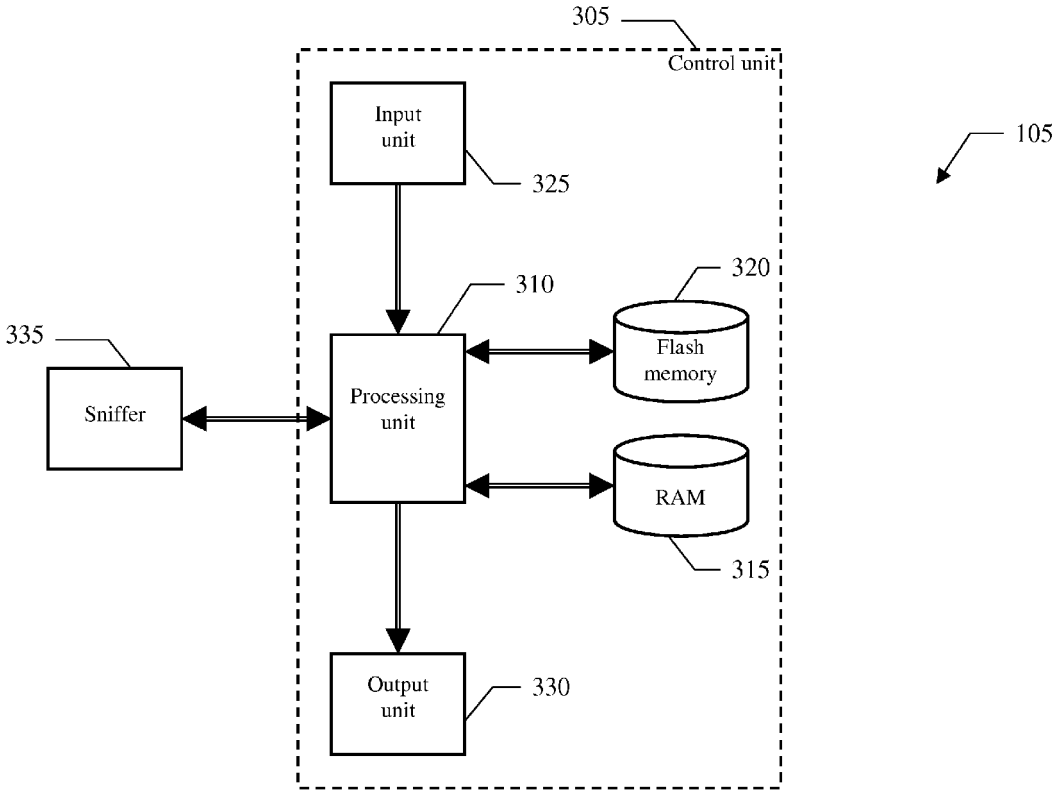

305
Control unit
Input unit
325
105
320
310
335
Flash memory
Sniffer
Processing unit
RAM
315
Output unit
330

FIG.3

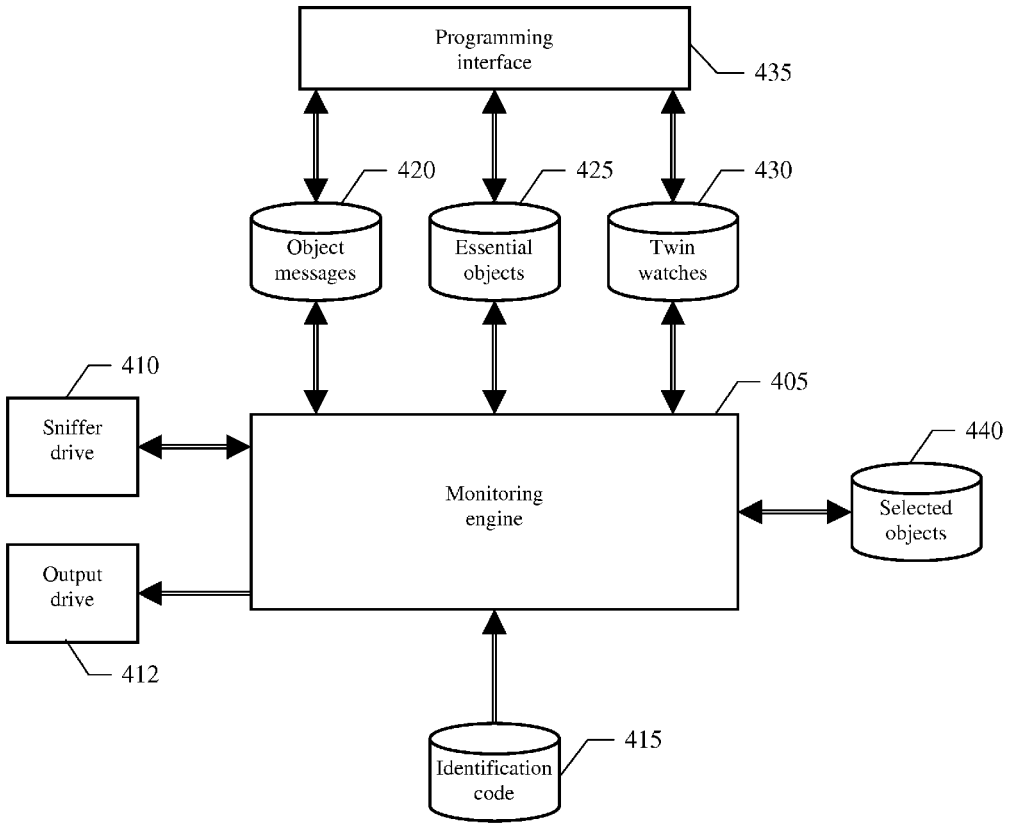

Programming interface
435
400
420
425
430
Object messages
Essential objects
Twin watches
410
405
Sniffer drive
440
Monitoring engine
Selected objects
Output drive
412
415
Identification code

FIG.4

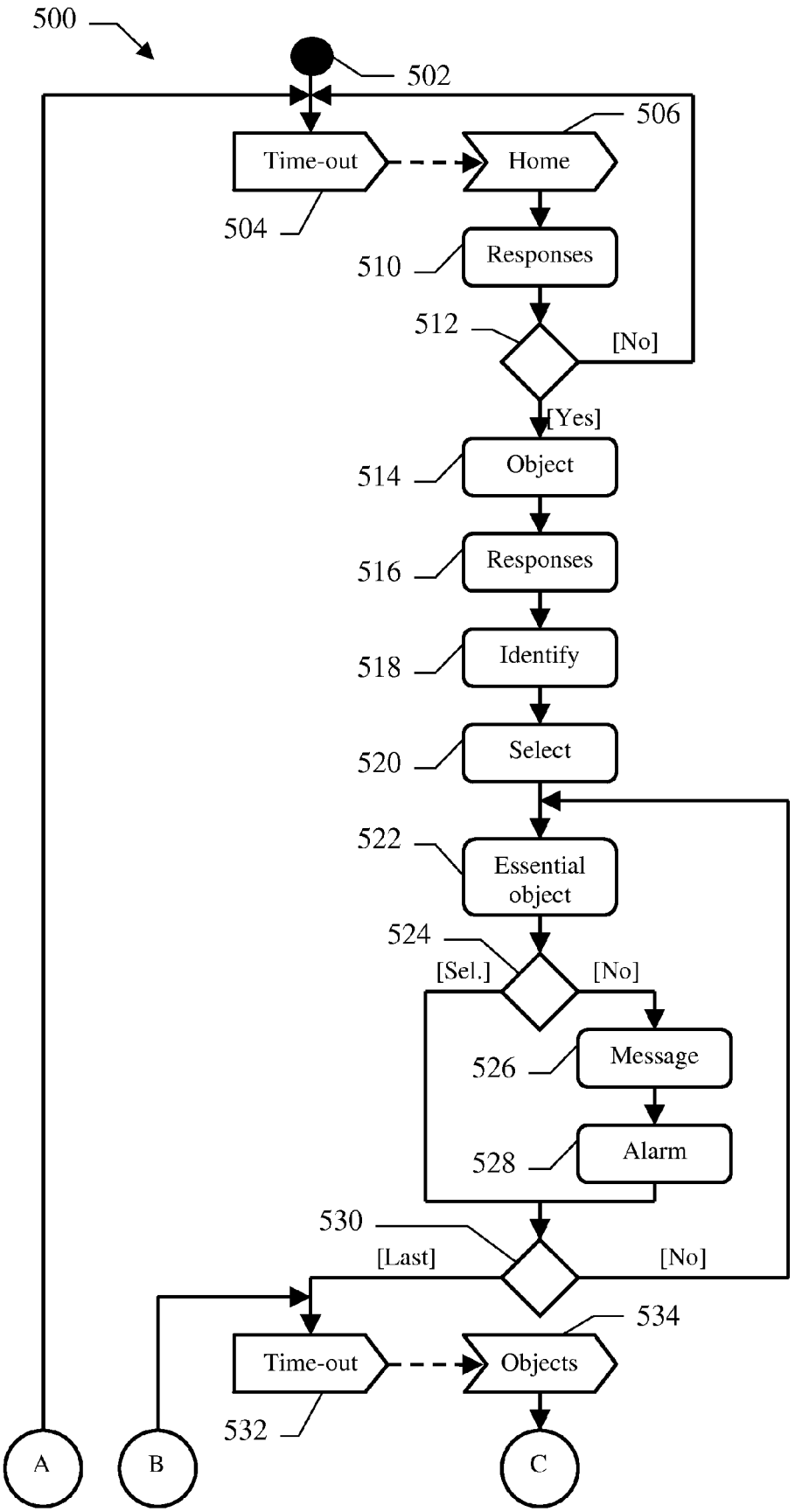

500
502
506
Time-out
Home
504
510
Responses
512
[No]
[Yes]
514
Object
516
Responses
518
Identify
520
Select
522
Essential object
524
[Sel.]
[No]
526
Message
528
Alarm
530
[Last]
[No]
534
Time-out
Objects
532
A
B
C

FIG.5A

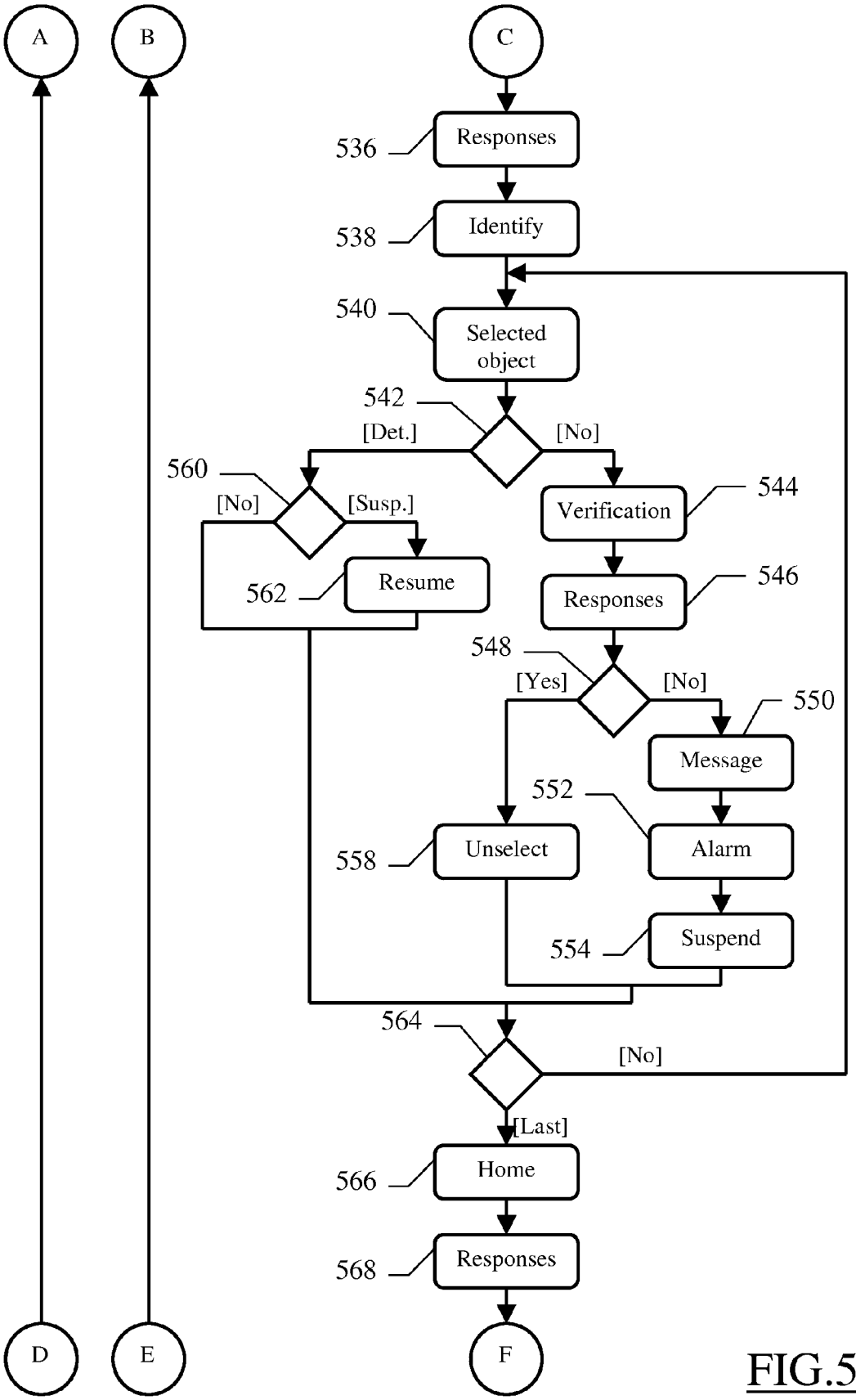

A
B
C
536
Responses
538
Identify
540
Selected object
542
[Det.]
[No]
560
[No]
[Susp.]
562
Resume
Verification
544
Responses
546
548
[Yes]
[No]
550
Message
552
Alarm
558
Unselect
Suspend
554
564
[No]
[Last]
566
Home
568
Responses
D
E
F

FIG.5B

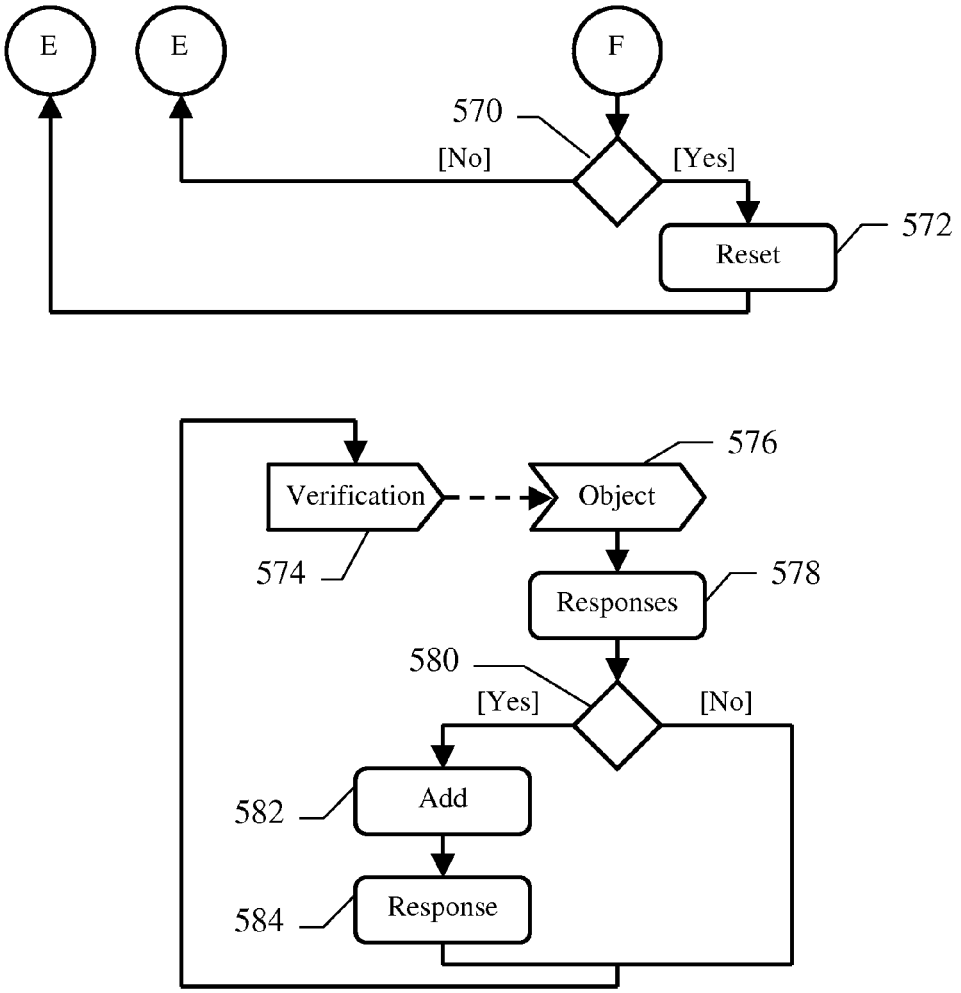

E
E
F
570
[No]
[Yes]
572
Reset
576
Verification
Object
574
578
Responses
580
[Yes]
[No]
582
Add
584
Response

FIG.5C

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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