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(54) **Monitoring system**

Überwachungssystem

Système de surveillance

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**Description****FIELD OF THE INVENTION**

[0001] The invention pertains to systems which can support independent living of individuals who may need assistance. More particularly, the invention pertains to systems which can assess and monitor activities of daily living, and physiological indicators of the health of such individuals, and facilitate appropriate communication to assist them in continuing to live independently.

**BACKGROUND OF THE INVENTION**

[0002] The ability to live independently hopefully evolves as a person matures through early adulthood and then extends through most or all of that person's life. However, such is not always the case.

[0003] It has been recognized that as individuals age, they lose a portion of their ability to independently carry out the activities of daily living. Common types of problems include loss of coordination and/or ability to understand where one's body is in space. These types of deficiencies can cause individuals to lose their balance and fall. The results of such falls, such as broken hips, can incapacitate the respective individual and leave them unable to summon help. The resulting delay in response, sometimes a day or more, can result in permanent disability or death in situations where quicker response could achieve full recovery.

[0004] Other forms of deficiencies arise from onset of dementia, and/or Alzheimer's Disease. Individuals with these syndromes lose their cognitive abilities, including their short term memory, in varying degrees. As a result of these losses, they often are unable to remember where they are or how to return, for example, to their residence, if they wander off (sometimes referred to as elopement). In early stages of dementia, they may simply need reminding about when to take medication, when to eat, and when to sleep, for example.

[0005] Younger individuals who are debilitated due to accidents (motorcycle riding, sports or the like) or diseases, such as cancer, alcoholism or hormonal imbalances represent another group whose ability to live independently may have been permanently compromised. Such individuals may also benefit from monitoring, reminders and the like.

[0006] Notwithstanding the types of deficiencies noted above, it has also been recognized that there is a substantial and important quality of life value in being able to continue to live substantially independently in one's residence. Not only is this psychologically, and perhaps physically, better for the individual (assuming the lifestyle can be carried out safely), it is substantially less expensive than maintaining the same individual in either an assisted living environment or a nursing home. Hence, there continues to be a need for systems and methods which support individuals who would like to remain at

home, despite the presence of physical or cognitive limitations (which might have been caused by aging, accident or disease). Preferably, such systems would enable such individuals to safely remain in their homes and assist them in continuing to be as independent as possible.

[0007] US 2004/162466 describes a method and apparatus for health and disease management combining patient data monitoring with wireless Internet connectivity. US 2004/017300 describes a portable communication device and corresponding method of operation.

**BRIEF DESCRIPTION OF THE DRAWINGS****[0008]**

Fig. 1 is a top plan view of a portion of a residence which incorporates a system in accordance with the invention;

Fig. 2 is a schematic diagram of a side elevational view of the residence illustrating additional details of the system of Fig. 1;

Fig. 3 is an overall block diagram of a system as in Fig. 1 used to implement a care giving and monitoring methodology in accordance with the invention.

**DETAILED DESCRIPTION OF THE EMBODIMENTS**

[0009] While embodiments of this invention can take many different forms, specific embodiments thereof are shown in the drawings and will be described herein in detail with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiment illustrated.

[0010] In accordance with the invention, a portable telephone device, which is wearable, incorporates one or more sensors, such as fall indicating or activity sensors in combination with position indicating circuitry useable for example with a global positioning system. Other sensors and devices within the individual's home or living area can be used to monitor activities of daily living. These include, for example, one or more environmental temperature sensors, such as thermostats or motion sensors to keep track of movement of the individual within an area. In addition to the aforementioned passive monitoring devices that do not require conscious interaction by the monitored individual the system may include manual devices, such as a panic button, or speed dial facility, that puts an individual in immediate contact with a responder during a personal emergency. Additionally, position sensors, such as switches, can be associated with doors or windows to provide feedback signals indicative of the opening and closing thereof. These can be used to indicate that the respective individual may have departed from the immediate area.

[0011] In a disclosed system, the system and other people using the system can communicate directly with the individual being monitored. Further, the monitored

individual can communicate using a wearable device.

**[0012]** In one embodiment of the invention, a wearable communicator, which is a cellular telephone can provide the individual with immediate access to assistance. Speed dialing capability can be provided as well as voice activation. The unit can be configured to operate in a hands free mode. Prompts or other types of alerts can be delivered to the communication device, which can be used to provide medication reminders or the like. Further, such devices can automatically detect situations such as a fall or a cessation of movement. Either of these circumstances are potentially indicative of critical situations.

**[0013]** The communications device can wirelessly communicate with a local base or charging station. The base or charging station can also receive data or signals from other sensors or equipment which has been installed in the residence or region being monitored. The base or charging station can provide backup communications, via a wired, or, land line telephone system in the event that the communication device fails, or, the cellular system is temporarily disrupted or unavailable.

**[0014]** The communication device can be slid into a docking port on the base to recharge it. The base station can respond to wired or wireless signals from one or more environmental sensing devices (e.g., temperature sensor), one or more activity sensing devices (e.g., motion sensors, contact switches) as well as one or more position sensing devices (e.g., RFID). This information can be transmitted wirelessly to the wearable communication device, or, can be transmitted via the land line connection to an external third party monitor.

**[0015]** The base station can also forward information to the third party monitor as to any problems detected with use or operation of the wearable communication device, battery charging problems or other sensed conditions which indicate deviations from normal activities of daily living. The base station can also, via regular monitoring of the wearable communication device determine that the device is or is not still within local range. The departure of the wearable communication device from the local region might be indicative of an elopement problem.

**[0016]** The local base station also implements supervisory algorithms to prompt the user to put the device on in the morning, or put it back in the cradle at night, thus ensuring both proper re-charging, and encouraging and reminding them to wear and use the device.

**[0017]** In another embodiment of the invention, the wearable communication device can be in communication with wearable physiological condition measurement devices such as blood pressure sensors, blood sugar sensors, individual temperature, pedometers and the like all without limitation.

**[0018]** In instances where the wearable device contains embedded activity sensors (e.g., fall sensor, pedometer) the device may be designed to be worn on or near the torso, for example, on the person's belt, or upper arm, where these sensing activities are most accurately

achieved. In other embodiments without these sensing requirements, the wearable communicating device may be designed to be worn on the extremities (e.g., wrist-watch) or as an item of jewelry (e.g., pendant).

**[0019]** Fig. 1 illustrates an exemplary system 10 which embodies the invention. The system 10 incorporates a wearable or portable communication device 12 and an associated charging or base station 14. The wearable communication device 12 is implemented as a cellular telephone.

**[0020]** The device 12 can incorporate circuitry for use with positioning systems (e.g., global positioning system, magnetometers or cellular triangulation) to identify the location thereof, or inertial sensors (e.g., accelerometers, gyroscopes, motion sensors) to provide indicia of activities of the individual carrying or wearing the device 12 (e.g., general motion, or specific occurrences such as falling). Other types of sensors which can be incorporated include temperature sensors, pedometers, or blood pressure monitors, all without limitation.

**[0021]** The charging or base station 14 can include a docking port indicated generally at 14a for receipt of the portion of the device 12 for storage and recharging any batteries in the device 12. The base 14 can be adapted to be coupled one or both of a wire line telephone system for purposes of providing telephone service to the base 14, or broad band, DSL type services. Alternately, the base 14 could be coupled to a cable modem 16b and a broadband cable system 16c for communications purposes.

**[0022]** The portable wearable device 12 can be in local bi-directional wireless communication C 1 with the base 14 using any one of a variety of available protocols as would be understood by those of skill in the art. The device 12 can carry out communications via channel C2 independent of the base 14.

**[0023]** As illustrated in Fig. 1, base 14 has been installed in a residence or residential region R. Region R might be some or all of a residence of an individual who could be carrying or wearing the device 12. It will be understood that while Fig. 1 illustrates a portion of such a residence, the configuration and size of the region R are not limitations of the present invention.

**[0024]** The system 10 can also incorporate motion sensors, such as sensors 20a, 20b ... 20n which are dispersed about the region R. The motion sensors 20a, 20b ... 20n can be in wireless communication with the base station 14. Alternately, they can be in wireless communication with the portable device 12.

**[0025]** Signals from the sensors 20a, 20b ... 20n are used to monitor daily living activities of the respective individual in the region R. These could include being able to ascertain if the individual is moving about the region R in a normal fashion without appearing to be experiencing any motion related emergencies. Alternately, the sensors 20a, b ... n could provide signals to either the wearable unit 12 or base station 14 indicative of a cessation of motion which might be indicative of an abnormal con-

dition. In such event, either the wearable unit 12 or base station 14 could communicate the lack of motion to a third party monitor for purposes of follow-up and investigation.

**[0026]** In addition, a thermostat or regional temperature sensor 22 can be provided in the region R and coupled to the base 14 and/or the wearable unit 12 for purposes of monitoring the temperature in the residence. Other medical devices such as oxygen supplies, or, self-standing physiological monitors, not carried by unit 12, could also be present in region or residence R and communicate wirelessly or be wired (continually or intermittently) to either the base station or the wearable communicator.

**[0027]** Fig. 2 illustrates additional details of the characteristics of the system 10. The remote services which can be provided via the communication link 16a can include capabilities for additionally processing signals received by the base 14 for purposes of alerting caregivers and the like to situations or trends. Information such as medication reminders can also be fed to base 14 and then to wearable unit 12 via the wireless communication link therebetween to provide various types of reminder information to the wearer of the device 12.

**[0028]** Other types of communications, without limitation, include being able to provide remote upgrades to the base station 14 or the wearable device 12, providing client information to the base station 14, providing feedback to the client from remote caregivers via device 12 or 14. Signals and information provided by the system 10 can be coupled via a base 14 to be integrated with external data associated with the respective resident or wearer of the communication device 12.

**[0029]** Base unit 14 can include a local sensor wireless interface 14-1 and communications circuit 14-2 to implement link C1 for communicating with unit 12. A processor 14-3 and associated software 14-4 can control the operation of base 14.

**[0030]** The base station 14 can also provide additional capability such as having a port for an additional battery for the device 12, which can be kept fully charged. Uploading collected sensor data to the wearable device 12 either via the wireless link or when the wearable device 12 is installed in docking port 14a.

**[0031]** The base 14 can also carry a display to enhance communication with the resident. Finally, the wearable unit 12 and the base station 14 each have the capacity to independently place outgoing communications or calls in the event that an emergency has been detected in the region R.

**[0032]** Fig. 3 illustrates the system 10 as it might be configured for use with a third party remote caregiver 40. In such an instance, an in-home caregiver 42 might also be available. The caregiver 42 could carry, for example, a radio frequency identification tag (either passive or active) to provide access to the region R as well as to provide tracking of time and services, when rendered as well as the duration thereof.

**[0033]** As illustrated in Fig. 3, system 10 includes a

personal network 10-1 implemented by unit 12 with on-board sensors, such as 12a, b. The unit 12 can be in wireless communication with additional physiological devices or sensors 12, c, d and 12e, which may be portable.

5 The unit 12, and network 10-1 can be within, adjacent to or displaced from home network 10-2.

**[0034]** Home network 10-2 includes base 14 as well as sensors 20a, 20b ... 20n and 22 (in residence of region R). Activated RFID tag(s) carried by care giver 42 can communicate, links C3, C4, with either or both of units 12, 14.

**[0035]** The present system and method could be used in a single person living environment. Alternately, it could be used in a multi-person community environment in conjunction with numerous different peripheral devices usable by multiple persons.

**[0036]** It will also be understood that the present system is modular with various sensors or other units usable with either the portable communications device or the base without limitation. The sensors or other units are preferably interchangeable and can be automatically identified by the respective device or base.

**[0037]** From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

## Claims

35 1. A monitoring system (10) comprising:

first and second units, the first unit (12) including a portable, wearable, wireless, voice activated communications device which includes a cellular-type telephone for communicating via a first channel (C2), the second unit (14) including a docking port for recharging the portable communication device and circuitry for communicating with third parties via a wired network connected to a residence (R) of a person, the first and second units (12, 14) being in wireless communication with each other via a second channel (C1); and

40 a plurality of sensors (20) adapted to be disposed within the residence (R) wherein at least some of the plurality of sensors (20) are adapted to be dispersed about the residence (R) to ascertain if the person is moving about the residence (R), the sensors (20) being configured to monitor daily living activities of the person and wherein each sensor (20) is coupled to at least one of the first and second units (12, 14),  
 45 wherein at least one sensor comprises at least

- one of a movement indicator, a body temperature sensor, a blood pressure measurement device, or a glucose measuring device, wherein the at least one sensor is incorporated into the first unit (12), and wherein the second unit (14) includes algorithms to prompt the person to put the portable communications device on in the morning, or put it back in the docking port (14a) at night.
2. A system (10) as in claim 1, wherein data from the at least one sensor is wirelessly communicated to the second unit (14).
  3. A system (10) as in claim 1, wherein information from the at least one sensor is wirelessly communicated via at least one of the first channel (C2), or the second channel (C1).
  4. A system (10) as in claim 3, wherein the communication is indicative of a potential emergency condition and is automatically communicated to a third party.
  5. A system (10) as in claim 4, wherein the first unit (12) includes circuitry for identifying the unit's location.
  6. A system (10) as in claim 5, wherein the first unit circuitry communicates wirelessly with elements of a global positioning system (12a).

#### Patentansprüche

1. Überwachungssystem (10), umfassend:

eine erste und eine zweite Einheit, wobei die erste Einheit (12) eine bewegliche tragbare drahtlose und durch Sprache aktivierte Kommunikationsvorrichtung enthält, die ein zellulares Telefon umfasst, mit dem man über einen ersten Kanal (C2) kommunizieren kann, und die zweite Einheit (14) einen Dockinganschluss zum Aufladen der tragbaren Kommunikationsvorrichtung und Schaltungen zum Kommunizieren mit dritten Parteien umfasst, und zwar über ein drahtgebundenes Netz, das mit der Wohnung (R) einer Person verbunden ist, wobei die erste und die zweite Einheit (12, 14) über einen zweiten Kanal (C1) drahtlos miteinander kommunizieren; und

eine Anzahl Sensoren (20), die dafür ausgelegt sind, dass sie in der Wohnung (R) angebracht werden, wobei zumindest einige der Sensoren (20) dafür ausgelegt sind, dass sie in der Wohnung (R) verteilt werden, um festzustellen, ob sich die Person in der Wohnung (R) bewegt, und die Sensoren (20) so konfiguriert sind, dass sie

die alltäglichen Lebenshandlungen der Person überwachen, und jeder Sensor (20) mindestens entweder mit der ersten oder der zweiten Einheit (12, 14) verbunden ist, wobei mindestens ein Sensor mindestens einen Bewegungsanzeiger oder Körpertempersensor oder eine Blutdruck-Messvorrichtung oder eine Glukose-Messvorrichtung umfasst, und der mindestens eine Sensor in der ersten Einheit (12) enthalten ist, und die zweite Einheit (14) Algorithmen enthält, die die Person auffordern, die tragbare Kommunikationsvorrichtung am Morgen anzulegen oder sie am Abend in den Dockinganschluss (14a) zurückzulegen.

2. System (10) nach Anspruch 1, wobei Daten von dem mindestens einen Sensor drahtlos an die zweite Einheit (14) übermittelt werden.
3. System (10) nach Anspruch 1, wobei Information von dem mindestens einen Sensor über mindestens den ersten Kanal (C2) oder den zweiten Kanal (C1) drahtlos übertragen wird.
4. System (10) nach Anspruch 3, wobei die Kommunikation einen möglichen Notfallzustand anzeigt und automatisch einer dritten Partei übermittelt wird.
5. System (10) nach Anspruch 4, wobei die erste Einheit (12) eine Schaltung enthält, die den Standort der Einheit erkennt.
6. System (10) nach Anspruch 5, wobei die Schaltung in der ersten Einheit drahtlos mit Elementen eines globalen Positionierungssystems (12a) kommuniziert.

#### Revendications

1. Système de surveillance (10), comprenant :

des première et seconde unités, la première unité (12) incluant un dispositif de communication portable, pouvant être porté, sans fil, activé par la voix, qui inclut un téléphone de type cellulaire pour la communication par l'intermédiaire d'un premier canal (C2), la seconde unité (14) incluant un adaptateur pour recharger le dispositif de communication portable et un circuit pour la communication avec des tiers par un réseau câblé connecté à une résidence (R) d'une personne, les première et seconde unités (12, 14) étant en communication sans fil l'une avec l'autre par un second canal (C1) ; et

une pluralité de capteurs (20) aptes à être disposés dans la résidence (R), où au moins quelques-uns de la pluralité de capteurs (20) sont

aptes à être dispersés autour de la résidence (R) pour vérifier si la personne se déplace autour de la résidence (R), les capteurs (20) étant configurés pour surveiller les activités de la vie de tous les jours de la personne, et où chaque capteur (20) est couplé à au moins une des première et seconde unités (12, 14),  
 où au moins un capteur comprend au moins un parmi un indicateur de mouvement, un capteur de la température corporelle, un dispositif de mesure de la pression sanguine ou un dispositif de mesure de glucose, où le au moins un capteur est incorporé dans la première unité (12), et où la seconde unité (14) comprend des algorithmes pour inciter la personne à mettre en service le dispositif de communication portable le matin, ou pour le remettre sur l'adaptateur (14a) la nuit.

2. Système (10) selon la revendication 1, dans lequel les données du au moins un capteur sont communiquées sans fil à la seconde unité (14). 5
3. Système (10) selon la revendication 1, dans lequel les informations du au moins un capteur sont communiquées sans fil par au moins un du premier canal (C2) ou du second canal (C1). 10
4. Système (10) selon la revendication 3, dans lequel la communication est indicative d'un état d'urgence potentiel et est automatiquement communiquée à un tiers. 15
5. Système (10) selon la revendication 4, dans lequel la première unité (12) comprend des circuits pour l'identification de l'emplacement de l'unité. 20
6. Système (10) selon la revendication 5, dans lequel les circuits de la première unité communiquent sans fil avec des éléments d'un système de positionnement global (12a). 25

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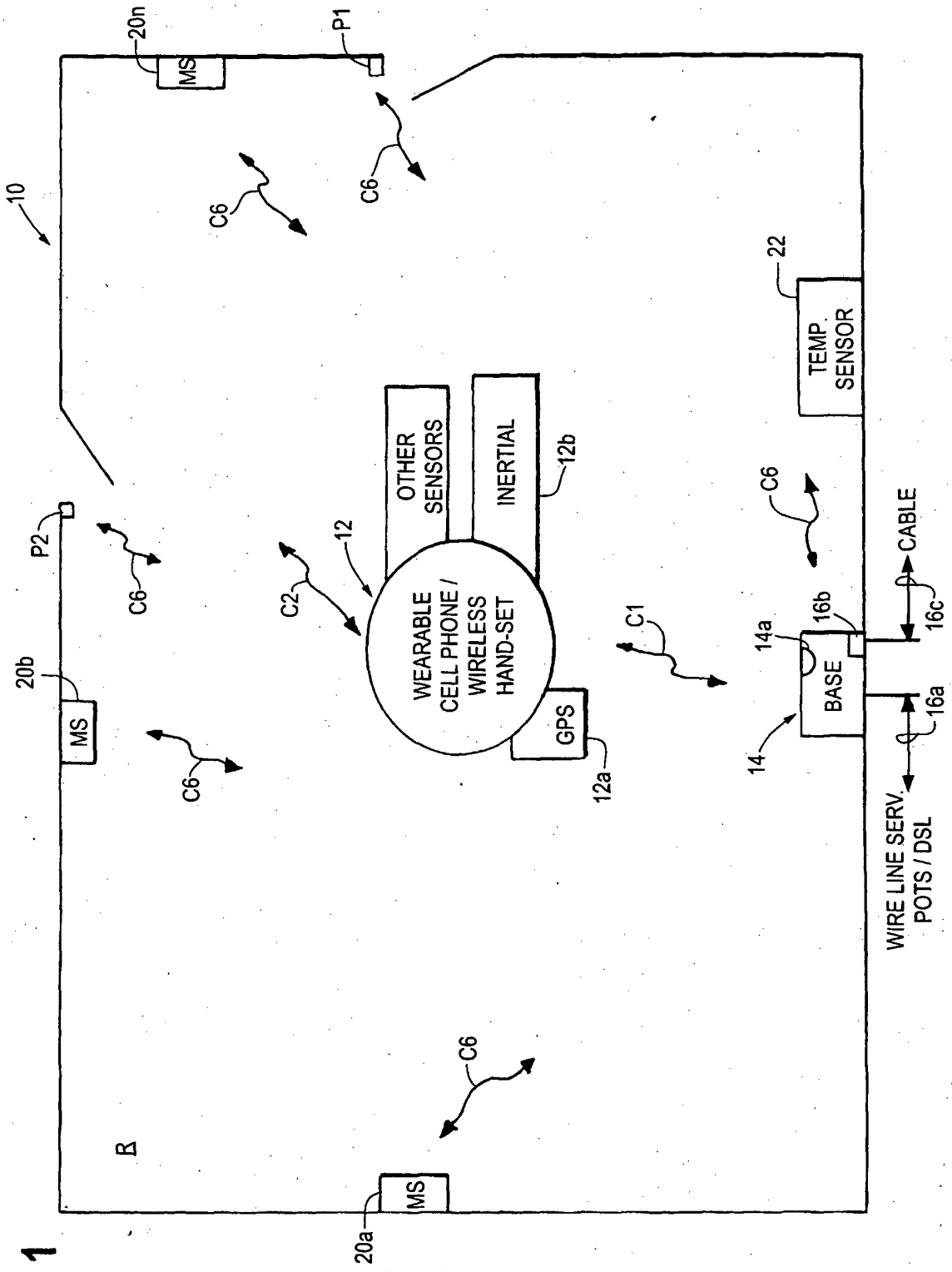


Fig. 1

FOR AREAS WITH NO CELLULAR COVERAGE THE PLATFORM PROVIDES STANDARD WIRELESS PHONE WITH ALL FEATURES EXCEPT MOBILITY AWAY FROM HOME.

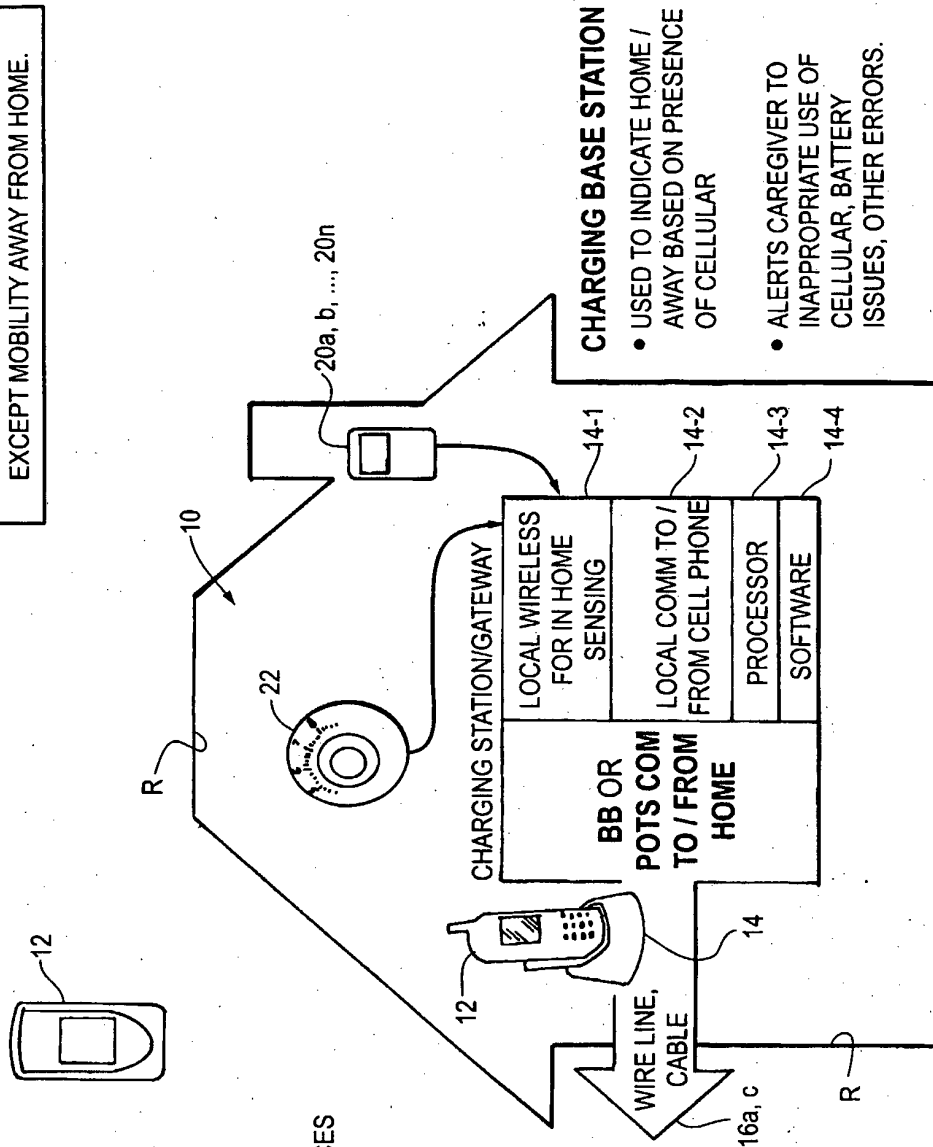
Fig. 2

**WEARABLE COMMUNICATOR**

- SPEAKER-PHONE
- VOICE-ACTIVATED
- EMBEDDED SENSORS
  - GPS
  - INERTIAL (FALLS / ACTIVITY)
  - SPEED DIALS
- LOCAL AREA COMM WITH HOME BASE STATION
- LOCAL COMM FOR PORTABLE MEDICAL DEVICES
- DELIVERS REMINDERS / ALERTS USER
- CELLULAR / ANALOG TELEPHONE SERVICES

**REMOTE SERVICES**

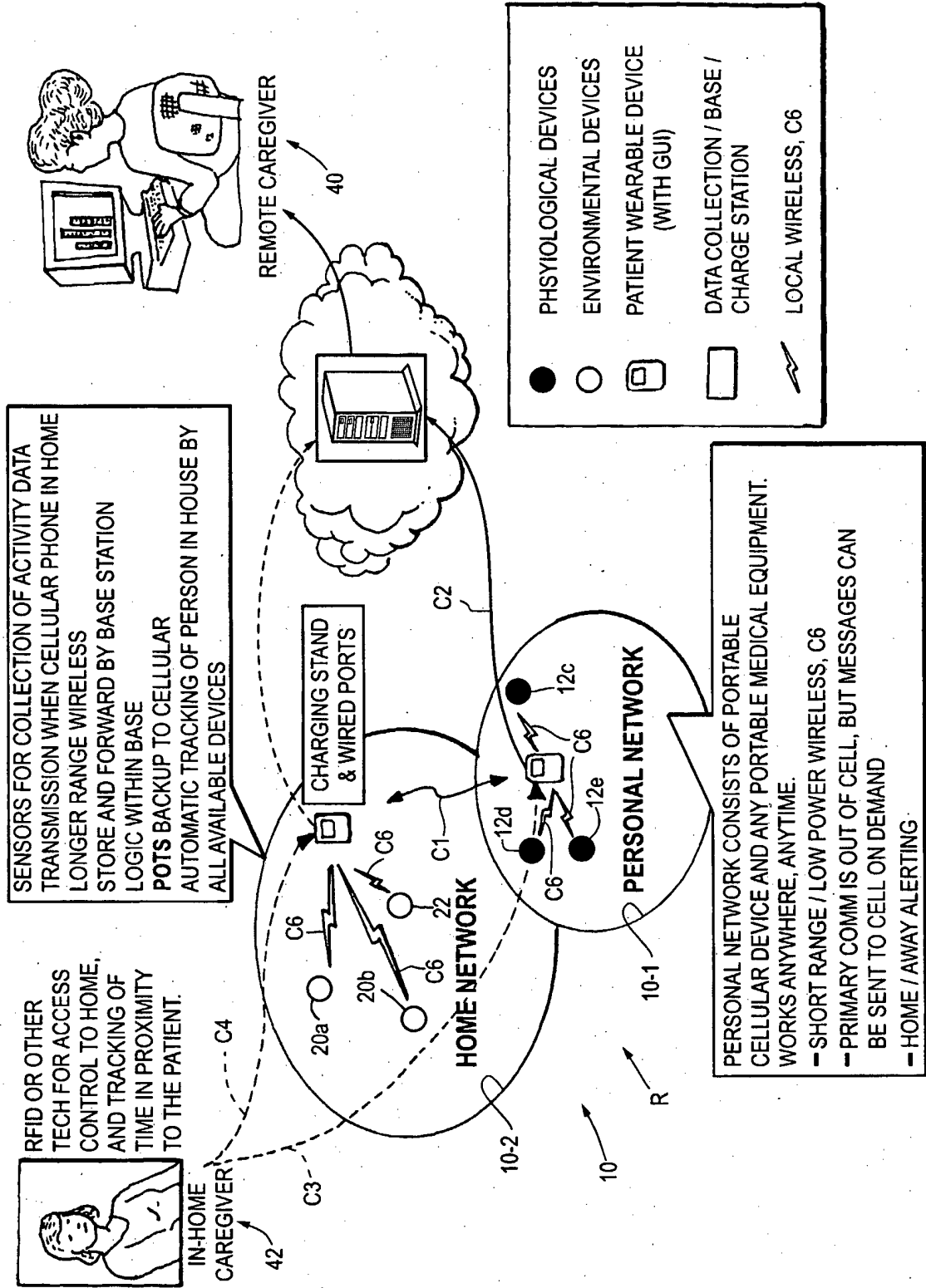
- LOGIC FOR ALERTING REGISTERED CAREGIVERS
- ADDITIONAL PROCESSING AND LOGIC
- ACCESS TO REPORTS FOR FAMILY OR PROFESSIONAL CAREGIVERS
- REMOTE UPGRADES TO BASE STATION
- REMOTE CONFIGURATION OF CLIENT INFORMATION THROUGH GATEWAY



**CHARGING BASE STATION**

- USED TO INDICATE HOME / AWAY BASED ON PRESENCE OF CELLULAR
- ALERTS CAREGIVER TO INAPPROPRIATE USE OF CELLULAR, BATTERY ISSUES, OTHER ERRORS.

Fig. 3



**REFERENCES CITED IN THE DESCRIPTION**

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- US 2004162466 A [0007]
- US 2004017300 A [0007]

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摘要(译)

用于增强独立生活的监视系统包括可穿戴通信设备，例如蜂窝电话，以及可以耦合到有线电话系统的充电基座。基站和可穿戴设备中的任一个或两者可以与散布在个人住所中的传感器通信，以便收集与日常生活活动有关的数据。可穿戴单元和基站中的任一个或两者可以包含响应于居民的生理参数的传感器。两个单元可以独立地与第三方监视器通信，以使用该系统来传达关于或直接关注个人状态的数据。

