



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.12.2010 Bulletin 2010/51

(51) Int Cl.:
G07C 9/00 (2006.01)

(21) Application number: **10382092.4**

(22) Date of filing: **22.04.2010**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA ME RS

(30) Priority: **18.06.2009 ES 200901447**

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(54) **Electronic equipment for the identification, control and safety of groups of individuals in mobility**

(57) ELECTRONIC EQUIPMENT FOR THE IDENTIFICATION, CONTROL AND SAFETY OF GROUPS OF INDIVIDUALS IN MOBILITY, comprising identification bracelets (one by group member) with RFID label for the periodical transmission of identification signals, SD card and mobile device with SD slot for the reception of the identification radio frequency signals transmitted by the bracelet and treatment of data contained within it. The mobile device is a PDA or UMPC or other, able to receive signal in a continuous manner, differentiate the potency, distinguish whether it is in a few centimetres range, which signals it receives, make listings, warn if one or more bracelets have not been received, implement a search and identify a bracelet and show data. Furthermore, it is contemplated a PC computer which the mobile device is synchronized with, provided with application and repository for managing data of individuals and bracelets and their relationships.

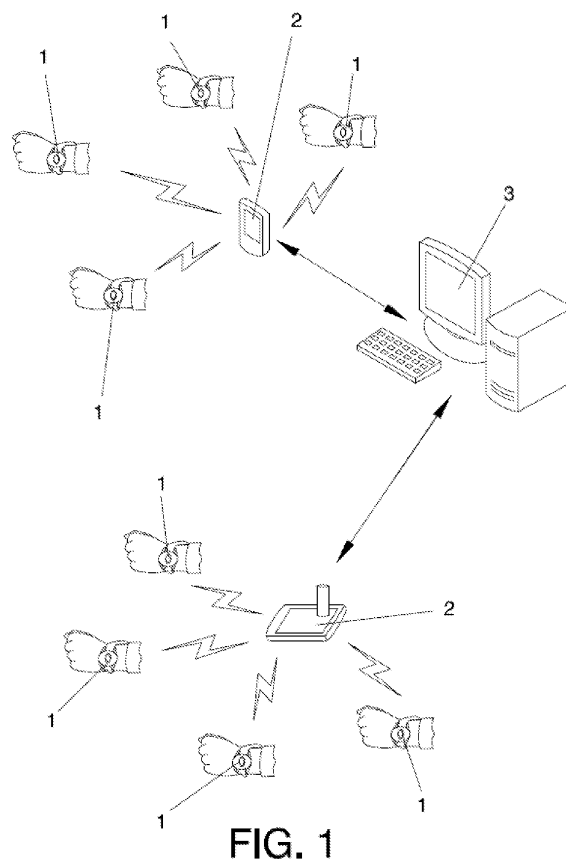


FIG. 1

Description

OBJECT OF THE INVENTION

[0001] The invention, as set forth in the statement of the present specification, relates to an electronic equipment for the identification, control and safety of groups of individuals in mobility, imparting to the function it is intended to, remarkable advantages and innovative characteristics, compared with other systems currently known in the market for the same purpose.

[0002] More particularly, the object of the invention focuses on a equipment with electronic devices which, being applicable for groups of children, old people, disabled people, tourists, etc., in excursions, guided tours, spare time trips, camps, or other activities requiring the group's mobility, and being basically formed by a mobile device controlled by the person responsible of the group and a plurality of devices with RFID label (which stands for *Radio Frequency Identification*), preferably consisting of a number of bracelets, worn by each one of the group's individuals, is aimed to constitute a system for the identification, control and safety of said group of individuals in said circumstances of mobility in a continual and autonomous way, allowing the person responsible of said group to keep in every moment under control to each and every one of the group's members, both in a overall way and individually, allowing the person, furthermore, among other advantages, to have access to further information about different aspects of each one of said individuals.

APPLICATION FIELD OF THE INVENTION

[0003] The application field of the present invention is framed within the technical field of radio frequency identification technologies, applied to the safety of groups of people in mobility. These technologies are usually known as RFID (*Radio Frequency Identification*).

BACKGROUND OF THE INVENTION

[0004] As it is known, RFID (which stands for *Radio Frequency Identification*) is a remote data storage and recovery system which uses devices called labels, transponders or RFID tags. The main purpose of the RFID technology is transmitting the identity of an object (similar to a unique serial number) through radio frequency waves. The RFID technologies are grouped within the so called Auto ID (Automatic Identification).

[0005] A RFID label is a little device, similar to a sticker, which can be adhered or incorporated to a product, animal or person. They contain antennas in order to allow them to receive and answer to radio frequency demands from a RFID transmitter-receiver, frequently called RFID readers. The passive labels have no need of inner electrical supply, whilst the active ones do have this need, using usually a battery to this end. One of the advantages

of using radio frequency (instead of, for example, the infrared technology) is that a direct view between transmitter and receiver is not required.

[0006] Based on this technology systems are appearing which allow, detecting the transit of people (passive RFID), or locating people within an area (active RFID), providing more complete traceability and safety solutions.

[0007] In the state of the art we find:

- Systems for tracking people with fixed infrastructures and based on active RFID:

Utility Model ES 1064033 U, ES Patent 2303465. These are composed mainly of an infrastructure of readers and antennas located in the transit zones for people, which are provided with an active RFID card which is identified when the person transits by the zone with antennas. These systems allow a certain distance (typically of a few meters) between tag and antenna for a correct identification.

- Systems based on objects identification using mobile readers: Patent IP 0700437, ES 2159502. These are composed of a mobile device acting as RFID reader which allows, at higher (active RFID) or lower (passive RFID) distance, the control mainly of objects.
- Systems based on the detection of objects moving away: Patent IP 0700437. Systems which detect the movement of an object away from a central reader.
- Systems for the safety of objects: ES patent 2280888. Systems based on RFID for preventing objects from being theft.

[0008] Therefore the RFID technology is combined in a different way to obtain different solutions:

- Infrastructure of antennas and fixed readers for the identification of the transit of passive (with action by the user) or active (for the automatic detection of the transit of people and objects) RFID tags. It allows the traceability and/or the tracking down of people and objects.
- Utilization of Mobile RFID readers, used mainly by individuals, for the identification of people and objects using mainly passive RFID tags and through the approaching of the RFID reader.
- Use of fixed and mobile RFID readers for detecting the movement away of active RFID tags, with anti-theft safety purposes.

[0009] The combination and the different use of the RFID technology offers various solutions for problems of objects and people identification, traceability, tracking down, control, safety, etc., however, in the current state of the art it is found no document or patent which, as the

invention herein proposed, gives a solution for the following general situation:

- Group of individuals assigned to one (or several) person(s), responsible for their safety in determined timeframes.
- Both the group and the responsible have geographic mobility at any level (inside a building, outdoor enclosure, unenclosed space, displacements between distinct geographic locations, etc.).
- the individuals of the group are exposed to get lost, want to escape from the group's discipline, stay forgotten in a place once the group has left it, or their identification being necessary for accessing to relevant data (identification, medical, familiar environment-related, contact data, etc.)

[0010] Therefore, the objects of the present invention are:

- The remote identification (meters) of the individuals by the responsible in order to:
 - * Control the presence of the individuals of the group both specific (group listings, on demand of the responsible) and continuous (safety radius, in an autonomous way without needing the interaction by the responsible)
 - * Search for lost individuals
- the identification in a short distance (centimetres) of the individuals by the responsible for the:
 - * Univocal identification of the individual
 - * Access to critical data (medical, familiar environment-related) for safety in situations such as possible allergies to meals, environment or medication, picking up by unauthorized people, etc.

[0011] The current state of the art does not solve all the challenges posed for covering the described situation:

- allowing the differentiation between remote identification (meters) of the individuals and identification by approaching (centimetres) the RFID reader or receiver to the identification tag or bracelet. The RFID technology is thought for identification without differentiating the distance. A system identifies or not, without considering the distance, only in case of reception or not in a RFID reader of the signal transmitted by a tag.
- Allowing the continuous identification in time and in mobility of all the components of the system.
- Manage the identification and the information for the control of specific and continuous presence.

[0012] Thus, therefore, by the applicant, it is unknown the existence of any other invention presenting technical, structural and configuration characteristics similar to the ones presented by the electronic equipment for the identification, control and safety of groups of individuals in mobility herein proposed, whose characterizing and distinctive details relating to what is yet known, are exhausted developed below and are conveniently collected in the final claims accompanying the present specification.

EXPLANATION OF THE INVENTION

[0013] Thus, therefore, and as has been pointed previously, the invention proposes an electronic equipment for the identification, control and safety of groups of individuals in mobility which constitutes a tool for tracking down, identification and safety of a group of individuals in mobility in a continuous and autonomous way, allowing to a person have in every moment under control each and everyone of the group's persons.

[0014] The equipment is intended to being applied in caring of groups (children, old people, disabled people ...) in excursions, guided tours, group trips, camps, spare time places, etc., preventing the risk of some of the group's components getting lost, besides of having a database of interest for each person.

[0015] To this end the equipment comprises, basically, a mobile device, consisting of a PDA or of a UMPC, which the person responsible of the group works with and which is provided with a SD type memory card, and a plurality of devices with transceptor or RFID label, preferably consisting of bracelets, worn by each one of the group's individuals, being contemplated a PC in which a computing application is incorporated and a repository in order to allow the management of the individuals, of the groups, and the assignment of bracelets, as well as the possibility of managing information from different group responsables, access permissions to the information, etc. The mobile device is able to synchronize the information managed in the PC for its subsequent use.

[0016] Thus, for example, in a possible use of the equipment, wherein a group of children goes for an excursion, a monitor or responsible of the group posses a mobile device (PDA or UMPC) whilst the children, each one, wear a bracelet. The bracelet emits periodically an identification signal received by the mobile device if they are within a range of about 20 meters.

[0017] Thanks to the continuous reception of the bracelets' identification, the monitor gets access to different functionalities:

- Lists Control: the responsible shall be able to make an entry listing of the children at the beginning of the excursion, check at any time that all the children are in a close radius and, at the end of the excursion, make an exit register of the members. To this end, the responsible just pushing a button shall be able to "call register" so that the mobile device identifies

- all of the bracelets being in the surrounding area.
- Individual Control: besides the "group" lists control explained above, one shall be also able to make a listing, one by one, of the users with bracelet, by approaching the mobile device to each bracelet of each child.
- Individual Information: the monitor, by approaching the mobile device to the bracelet, shall have access to data related to the bracelet's user (name, surname, information of interest, as for example people authorized for picking up a child, medical data, etc.).
- Safety Radius: the mobile device shall be able to warn the monitor if any of the children was not detected during a determined period of time (for example 2 minutes), in order to prevent a child from getting lost.
- Search for a child: the monitor shall be able to select a child so that the mobile device searches for the signal of a child who can have got lost.

[0018] Beside the described functionalities, a PC application is provided, allowing the management of the individuals, of the groups, and the assignment of bracelets, as well as the possibility of managing information by the monitors, permissions for accessing to the information, etc. The mobile device is able to synchronize the information managed in the PC for its subsequent use described in the above points.

[0019] Additionally, it is contemplated the possibility of incorporating to the equipment, as long as the circumstances allow it, being particularly optimal for its use indoor, one or more beacons fixed in the area to be monitored, thus getting a higher coverage and, even, the advantage of being able to track down, in certain defined areas, where the bracelet is in every moment located.

[0020] Briefly, the advantages of the invention in relation with the current state of the art are essentially the following:

It is a mobile identification electronic equipment based on radio frequency comprising a plurality of identification bracelets (one by each member of the group) small in size, provided with a RFID label for sending periodically identification signals and a mobile device allowing, by the use of a SD (secure digital) type memory card, the reception of the RF identification signals transmitted by the identification bracelets, as well as the data treatment.

[0021] Moreover, it is contemplated the existence of a PC computer, for managing the data of the individuals and of the identification bracelets and its relationships.

[0022] The aforementioned mobile device can be a PDA or UMPC (*Ultra Mobile PC*) or any portable device with a slot for SD card, being able to receive the identification signals from one or more identification bracelets, as well as to discriminate the potency of the received identification signals, being able to distinguish if it is in a

distance of meters or centimetres by potency threshold of the received signals.

[0023] It is to be remarked, furthermore, that the mobile device can receive in a continuous manner the identification signals without needing of interaction by the responsible user, and synchronizes itself with the computer's information.

[0024] The mobile device, through the SD card can distinguish specifically which received identification signals from the bracelets are within its coverage radius in order to know which bracelets (or individuals wearing them) in order to know if anyone is missing, being able to make group listings of the entry of individuals, specific, and of the exit.

[0025] The mobile device can warn if one or more bracelets have not been received in a determined time (safety radius).

[0026] Furthermore, thanks to the SD card and to the possibility of differentiation of the signals potency, it implements the search of one or more bracelets (or individuals wearing them).

[0027] The mobile device allows, by the possibility of distinguish whether the bracelet is in a centimetres range of said device, identifying a bracelet and showing the data (personal, medical, environmental, etc.) corresponding to the individual wearing it.

[0028] The described electronic equipment for the identification, control and safety of groups of individuals in mobility represents, then, an innovative structure with structural and constitutive characteristics unknown so far to this end, reasons which in combination with its practical utility, provide it with enough basis to obtain the exclusivity privilege which is applied for.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] In order to complement the description being fulfilled and with the aim of helping to a better understanding of the characteristics of the invention, the present specification is accompanied, as an integral part thereof, by a set of plans, in which by way of illustration and not of limitation, is represented the following:

Figure number 1.- shows a schematic view of the three basic elements of the equipment object of the invention and their interactions: identification bracelets, which emit the identification signal, received by mobile devices, which can synchronize the information with the PC.

REALIZACIÓN PREFERENTE OF THE INVENTION

[0030] In light of the mentioned figures, and according to the numbering taken on them, it is noted how the device in question comprises the following elements:

A plurality of bracelets (1) with RFID label, a mobile device (2) with SD card and a PC (3).

[0031] The PC (3) is a personal computer where the system's managing software is installed, for which it is provided with an application in which one shall be able to manage all the devices and users of the system, as well as the a data repository which shall include the data of the application.

[0032] On its part, the mobile device (2) can consist of a PDA or of a UMPC (UltraMobile PC with or without keyboard) and, through the SD type memory card, will allow the control of the bracelets (1) according to the configuration made in the application of the PC (3), so that it will allow the display of the data and the control of the bracelets (1) with the corresponding functionalities, while the data repository contains a replica of the PC's database (3).

[0033] The mobile device (2) PDA or UMPC, as it is represented in figure 1, synchronizes the data of the database managed in the PC (3), so that, from the identification signals transmitted by the bracelets (1) and the data of the data repository can offer the functionalities of lists control, individual control and identification, search and safety radius.

[0034] Talking about the bracelets (1), each one of them has a PCB (Printed Circuit Board) as a support for a transceptor or RFID label, i.e., of radio frequency based on the standard IEEE 802.15.4 (such as the CC2430 type from Texas Instruments) plus the additional components needed for its operation (2 crystals for the watches, decoupling capacitors, polarization resistors, adaptation for the RF port and antenna).

[0035] The antenna is, for example, an antenna in microstrip adapted by a commercial balun.

[0036] The whole device is fed through a battery holder for a watch battery.

[0037] Each bracelet (1) transmits an identification frame, containing the information on the MAC address of the transceptor chip of radio frequency or RFID label and the value of the battery, resting between frames in low consumption mode.

[0038] To this end the bracelet's firmware consist of four different blocks:

- Radio frequency control
- Timing of tracking down frames
- Button control
- Battery control
- The radio frequency control block is in charge of the transmission of ZigBee frames.
- The tracking down frames timing block is in charge of the randomization of the time between frames in order to prevent collisions and builds the tracking down frame to be transmitted. It also includes the data of the battery level in the frame.
- The button control block runs the interruption attention routine when the bracelet's button is pushed.
- The battery control block monitorizes the battery level and determines whether said value is above the minimum value for the operation of the bracelet.

[0039] On its part, the SD type memory card the mobile device (2) is provided with is, for example, a ZigBee-SDIO card, and consist of a PCB as support, for example a CC2430 from Texas Instruments, plus the additional components needed for its operation (2 crystals for the watches, decoupling capacitors, polarization resistors, adaptation for the RF port and antenna).

[0040] The antenna is, for example, a microstrip antenna adapted by a commercial balun.

[0041] The device is fed through the SD interface being introduced in the Host's slot, i.e., of the mobile device (2).

[0042] The firmware of the mobile device (2) consists of two different blocks:

- RF control
- Interface SDIO control

[0043] The radio frequency control block is in charge of the reception of ZigBee frames. When a frame is stored and in the control block of the SDIO interface an event is generated, so that this generates an interruption to the host.

[0044] The SDIO interface control block manages the communications through the SD interface generating the answers to the received commands.

[0045] In case that the mobile device (2) is a PDA, this one, whose only requirement will be that it has a operating system compatible with the application of the PC and it contains a slot for the SD memory card, thanks to the continuous reception of the identification from the bracelets (1), offers the following functionalities:

Lists control: it allows making an entry listing of the bracelet wearers (1), checking at any time whether all the bracelet wearers are within a close radius and an exit register of the members.

- Individual control: besides the "group" lists control explained above, one shall be also able to make a listing, one by one, of the users with bracelet, by approaching the mobile device to each bracelet.
- Individual Information: the monitor, by approaching the mobile device to the bracelet, shall have access to data related to the bracelet's user (name, surname, information of interest, as for example people authorized for picking up a child, medical data, etc.).
- Safety Radius: the mobile device shall be able to warn the monitor if any of the children was not detected during a determined period of time (for example 5 minutes), in order to prevent a child from getting lost.
- Search for a user with a bracelet: allows the selection of a user with a bracelet so that the mobile device searches for the signal of a child who can have got lost.
- Synchronization with the PC's database: it al-

lows synchronizing the data from the PC's database managed by the application, so that in the PDA one has the data of the bracelets, of the bracelet wearers, and theirs relationships.

[0046] The same functionalities offered in the PDA, are offered for small sized computers such as the *UltraMobilePC* (UMPC). Therefore, through the UMPC it is also possible to make:

- Lists control
- Individual control
- Individual information
- Search
- Safety radius

[0047] Any UMPC commercially available can be used, which has a 7 inches screen, compatible operating system and SD slot.

[0048] The PC's application, on its part, allows the management of the users wearing the bracelets and of the bracelets, by offering:

- Managing of the users: allows the creation, modification, and deletion of the data of the users.
- Managing of groups: allows the management of the users in groups.
- Managing of bracelets: allows the creation, modification, and deletion of the data of the system's bracelets.
- Assignment of bracelets to the users: allows the assignment of the bracelets to the users for their subsequent relationship in the identification and other functionalities offered in the PDA and the UMPC.
- Synchronization: in order to allow the data synchronization.

[0049] Finally, it can be highlighted that, additionally, it is contemplated the incorporation to the equipment of one or more beacons (not represented in figures) fixed to the area to be monitorized, intended to get a higher coverage and be able to track down in certain defined areas where is each bracelet in each moment, being composed of a PCB as support (for example a CC2430 from Texas Instruments), plus the additional components needed for its operation: two crystals for the watches, decoupling capacitors, polarization resistors, adaptation for the RF port, alimentation and antenna.

[0050] Having sufficiently described the nature of the present invention, as well as a way of putting it into practice, it is not considered necessary to make a more extensive explanation in order that any expert in this area will understand its scope and the advantages that can be derived from it, making known that, within reason it could be put into practice in other embodiments differing in detail from that indicated by way of example, and which will obtain the same degree of protection, provided that they do not alter, change, or modify its fundamental prin-

ciple.

Claims

1. ELECTRONIC EQUIPMENT FOR THE IDENTIFICATION, CONTROL AND SAFETY OF GROUPS OF INDIVIDUALS IN MOBILITY, of the radio frequency-based type, **characterized in that** it comprises a plurality of small sized identification bracelets (1) (one for each member of the group) provided with a RFID label for the periodical transmission of identification signals, at least a SD type memory card, in order to allow to a mobile device the reception of the radio frequency signals transmitted by the identification bracelets, and at least a mobile device (2) with a slot suitable for incorporating said SD type memory card and allowing, by its use, the reception of the identification radio frequency signals transmitted by the bracelet, as well as the treatment of the data contained in said card.
2. ELECTRONIC EQUIPMENT FOR THE IDENTIFICATION, CONTROL AND SAFETY OF GROUPS OF INDIVIDUALS IN MOBILITY, according to claim 1, **characterized in that** the mobile device (2) is a PDA, a UMPC (*Ultra Mobile PC*) or any other portable device with slot for SD card, which is able to receive the identification signals from one or more identification bracelets in a continuous manner without needing the interaction by the user, to differentiate the potency of the identification signals received, to distinguish whether it is in a meters or centimetres range by potency threshold of the received signals, to distinguish specifically which identification signals are within its coverage radius and to make listings, to warn if one or more bracelets have not been received in a determined time, to implement the search of one or more bracelets, as well as to identify one bracelet and show the data (personal, medical, of environment, etc.) corresponding to the individual wearing it.
3. ELECTRONIC EQUIPMENT FOR THE IDENTIFICATION, CONTROL AND SAFETY OF GROUPS OF INDIVIDUALS IN MOBILITY, according to claims 1 and 2, **characterized in that** it is contemplated, furthermore, a PC computer (3), with which the mobile device (2) is synchronized, wherein it is incorporated a computer application and a repository for the management of the data of the individuals and of the identification bracelets (1) and theirs relationships.
4. ELECTRONIC EQUIPMENT FOR THE IDENTIFICATION, CONTROL AND SAFETY OF GROUPS OF INDIVIDUALS IN MOBILITY, according to claims 1 to 3, **characterized in that** it incorporates, addi-

tionally, one or more fixed beacons in the area to be
monitorized, in order to increase the coverage and
being able to track down in certain defined areas
where is each bracelet in each moment, being com-
posed by a PCB as support (for example a CC2430 5
from Texas Instruments), plus the additional compo-
nents needed for its operation: two crystals for the
watches, decoupling capacitors, polarization resis-
tors, adaptation for the RF port, alimentation and an-
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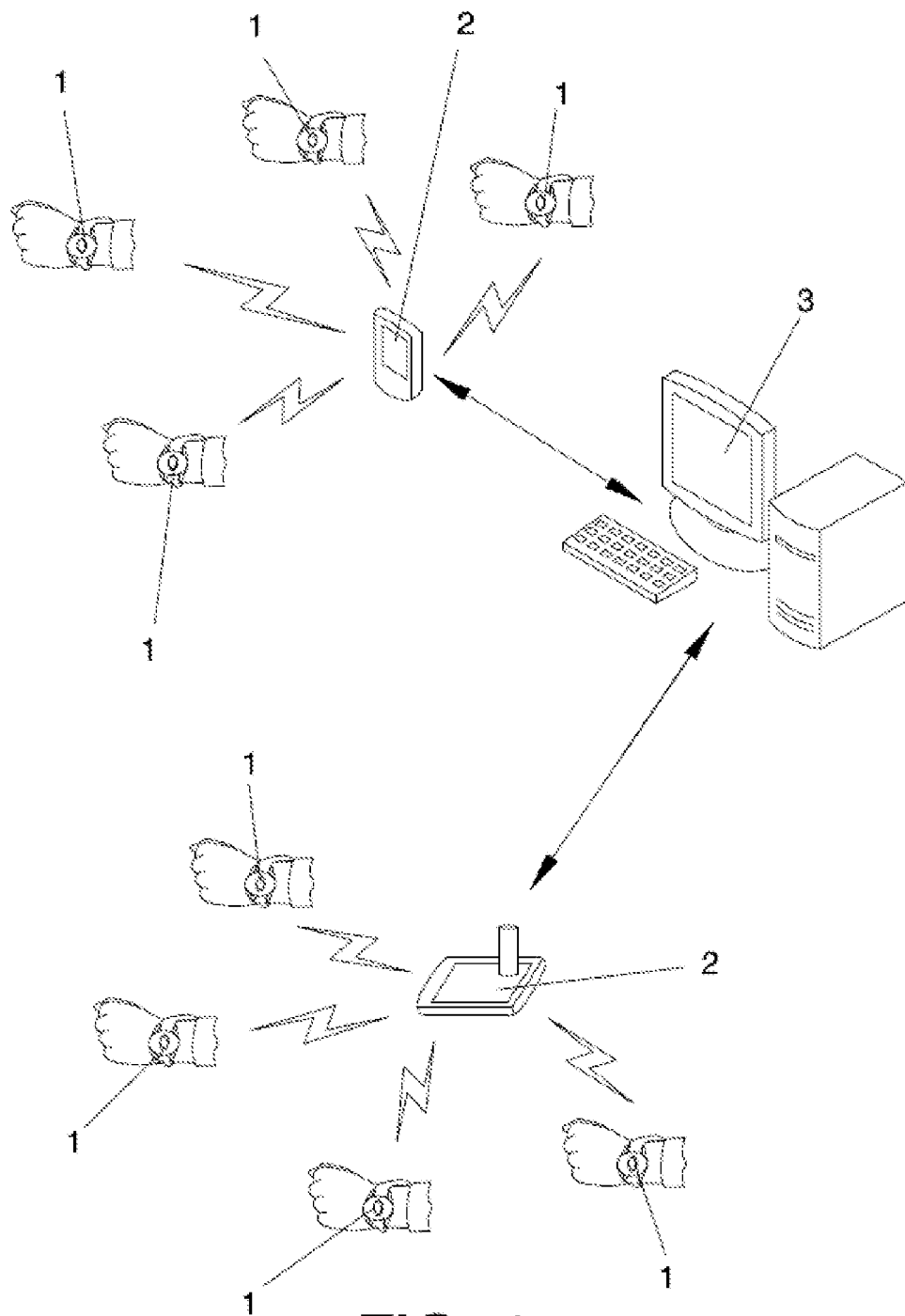


FIG. 1

REFERENCES CITED IN THE DESCRIPTION

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