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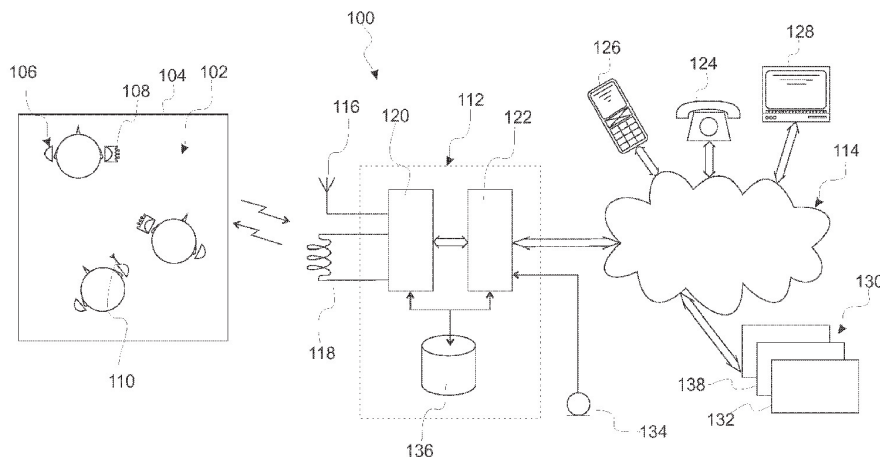
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(54) Title: SYSTEM AND METHOD FOR SHARING NETWORK RESOURCES BETWEEN HEARING DEVICES



(57) Abstract: This invention relates to a system (100, 200) for enabling a hearing device (106, 202) wireless access to a communication network (114). The system (100, 200) comprises a first transceiver unit (108) in said hearing device (106, 202) communicating according to a first communication protocol. The system (100, 200) further comprises a server device (112, 204) comprising an input/output unit (122), which is connected to the communication network (114) and communicates according to a second communication protocol, a second transceiver unit (118), which is connected wirelessly to the first transceiver unit (108) and communicates according to the first communication protocol, and comprising a translator unit (120), which interconnects the second transceiver unit (118) and the input/output unit (122) and translates between the first and second communication protocol.

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SYSTEM AND METHOD FOR SHARING NETWORK RESOURCES BETWEEN
HEARING DEVICES

Field of invention

5 This invention relates to a system and method for sharing
network resources between hearing devices. In particular, this
invention relates to a communications network enabling one or
more hearing devices to access shared services. This invention
further relates to a gateway device enabling hearing devices
10 and user's thereof to utilise the system for sharing resources.

Background of invention

Wireless communication between a pair of hearing aids and
15 various electrical appliances is known from European patent
application no.: EP 1 460 769. This patent application
discloses a mobile transceiver comprising a number of receivers
receiving electrical or electro-magnetic signals carrying audio
signals. The mobile transceiver further comprises a
20 prioritising module assigning a priority to audio signals
received by the receivers so as to ensure that essential
information is communicated before general information. In one
embodiment of the mobile transceiver comprises a positioning
means determining current geographic position and the
25 prioritising module is designed to assign a priority value to a
received audio signal according to determined current
geographic position.

Further, German patent application no.: DE 102 22 408,
discloses a hearing aid system with a radio interface enabling
communication with external household appliances. The disclosed
system enables a plurality of hearing aid users to connect
5 through their hearing aids to a communication bus for
individually controlling household appliances through the
communication bus. The hearing aids connect wirelessly to the
communication bus and receive status information from the
household devices, such as "incoming telephone call" or
10 "heating on". The hearing aids in addition may transmit control
signals to the household devices by depression of button on
hearing aids or by vocal control.

Even though the above hearing aid systems provide extended
15 possibilities for the hearing impaired, further advances may be
achieved. For example, the problem still remains in providing a
wirelessly communicating module or unit within the limited
space of a hearing aid. This problem is not addressed in the
above patent applications, and therefore the hearing aids in
20 the context of the above referred systems still require
physical add-on technology.

Summary of the invention

25 An object of the present invention is therefore to provide a
hearing device system overcoming the above problems by
providing a wireless communication between a plurality of
hearing devices and a communications network.

30 A particular advantage of the present invention is the
provision of access to common services for hearing devices,
such as updating hearing aid software with new features,
accessing a multimedia event, or accessing service information.

A particular feature of the present invention is the provision of a gateway translating from a hearing devices protocol to a communication specific protocol and from a communication
5 specific protocol to a hearing device protocol.

The above object, advantage and feature together with numerous other objects, advantages and features, which will become evident from below detailed description, are obtained according
10 to a first aspect of the present invention by a system for enabling a hearing device wireless access to a communication network, and comprising a first transceiver unit in said hearing device communicating according to a first communication protocol; a server device comprising an input/output unit
15 connected to said communication network and adapted to communicate according to a second communication protocol, a second transceiver unit connected wirelessly to said first transceiver unit and adapted to communicate according to said first communication protocol, and a translator unit
20 interconnecting said second transceiver unit and said input/output unit and adapted to translate between said first and second communication protocol; and wherein said hearing device is adapted to upload and download data to and from said communication network through said server device.

25 The term "a" or "an" is in this context to be construed as one or more, a plurality, or a multiplicity of parts.

Further, the term "hearing device" is in this context to be
30 construed as a hearing aid, a headset, a headphone, an ear-level hearing device, or any combinations thereof.

Additionally, the term "server device" is in this context to be construed as a personal device for handling a single hearing device as well as a shared device for handling a number of hearing devices. That is, the server device may be a body worn mobile device or a stationary public device.

The system according to the first aspect of the present invention provides further advances in communication possibilities for hearing devices and, in particular, for hearing impaired using hearing devices. The system enables a user of the hearing device to access and download data from, for example, the Internet or a local area network. Thus the communication network may comprise a wired or wireless telephone network, such as public switched telephone network (PSTN), global system for mobile communication (GSM), enhanced data GSM environment (EDGE), digital enhanced cordless telecommunications (DECT), a computer network, such as dedicated line, a local area network (LAN), a metropolitan area network (MAN), wide area network (WAN), an inter-network (e.g. the Internet), a media network, such as a cable or satellite television or radio network, or any combination thereof. Thus the communication network may advantageously comprise a wide variety of network compositions, which enable audio as well control communication to the hearing device.

The data according to the first aspect of the present invention may comprise a data package, such as digital data configured in a transmission block, a data packet, a data parcel, datagram, and the like. The data package may have a first configuration for the communication between the first and second transceiver units and a second configuration for the communication on the communications network.

The data package according to the first aspect of the present invention may comprise a header section comprising routing and transmission control data, such as transmitting and receiving addresses, and a data section comprising data payload. Hence
5 the data package may be self-contained, independent entity of data carrying information to be routed from the hearing device to the server device or from the server device to the hearing device without reliance on earlier exchanges.

10 The wireless communication between the first and second transceiver elements may be implemented by capacitive or inductive coupling. The wireless communication may further be implemented using a modulation technique, a multiplexing technique, a coding technique, or any combination thereof. The
15 wireless communication may comprise frequency modulation (FM), amplitude modulation (AM), code-division multiple access (CDMA), phase shift keying (PSK), or any combination thereof. The first and second transceiver elements may comprise a coil antenna, so as to provide means for communicating inductively
20 between a coil antenna of the first transceiver element and a coil antenna of the second transceiver element.

The first communication protocol according to the first aspect of the present invention may comprise Bluetooth, CDMA protocol,
25 proprietary wireless link protocol, or any combination thereof.

The communication between the first and second transceiver elements may be accomplished in a high frequency range, such as between 800 MHz to 3 GHz. Thus the first and second transceiver
30 element may each comprise a modulator and a demodulator adapted to transform data to high frequency signals communicated between the first and second transceiver. The first and second transceiver element may further each comprise a CODEC adapted

to generate said data package. The term "CODEC" is in this context to be construed as an encoder/decoder and/or a compressor/de-compressor.

5 The second communication protocol according to the second aspect of the present invention may comprise CDMA, stream control transmission protocol (SCTP), telephone system's signalling system 7 (SS7), transmission control protocol/Internet protocol (TCP/IP), serial line Internet
10 protocol (SLIP), point-to-point protocol (PPP), user datagram protocol (UDP), Internet control message protocol (ICMP), interior gateway protocol (IGP), exterior gateway protocol (EGP), border gateway protocol (BGP), or any combination thereof. Further, the second communication protocol may
15 comprise Bluetooth, I²C, proprietary wireless link protocol, or any combination thereof. Hence the second communication protocol may encompass the task of handling all required network operations being general, telephone-related, computer-related, or any combinations thereof, such as IP telephony.

20

The server device according to the first aspect of the present invention may comprise memory element adapted to buffer said data to be up- and downloaded on said communication network. The server device may comprise access to a plurality of service
25 providers in the communication network. The service providers advantageously provide all types of services for the hearing device users. For example, the service providers may provide updated hearing aid software with new features, access to a multimedia event, access service information, or any
30 combination thereof. In addition, the server unit may comprise access to a telephone, such as a mobile or cellular telephone or a wired PSTN telephone, a computer, a personal digital assistant, a television, or any combination thereof.

The server device according to the first aspect of the present invention may further comprise a location identifying element adapted to identify present location of the server device. The location identifying element may thus advantageously identify a location of the server device, which location may include associations to particular hearing device programs. The term "program" is in this context to be construed as a setting of the hearing device determining the gain transfer function. The gain transfer function may be established according to a particular hearing loss or impairment or may be established according to a particular acoustic environment. Hence the location identifying element may assist in selecting an appropriate program for a hearing aid communicating with the server or, in fact, to a plurality of hearing aids communicating with the server device.

The server device according to the first aspect of the present invention may be incorporated in a mobile or cellular telephone. Thus the location identifying element may utilise triangulation for determining location of the server device. Alternatively, the server device may comprise a global positioning system (GPS) module adapted to determine the location of the server device.

The server device according to the first aspect of the present invention may be fixed at a permanent location, such as an airport, an aeroplane, a bus, a train, a cinema and the like. Thus the server device may be utilised for controlling one or more hearing devices in the same location with common external noise reduction schemes. That is, the server device may ensure that hearing aids in an aeroplane are controlled so as to reduce the noise experienced by the wearer of the hearing

device. Similarly, the server device may also provide audio from the in-flight video as well as service messages to the wearer of the hearing device.

5 The hearing device according to the first aspect of the present invention may further comprise an acoustic environment detector adapted to generate an environment signal to be forwarded as data payload in a data package to an environment service
10 provider in the communication network. The environment signal may comprise amplitude and frequency data relating to acoustic background noise of location of hearing device. The environment service provider may comprise a controller element adapted to generate an environment compensation signal to be forwarded as data payload in a data package to the hearing device. The
15 hearing device may be adapted to utilise the environment compensation signal for increasing signal-to-noise ratio of an audio signal presented to the user of the hearing device. The environment compensation signal may comprise a phase shifted version of the environment signal. Hence the environment
20 service provider may utilise the environment signal for generating a phase shifted copy to be incorporated in the audio signal presented to the user of the hearing device so as to mask the acoustic background noise. The environment service provider according to the first aspect of the present invention
25 may comprise an environment bank memory adapted to store a number of environment compensation signals each associated with a predefined noise situation.

The server device according to the first aspect of the present
30 invention may incorporate the environment service provider. Thus the server device may establish a stand alone service for hearing devices connecting thereto. Further, the server device may comprise a broadcasting element adapted to broadcast to any

hearing devices in a predefined area of the location of the server device. Thus the environment compensation signal may be utilised for reducing background noise, for example, in an aeroplane for passengers wearing hearing devices.

5

The above objects, advantages and features together with numerous other objects, advantages and features, which will become evident from below detailed description, are obtained according to a second aspect of the present invention by a server device adapted to operate in the system according to the first aspect of the present invention.

10

The server device according to the second aspect of the present invention may incorporate any features of the system and in particular the server device according to the first aspect of the present invention.

15

Brief description of the drawings

The above, as well as additional objects, features and advantages of the present invention, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments of the present invention, with reference to the appended drawing, wherein:

25

figure 1, shows a system according to a first embodiment of the present invention; and

30

figure 2, shows a system according to a second embodiment of the present invention.

Detailed description of preferred embodiments

In the following description of the various embodiments, reference is made to the accompanying figures, which show by way of illustration how the invention may be practiced. It is to be understood that other embodiments may be utilised and structural and functional modifications may be made without departing from the scope of the present invention.

10 Figure 1, shows a system according to a first embodiment of the present invention, which is designated in entirety by reference numeral 100. The system 100 comprises one or more wearers of hearing devices 102 in a defined area 104.

15 The hearing devices are designated in entirety by reference numeral 106 and are shown in figure 1 as three sets of hearing devices. The hearing devices 106 may be headsets, headphones, hearing aids, or any combination thereof.

20 Each of the hearing devices 106 comprises an antenna, which may be an inductive coil 108 or a dipole antenna 110. The antenna 108, 110 enable the hearing devices 106 to receive and transmit signals with a server 112. The server 112 enables each of the connecting hearing devices 106 to access a communications
25 network 114, which may comprise a computer network, media network, telecommunications network, or any combinations thereof.

The server 112 comprises one or more antennas 116, 118 for
30 transmitting and receiving data from the hearing devices 106, which data are configured according to a wireless proprietary protocol especially developed for hearing devices in particular hearing aids. The server 112 comprises a gateway unit 120 for

converting data from the antennas from the wireless proprietary protocol to a general communications protocol. The general communications protocol may comprise CDMA, SCTP, SS7, TCP/IP, SLIP, PPP, UDP, ICMP, IGP, EGP, BGP, Bluetooth, I²C, a second
5 proprietary protocol, or in fact any combination thereof.

The term "gateway" is in this context to be construed as a translator translating from one transmission configuration and/or data configuration to another.

10

The server 112 further comprises an input/output (I/O) unit 122 for connecting to the communications network 114. The I/O unit 122 thus may connect to a wide variety of services in the communication network 114, such as a public switched telephone
15 124, a cellular or mobile telephone 126, or a computer 128. In addition the communications network 114 comprises access to a plurality of services provided by service providers 130. The service provides 130 comprise an environment service provider 132 for reducing background noise experienced by the hearing
20 devices 106.

The hearing devices 106 comprise acoustic environment detectors generating environment signals forwarded as a data payload in a data package to the environment service provider 132 in the
25 communication network 114. The environment signals comprise amplitude and frequency data relating to acoustic background of hearing devices 106.

Further, the I/O unit 122 of the server 112 connects to a
30 microphone 134, which may be applied as a further acoustic environment detector for commonly determining the acoustic environment of the defined area 104. The server 112 generates an environment signal based on the acoustic environment of the

defined area 104, and forwards the environment signal as a data payload in a data package to the environment service provider 132.

5 The environment service provider 132 generates an environment compensation signal based on the environment signals, which environment compensation signal is forwarded as a data payload in a data package to the hearing devices 106. The hearing devices 106 utilise the environment compensation signal for
10 increasing signal-to-noise ratio of an audio signal presented to the wearers 102 of the hearing devices 106.

The environment compensation signal comprises a phase shifted version of the environment signal. Hence the environment
15 service provider 132 may utilise the environment signal for generating a phase shifted copy to be incorporated in the audio signal presented to the wearers 102 of the hearing devices 106 so as to mask the acoustic background noise.

20 In a further embodiment of the present invention the microphone 134 is used for categorising the acoustic environment of the position of the microphone 134. The server 112 uses this categorisation for broadcasting a control signal to the hearing devices 106 in the defined area 104.

25 The server 112 further comprises a memory 136 wherein the server 112 stores signal processing settings controlling the signal processing of the hearing devices 106. The server 112 may thus firstly determine an acoustic environment of the
30 defined area 104 and broadcast a setting to the hearing devices 106, which setting processes the sound in accordance with the acoustic environment.

Similarly, the communications network 114 comprises a storage provider 138 operable by the server 112 to store and communicate an appropriate setting to the hearing devices 106.

5 Figure 2 shows a system according to a second embodiment of the present invention and designated in entirety by reference numeral 200. Elements described with reference to figure 1 having an identical function are designated with the same reference numeral in figure 2.

10

The system 200 comprises a hearing device 202 communicating with a personal server 204 through antennas 108, 118. The personal server 204 further comprises a second antenna 206 enabling wireless communication with a wireless access service provider 210 connecting to the communication network 114. The 15 wireless access service provider 210 communicates with the personal server 204 through an antenna 212. The personal server 204 has a size, which makes it particularly advantageous as a body-worn device.

20

The wireless access service provider 210 thus enables the hearing device access to a wide variety of service provided on the communication network 114. For example, the hearing device may receive audio streams of travel information, position data, 25 or media content (e.g. radio or sound track of television).

As in the server 112, described with reference to figure 1, the personal server 204 comprises a memory 136, which may be utilised storing hearing device 202 specific data such as 30 environmental acoustic data logged during a period, and the wearer's reactions to the hearing device's selections of programs in certain acoustic environments. Further, the personal server 204 comprises a processor 214 adapted to assist

and/or support a signal processor of the hearing device in calculations performed on the environmental acoustic data.

The personal server 204 comprises a user interface (UI) 216
5 allowing the wearer of the hearing device 202 to control the hearing device 202 and allowing the wearer to control access to the communication network 114. The UI 216 may comprise a display and keypad for displaying either services provided by the service providers 130 in the communication network 114 or
10 explanatory information from the operation of the hearing device 202.

The second antenna 206, in a further embodiment of the present invention, connects directly to cellular or mobile phone 126
15 through antenna 218. In this embodiment of the present invention, the personal server 204 utilises the cellular or mobile phone 126 for accessing the communication network 114.

In a third embodiment of the present invention, the personal
20 server 204 is incorporated in the cellular or mobile phone 126, thus enabling accesses to the service providers 130 or devices 124, 128 connecting to the communication network 114 by means of the cellular or mobile phone 126. The cellular or mobile phone 126 incorporates all the features of the server 112 and
25 personal server 204, described with reference to the figures.

The second and third embodiments of the present invention advantageously may thus provide a wearer of a hearing device such as a hearing aid with positioning information, audio
30 streaming etc. In addition, the second and third embodiment may provide an improved user interface for a wearer of a hearing device such as a hearing aid since the wearer is presented with

a display and keypad, either directly on the personal server 204 or indirectly on the cellular or wireless phone 126.

The second and third embodiments of the present invention may
5 further advantageously utilise the microphone 134 as a conference microphone recording the voice of the wearer and transmitting the voice to other wearers of hearing devices.

Finally, the first, second and third embodiments of the present
10 invention may support the hearing devices 106 in signal processing, for example, in accordance with a hearing impairment, and in calculation of features such as directionality of acoustic signal detected by the hearing devices 106 or noise reduction schemes.

Claims

1. A system for enabling a hearing device wireless access to a communication network, and comprising a first transceiver unit
5 in said hearing device communicating according to a first communication protocol; a server device comprising an input/output unit connected to said communication network and adapted to communicate according to a second communication protocol, a second transceiver unit connected wirelessly to
10 said first transceiver unit and adapted to communicate according to said first communication protocol, and a translator unit interconnecting said second transceiver unit and said input/output unit and adapted to translate between said first and second communication protocol; and wherein said
15 hearing device is adapted to upload and download data to and from said communication network through said server device.
2. A system according to claim 1, wherein said communication network comprises a wired or wireless telephone network, a
20 computer network, media network, or any combination thereof.
3. A system according to any of claims 1 to 2, wherein said data comprises a data package, such as digital data configured in a transmission block, a data packet, a data parcel, or
25 datagram.
4. A system according to claim 3, wherein said data package comprises a header section comprising routing and transmission control data, and a data section comprising data payload.
30
5. A system according to any of claims 1 to 4, wherein said wireless communication between said first and second

transceiver elements comprises capacitive or inductive coupling.

6. A system according to any of claims 1 to 5, wherein said
5 first and second transceiver elements each comprise a coil antenna adapted to communicate inductively with one another.

7. A system according to claims 1 to 6, wherein said
communication network comprising connections to a plurality of
10 service providers in said communication network.

8. A system according to claim 7, wherein said service
providers are adapted to provide all types of services for the
hearing device users, such as updated hearing aid software with
15 new features, access to a multimedia event, access service information, or any combination thereof.

9. A system according to any of claims 1 to 8, wherein said
communication network comprising further connections to a
20 telephone, a computer, a personal digital assistant, a television, or any combination thereof.

10. A system according to any of claims 1 to 9, wherein said
server device further comprises a location identifying element
25 adapted to identify present location of the server device.

11. A system according to any of claims 1 to 10, wherein said
server device is incorporated in a mobile or cellular
telephone.

30

12. A system according to any of claims 10, wherein said server
device comprises a global positioning system (GPS) module
adapted to determine the location of said server device.

13. A system according to any of claims 1 to 12, wherein said hearing device further comprises an acoustic environment detector adapted to generate an environment signal to be
5 forwarded as data payload in a data package to an environment service provider in said communication network.

14. A system according to claim 13, wherein said environment signal comprises amplitude and frequency data relating to
10 acoustic background noise of location of said hearing device.

15. A system according to any of claims 13 to 14, wherein said environment service provider comprises a controller element adapted to generate an environment compensation signal to be
15 forwarded as data payload in a data package to said hearing device.

16. A system according to claim 15, wherein said hearing device is adapted to utilise said environment compensation signal for
20 increasing signal-to-noise ratio of an audio signal presented to the user of the hearing device.

17. A system according to any of claims 15 to 16, wherein said environment compensation signal comprises a phase shifted
25 version of the environment signal.

18. A system according to any of claims 13 to 17, wherein said environment service provider comprises an environment bank memory adapted to store a number of environment compensation
30 signals each associated with a predefined noise situation.

19. A system according to any of claims 13 to 18, wherein said server device incorporates the environment service provider.

20. A system according to any of claims 15 to 19, wherein said
server device comprises a broadcasting element adapted to
broadcast to any the hearing devices in a predefined area of
5 the location of the server device.

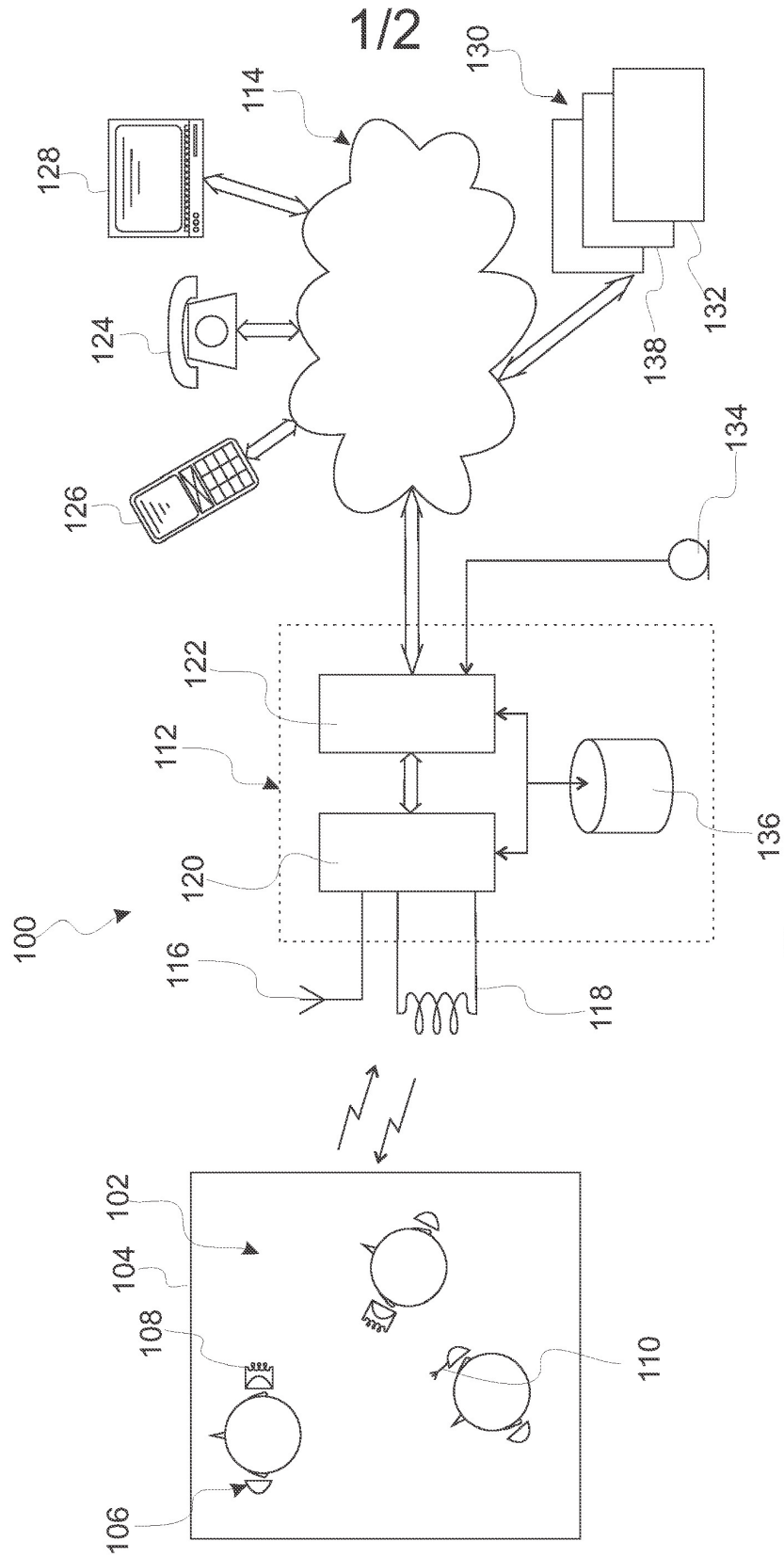


Fig. 1

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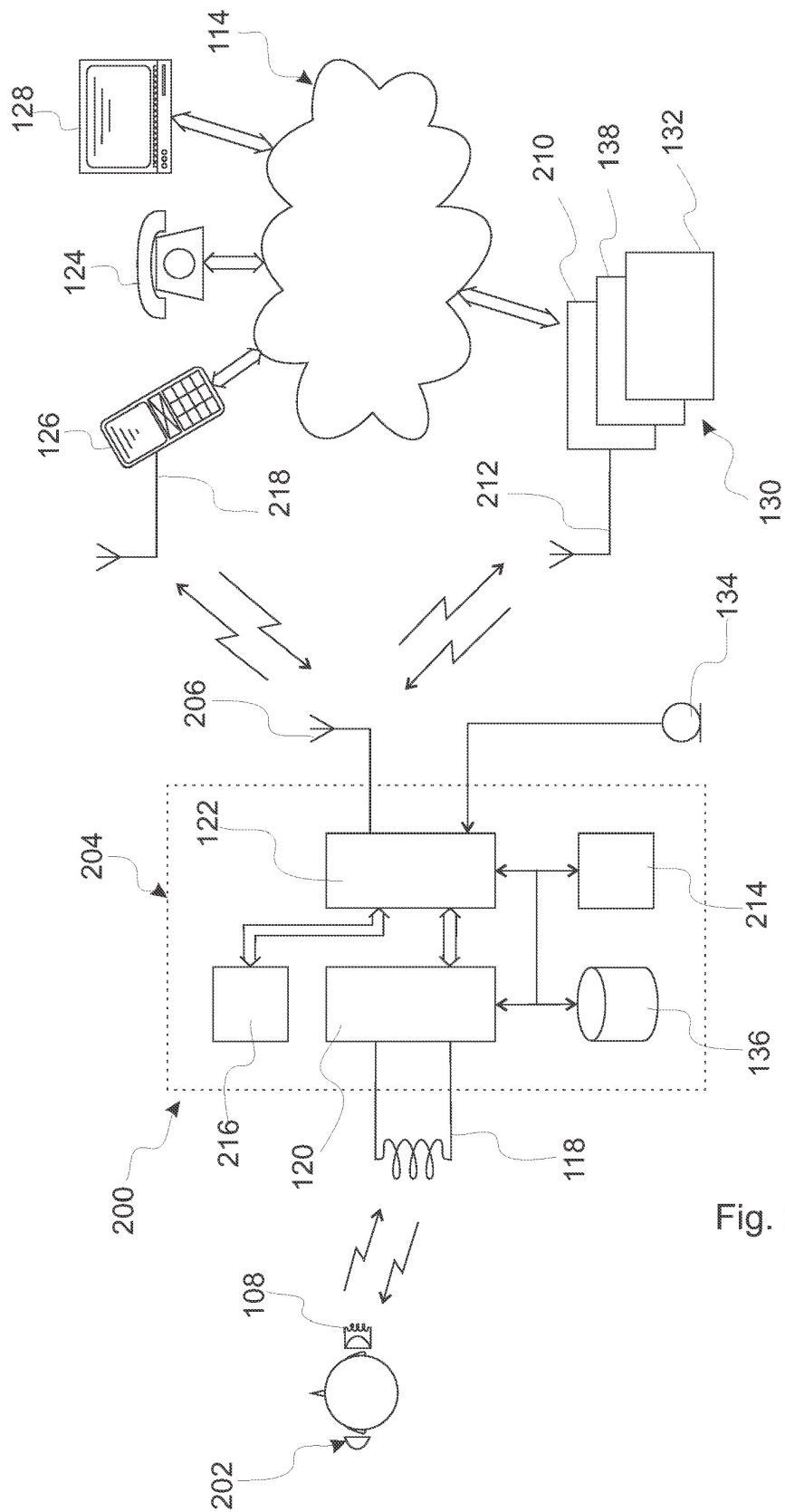


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/061964

A. CLASSIFICATION OF SUBJECT MATTER INV. H04R25/00 H04B1/20 H04M1/05 H04L29/06		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H04R H04B H04M H04L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 850 775 B1 (BERG CHRISTIAN) 1 February 2005 (2005-02-01) column 1, paragraph 5 - column 2, paragraph 4 column 3, paragraph 5 - paragraph 6 column 4, paragraph 4 column 5, paragraph 3 column 6, paragraph 2	1-20
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents :		
A document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed		*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family
Date of the actual completion of the international search <p align="center">29 June 2006</p>		Date of mailing of the international search report <p align="center">06/07/2006</p>
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer <p align="center">Huber, O</p>

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Information on patent family members

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