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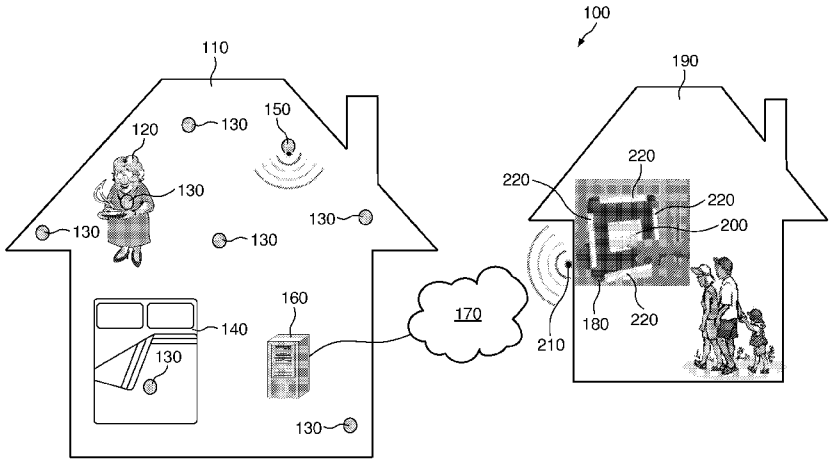

FIG. 1

(57) Abstract: An apparatus (180) is described for conveying information about the wellbeing of an individual (120), for example an elderly person living alone, at the home of a remotely living caregiver, such as the elderly persons child. Thereto, light is used having a characteristic, which depends on a state of wellbeing of the individual. The used characteristic is for example the color or the brightness of the light. The apparatus (180) is part of a larger system that comprises sensors (130) located at the home (110) of the individual (120) measuring parameters relevant to his/her wellbeing. The system derives the state of wellbeing of the individual from an accumulation of these parameters.

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Conveying wellbeing information of an individual

TECHNICAL FIELD

The present invention relates to an apparatus and a method for conveying information about the wellbeing of an individual.

DESCRIPTION OF RELATED ART

There are an increasing number of seniors and an increasing number of so called 'sandwich generations'. The latter are those adults who have full-time jobs, kids to take care of, and an elderly parent living alone. These adults often lose touch with their elderly parent and feel guilty of not being involved in their parent's wellbeing. Visits and phone calls are often not enough to get a clear picture of the parent's welfare.

Generally, the elderly fear of worrying their children or putting a burden on them, while they don't mind sharing wellbeing information with them. The children, on the other hand, although fearing of invading the privacy of their elderly parent, wish to know about their parent's wellbeing, and do not consider it to be a burden as long as they are unobtrusively informed. The elderly like it when they receive signs of care from their children, in particular in case that they live alone and at a distance from their children.

In the article "Digital Family Portraits: Supporting Peace of Mind of Extended Family Members", by Elizabeth D. Mynatt, et al, in *Proceedings of the ACM Conference on Human Factors in Computing Systems* (CHI 2001). Seattle, Washington: ACM Press, pp. 333-340, the concept is introduced of a digital family portrait that provides qualitative visualizations of a remotely living family member's daily life. In a first design the frame is populated with iconic imagery, arranged around a picture of the family member, summarizing the categories health, relationships, activities and events in a person's daily life over a certain time period. The density of icons represents the measurement for a certain category. The greater the density of the icons, the higher the measurement is for that category. A band closest to the picture represents the most recent time period and the outer bands represent previous time periods. In a second design the icons are ordered around the frame in a clockwise motion, wherein each icon represents a certain time period. The background color of the icons varies around the frame, thereby indicating to which time

period an icon belongs. Bigger icons represent higher measurements for the corresponding category.

Although the digital family portrait informs about the wellbeing of an individual without being obtrusive, the wellbeing information is conveyed in a rather complex way. As a result, the caregiver has to make an effort to read and interpret this information and sometimes this information is erroneously interpreted.

It is an object of the invention to provide an apparatus and a method, which conveys the wellbeing information of an individual in an unobtrusive but clear way.

SUMMARY OF THE INVENTION

Thereto, according to an aspect of the invention an apparatus according to independent claim 1 and a method according to independent claim 14 are provided. Favorable embodiments are defined in dependent claims 2-13 and 15.

According to an aspect of the invention an apparatus is provided for conveying information about the wellbeing of an individual comprising a light emitter for emitting light having a characteristic, which depends on a state of wellbeing of the individual. So, different states of wellbeing of the individual each result in emitted light having a different characteristic. Conveying wellbeing information by means of a light characteristic is unobtrusive for a caregiver and enables the reading of the information at a glance, even when the caregiver is at a certain distance from the apparatus. It also protects the privacy of seniors since detailed information is not displayed to the caregivers, but rather a high-level general picture and indication of wellbeing. Preferably, the apparatus is implemented as an ambient display keeping its obtrusiveness in the caregiver's home to a minimum. Through the awareness of the seniors' wellbeing, connectedness is enhanced between them and their caregivers, generally their children, especially when they are physically apart by long distances. The children of elderly are able to feel involved in the wellbeing of their parents without feeling a burden. Furthermore, more relevant communication between children and their elderly parents is promoted and irrelevant or unnecessary "polling" of children to assess their parents' welfare is reduced. Because the children can keep an eye on their parents from a distance, seniors may stay longer in their own homes, delaying the move to a care facility, and thus keeping them as independent as possible.

The light characteristic that is used for conveying the information may be the color thereof. Intuitive colors may be used for conveying the information, for example soothing colors for conveying positive or improving states of wellbeing and "arousing"

colors for conveying abnormal trends or worrisome wellbeing states. In this case the caregiver will immediately associate the emitted color to the corresponding wellbeing state. Different severity levels of the wellbeing states may be shown by using different colors.

Next to using a particular color, a color pattern or a color sequence of the light may be used to inform the caregiver of a particular state of wellbeing. Each color may correspond to a different wellbeing category, such as sleeping or eating. In this way the caregiver may be informed of the states of a plurality of wellbeing categories.

Alternatively or additionally, the characteristic is a brightness of the light. For example, a high brightness may correspond to a high value of a certain wellbeing indicator and a low brightness may correspond to a low value thereof. This way of conveying the wellbeing information is intuitive for the caregiver.

According to an embodiment of the invention the light emitter is adapted for emitting a light aura around an area to be used for displaying a picture. The picture to be displayed may be the picture of the individual whose wellbeing information is conveyed, or a picture of something related to the individual, a memory about the individual or something representing the person. The wellbeing information may then be conveyed by creating a colored aura around the picture of the concerned individual. Since the apparatus is likely to be placed in a common area of the home of the caregiver such as a family/TV room, dining area, home office or kitchen it may be implemented as a digital photo-frame, which blends nicely with the décor of such a common area.

According to a further embodiment the light emitter is adapted for emitting light with different characteristics at different sides of the picture area. Each side of the picture may be a separate channel to indicate either four categories of wellbeing at once, or the wellbeing of different people.

According to a still further embodiment, the apparatus comprises a user interface for enabling a user to personalize the characteristic of the light to be emitted in case of the occurrence of a certain state of wellbeing and wherein the light emitter is adapted to emit light with the personalized characteristic in the case of occurrence of the certain state of wellbeing. So, other persons such as visitors are not able to identify the wellbeing status of the concerned individual, keeping the wellbeing information personal and private.

Furthermore, the user interface may enable the access to detailed information on the wellbeing of the individual. So, in case that the high level picture of wellbeing shown by the light characteristic is not as expected, the caregiver may retrieve more information to look into the cause of this situation.

According to yet a further embodiment, the light emitter is adapted to emit light with a characteristic representing presence information of the individual, i.e. information if the concerned individual is at home or not. The display of such information makes the caregiver and the senior feel connected and in touch.

The apparatus for conveying wellbeing information is part of a larger system comprising an inference engine for deriving the state of wellbeing of the individual from an accumulation of parameters relevant to the wellbeing. The parameters relevant to the wellbeing are for example several health measurements, biometrics, and/or activities of daily living of the elder. Typical activities of daily living are sleeping, eating, bathing, toileting, and so. By using an accumulation of the parameters relevant to the wellbeing of a person to reason upon, a good estimate of the state of wellbeing of an individual is obtained.

The system may comprise sensors to measure at least a part of the parameters relevant to the wellbeing. In this way, the parameters may be collected without being obtrusive to the person being assessed.

The system may furthermore comprise a sensor for detecting the presence of the individual. The resulting presence information is displayed by the apparatus of the caregiver.

An issue of concern about relaying presence information is security. To avoid hackers to access such information transmitted to the apparatus of the caregiver, an algorithm may mask the data depending on a time schedule. Such a security measure may be applied not just to presence information but to any private information that is communicated to caregivers.

According to a further aspect of the invention, a method is provided for conveying information about the wellbeing of an individual, comprising the step of emitting light having a characteristic that depends on a state of wellbeing of the individual.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and its numerous objects and advantages will become more apparent to those skilled in the art by reference to the following drawings, in conjunction with the accompanying specification, in which:

Fig. 1 shows the architecture of a system for determining and conveying wellbeing information of an individual according to an exemplary embodiment of the present invention.

Fig. 2 shows a front view of an apparatus for conveying wellbeing information of an individual according to an exemplary embodiment of the present invention.

Fig. 3 shows a flow diagram of the process implemented by the system depicted in Fig. 1.

Fig. 4 depicts an example of showing detailed information related to the wellbeing of the individual by the apparatus for conveying the wellbeing information.

Throughout the figures like reference numerals refer to like elements.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

Referring to Figure 1, an exemplary embodiment of the system according to the invention will be described. The system determines the wellbeing of an individual to be assessed and conveys the wellbeing information to a remote caregiver. The individual to be assessed is for example a senior living alone, a person with a light handicap, etc. In the home 110 of the individual 120 to be assessed, a plurality of sensors 130 is used to capture parameters relevant to the wellbeing of the individual. Such parameters may be activities of daily living (hereinafter ADL), such as eating, sleeping, bathing, and toileting, biostatistics, health measurements, presence information of the person, security information, etc. The parameters are preferably sensed or detected in an unobtrusive way, so that the person does not need to perform any specific tasks to input data into the system, by using simple sensors embedded at home measuring physical entities such as heat, pressure, sound level or light intensity. For example, simple load sensors placed under each leg of the bed 140 can give an estimate of sleep and weight patterns, and the same could give an indication if the person frequently goes to the bathroom or eats during the night. Such a sensor system for use under a bed is disclosed in detail in the patent application WO 2007/042960 of the applicant. Simple sensors may be used to detect the presence of the person at home, such as RF key fobs, passive Infra Red sensors detecting movement at home together with switches on doors, CO2 detectors, temperature sensors, pressure sensors, heat cameras, etc. The data of the sensor measurements are collected by a node 150 in the home 110 of the elderly, which retransmits the sensor data over a wired or wireless connection to an inference engine 160. The inference engine 160 may be implemented by means of a computer program run on a general purpose computer or a server. In Figure 1, the inference engine is shown as being located in the home

of the elderly but it may be located elsewhere, for example on a server accessible over the internet. As described in more detail herein below, the inference engine 160 accumulates the sensed information and determines the state of the individual according to one or more wellbeing categories. This information is accessed over an internet connection 170 by an apparatus 180 for conveying the wellbeing information, which is placed in the home 190 of a caregiver, for example a child of the senior 120. The apparatus 180 may be a digital photo-frame with a touch screen 200, as shown in Figure 2. In normal operation the digital photo-frame may show a picture of the senior 120 or play a slideshow of pictures. The apparatus 180 comprises furthermore an interface 210 for connecting to the internet and a light emitter 220, which may be implemented as a thin, flexible and low cost light emitting surface. Such light emitting surfaces are well known, examples are described in J.G. Chang, "Dot-pattern design of a light guide in an edge-lit backlight using a regional partition approach", Opt Eng. 46(4), April 2007, WO 2007/143383 and US 5,803,573. The light emitter creates colored auras around the picture to convey the status of wellbeing of the concerned person. In order to achieve the "aura effect", the light emitter may be positioned around the picture area or at the edge of the picture area. The light guide may be implemented on a thin sheet of transparent material, like Plexiglas. The flat sheet of Plexiglas is covered with an out coupling structure on the surface which is barely noticeable. Color LEDs placed at the edge of the sheet cause the material to light-up uniformly, distributing light across the sheet. Alternatively, projections of light may be used for creating an aura around and/or overlapping the picture. It could project on the wall or surrounding objects, such as objects related to the person.

Referring now to Figure 3 a flow diagram of the process implemented by the system is described. The following parameters relevant to the wellbeing are measured by the sensors 130 in the home 110 of the elderly 120: parameters 310 related to ADLs, parameters 320 concerning biostatistics and health information and wellbeing parameters 330 of other sources, such as social indicators, environment, security, etc. Examples of such parameters are an unlocked door at night, lights still on in the middle of the night, no visitors for a long period of time, etc. These sensor data are forwarded to databases that log the data (step 340). Furthermore, manual input 350 from the person concerned may optionally be stored. Such input is for example data obtained from a computer exercise for assessing the cognitive abilities of the elderly. Furthermore, optionally data 360 from medical records, care providers and online sources may be logged by the databases. Next, predetermined rules are applied on the data (step 370) in order to determine a wellbeing score for the assessed person. At this

stage, as a further input data 390 concerning the wellbeing history such as trends or patterns is used. The determined wellbeing score may be a single "all over score" for all wellbeing categories such as eating, sleeping, weight, etc. or may consist of several partials scores for each category. Then, the wellbeing scores are processed (step 380) and based thereon the wellbeing history data are updated. Based on the wellbeing score(s), the colored aura to be emitted at the caregiver's home is updated (step 400). This step is performed based on configuration data 410 from a library of preferences. Then, as shown in step 420 a control signal regarding the colored aura to be emitted is provided to one or more apparatuses 180.

The configuration data 410 may be predefined by a system manufacturer or a service provider, who sets the colors to be emitted in case of certain wellbeing states. Alternatively, the user is enabled to personalize the color and brightness of the light to be emitted in case of the occurrence of a certain state of wellbeing by inserting the settings by means of a user interface shown on the photo-frame.

The steps 340,370,380,400 and 420 of the process may all be performed by the inference engine 160. Alternatively, step 400 may be performed by the apparatus 180 for conveying the wellbeing information. In this case, the configuration data from the library of preferences may also be stored locally at the apparatus 180.

Different thresholds for different aspects of wellbeing are assessed and predefined per individual, or captured during a training period. If any aspect of wellbeing is out of range a colored aura indicating the severity and possibly the aspect of wellbeing that is of concerned, will be created on the photo frame at the caregiver's home. Besides negative changes, improvement in wellbeing may also be shown with soothing colored auras. Next to a single color, a colored pattern may be used to indicate further information about wellbeing. For example, the brightness of the aura may indicate the activity or exercise level, or the mood of a person. Alternatively or in addition to brightness, a sequence of colors may convey a particular state of wellbeing, i.e. a combination of brightness and colors, which is possibly predefined by users for privacy issues so that only they can interpret the patterns, conveys the wellbeing of multiple wellbeing indicators.

Furthermore, each side of the photo frame could be a separate channel to indicate either several aspects of wellbeing at once, or for different people. Furthermore, the photo-frame may indicate with an aura whenever the person in the photo frame is at home or whether there are appliances at home that are in use or not. Also safety information may be relayed (e.g. flooding, gas, etc.).

Also a time factor may be included such that a light pattern on the frame is formed to indicate the progress of wellbeing, for example colored light patterns between red and green within a time frame (e.g. the last year). In this way, it is easy to show health/wellbeing improvement or deterioration over a time period. The colored pattern may run in the direction around the picture area as a function of time (e.g. in clockwise or counter clockwise direction) with a starting point indicating the current wellbeing state and wherein the history of the wellbeing state over the time frame is shown around the picture. Alternatively, the color pattern may show the current wellbeing state by a color at the inner side of the light emitting surface, next to the picture and the history by colors further to the outside.

The caregiver can access detailed information by interacting with the photo frame's screen which provides charts with patterns of wellbeing information, such as sleep patterns, weight trends, activity levels, etc. Each chart may be retrieved by interacting with the corresponding icon. Figure 4 shows a sample chart showing sleep patterns. Along the x-axis the time is depicted and the y-axis the date is depicted. The classification of a night of sleep is shown by a color. A night of sleep may be classified as normal 500, restless 510 or highly restless 520. As the user interacts with different charts, the aura on the photo frame changes reflecting the state of the chart or wellbeing parameter viewed. Charts do not give details such as wake-up or bed times, or the number of times of certain activities, but rather a high-level visualization of how different aspects of wellbeing are going.

The system optionally has a feedback channel, such that if an abnormality or improvement is indicated and the caregiver asks for details, the senior is notified about it.

To avoid hackers to access such information transmitted to the apparatus of the caregiver, an algorithm may mask the data depending on a time schedule. For example, presence at home is first assessed as in or out, and the algorithm will translate it such that 1 is in and 0 is out, or vice-versa, and this depends on the time stamp. The algorithm uses a schedule that may be changed on a regular basis. The masked information is relayed and interpreted at the destination, i.e. the apparatus of the caregiver. Such a security measure may be applied not just to presence information but to any private information that is communicated to caregivers.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.

For instance, the apparatus 180 for conveying the wellbeing information is not necessarily a photo-frame but any other devices capable of emitting colored light patterns may be envisaged.

Furthermore, in the embodiment described herein above, three types of parameters relevant to the wellbeing and measured by the sensors 130 in the home 110 of the elderly 120 are accumulated and used in combination for determining the wellbeing score: parameters 310 related to ADLs, parameters 320 concerning biostatistics and health information and wellbeing parameters 330 of other sources, such as social indicators, environment, security, etc. However, it is also possible to use only a subset of these parameters for determining the wellbeing score, for example only the parameters 310 related to the ADLs or even multiple parameters (i.e. measurements) over time concerning a single ADL. The ADL sensed data could detect the availability of a person: is the person busy or not and inform other parties (e.g. caregivers). If the person is sleeping or showering, etc. it would be not available, but watching TV, reading a book, it would be available. A light aura would indicate to caregivers (e.g. green available, red not available).

Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measured cannot be used to advantage. A computer program may be stored/distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the Internet or other wired or wireless telecommunication systems. Any reference signs in the claims should not be construed as limiting the scope.

CLAIMS:

1. Apparatus (180) for conveying information about the wellbeing of an individual (120), comprising a light emitter (220) for emitting light having a characteristic, which depends on a state of wellbeing of the individual.

2. Apparatus according to claim 1 wherein the characteristic is a color of the light.

3. Apparatus according to claim 2 wherein the characteristic is a color pattern or a color sequence of the light.

4. Apparatus according to claim 1 wherein the characteristic is a brightness of the light.

5. Apparatus according to claim 1 wherein the light emitter is adapted for emitting a light aura around an area (200) to be used for displaying a picture.

6. Apparatus according to claim 5 wherein the light emitter is adapted for emitting light with different characteristics at different sides of the area.

7. Apparatus according to claim 1 further comprising a user interface for enabling a user to personalize the characteristic of the light to be emitted in case of the occurrence of a certain state of wellbeing and wherein the light emitter is adapted to emit light with the personalized characteristic in the case of occurrence of the certain state of wellbeing.

8. Apparatus according to claim 7 wherein the user interface enables the access to detailed information on the wellbeing of the individual.

9. Apparatus according to claim 1 wherein the light emitter is adapted to emit light with a characteristic representing presence information of the individual.

10. System for determining the wellbeing of an individual and conveying information about the wellbeing comprising:

- an inference engine (160) for deriving a state of wellbeing of the individual from an accumulation of parameters relevant to the wellbeing; and
- an apparatus (180) according to any of the preceding claims.

11. System according to claim 10 comprising sensors (130) to measure at least a part of the parameters relevant to the wellbeing.

12. System according to claim 10 comprising a sensor for detecting the presence of the individual.

13. System according to claim 10 wherein the engine (160) and the apparatus (180) are adapted for masking information exchanged between them according to a masking algorithm.

14. Method for conveying information about the wellbeing of an individual (120), comprising the step of emitting light having a characteristic that depends on a state of wellbeing of the individual.

15. Method according to claim 14 comprising the further steps of:

- measuring parameters relevant to the wellbeing (310,320,330); and
- deriving the state of wellbeing of the individual from an accumulation of the parameters (370);

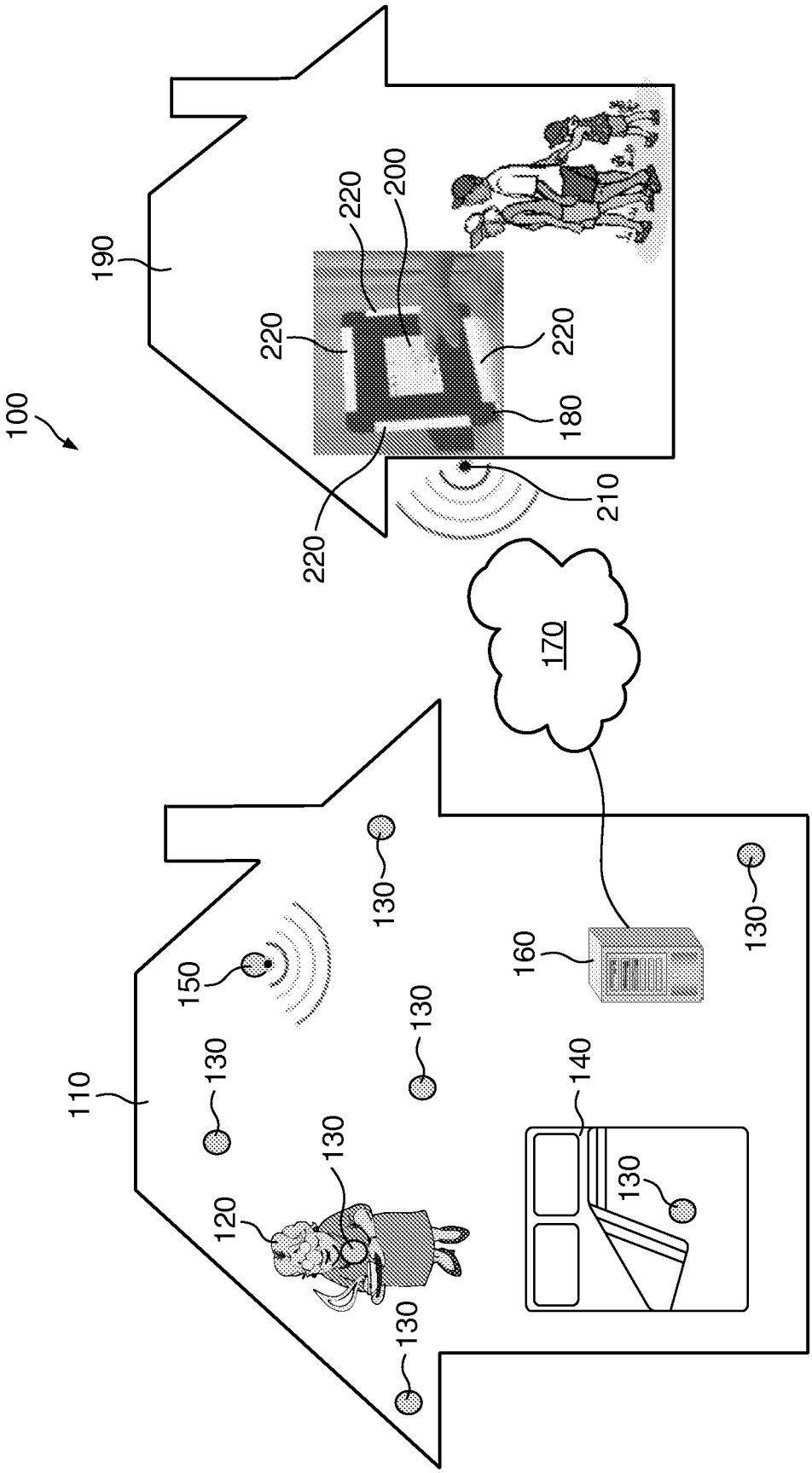
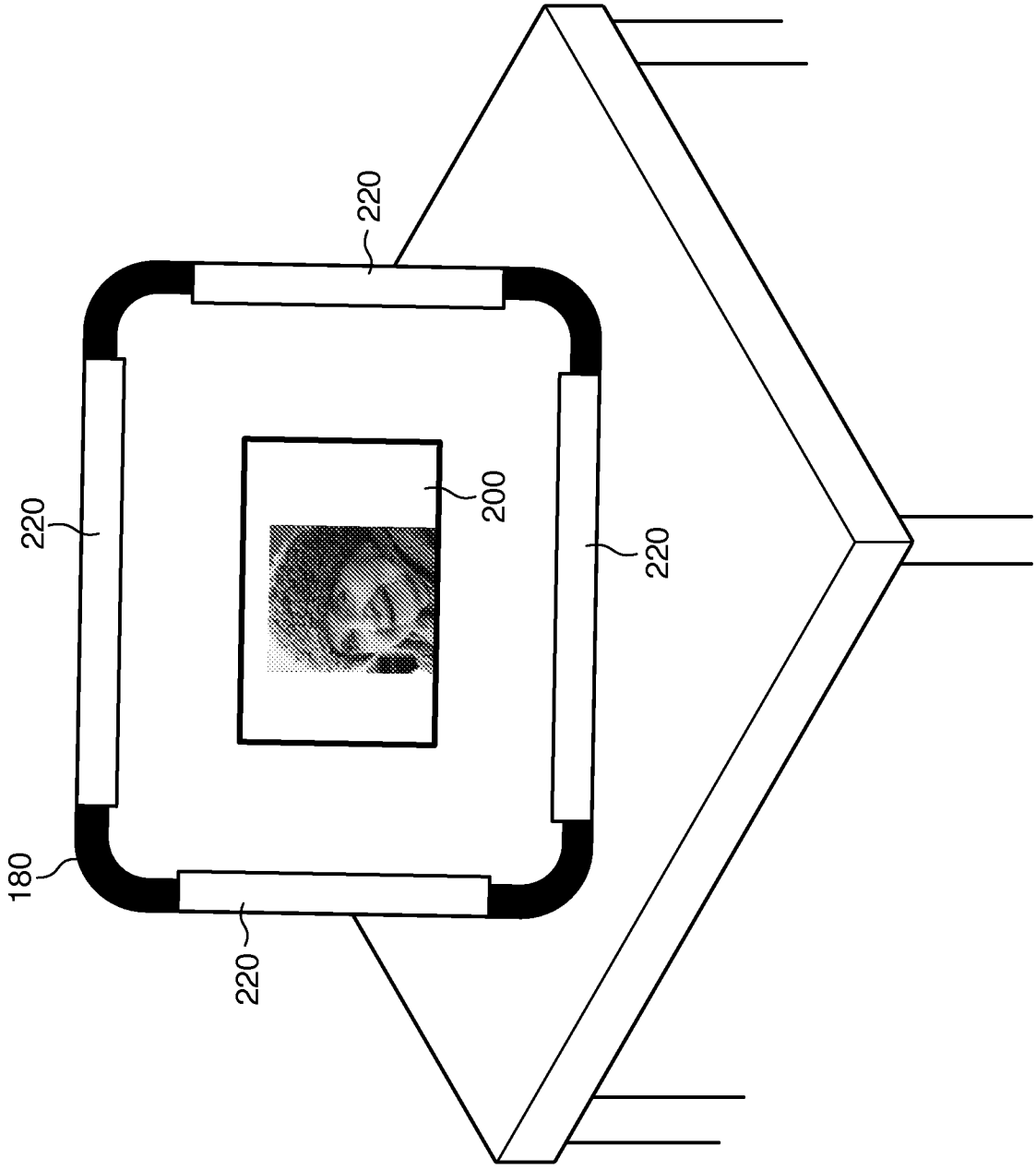


FIG. 1

FIG. 2



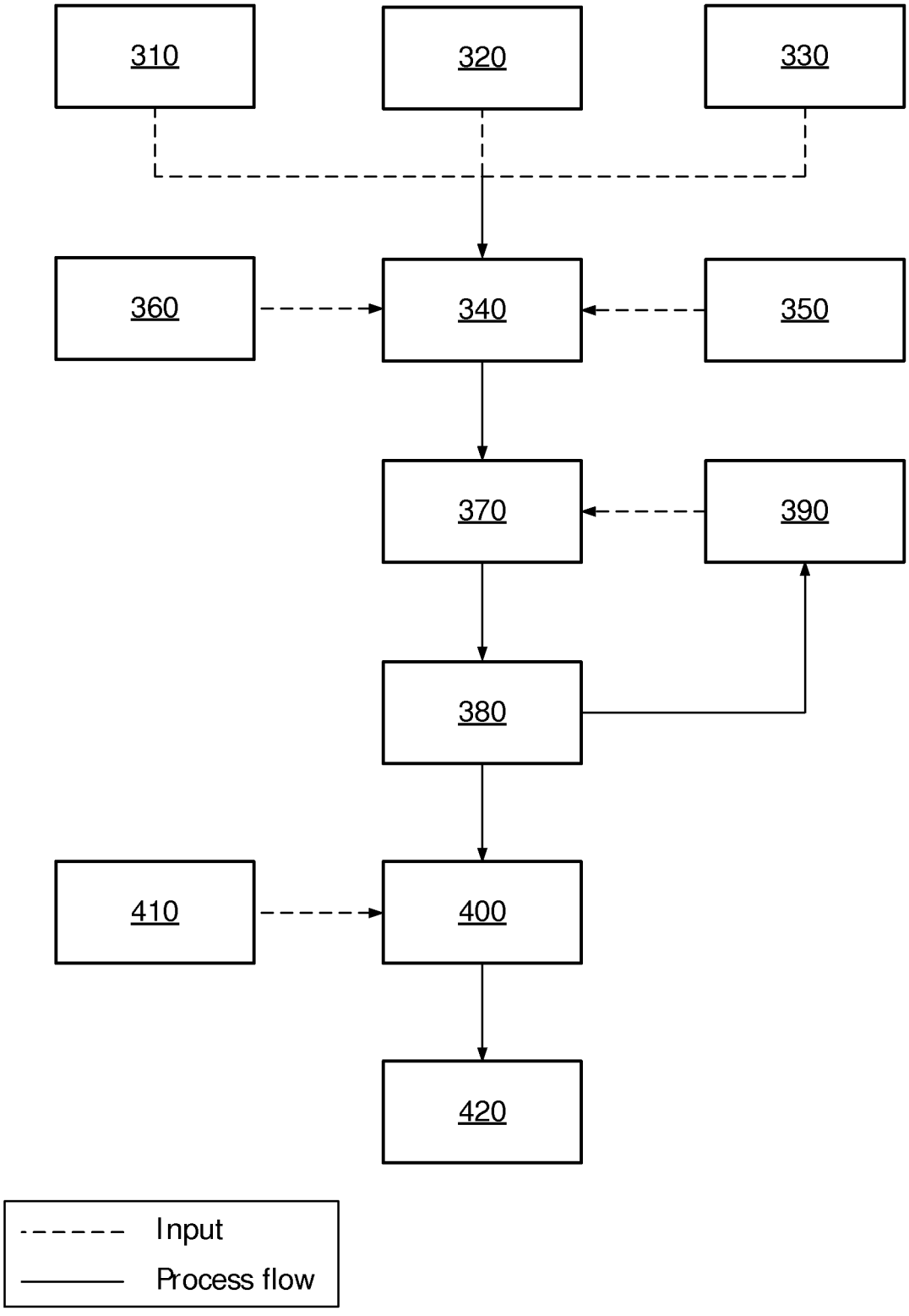

310
320
330
360
340
350
370
390
380
410
400
420
Input
Process flow

FIG. 3

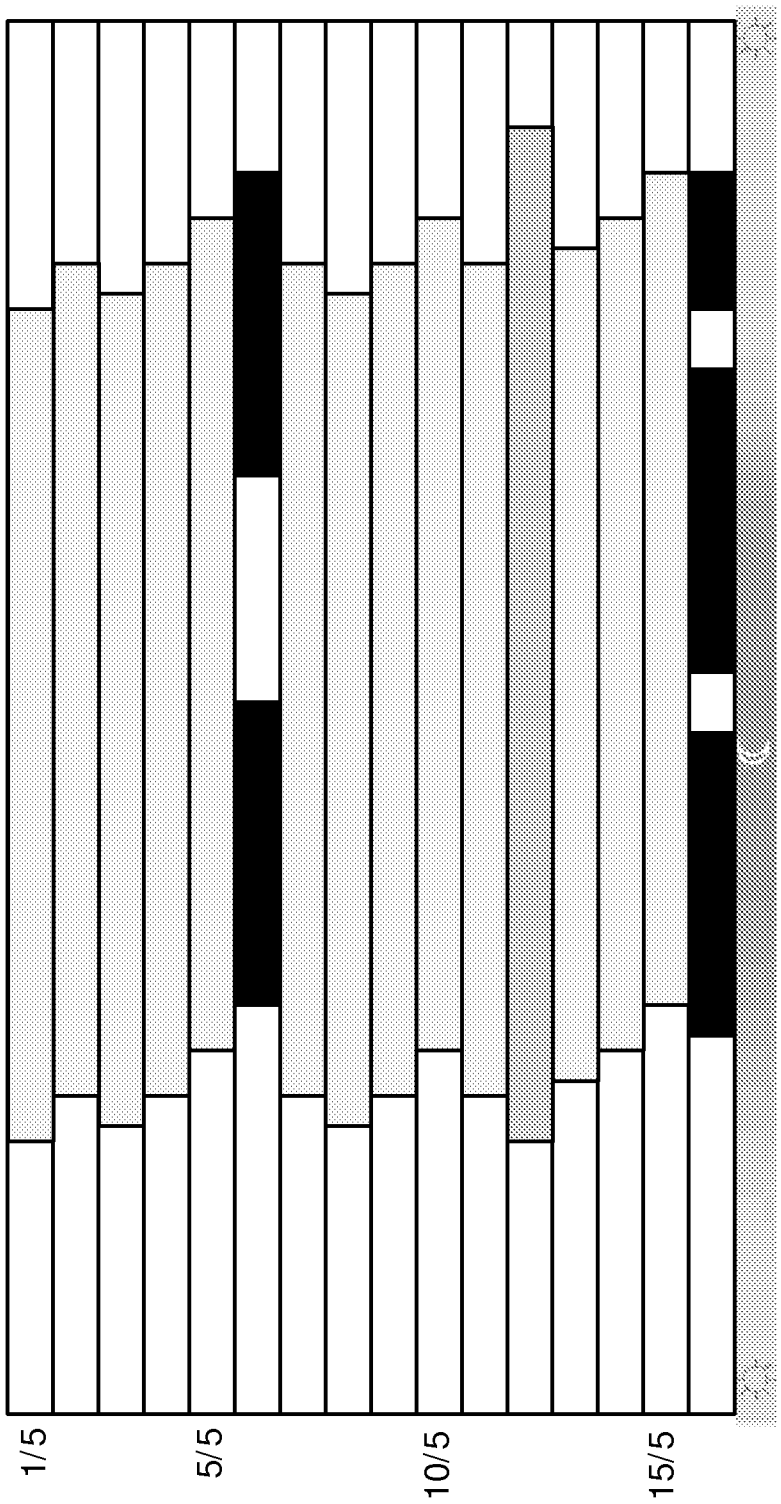


FIG. 4