(12) UK Patent Application (19) GB (11) 2611880 (13) A

(43) Date of A Publication 19.04.2023

(21) Application No: 2213605.5

(22) Date of Filing: 16.09.2022

(30) Priority Data:
(31) 2113901 (32) 29.09.2021 (33) GB

(71) Applicant(s):
Prevayl Innovations Limited
57 Spring Gardens, Manchester, M2 3AZ,
United Kingdom

(72) Inventor(s):
Michael John Lynch

(74) Agent and/or Address for Service:
Prevayl Innovations Limited
57 Spring Gardens, Manchester, M2 3AZ,
United Kingdom

(51) INT CL:
A47G 25/14 (2006.01)

(56) Documents Cited:
WO 2014/073983 A1 **CN 209235652 U**
CN 205741668 U **CN 108013710 A**
DE 102020126289 A1 **US 20180289189 A1**

(58) Field of Search:
INT CL **A41D, A47G**
Other: **WPI, EPODOC, Patent Fulltext**

(54) Title of the Invention: **Garment hanger and system**
Abstract Title: **A garment hanger with means to retain an electronics module**

(57) A garment hanger 1008 comprises a hanging structure 1004 and a body 1006 connected to the hanging structure with a central region 1014 and left and right shoulder support regions 1010, 1012. A recess 1102 in the body is sized to receive and removably retain an electronics module 110. A magnetic material (1210, Fig 12) may couple with the electronics module when positioned in the recess. Preferably a power transfer interface (1206, Fig 12) transfers power to the electronics module when positioned in the recess with a conductive electrical connection and / or a wireless power transmitter. A power receiving interface (1212, Fig 12) may receive power from an external power source which may couple the garment hanger to a wired external power source and / or to a wireless external power source. The power receiving interface may comprise an antenna (1202, Fig 12). The garment hanger may convert the received wireless energy into a DC output for supply to the electronics module via the power transfer interface. A system is also claimed.

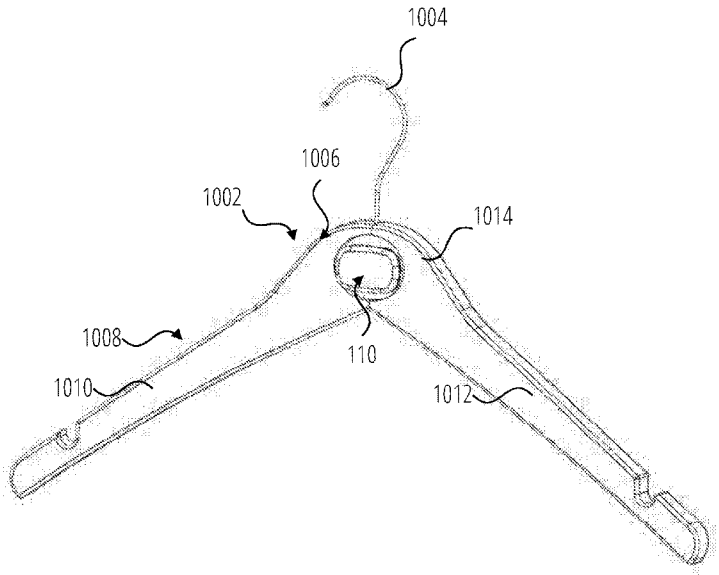


FIG. 10

GB 2611880 A

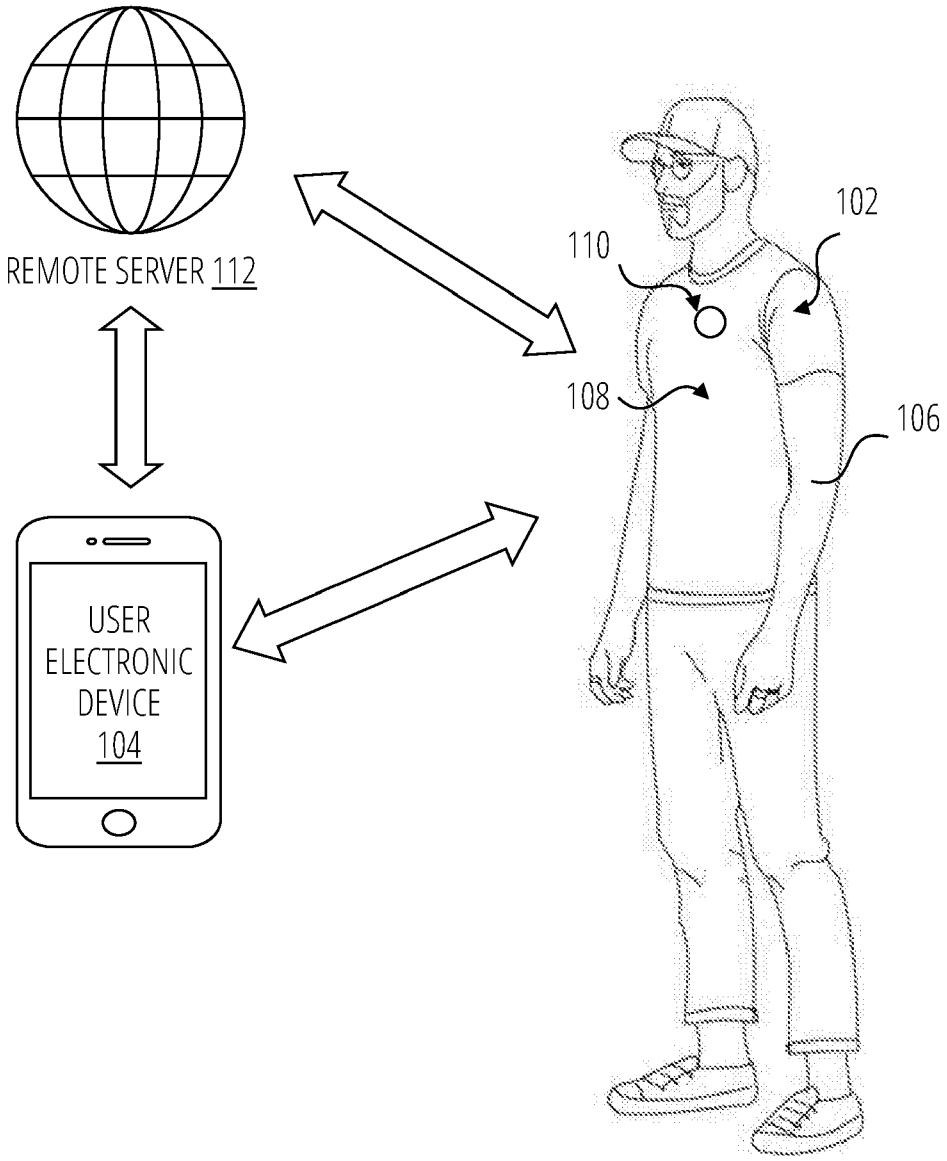

REMOTE SERVER 112
USER ELECTRONIC DEVICE 104
102
110
108
106

FIG. 1

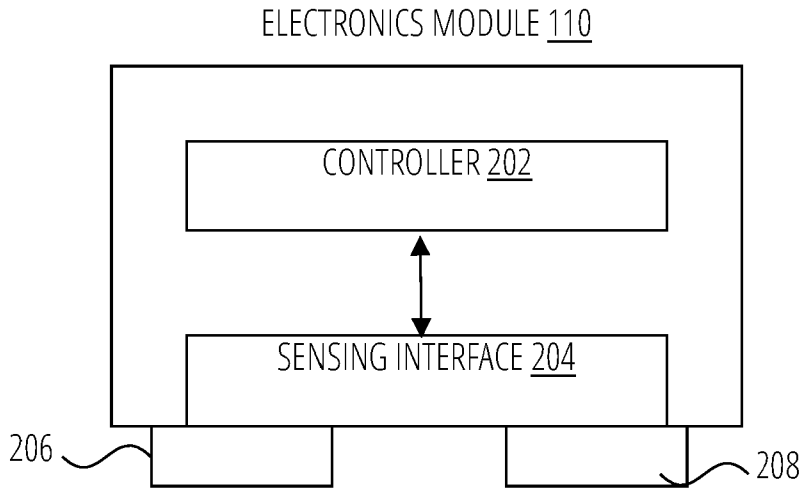

ELECTRONICS MODULE 110
CONTROLLER 202
SENSING INTERFACE 204
206
208

FIG. 2

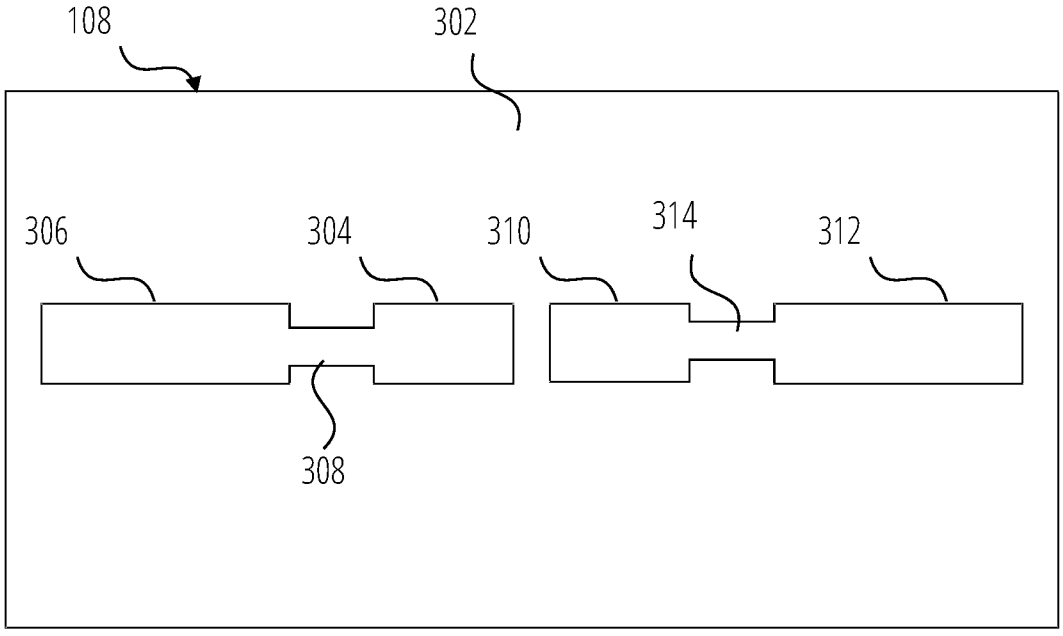

108
302
306
304
310
314
312
308

FIG. 3

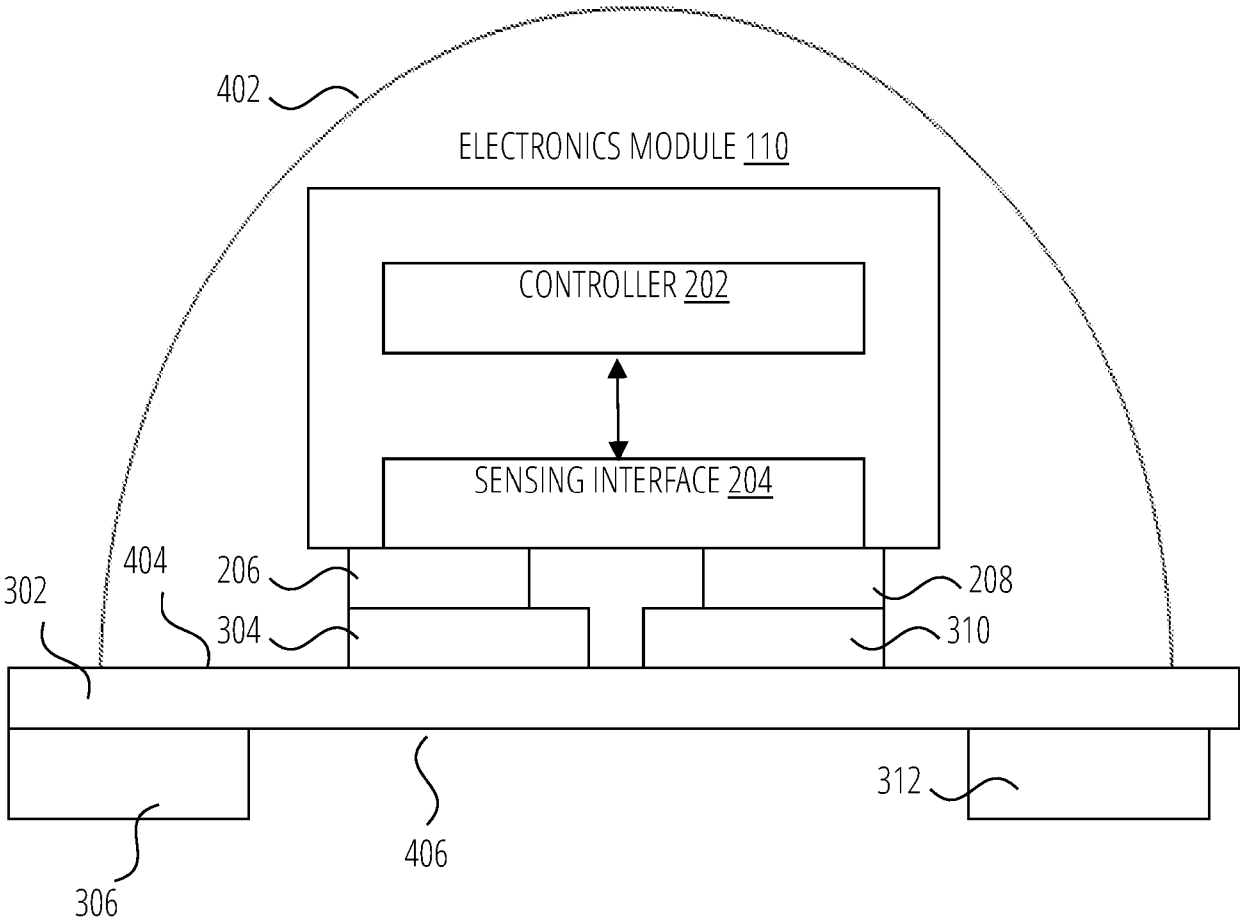

402
ELECTRONICS MODULE 110
CONTROLLER 202
SENSING INTERFACE 204
404
206
208
302
304
310
312
406
306

FIG. 4

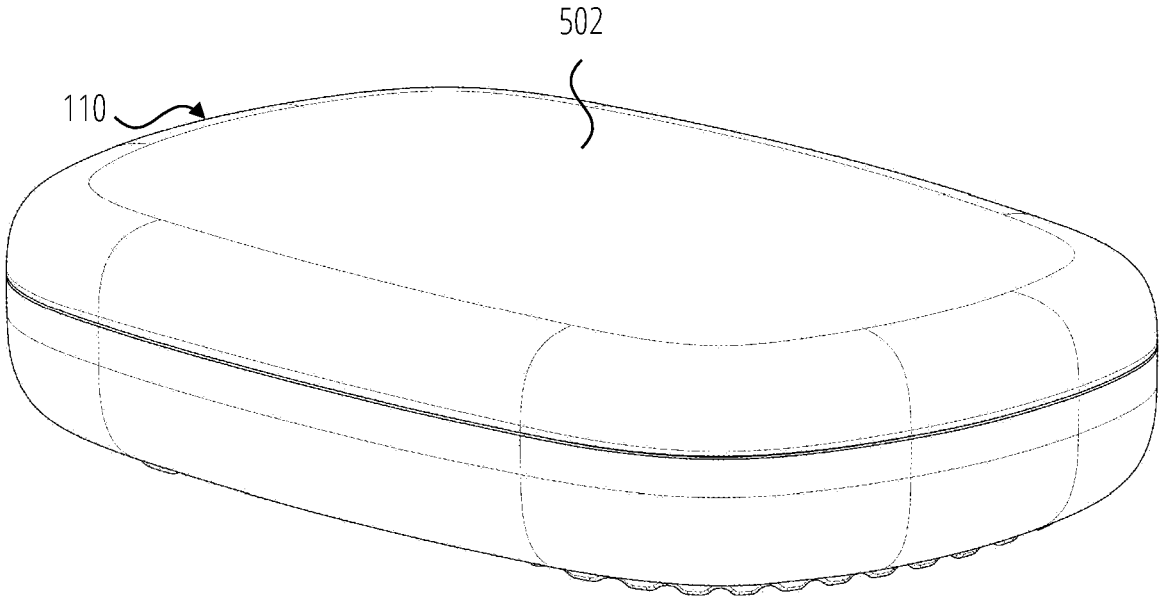


FIG. 5A

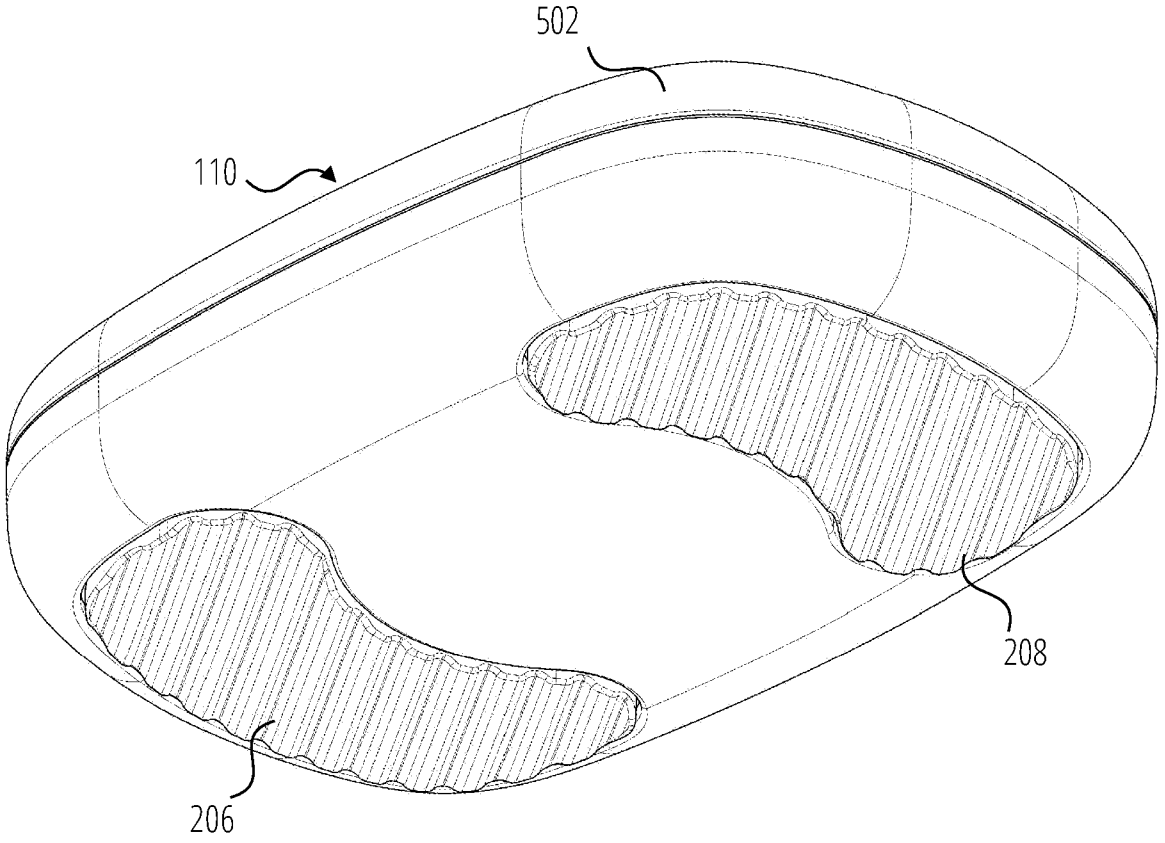


FIG. 5B

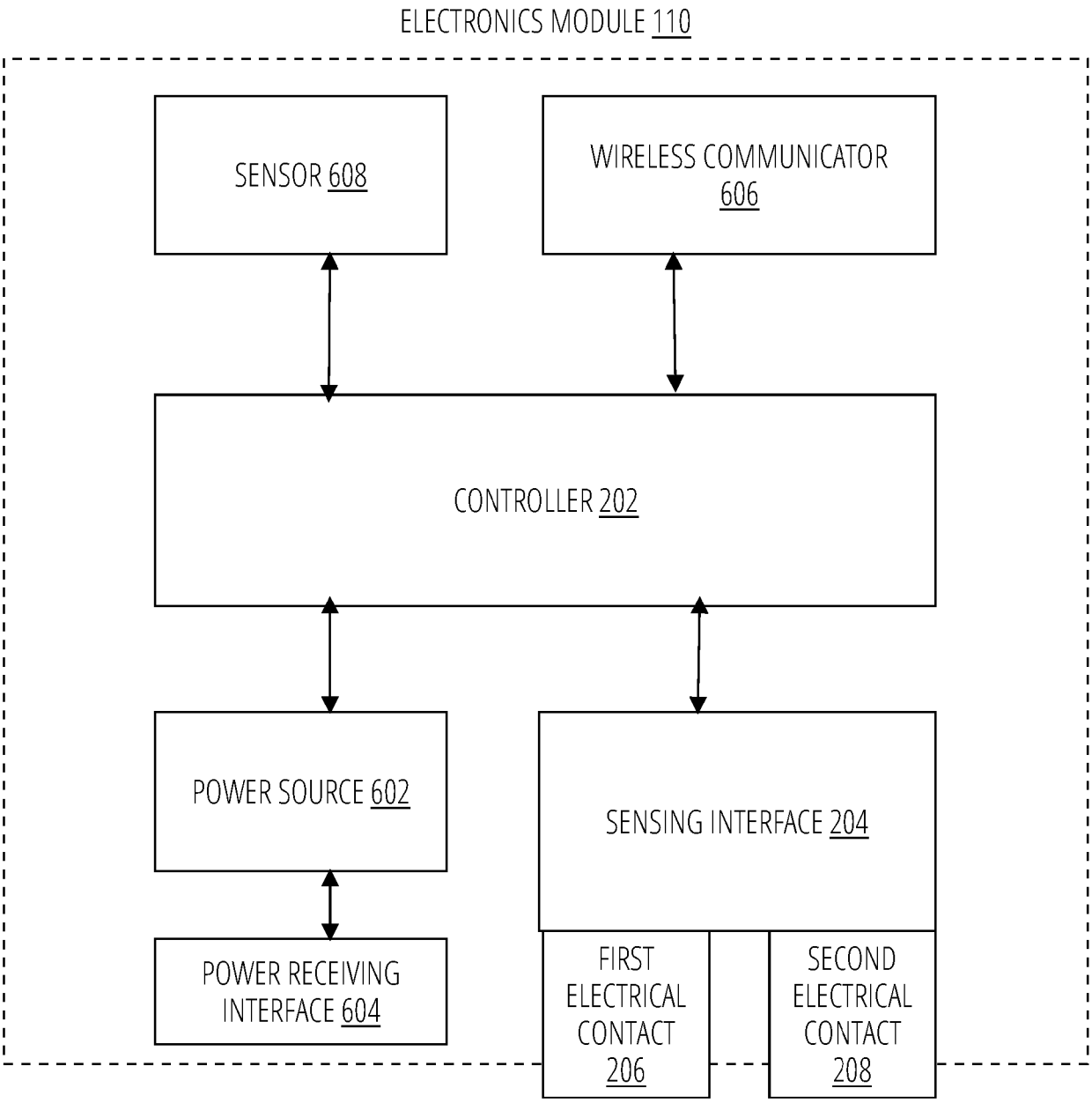

ELECTRONICS MODULE 110
SENSOR 608
WIRELESS COMMUNICATOR 606
CONTROLLER 202
POWER SOURCE 602
SENSING INTERFACE 204
POWER RECEIVING INTERFACE 604
FIRST ELECTRICAL CONTACT 206
SECOND ELECTRICAL CONTACT 208

FIG. 6

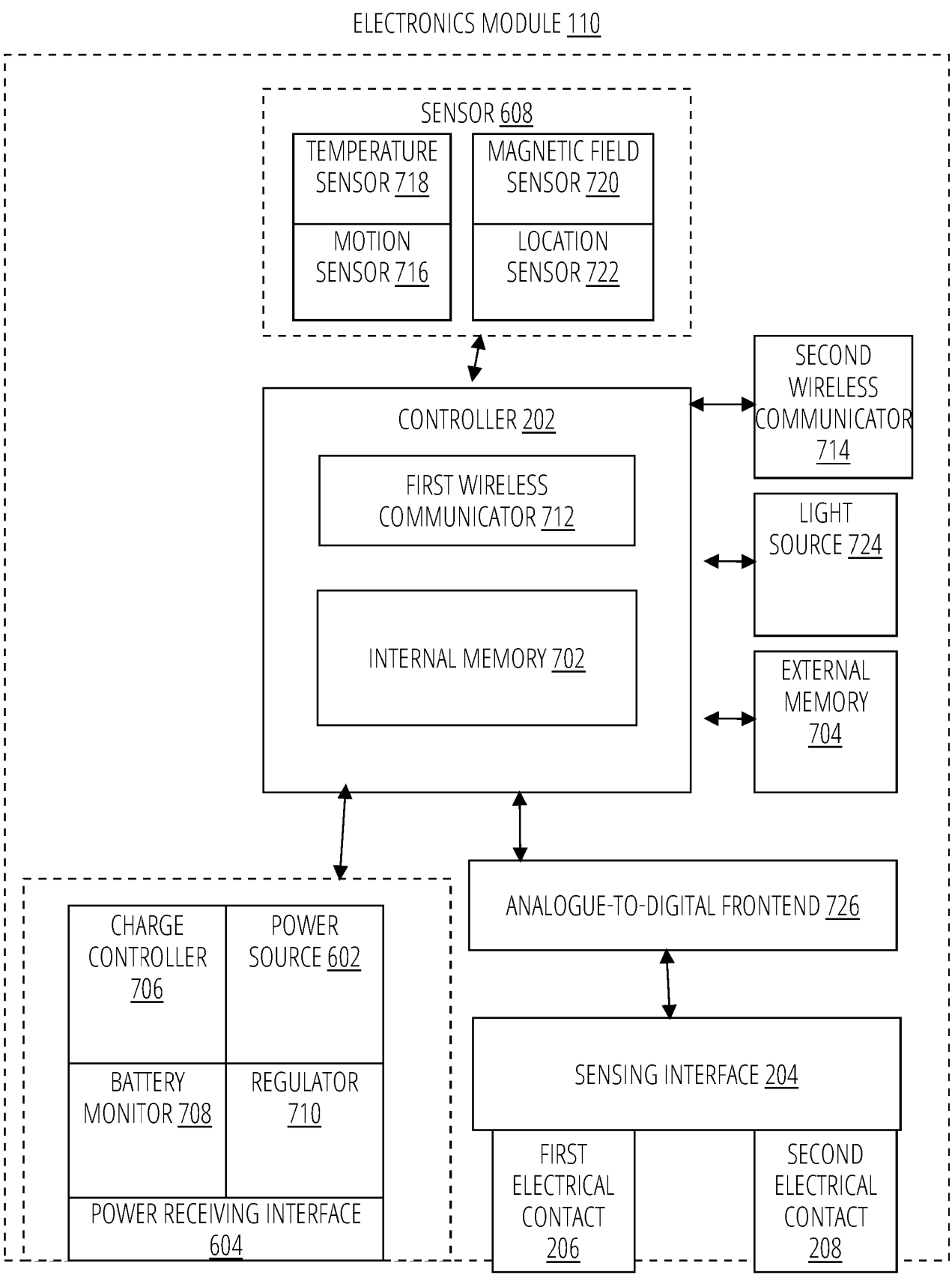

ELECTRONICS MODULE 110
SENSOR 608
TEMPERATURE SENSOR 718
MAGNETIC FIELD SENSOR 720
MOTION SENSOR 716
LOCATION SENSOR 722
CONTROLLER 202
FIRST WIRELESS COMMUNICATOR 712
INTERNAL MEMORY 702
SECOND WIRELESS COMMUNICATOR 714
LIGHT SOURCE 724
EXTERNAL MEMORY 704
ANALOGUE-TO-DIGITAL FRONTEND 726
SENSING INTERFACE 204
FIRST ELECTRICAL CONTACT 206
SECOND ELECTRICAL CONTACT 208
CHARGE CONTROLLER 706
POWER SOURCE 602
BATTERY MONITOR 708
REGULATOR 710
POWER RECEIVING INTERFACE 604

FIG. 7

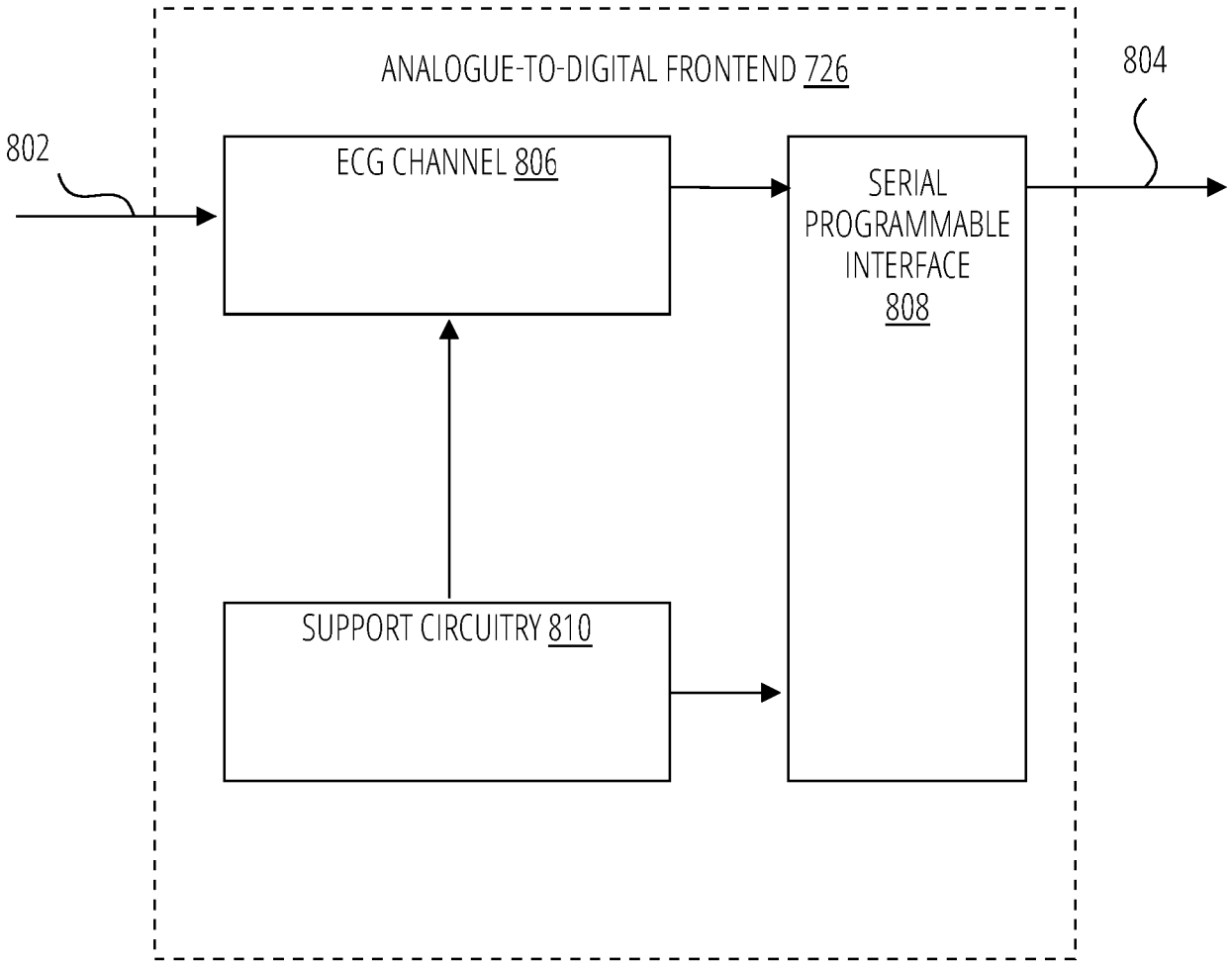

ANALOGUE-TO-DIGITAL FRONTEND 726
802
804
ECG CHANNEL 806
SERIAL PROGRAMMABLE INTERFACE 808
SUPPORT CIRCUITRY 810

FIG. 8

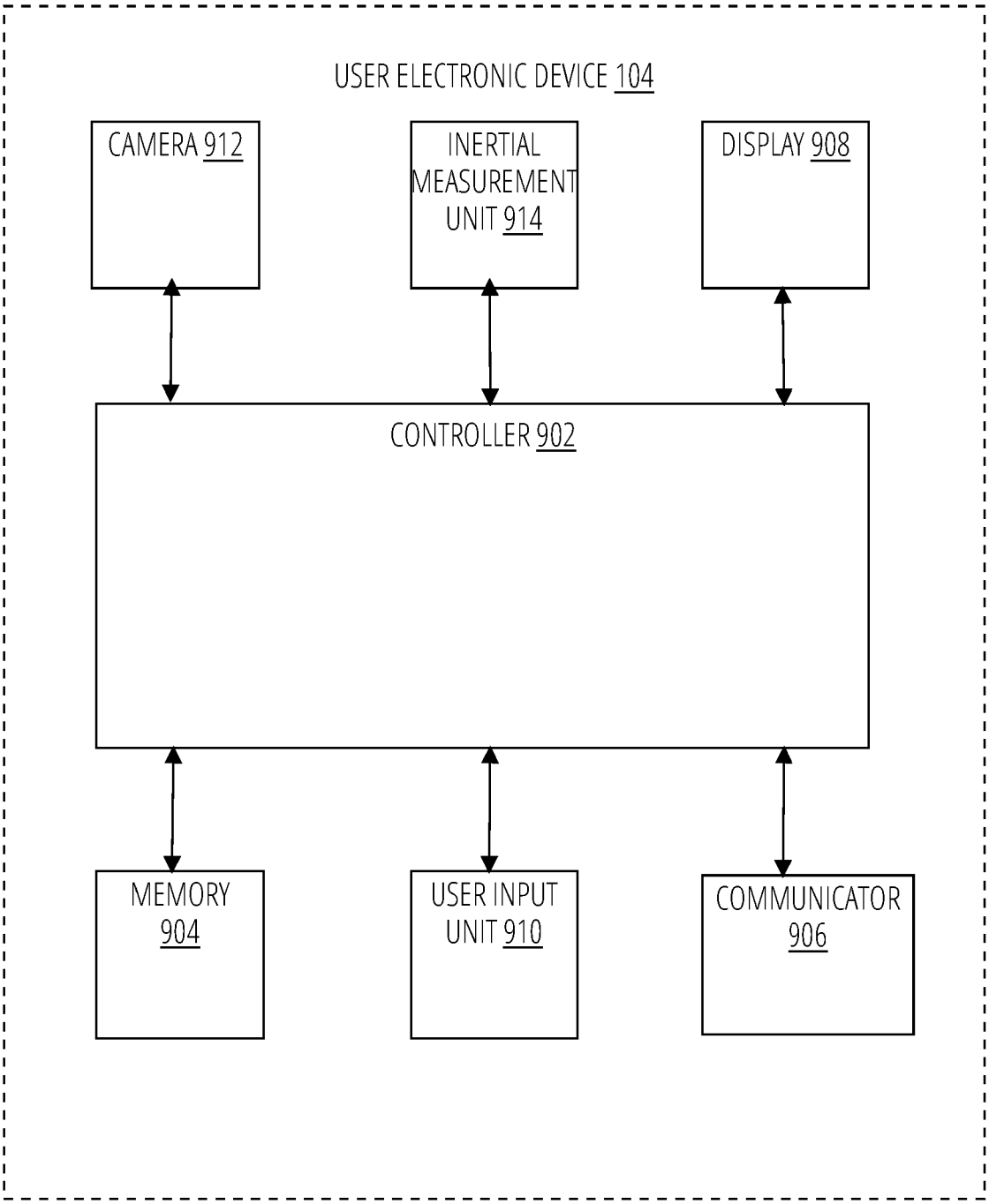

USER ELECTRONIC DEVICE 104
CAMERA 912
INERTIAL MEASUREMENT UNIT 914
DISPLAY 908
CONTROLLER 902
MEMORY 904
USER INPUT UNIT 910
COMMUNICATOR 906

FIG. 9

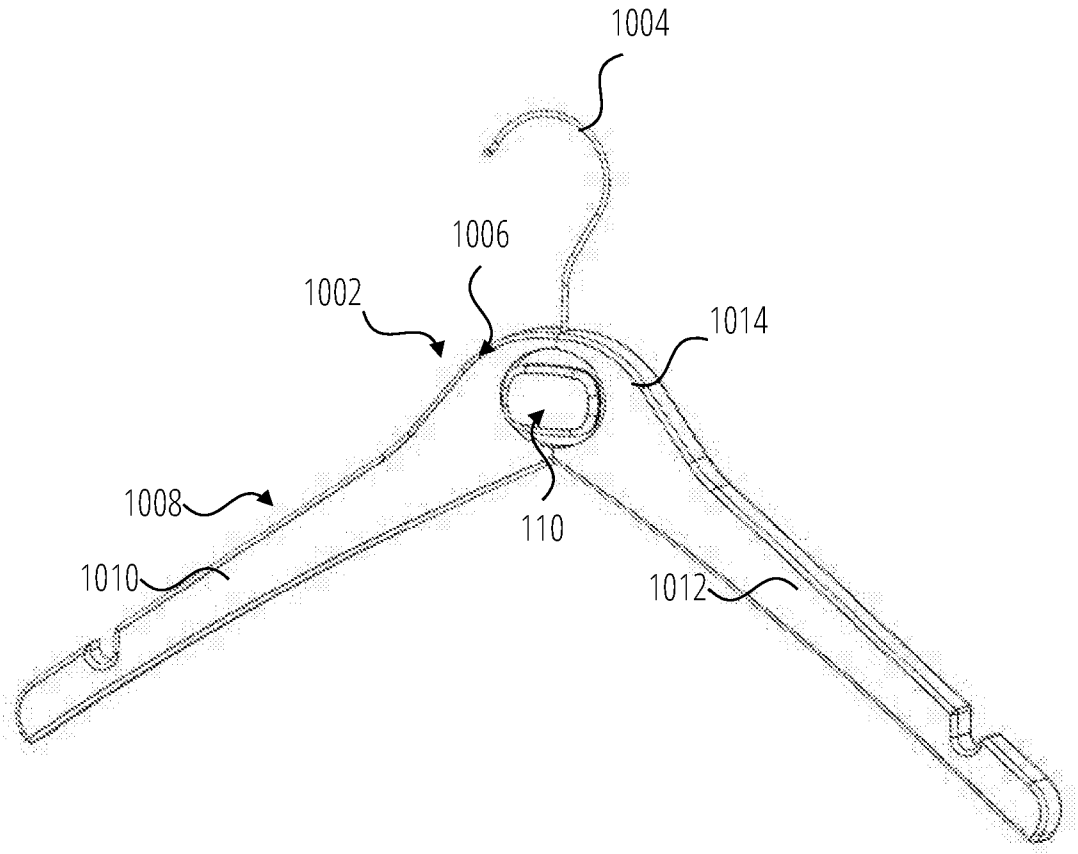


FIG. 10

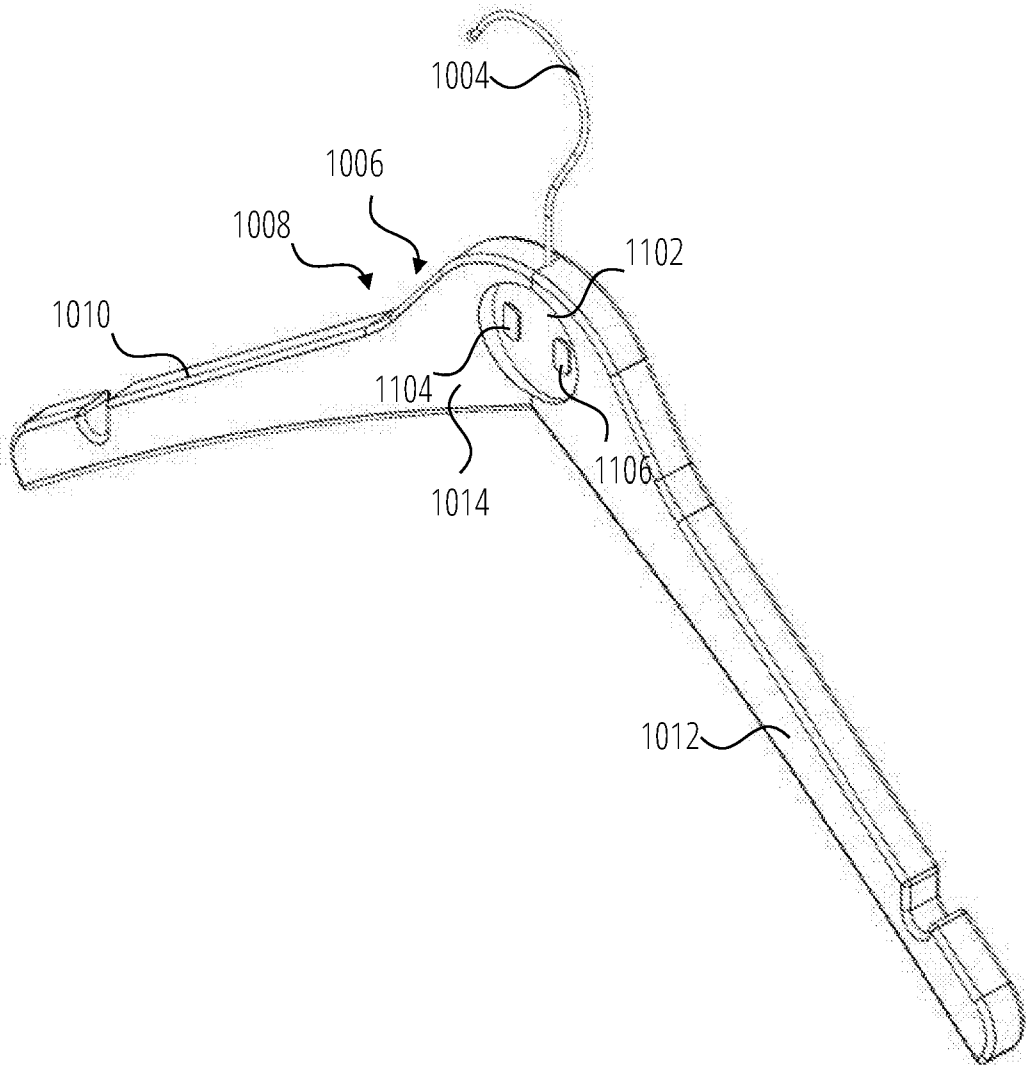


FIG. 11

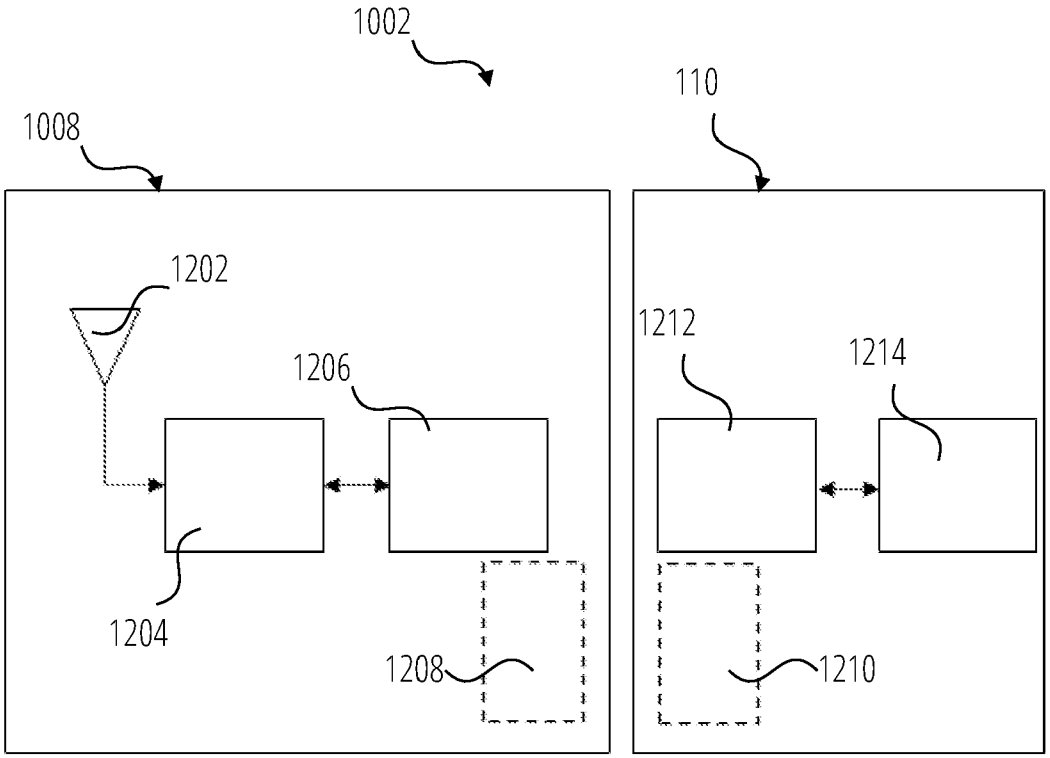


FIG. 12

GARMENT HANGER AND SYSTEM

[0001] The present invention is directed towards a garment hanger and a system comprising the garment hanger. The garment hanger is constructed so as to removably retain an electronics module.

BACKGROUND

[0002] Wearable articles, such as garments, incorporating sensors are wearable electronics used to measure and collect information from a wearer. Such wearable articles are commonly referred to as 'smart clothing'. It is advantageous to measure biosignals of the wearer during exercise, or other scenarios.

[0003] It is known to provide a garment, or other wearable article, to which an electronic device (i.e. an electronics module, and/or related components) is attached in a prominent position, such as on the chest. Advantageously, the electronic device is a detachable device. The electronic device is configured to process the incoming signals, and the output from the processing is stored and/or displayed to a user in a suitable way.

[0004] A sensor senses biosignals such as electrocardiogram (ECG) signals and the biosignals are coupled to the electronic device, via a communication interface of the wearable article.

[0005] The sensors may be coupled to the interface by means of conductors which are connected to terminals provided on the communication interface to enable coupling of the signals from the sensor to the communication interface.

[0006] Electronics modules for wearable articles such as garments are known to communicate with user electronic devices over wireless communication protocols such as Bluetooth ® and Bluetooth ® Low Energy. These electronics modules are typically removably attached to the wearable article, interface with internal electronics of the wearable article, and comprise a Bluetooth ® antenna for communicating with the user electronic device.

[0007] The electronics module includes drive and sensing electronics comprising components and associated circuitry, to provide the required functionality.

[0008] The drive and sensing electronics include a power source to power the electronic device and the associated components of the drive and sensing circuitry.

[0009] ECG sensing is used to provide a plethora of information about a person's heart. It is one of the simplest and oldest techniques used to perform cardiac investigations. In its most basic form, it provides an insight into the electrical activity generated within heart muscles that changes over time. By detecting and amplifying these differential biopotential signals, a lot of information can be gathered quickly, including the heart rate.

[0010] Typically, the detected ECG signals can be displayed as a trace to a user for information. Alternatively, or in addition to a signal trace, information can be derived from raw ECG signals through digital signal processing and displayed or presented to the user in other ways, for example such as simple hear rate figures in beats per minute.

[0011] The trace and/or the additional information can be displayed or presented to a user on a user electronic device such as a mobile phone. Within the context of the present disclosure the user can be a wearer of the electronics module of any other user of the electronics module.

[0012] The electronics module is typically removable from the wearable article. The electronics module may be removed to enable the wearable article to be washed or so as to charge the electronics module. It

can be easy to misplace the electronics module or accidentally separate the electronics module from the wearable article it is to be used with. This is a particular problem in environments where there may be multiple electronics modules and wearable articles for different wearers such as in a clinical, workplace or team sports setting.

[0013] It is an object of the present disclosure, to improve on the prior art whether expressly acknowledged herein or otherwise.

SUMMARY

[0014] According to the present disclosure there is provided a garment hanger and system as set forth in the appended claims. Other features of the invention will be apparent from the dependent claims, and the description which follows.

[0015] According to a first aspect of the disclosure, there is provided a garment hanger comprising: a hanging structure; a body connected to the hanging structure, the body comprising a central region and left and right shoulder support regions extending from the central region, wherein the body further comprises a recess sized to receive and removably retain an electronics module.

[0016] The body may further comprise a magnetic material arranged to magnetically couple with the electronics module when positioned in the recess.

[0017] The garment hanger may also comprise a power transfer interface arranged to transfer power to the electronics module when positioned in the recess.

[0018] The power transfer interface may be arranged to form a conductive electrical connection with the electronics module when positioned in the recess. In addition to power transfer, the conductive electrical connection may beneficially be used for communication between the electronics module and the garment hanger.

[0019] The power transfer interface may comprise a wireless power transmitter arranged to wirelessly transfer power to the electronics module when positioned in the interface. Advantageously, this means that a physical electrical interface does not need to be formed between the electronics module and the power transfer interface for power transfer to take place. This can simplify the construction of the electronics module and make it easier to waterproof the electronics module.

[0020] The garment hanger may also comprise a power receiving interface arranged to receive power from an external power source for subsequent transfer to the electronics module via the power transfer interface.

[0021] The power receiving interface may be arranged to couple the garment hanger to a wired external power source. The power receiving interface may, for example, comprise a USB interface for coupling to an external power source.

[0022] The power receiving interface may be arranged to couple the garment hanger to a wireless external power source. The power receiving interface may comprise a wireless power receiving antenna such as for receiving power inductively from a wireless external power source.

[0023] The power receiving interface may comprise an antenna arranged to receive wireless energy.

[0024] The garment hanger may be arranged to convert the received wireless energy into a DC output for supply to the electronics module via the power transfer interface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] To easily identify the discussion of any particular element or act, the most significant digit or digits in a reference number refer to the figure number in which that element is first introduced.

[0026] FIG. 1 illustrates an example system in accordance with aspects of the present disclosure.

[0027] FIG. 2 illustrates a schematic for an example electronics module in accordance with aspects of the present disclosure.

[0028] FIG. 3 illustrates an example wearable article in accordance with aspects of the present disclosure.

[0029] FIG. 4 illustrates an example wearable assembly comprising an electronics module and wearable article in accordance with aspects of the present disclosure.

[0030] FIG. 5A illustrates an external view of an example electronics module in accordance with aspects of the present disclosure.

[0031] FIG. 5B illustrates an external view of an example electronics module in accordance with aspects of the present disclosure.

[0032] FIG. 6 illustrates a schematic for an example electronics module in accordance with aspects of the present disclosure.

[0033] FIG. 7 illustrates a more detailed schematic for an example electronics module in accordance with aspects of the present disclosure.

[0034] FIG. 8 illustrates an example analogue-to-digital frontend of an electronics module according to aspects of the present disclosure.

[0035] FIG. 9 illustrates an example user electronic device according to aspects of the present disclosure.

[0036] FIG. 10 illustrates an example system comprising a garment hanger according to aspects of the present disclosure.

[0037] FIG. 11 illustrates the garment hanger of FIG. 10 in isolation.

[0038] FIG. 12 illustrates an example system comprising a garment hanger according to aspects of the present disclosure..

DETAILED DESCRIPTION

[0039] "Wearable article" refers to any form of article which may be worn by a user such as a smart watch, necklace, garment, bracelet, or glasses. The wearable article may be a textile article. The wearable article may be a garment. The garment may refer to an item of clothing or apparel. The garment may be a top. The top may be a shirt, t-shirt, blouse, sweater, jacket/coat, or vest. The garment may be a dress, garment brassiere, shorts, pants, arm or leg sleeve, vest, jacket/coat, glove, armband, underwear, headband, hat/cap, collar, wristband, armband, chestband, waistband, stocking, sock, or shoe, athletic clothing, personal protective equipment, including hard hats, swimwear, wetsuit or dry suit.

[0040] The type of wearable garment may dictate the type of biosignals to be detected. For example, a hat or cap may be used to detect electroencephalogram or magnetoencephalogram signals.

[0041] The wearable article (e.g., a garment) may be constructed from a woven or a non-woven material. The wearable article may be constructed from natural fibres, synthetic fibres, or a natural fibre blended with one or more other materials which can be natural or synthetic. The yarn may be cotton. The cotton may be blended with polyester and/or viscose and/or polyamide according to the application. Silk may also be used as the natural fibre. Cellulose, wool, hemp and jute are also natural fibres that may be

used in the wearable article. Polyester, polycotton, nylon and viscose are synthetic fibres that may be used in the wearable article.

[0042] The garment may be a tight-fitting garment or a loose-fitting (e.g. freeform garment). A tight-fitting garment helps ensure that the sensor devices of the garment are held in contact with or in the proximity of a skin surface of the wearer. The tight-fitting garment may be a compression garment. The tight-fitting garment may be an athletic garment such as an elastomeric athletic garment. A loose-fitting garment is generally more comfortable to wear over extending time periods and during sleep.

[0043] The garment has sensing units provided on an inside surface which are typically held in close proximity to a skin surface of a wearer wearing the garment. This enables the sensing units to measure biosignals for the wearer wearing the garment.

[0044] "Wearer" refers to the person or other form of animal who is wearing, or otherwise holding, the wearable article and/or electronics module. The wearer may also be referred to as a user. Although the user and wearer may be different entities in certain situations.

[0045] "Biosignal" refers to signals from living beings that can be continually measured or monitored. Biosignals may be electrical or non-electrical signals. Signal variations can be time variant or spatially variant.

[0046] "Sensing units" refers to one or more elements more measuring signals from a wearer of the wearable article. A sensing unit may comprise the combination of a sensor, such as an electrode, a connection region, and a communication pathway coupling the electrode to the connection region. An electronics module communicatively coupled to the connection region is able to obtain measurement signals from the sensor via the communication pathway and connection region. The sensing units may be made of a (electrically) conductive material such as a conductive yarn, conductive ink, conductive transfer, or conductive paste. When formed form conductive yarn, the sensing units may be knitted, woven, embroidered, stitched or otherwise incorporated into the wearable article. The sensing units may be integrally formed with the wearable article such as by being integrally knitted with the wearable article.

[0047] The sensing units may be arranged to measure one or more biosignals of a wearer wearing the wearable article.

[0048] Sensing units may be used for measuring one or a combination of bioelectrical, bioimpedance, biochemical, biomechanical, bioacoustics, biooptical or biothermal signals of the wearer. The sensing units may be incorporated into the wearable article, an electronics module coupled to or forming part of the wearable article, or may be shared between the electronics module and the wearable article. For example, the wearable article may comprise sensors (e.g. sensing electrodes) while the electronics module may comprise the processing logic for the sensing electrodes. The processing logic will review the signals from the sensors and perform operations such as filtering and analogue-to-digital conversion on the signals. The bioelectrical measurements include electrocardiograms (ECG), electrogastrograms (EGG), electroencephalograms (EEG), and electromyography (EMG). The bioimpedance measurements include plethysmography (e.g., for respiration), body composition (e.g., hydration, fat, etc.), and electroimpedance tomography (EIT). The biomagnetic measurements include magnetoneurograms (MNG), magnetoencephalography (MEG), magnetogastrogram (MGG), magnetocardiogram (MCG). The biochemical measurements include glucose/lactose measurements which may be performed using chemical analysis of the wearer's sweat. The biomechanical measurements include blood pressure. The bioacoustics measurements include phonocardiograms (PCG). The biooptical measurements include

photoplethysmography (PPG) and orthopantomograms (OPG). The biothermal measurements include skin temperature and core body temperature measurements.

[0049] "Electronics module" may refer to an electronic device that is able to communicatively couple with sensing units in a wearable article so as to obtain measurement signals from the sensing units and/or apply signals to the sensing units. The electronics module may also be a stand-alone component that performs measurements using internal sensors without communicatively coupling to a wearable article.

[0050] Electronics modules typically comprise a sensing interface for communicatively coupling with the wearable article, a controller, and a wireless communicator for communicating with an external device such as a user electronic device over a wireless communication protocol.

[0051] The electronics module is typically removably coupled to the wearable article such that it is retained by the wearable article when worn. The electronics module can be removed from the wearable article so that the wearable article can be washed without damaging the internal electronics of the electronics module. The electronics module can also be removed from the wearable article for charging. In other examples, the electronics module is integrally formed with the wearable article such as when the wearable article/electronics module form a smartwatch.

[0052] Generally, the electronics module comprises all of the components required for data transmission and processing such that the wearable article only comprises the sensing units. In this way, the manufacture of the wearable article may be simplified. In addition, it may be easier to clean a wearable article which has fewer electronic components attached thereto or incorporated therein. Furthermore, the removable electronics module may be easier to maintain or troubleshoot than embedded electronics. The electronics module may comprise flexible electronics such as a flexible printed circuit (FPC).

[0053] An electronics module that performs physiological monitoring is also referred to as a portable physiological monitoring device in this specification.

[0054] The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of various embodiments of the disclosure as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the various embodiments described herein can be made without departing from the scope and spirit of the disclosure. In addition, descriptions of well-known functions and constructions may be omitted for clarity and conciseness.

[0055] The terms and words used in the following description and claims are not limited to the bibliographical meanings but are merely used by the inventor to enable a clear and consistent understanding of the disclosure. Accordingly, it should be apparent to those skilled in the art that the following description of various embodiments of the disclosure is provided for illustration purpose only and not for the purpose of limiting the disclosure as defined by the appended claims and their equivalents.

[0056] It is to be understood that the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise.

[0057] FIG. 1 shows a system according to aspects of the present disclosure. The system comprises a wearable assembly 102 and a user electronic device 104. The wearable assembly 102 is worn by a user who in this embodiment is the wearer 106 of the wearable assembly 102.

[0058] The wearable assembly 102 comprises a wearable article 108 which, in this is example, is in the form of a garment.

[0059] The wearable assembly 102 comprises an electronics module 110. The electronics module 110 is releasably coupled to the wearable article 108. The wearable article 108 comprises an electronics module holder (not shown) arranged to removably retain the electronics module 110. The electronics module holder enables the electronics module to be attached and removed from the wearable article 108.

[0060] In some examples, the electronics module holder comprises a pocket such as a garment pocket. The pocket has an opening through which the electronics module 110 may be inserted and removed from the pocket. The pocket may be formed from fabric layers of the wearable article 108.

[0061] The present disclosure is not limited to electronics module holders in the form pockets.

[0062] The electronics module 110 may be configured to be releasably mechanically coupled to the wearable article 108. The mechanical coupling of the electronics module 110 to the wearable article 108 may be provided by a mechanical interface such as a clip, a plug and socket arrangement, etc. The mechanical coupling or mechanical interface may be configured to maintain the electronics module 110 in a particular orientation with respect to the wearable article 108 when the electronics module 110 is coupled to the wearable article 108. This may be beneficial in ensuring that the electronics module 110 is securely held in place with respect to the wearable article 108 and/or that any electronic coupling of the electronics module 110 and the wearable article 108 can be optimized. The mechanical coupling may be maintained using friction or using a positively engaging mechanism, for example.

[0063] The electronics module 110 is arranged to wirelessly communicate data to the user electronic device 104. Various protocols enable communication between the electronics module 110 and the user electronic device 104. Example communication protocols include Bluetooth ®, Bluetooth ® Low Energy, and near-field communication (NFC).

[0064] The system also comprises a remote server 112 which may be in communication with the user electronic device 104 and/or the electronics module 110.

[0065] FIG. 2 shows a simplified diagram of an example electronics module 110 according to aspects of the present disclosure. The electronics module 110 comprises a controller 202 and a sensing interface 204 communicatively coupled to the controller 202.

[0066] The sensing interface 204 in this example comprises a first electrical contact 206 and a second electrical contact 208. The sensing interface 204 receives measurement signals from the electrical contacts 206, 208. The measurement signals, or a processed version thereof, are provided to the controller 202. The measurement signals may be any form of biosignal as described above. The sensing interface 204 is therefore able to receive physiological signals from a wearer of the electronics module 110.

[0067] The controller 202 is able to process the signals received from the sensing interface. The controller 202 may control a wireless communicator (not shown) of the electronics module 110 to transmit data to an external device such as user electronic device 104 of FIG. 1.

[0068] FIG. 3 shows a simplified diagram of an example wearable article 108. The wearable article 108 comprises a fabric layer 302.

[0069] A first communication interface 304 is provided on the fabric layer 302. The first communication interface 304 is accessible from the electronics module holder of the wearable article 108.

[0070] The first communication interface 304 is communicatively coupled to a first sensor 306 via a first communication pathway 308. The first communication interface 304, first sensor 306 and first communication pathway 308 form a first sensing unit of the wearable article 108. The first sensor 306 is in the form of an electrode. The first sensor 306 may be arranged to be provided on the wearable article 108

such that it faces the skin surface of the wearer when the wearable article 108 is worn. This enables the first sensor 306 to contact the skin surface and measure biosignals from the skin surface and/or apply signals to the skin surface. Signals may be applied to the skin surface in therapeutic applications for example.

[0071] A second communication interface 310 is provided on the fabric layer 302. The second communication interface 310 is accessible from the electronics module holder of the wearable article 108.

[0072] The second communication interface 310 is communicatively coupled to a second sensor 312 via a second communication pathway 314. The second communication interface 310, second sensor 312, and second communication pathway 314 form a second sensing unit of the wearable article 108. The second sensor 312 is in the form of an electrode. The second sensor 312 may be arranged to be provided on the wearable article 108 such that it faces the skin surface of the wearer when the wearable article 108 is worn. This enables the second sensor 312 to contact the skin surface and measure biosignals from the skin surface and/or apply signals to the skin surface. Signals may be applied to the skin surface in therapeutic applications for example.

[0073] In this example, the first sensor 306 and second sensor 312 are electrodes. This is not required in all examples. Other forms of sensors such as temperature sensors, optical sensors, chemical sensors, and moisture sensors may be included. The wearable article 108 may include any combination of different types of sensors.

[0074] FIG. 4 shows a simplified diagram of an electronics module 110 coupled to a wearable article 108 to form an example wearable assembly 102. The electronics module 110 is positioned inside an electronics module holder 402 of the wearable article 108 which in this example is in the form of a pocket.

[0075] The first communication interface 304 and the second communication interface 310 are provided on a first surface of fabric layer 404 such that they are located within the pocket space. The first sensor 306 and the second sensor 312 are provided on a second surface of fabric layer 406 that opposes the first surface of fabric layer 404. The first sensor 306 and second sensor 312 are arranged such that they face towards the skin surface of the wearer of the wearable article 108. The first and second communication pathways are not shown in FIG. 4 but, as discussed above in relation to FIG. 3, couple the sensors to their respective communication interfaces 304, 310.

[0076] The electronics module 110 is positioned within the pocket space. The first electrical contact 206 of the electronics module 110 contacts and is electrically coupled to the first communication interface 304. The second electrical contact 208 of the electronics module 110 contacts and is electrically coupled to the second communication interface 310. The electronics module 110 is therefore coupled to the first sensor 306 and the second sensor 312 via the communication pathways, communication interfaces 304, 310, and electrical contacts 206, 208.

[0077] FIG. 5A and FIG. 5B show external views of an electronics module 110 according to aspects of the present disclosure. The electronics module 110 has a housing 502. Components of the electronics module 110 such as the controller 202 are disposed within the housing 502. The first electrical contact 206 and the second electrical contact 208 are located on an external surface of the housing 502.

[0078] The electronics module 110 may have a length of between 20 mm and 60 mm, a width of between 15 mm and 35 mm, and a depth of between 5 mm and 15 mm. In some examples, the electronics module 110 has a length of between 30 mm and 40 mm or between 35 mm and 38 mm. In some examples, the electronics module 110 has a width of between 20 mm and 30 mm or between 24 and 26 mm. In preferred examples, the electronics module 110 has a width of 25 mm. In some examples, the

electronics module 110 has a depth of between 8 mm and 12 mm or between 9 mm and 11 mm. In preferred examples, the electronics module 110 has a depth of between 9.7 mm and 10 mm. In one particular example, the electronics module 110 has a length of 38 mm, a width of 25 mm and a depth of 9.6 mm.

[0079] FIG. 6 shows a simplified schematic diagram for an example electronics module 110 as shown in FIG. 4. It will be appreciated that not all of the components shown in FIG. 6 are required and additional components may also be provided.

[0080] The electronics module 110 comprises a controller 202 and a sensing interface 204 as described in FIG. 4. The sensing interface 204 comprises a first electrical contact 206 and a second electrical contact 208. The controller 202 is communicatively coupled to the sensing interface 204 and is operable to receive signals from the sensing interface 204 for further processing.

[0081] The sensing interface 204 comprises electrical contacts 206, 208 in this example. This means that the communicative coupling in this example is a conductive coupling formed by direct contact between the electrical contacts 206, 208 and the connection regions of the wearable article, but this is not required in all examples. The communicative coupling may be a wireless (e.g., inductive) coupling.

[0082] The electronics module 110 further comprises a power source 602 and a power receiving interface 604.

[0083] The power source 602 may comprise one or a plurality of power sources. The power source 602 may be a battery. The battery may be a rechargeable battery. The battery may be a rechargeable battery adapted to be charged wirelessly such as by inductive charging. The power source 602 may comprise an energy harvesting device. The energy harvesting device may be configured to generate electric power signals in response to kinetic events such as kinetic events performed by the wearer of the wearable article. The kinetic event could include walking, running, exercising or respiration of the wearer. The energy harvesting material may comprise a piezoelectric material which generates electricity in response to mechanical deformation of the converter. The energy harvesting device may harvest energy from body heat of the wearer. The energy harvesting device may be a thermoelectric energy harvesting device. The power source may be a super capacitor, or an energy cell.

[0084] The power receiving interface 604 is operable to receive power from an external power store for charging the power source. The power receiving interface 604 may be a wired or wireless interface. A wireless interface may comprise one or more wireless power receiving coils for receiving power from the external power store. In some examples, one or both of the first and second electrical contacts 206, 208 may also function as the power receiving interface 604 to enable power to be received from the external power store.

[0085] The power receiving interface 604 may also be coupled to the controller 202 to enable direct communication between the controller 202 and an external device if required.

[0086] The electronics module 110 further comprises a wireless communicator 606. The wireless communicator 606 may utilise any communication protocol such as used for communication over: a wireless wide area network (WWAN), a wireless metro area network (WMAN), a wireless local area network (WLAN), a wireless personal area network (WPAN), Bluetooth ® Low Energy, Bluetooth ® Mesh, Thread, Zigbee, IEEE 802.15.4, Ant, a Global Navigation Satellite System (GNSS), a cellular communication network, or any other electromagnetic RF communication protocol. The cellular communication network may be a fourth generation (4G) LTE, LTE Advanced (LTE-A), LTE Cat-M1, LTE

Cat-M2, NB-IoT, fifth generation (5G), sixth generation (6G), and/or any other present or future developed cellular wireless network.

[0087] The electronics module 110 further comprises a sensor 608. The sensor 608 may comprise one or a combination of an optical sensor, temperature sensor, motion sensor, magnet sensor, and location sensor. Other sensors may also be included in the electronics module 110. The optical sensor may be arranged to measure optical signals from a skin surface of the wearer when the wearable article is worn. The sensor 608 may be provided instead of or in addition to sensing units in the wearable article.

[0088] FIG. 7 shows a more detailed schematic diagram for the example electronics module 110 shown in FIG. 4 and FIG. 6.

[0089] The electronics module 110 comprises a controller 202, sensing interface 204, first electrical contact 206, second electrical contact 208, sensor 608, power source 602, and power receiving interface 604 as described above.

[0090] The controller 202 comprises an internal memory 702. The controller 202 is also communicatively connected to an external memory 704 which in this example is a NAND Flash memory. The external memory 704 is used to for the storage of data when no wireless connection is available between the electronics module 110 and an external device such as a user electronic device (e.g., user electronic device 104 of FIG. 1). The external memory 704 may have a storage capacity of at least 1GB and preferably at least 2 GB.

[0091] The electronics module 110 also includes additional peripheral devices that are used to perform specific functions as will be described in further detail herein.

[0092] The power source 602 in this example is a lithium ion battery. The battery is rechargeable and charged via power receiving interface 604. The power receiving interface 604 is arranged to receive wireless power inductively. Of course, the present disclosure is not limited to recharging via inductive charging and instead other forms of charging such as a wired connection or far field wireless charging are within the scope of the present disclosure. Additional battery management functionality is provided in terms of a charge controller 706, battery monitor 708 and regulator 710. These components may be provided through use of a dedicated power management integrated circuit (PMIC).

[0093] The controller 202 is communicatively connected to a battery monitor 708 so that that the controller 202 may obtain information about the state of charge of the battery.

[0094] The electronics module 110 comprises a first wireless communicator 712 and a second wireless communicator 714.

[0095] The first wireless communicator 712 is arranged to communicatively couple with an external device over a first wireless communication protocol. The first wireless communication protocol may be a Bluetooth ® protocol, Bluetooth ® 5 or a Bluetooth ® Low Energy protocol but is not limited to any particular communication protocol. In the present embodiment, the first wireless communicator 712 is integrated into controller 202. The first wireless communicator 712 enables communication between the external device and the controller 202 for configuration and set up of the controller 202 and the peripheral devices as may be required. Configuration of the controller 202 and peripheral devices utilises the Bluetooth ® protocol in this example.

[0096] Other wireless communication protocols can also be used, such as used for communication over: a wireless wide area network (WWAN), a wireless metro area network (WMAN), a wireless local area network (WLAN), a wireless personal area network (WPAN), Bluetooth ® Low Energy, Bluetooth ® Mesh, Thread, Zigbee, IEEE 802.15.4, Ant, a Global Navigation Satellite System (GNSS), a cellular

communication network, or any other electromagnetic RF communication protocol. The cellular communication network may be a fourth generation (4G) LTE, LTE Advanced (LTE-A), LTE Cat-M1, LTE Cat-M2, NB-IoT, fifth generation (5G), sixth generation (6G), and/or any other present or future developed cellular wireless network.

[0097] The second wireless communicator 714 is arranged to communicatively couple with an external device using a second communication protocol. The external device is powered to induce a magnetic field in an antenna of the second wireless communicator 714. When the external device is placed in the magnetic field of the antenna of the second wireless communicator 714, the external device induces current in the second wireless communicator 714. This induced current is used to retrieve the information from a memory and transmit the same back to the external device. The controller 202 is arranged to energize the second wireless communicator 714 to transmit information.

[0098] In an example operation, the external device is a user electronic device (e.g., user electronic device 104 of FIG. 1). The user electronic device is brought into proximity with the electronics module 110. In response to this, the electronics module 110 is configured to energize the second wireless communicator 714 to transmit information to the user electronic device over the second wireless communication protocol. Beneficially, this means that the act of the user electronic device approaching the electronics module 110 energizes the second wireless communicator 714 to transmit the information to the user electronic device.

[0099] The information may comprise a unique identifier for the electronics module 110. The unique identifier for the electronics module 110 may be an address for the electronics module 110 such as a MAC address or Bluetooth ® address.

[0100] The information may comprise authentication information used to facilitate the pairing between the electronics modules 110 and the user electronic device over the first wireless communication protocol. This means that the transmitted information is used as part of an out of band (OOB) pairing process.

[0101] The information may comprise application information which may be used by the user electronic device to start an application on the user electronic device or configure an application running on the user electronic device. The application may be started on the user electronic device automatically (e.g., without user input). Alternatively, the application information may cause the user electronic device to prompt the user to start the application on the user electronic device. The information may comprise a uniform resource identifier such as a uniform resource location to be accessed by the user electronic device, or text to be displayed on the user electronic device for example. It will be appreciated that the same electronics module 110 can transmit any of the above example information either alone or in combination. The electronics module 110 may transmit different types of information depending on the current operational state of the electronics module 110 and based on information it receives from other devices such as the user electronic device.

[0102] The electronics module 110 has sensors 608 including a motion sensor 716, a temperature sensor 718, a magnetic field sensor 720, and a location sensor 722. It will be appreciated that not all of these sensors 608 are required in all examples and additional sensors, such as optical sensors, chemical sensors, humidity sensors, and pressure sensors may also be provided.

[0103] The location sensor 722 may be a GNSS (Global Navigation Satellite System) device which is arranged to provide location and position data for applications as required. In particular, the location sensor 722 provides geographical location data at least to a nation state level. Any device suitable for providing location, navigation or for tracking the position could be utilised. The GNSS device may include

Global Positioning System (GPS), BeiDou Navigation Satellite System (BDS) and the Galileo system devices.

[0104] The motion sensor 716 in this example is in the form of an inertial measurement unit (IMU) which may comprise an accelerometer and optionally one or both of a gyroscope and a magnetometer. A gyroscope/magnetometer is not required in all examples, and instead only an accelerometer may be provided, or a gyroscope/magnetometer may be present but put into a low power state.

[0105] The IMU can therefore be used to detect can detect orientation and gestures with event-detection interrupts enabling motion tracking and contextual awareness. It has recognition of free-fall events, tap and double-tap sensing, activity or inactivity, stationary/motion detection, and wakeup events in addition to 6D orientation. A single tap, for example, can be used enable toggling through various modes or waking the electronics module 110 from a low power mode.

[0106] Known examples of IMUs that can be used for this application include the ST LSM6DSOX manufactured by STMicroelectronics. This IMU a system-in-package IMU featuring a 3D digital accelerometer and a 3D digital gyroscope.

[0107] Another example of a known IMU suitable for this application is the LSM6DSO also be STMicroelectronics.

[0108] The IMU can include machine learning functionality, for example as provided in the ST LSM6DSOX. The machine learning functionality is implemented in a machine learning core (MLC). The machine earning processing capability uses decision-tree logic. The MLC is an embedded feature of the IMU 211 and comprises a set of configurable parameters and decision trees. As is understood in the art, decision tree is a mathematical tool composed of a series of configurable nodes. Each node is characterized by an "if-then-else" condition, where an input signal (represented by statistical parameters calculated from the sensor data) is evaluated against a threshold.

[0109] Decision trees are stored and generate results in the dedicated output registers. The results of the decision tree can be read from the application processor at any time. Furthermore, there is the possibility to generate an interrupt for every change in the result in the decision tree, which is beneficial in maintaining low-power consumption.

[0110] Decision trees can be generated using a known machine learning tool such as Waikato Environment for Knowledge Analysis software (Weka) developed by the University of Waikato or using MATLAB® or Python™.

[0111] The electronics module 110 further comprises a light source 724, such as a light emitting diode, for conveying status information about the electronics module 110 and/or the wearer of the electronics module 110. More generally, any form of output unit may be provided in addition to or instead of the light source 724. The output unit may comprise one or a combination of an audio output unit, a visual output unit (e.g., light source 724 or a display) and a haptic feedback unit.

[0112] The electronics module 110 also comprises conventional electronics components which are not shown in FIG. 7 including a power-on-reset generator, a development connector, a real time clock and a PROG header.

[0113] The electronics module 110 in this example comprises first wireless communicator 712 and second wireless communicator 714 but this is not required in all examples. More generally, the electronics module 110 may have one or a plurality of wireless communicators to enable the electronics module 110 to communicate wirelessly over an external device such as a user electronic device or a remote server.

[0114] The electronics module 110 may additionally comprise a Universal Integrated Circuit Card (UICC) that enables the garment to access services provided by a mobile network operator (MNO) or virtual mobile network operator (VMNO). The UICC may include at least a read-only memory (ROM) configured to store an MNO or VMNO profile that the garment can utilize to register and interact with an MNO or VMNO. The UICC may be in the form of a Subscriber Identity Module (SIM) card. The electronics module 110 may have a receiving section arranged to receive the SIM card. In other examples, the UICC is embedded directly into a controller of the electronics module 110. That is, the UICC may be an electronic/embedded UICC (eUICC). A eUICC is beneficial as it removes the need to store a number of MNO profiles, i.e. electronic Subscriber Identity Modules (eSIMs). Moreover, eSIMs can be remotely provisioned to garments. The electronics module 110 may comprise a secure element that represents an embedded Universal Integrated Circuit Card (eUICC).

[0115] The sensing interface comprises an analogue-to-digital frontend that couples signals received from the electrical contacts 206, 208 to the controller 206 and optionally an electrostatic discharge (ESD) protection circuit. The analogue-to-digital frontend is shown in detail in FIG. 8.

[0116] FIG. 8 is a schematic illustration of the component circuitry for the analogue-to-digital frontend 726 shown in FIG. 7.

[0117] In the example described herein, the analogue-to-digital frontend 726 is an integrated circuit (IC) chip which converts the raw analogue biosignal received via the sensing interface into a digital signal for further processing by the controller (e.g., controller 202 of FIG. 7). ADC IC chips are known, and any suitable one can be utilised to provide this functionality. ADC IC chips for ECG applications include, for example, the MAX30003 chip produced by Maxim Integrated Products Inc.

[0118] The analogue-to-digital frontend 726 includes an input 802 and an output 804.

[0119] Raw biosignals from the sensing interface (e.g., sensing interface 204 of FIG. 7) are input to the analogue-to-digital frontend 726, where received signals are processed in an ECG channel 806 and subject to appropriate filtering through high pass and low pass filters for static discharge and interference reduction as well as for reducing bandwidth prior to conversion to digital signals. The reduction in bandwidth is important to remove or reduce motion artefacts that give rise to noise in the signal due to movement of the sensors coupled to the sensing interface.

[0120] The output digital signals may be decimated to reduce the sampling rate prior to being passed to a serial programmable interface 808 of the analogue-to-digital frontend 726.

[0121] ADC front end IC chips suitable for ECG applications may be configured to determine information from the input biosignals such as heart rate and the QRS complex and including the R-R interval of the QRS complex. Support circuitry 810 provides base voltages for the ECG channel 806.

[0122] The determining of the QRS complex can be implemented for example using the known Pan Tomkins algorithm as described in Pan, Jiapu; Tompkins, Willis J. (March 1985). "A Real-Time QRS Detection Algorithm". IEEE Transactions on Biomedical Engineering. BME-32 (3): 230–236.

[0123] Signals are output to the controller via the serial programmable interface 808.

[0124] The controller can also be configured to apply digital signal processing (DSP) to the digital signal from the analogue-to-digital frontend 726.

[0125] The DSP may include noise filtering additional to that carried out in the analogue-to-digital frontend 726 and may also include additional processing to determine further information about the signal from the analogue-to-digital frontend 726.

[0126] The controller is configured to send the biosignals to an external device such as a user electronic device using a wireless communicator (e.g., first wireless communicator 712 of FIG. 7).

[0127] Referring to FIG. 9, there is shown a schematic diagram of a user electronic device 104 according to an example aspect of the present disclosure. The user electronic device 104 is in the form of a mobile phone or tablet and comprises a controller 902, a memory 904, a wireless communicator 906, a display 908, a user input unit 910, a capturing device in the form of a camera 912 and an inertial measurement unit 914. The controller 902 provides overall control to the user electronic device 104.

[0128] The user input unit 910 receives inputs from the user such as a user credential.

[0129] The memory 904 stores information for the user electronic device 104.

[0130] The display 908 is arranged to display a user interface for applications operable on the user electronic device 104.

[0131] The inertial measurement unit 914 provides motion and/or orientation detection and may comprise an accelerometer and optionally one or both of a gyroscope and a magnetometer.

[0132] The user electronic device 104 may also include a biometric sensor. The biometric sensor may be used to identify a user or users of device based on unique physiological features. The biometric sensor may be: a fingerprint sensor used to capture an image of a user's fingerprint; an iris scanner or a retina scanner configured to capture an image of a user's iris or retina; an ECG module used to measure the user's ECG; or the camera of the user electronic arranged to capture the face of the user. The biometric sensor may be an internal module of the user electronic device 104. The biometric module may be an external (stand-alone) device which may be coupled to the user electronic device 104 by a wired or wireless link.

[0133] The controller 902 is configured to launch an application which is configured to display insights derived from the biosignal data processed by the analogue-to-digital frontend (e.g., analogue-to-digital frontend 726 of FIG. 8) of the electronics module (e.g., electronics module 110 of FIG. 7) , input to electronics module controller (e.g., controller 202 of FIG. 7), and then transmitted from the electronics module. The transmitted data is received by the wireless communicator 906 of the user electronic device 104 and input to the controller 902.

[0134] Insights include, but are not limited to, heart rate, respiration rate, core temperature but can also include identification data for the wearer using the wearable assembly (e.g., wearable assembly 102 of FIG. 1).

[0135] The display 908 is also configured to display an ECG signal trace. To display a signal trace may use raw ECG data from the electronics module.

[0136] The display 908 may be a presence-sensitive display and therefore may comprise the user input unit 910 The presence-sensitive display may include a display component and a presence-sensitive input component. The presence sensitive display may be a touch-screen display arranged as part of the user input unit 910.

[0137] User electronic devices 104 in accordance with the present disclosure are not limited to mobile phones or tablets and may take the form of any electronic device which may be used by a user to perform the methods according to aspects of the present disclosure. The user electronic device 104 may be a smartphone, tablet personal computer (PC), mobile phone, smart phone, video telephone, laptop PC, netbook computer, personal digital assistant (PDA), mobile medical device, camera or wearable device. The user electronic device 300 may include a head-mounted device such as an Augmented Reality, Virtual

Reality or Mixed Reality head-mounted device. The user electronic device 104 may be desktop PC, workstations, television apparatus or a projector, e.g. arranged to project a display onto a surface.

[0138] In use, the electronics module is configured to receive raw biosignal data from the sensors of the wearable article and which are coupled to the controller via the sensing interface and the analogue-to-digital frontend 726 for further processing and transmission to the user electronic device 104 as described above. The data transmitted to the user electronics user electronic device 104 includes raw or processed biosignal data such as ECG data, heart rate, respiration data, core temperature, IMU data and other insights as determined, and as required.

[0139] The controller 902 is also operable to launch an application which is configured to receive, process and display data, such as raw or processed biosignal data, from the electronics module. A user, such as the wearer, is able to configure the application, using user inputs, to receive, process and display the received data in accordance with these user inputs.

[0140] The user electronic device 104 is arranged to receive the transmitted data from the electronics module via the communicator 906 and which are coupled to the controller 902, and then to process and display the data in accordance with the user configuration.

[0141] The controller 902 of the user electronics user electronic device 104 is operable to display information to a user on the display 908 as part of the user interface. Information displayed can be an ECG trace as well using raw data points transmitted from the electronics module. Other insights and data can be displayed on the display 908 as part of the user interface and as required. Examples might be a heart rate in beats per minute, core temperature data and respiration rate.

[0142] As described above, the electronics module 110 is coupled to the wearable article 108 so as to perform sensing functions. When not in use, the electronics module 110 is removed from the wearable article 108 and placed in a storing or charging location.

[0143] Aspects of the present disclosure relate to providing a garment hanger 1008 that can removably retain the electronics module 110 for storage and optionally to charge the electronics module 110. The garment hanger 1008 can also be used to hang the wearable article 108. This provides a convenient arrangement to store the wearable article 108 and the electronics module 110 together such that they are located with one another and are less likely to be accidently separated.

[0144] FIG. 10 shows a system 1002 comprising a garment hanger 1008 and an electronics module 110 according to aspects of the present disclosure.

[0145] The garment hanger 1008 comprises a hanging structure 1004 in the form of a hook portion and a body 1006 connected to the hanging structure 1004. The body 1006 comprises a central region 1014, a left shoulder support region 1010 extending from the central region 1014, and a right shoulder support region 1012 extending from the central region 1014. The left and right shoulder support portions 1010, 1012 slope downwardly from the central region 1014 to form an approximate inverted V shape.

[0146] The electronics module 110 is positioned on the body 1006 of the garment hanger 1008. The electronics module 110 is removably coupled to the garment hanger 1008.

[0147] FIG. 11 shows the garment hanger 1008 of FIG. 10 with the electronics module 110 removed. The central region 1014 of the body 1006 comprises a recess 1102 sized to receive the electronics module 110. Once positioned in the recess 1102, the electronics module 110 is retained by an attachment mechanism which may comprise the recess 1102 alone and optionally with other components. The attachment mechanism may include magnetic materials or may comprise elements such as studs, hook-

and-loop fasteners or clips. In some examples, the recess 1102 is tight enough to hold the electronics module 110 in place without the need for a separate attachment mechanism.

[0148] The recess 1102 comprises a first electrical contact 1104 and a second electrical contact 1106 which may electrically couple with the electronics module 110 to allow for power and/or data transfer. The electronics module 110 has corresponding first electrical contact 206 and second electrical contact 208 as shown in FIG. 5B.

[0149] In some examples, the garment hanger 1008 is used for charging the electronics module 110 in addition to storing the electronics module 110. The garment hanger 1008 can comprise a power transfer interface for transferring power to the electronics module 110. The power transfer interface may be a wired or wireless power transfer interface. The wired power transfer interface may make use of the first and second electrical contacts 1104, 1106. The wireless power transfer interface may make use of a wireless power transmitter such as an inductive coil positioned within the body 1006 of the garment hanger 1008.

[0150] The garment hanger 1008 may also comprise a power receiving interface so as to receive power from an external power store such as via a wired or wireless charging interface.

[0151] In some examples, the garment hanger 1008 may receive power via the hanging structure 1004. The hanging structure 1004 may receive power from conductive tracks on a hanging rail as described in UK Patent Application Publication No. GB 2331631 A,

[0152] FIG. 12 shows a schematic diagram of an example system 1002 according to aspects of the present disclosure. The system comprises a garment hanger 1008 (FIG. 10) and an electronics module 110 (FIG. 10). The electronics module 110 is removably coupled to the garment hanger 1008.

[0153] The garment hanger 1008 comprises a power receiving interface which comprises an antenna 1202. The antenna 1202 is suitable for receiving wireless energy over a long-range wireless power transfer mechanism. The antenna 1202 may be arranged to receive wireless energy over a frequency range suitable for wireless power transmission. In some examples, antenna 1202 is arranged to receive wireless energy at a frequency of 915 MHz as used by the Powercast (RTM) system. The antenna 1202 has a length suitable to receive wireless energy at the desired frequency. For a dipole antenna, the length is determined according to the equation:

[0154] Length (in metres) = 143/frequency (in MHz).

[0155] The garment hanger 1008 further comprises an RF-to-DC converter 1204 and a power transfer interface 1206.

[0156] The electronics module 110 comprises a power receiving interface 1212 and an energy store 1214.

[0157] The RF-to-DC converter 1204 coverts the wireless energy received from the antenna 1202 into a DC output and supplies the energy to the electronics module 110 via the power transfer interface 1206 and power receiving interface 1212. The interfaces may include a wired interface or a wireless (e.g. inductive) interface. That is, the power transfer interface 1206 may include a wireless transmitter and the power receiving interface 1212 may include a wireless receiver.

[0158] Although not required in all examples, the garment hanger 1008 further comprises a magnetic material 1208. The electronics module 110 also comprises a magnetic material 1210. Magnetic materials 1208, 1210 used to form a releasable magnetic coupling between the garment hanger 1008 and the electronics module 110.

[0159] At least some of the example embodiments described herein may be constructed, partially or wholly, using dedicated special-purpose hardware. Terms such as 'component', 'module' or 'unit' used herein may include, but are not limited to, a hardware device, such as circuitry in the form of discrete or integrated components, a Field Programmable Gate Array (FPGA) or Application Specific Integrated Circuit (ASIC), which performs certain tasks or provides the associated functionality. In some embodiments, the described elements may be configured to reside on a tangible, persistent, addressable storage medium and may be configured to execute on one or more processors. These functional elements may in some embodiments include, by way of example, components, such as software components, object-oriented software components, class components and task components, processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuitry, data, databases, data structures, tables, arrays, and variables.

[0160] Although the example embodiments have been described with reference to the components, modules and units discussed herein, such functional elements may be combined into fewer elements or separated into additional elements. Various combinations of optional features have been described herein, and it will be appreciated that described features may be combined in any suitable combination. In particular, the features of any one example embodiment may be combined with features of any other embodiment, as appropriate, except where such combinations are mutually exclusive. Throughout this specification, the term "comprising" or "comprises" means including the component(s) specified but not to the exclusion of the presence of others.

[0161] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0162] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0163] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A garment hanger comprising:

a hanging structure;

a body connected to the hanging structure, the body comprising a central region and left and right shoulder support regions extending from the central region,

wherein the body further comprises a recess sized to receive and removably retain an electronics module.

2. The garment hanger of claim 1, wherein the body further comprises a magnetic material arranged to magnetically couple with the electronics module when positioned in the recess.

3. The garment hanger of claim 1 or 2, further comprising a power transfer interface arranged to transfer power to the electronics module when positioned in the recess.

4. The garment hanger of claim 3, wherein the power transfer interface is arranged to form a conductive electrical connection with the electronics module when positioned in the recess.

5. The garment hanger of claim 3, wherein the power transfer interface comprises a wireless power transmitter arranged to wirelessly transfer power to the electronics module when positioned in the interface.

6. The garment hanger of any of claims 3 to 5, further comprising a power receiving interface arranged to receive power from an external power source for subsequent transfer to the electronics module via the power transfer interface.

7. The garment hanger of claim 6, wherein the power receiving interface is arranged to couple the garment hanger to a wired external power source.

8. The garment hanger of claim 6, wherein the power receiving interface is arranged to couple the garment hanger to a wireless external power source.

9. The garment hanger of claim 8, wherein the power receiving interface comprises an antenna arranged to receive wireless energy.

10. The garment hanger of claim 9, wherein the garment hanger is arranged to convert the received wireless energy into a DC output for supply to the electronics module via the power transfer interface.

11. A system comprising the garment hanger as claimed in any preceding claim and an electronics module.

Intellectual Property Office

Application No:	GB2213605.5	**Examiner:**	Mr Mat Smith
Claims searched:	1-11	**Date of search:**	14 February 2023

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-11	WO 2014/073983 A1 (LARSEN) See figures and description. In particular electronic display module 6 and page 20, lines 11-15.
X	1-11	CN 108013710 A (LIN) See figures and EPODOC abstract. In particular electric blower 2 and holder (recess) 11.
X	1-11	CN 205741668 U (ZHAO) See figures and EPODOC abstract. In particular controller 2, coupler socket 2 and bonder plug 22.
X	1-11	CN 209235652 U (ZHANG) See figures and EPODOC abstract. In particular removable ion generator 5.
A		US 2018/0289189 A1 (LAZZI et al) See figures and description. In particular power transfer arrangement 105, 115 & 110.
A		DE 102020126289 A1 (BRAY et al) See figures. In particular removable electrical connector 2.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A41D; A47G

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, Patent Fulltext

Intellectual Property Office

International Classification:

Subclass	Subgroup	Valid From
A47G	0025/14	01/01/2006