US 20050171451A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2005/0171451 A1**

Yeo et al. (43) **Pub. Date: Aug. 4, 2005**

(54) **SYSTEM AND METHOD FOR MANAGING GROWTH AND DEVELOPMENT OF A USER**

(76) Inventors: **Hyung-sok Yeo**, Yongin-si (KR); **Jin-sang Whang**, Suwon-si (KR); **Kyung-ho Kim**, Yongin-si (KR); **Jeong-hwan Lee**, Suwon-si (KR)

Correspondence Address:
LEE, STERBA & MORSE, P.C.
SUITE 2000
1101 WILSON BOULEVARD
ARLINGTON, VA 22209 (US)

(21) Appl. No.: **11/049,946**

(22) Filed: **Feb. 4, 2005**

(30) **Foreign Application Priority Data**

Feb. 4, 2004 (KR) 10-2004-0007232

Publication Classification

(51) **Int. Cl.**[7] **A61B 5/05**; A61B 5/04; A61B 5/00

(52) **U.S. Cl.** **600/547**; 600/300; 600/509

(57) **ABSTRACT**

In a system and method for managing growth and development of a user, e.g., a child, the system includes a biological information measuring module for acquiring at least two biological signals to be used for analyzing growth and development of the user, and for identifying the user by analyzing at least one biological signal of the at least two acquired biological signals and a biological information processing module for evaluating a development state and a growth level of the user according to the biological signals, for storing and managing personal data and the results of the evaluation of the user.

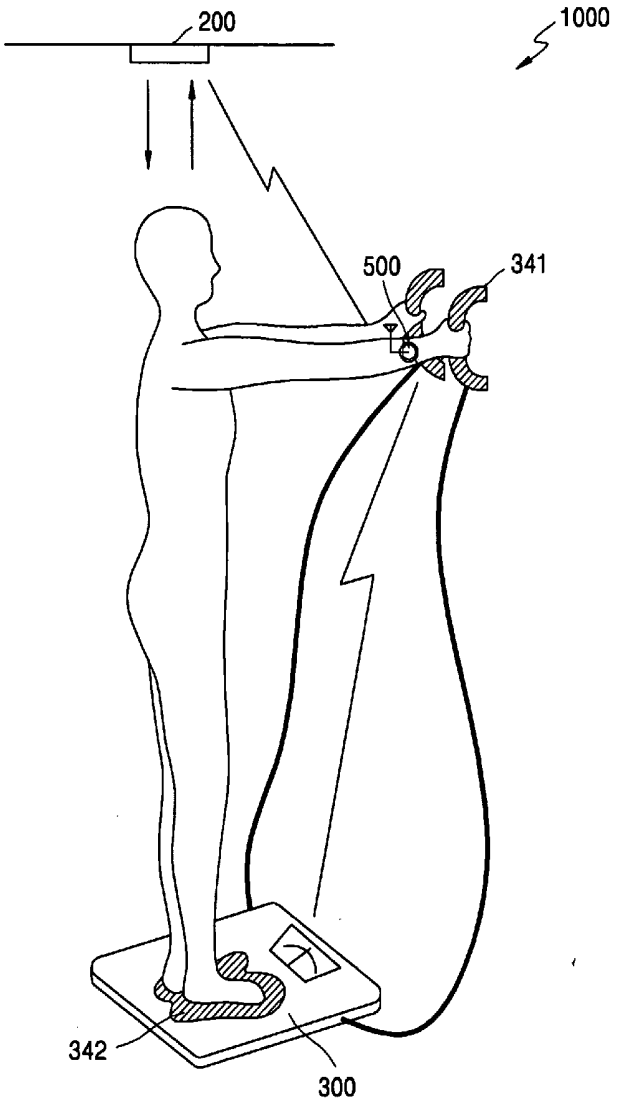


FIG. 1

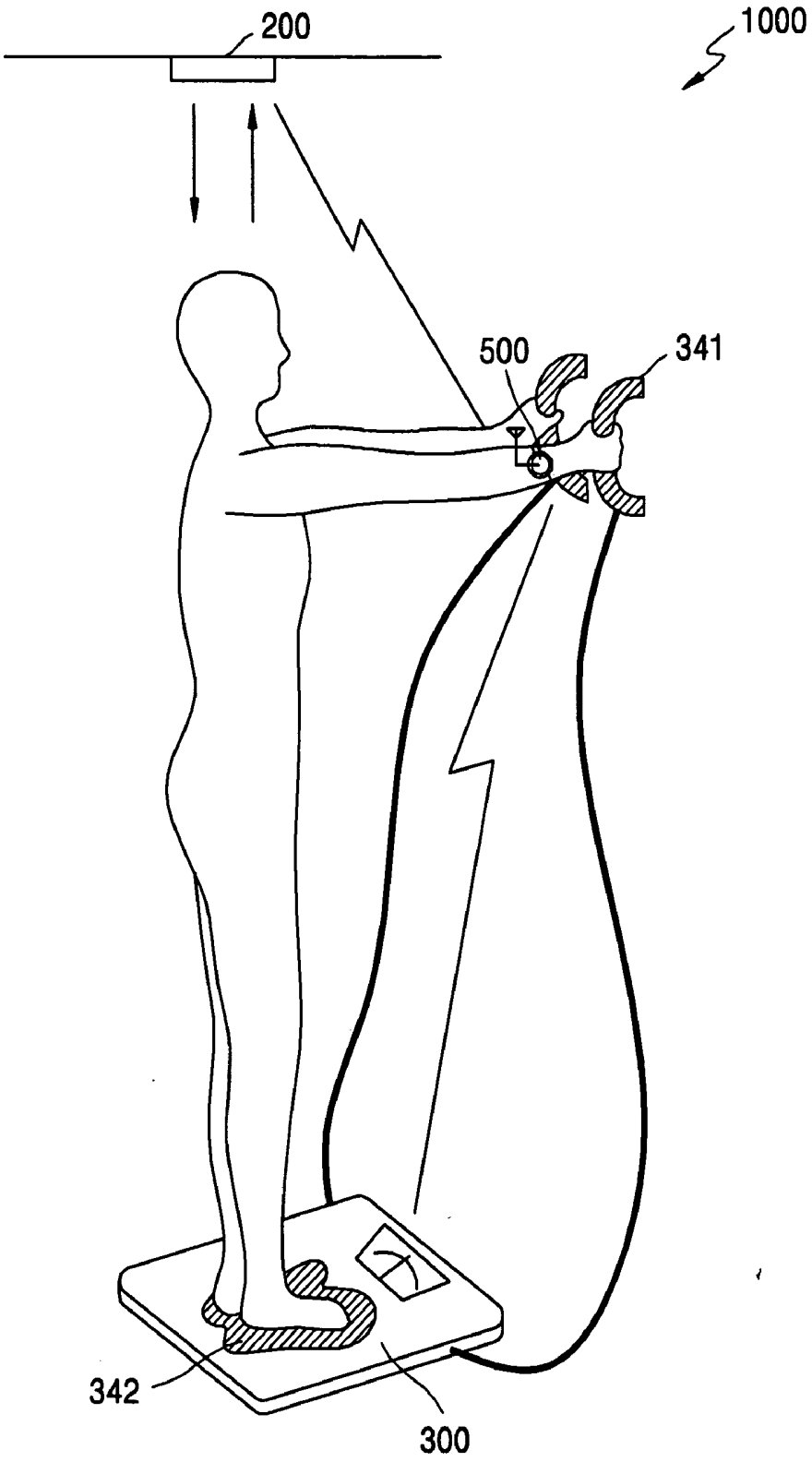


FIG. 2

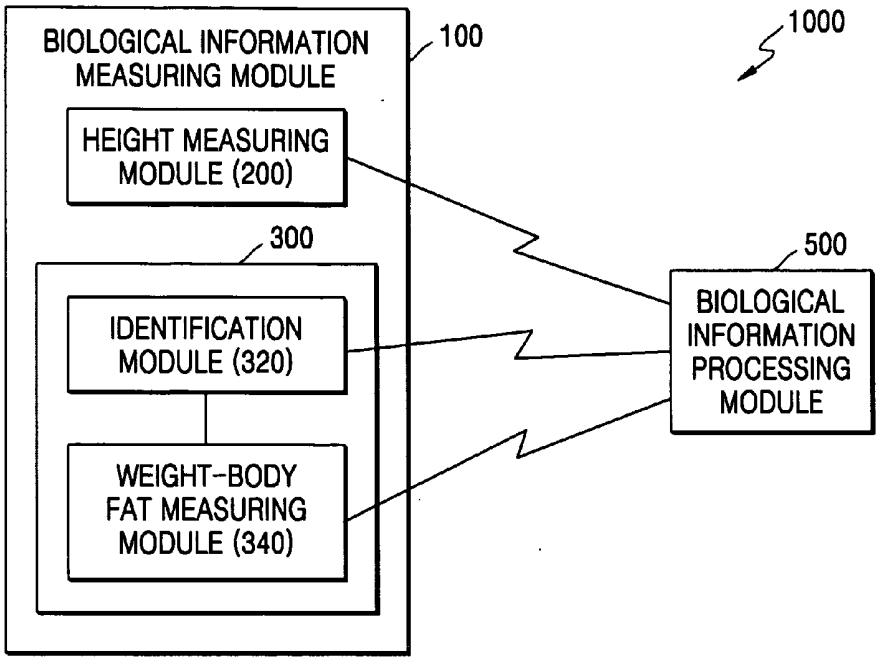

BIOLOGICAL INFORMATION MEASURING MODULE
100
1000
HEIGHT MEASURING MODULE (200)
300
500
IDENTIFICATION MODULE (320)
WEIGHT-BODY FAT MEASURING MODULE (340)
BIOLOGICAL INFORMATION PROCESSING MODULE

FIG. 3

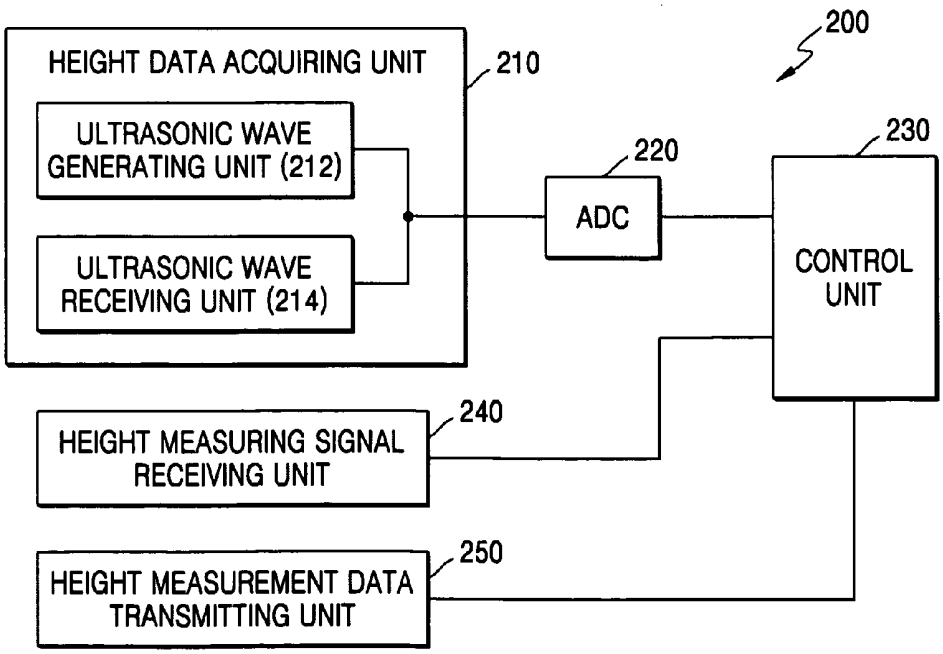

HEIGHT DATA ACQUIRING UNIT
210
200
ULTRASONIC WAVE GENERATING UNIT (212)
220
230
ADC
CONTROL UNIT
ULTRASONIC WAVE RECEIVING UNIT (214)
240
HEIGHT MEASURING SIGNAL RECEIVING UNIT
250
HEIGHT MEASUREMENT DATA TRANSMITTING UNIT

FIG. 4

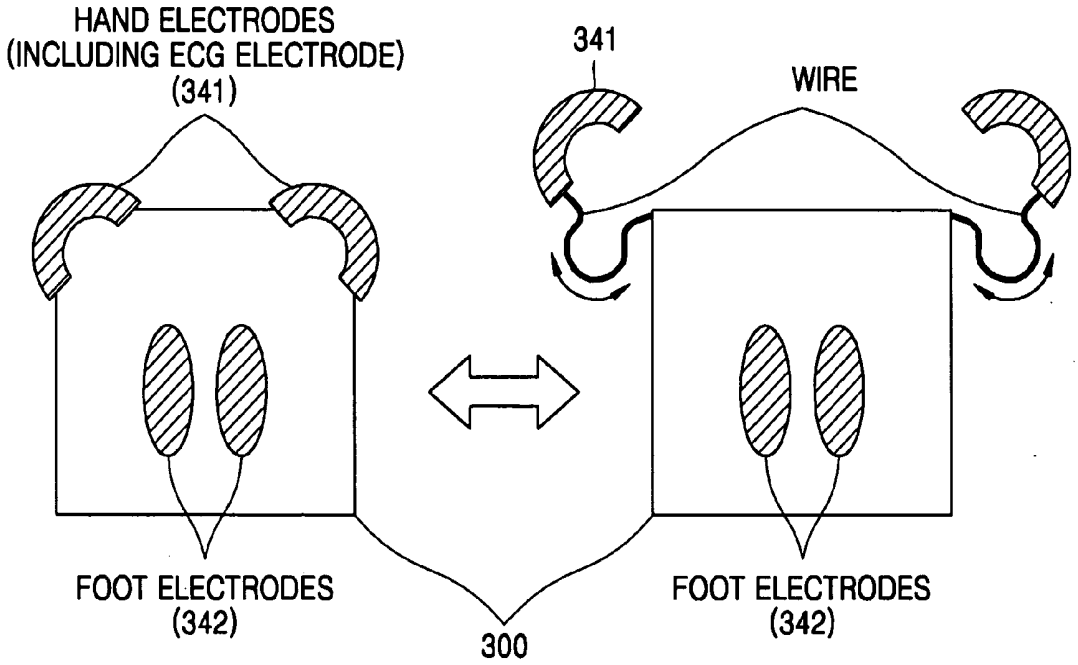

HAND ELECTRODES
(INCLUDING ECG ELECTRODE)
(341)
341
WIRE
FOOT ELECTRODES
(342)
300
FOOT ELECTRODES
(342)

FIG. 5

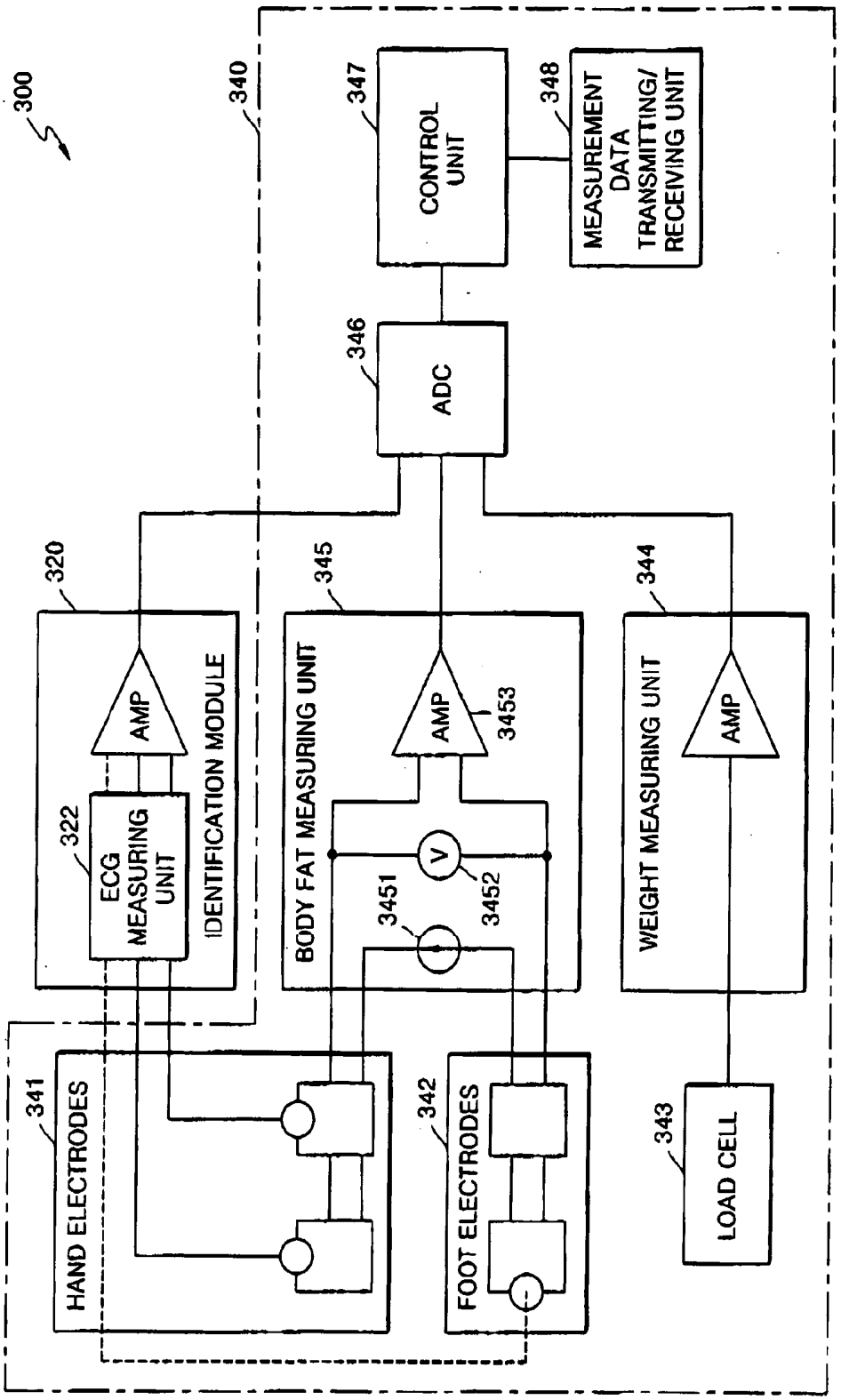

300
340
347
CONTROL UNIT
348
MEASUREMENT DATA TRANSMITTING/ RECEIVING UNIT
346
ADC
320
IDENTIFICATION MODULE
AMP
322
ECG MEASURING UNIT
345
BODY FAT MEASURING UNIT
AMP
3453
V
3451
3452
344
WEIGHT MEASURING UNIT
AMP
341
HAND ELECTRODES
342
FOOT ELECTRODES
343
LOAD CELL

FIG. 6

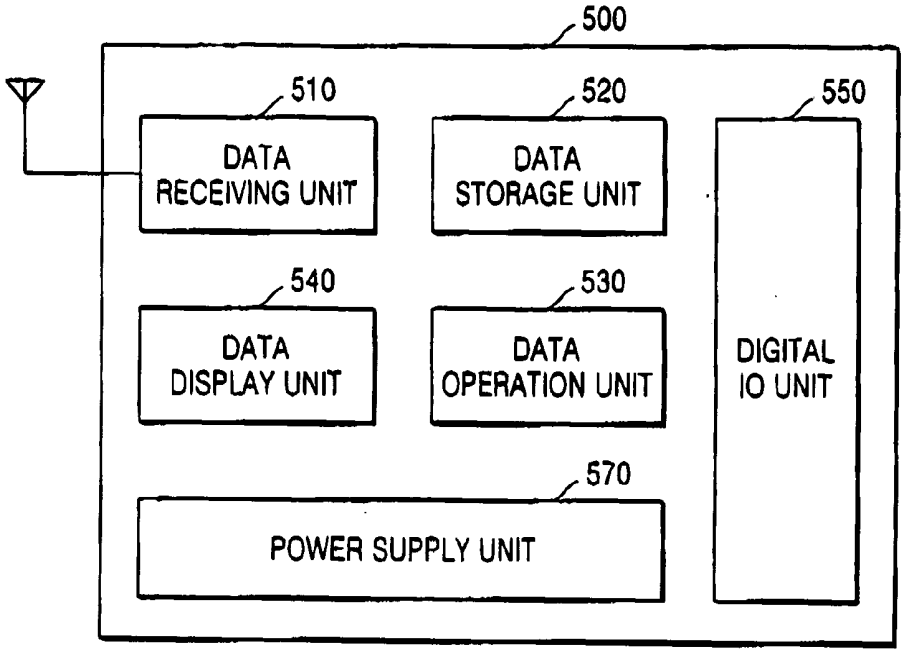

500
510
DATA RECEIVING UNIT
520
DATA STORAGE UNIT
550
DIGITAL IO UNIT
540
DATA DISPLAY UNIT
530
DATA OPERATION UNIT
570
POWER SUPPLY UNIT

FIG. 7

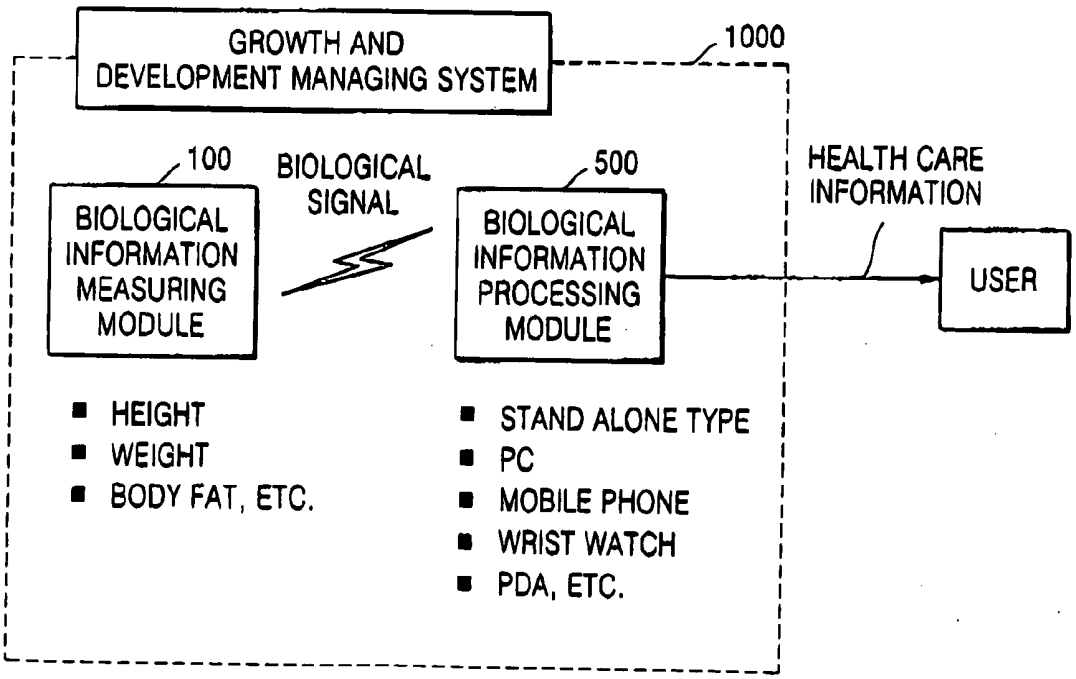

GROWTH AND DEVELOPMENT MANAGING SYSTEM
1000
100
BIOLOGICAL INFORMATION MEASURING MODULE
BIOLOGICAL SIGNAL
500
BIOLOGICAL INFORMATION PROCESSING MODULE
HEALTH CARE INFORMATION
USER
HEIGHT
WEIGHT
BODY FAT, ETC.
STAND ALONE TYPE
PC
MOBILE PHONE
WRIST WATCH
PDA, ETC.

FIG. 8

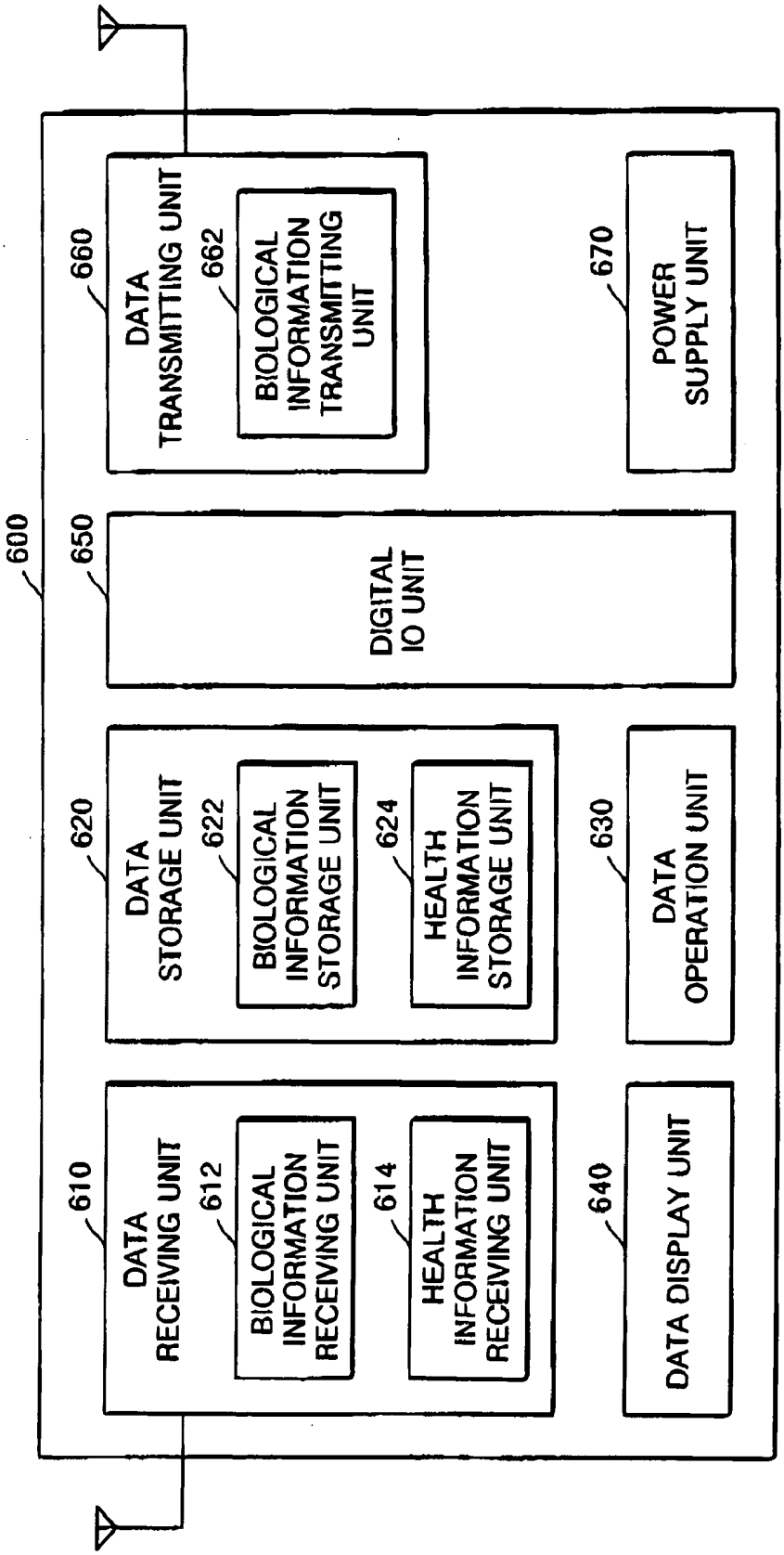

600
610
DATA RECEIVING UNIT
612
BIOLOGICAL INFORMATION RECEIVING UNIT
614
HEALTH INFORMATION RECEIVING UNIT
620
DATA STORAGE UNIT
622
BIOLOGICAL INFORMATION STORAGE UNIT
624
HEALTH INFORMATION STORAGE UNIT
630
DATA OPERATION UNIT
640
DATA DISPLAY UNIT
650
DIGITAL IO UNIT
660
DATA TRANSMITTING UNIT
662
BIOLOGICAL INFORMATION TRANSMITTING UNIT
670
POWER SUPPLY UNIT

FIG. 9

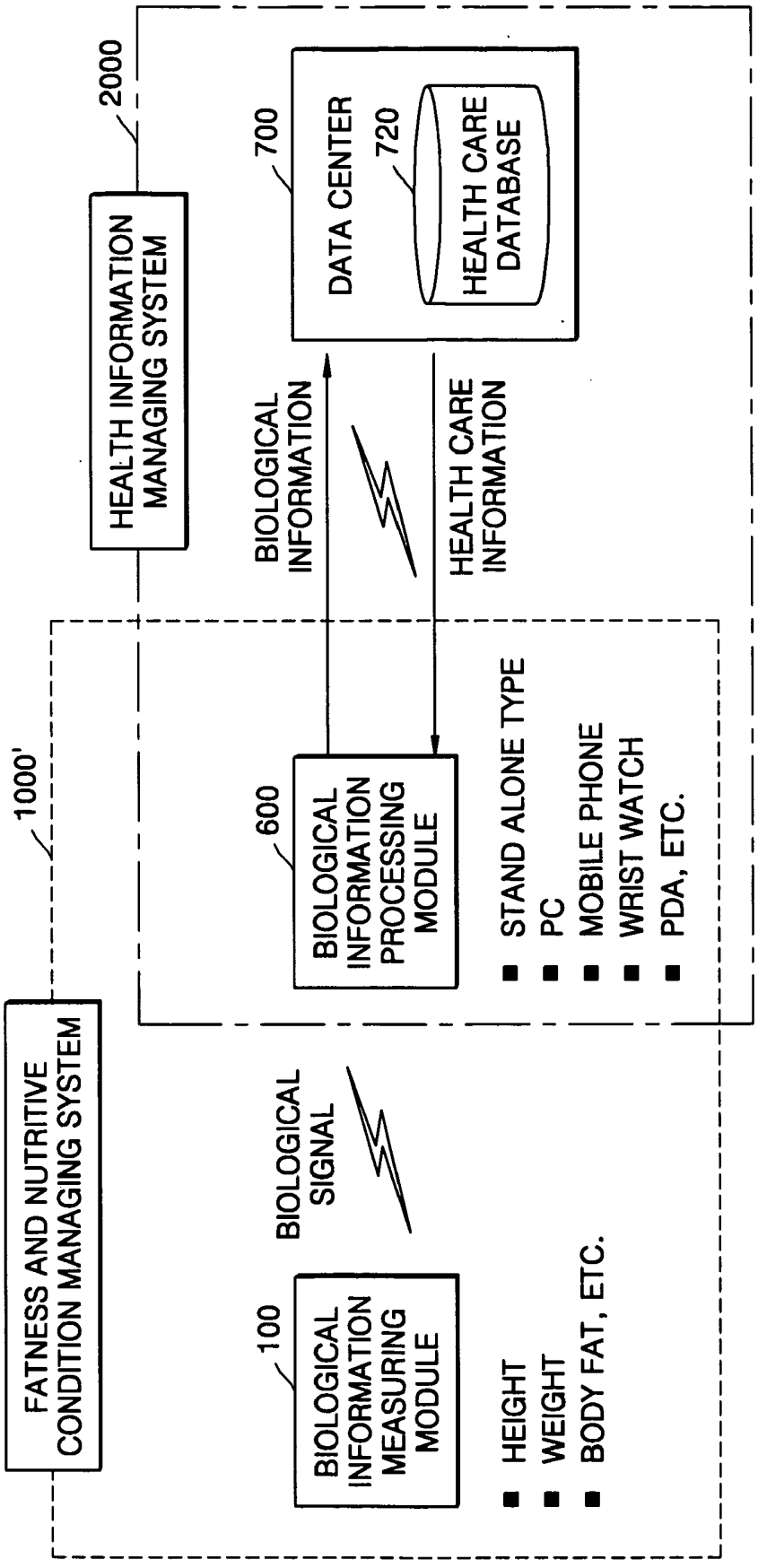

2000
HEALTH INFORMATION MANAGING SYSTEM
700
DATA CENTER
720
HEALTH CARE DATABASE
BIOLOGICAL INFORMATION
HEALTH CARE INFORMATION
1000'
600
BIOLOGICAL INFORMATION PROCESSING MODULE
STAND ALONE TYPE
PC
MOBILE PHONE
WRIST WATCH
PDA, ETC.
FATNESS AND NUTRITIVE CONDITION MANAGING SYSTEM
BIOLOGICAL SIGNAL
100
BIOLOGICAL INFORMATION MEASURING MODULE
HEIGHT
WEIGHT
BODY FAT, ETC.

FIG. 10

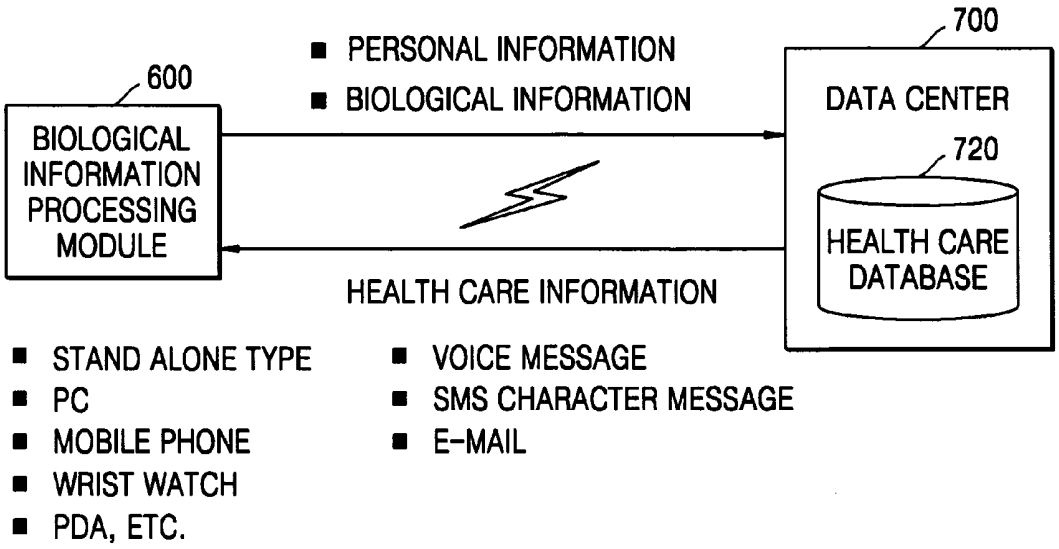

700
PERSONAL INFORMATION
BIOLOGICAL INFORMATION
600
DATA CENTER
BIOLOGICAL INFORMATION PROCESSING MODULE
720
HEALTH CARE DATABASE
HEALTH CARE INFORMATION
STAND ALONE TYPE
PC
MOBILE PHONE
WRIST WATCH
PDA, ETC.
VOICE MESSAGE
SMS CHARACTER MESSAGE
E-MAIL

FIG. 11

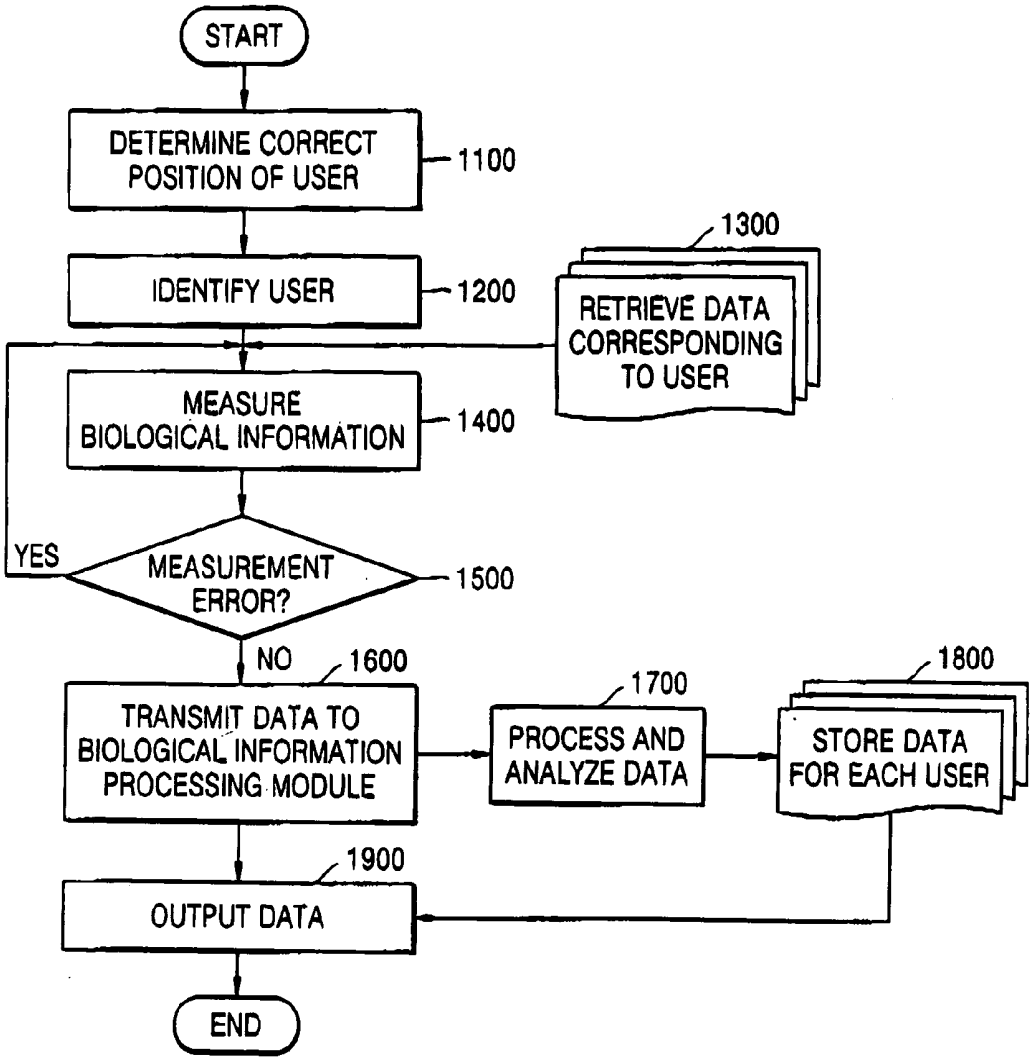

START
DETERMINE CORRECT POSITION OF USER
1100
IDENTIFY USER
1200
1300
RETRIEVE DATA CORRESPONDING TO USER
MEASURE BIOLOGICAL INFORMATION
1400
YES
MEASUREMENT ERROR?
1500
NO
1600
TRANSMIT DATA TO BIOLOGICAL INFORMATION PROCESSING MODULE
1700
PROCESS AND ANALYZE DATA
1800
STORE DATA FOR EACH USER
1900
OUTPUT DATA
END

FIG. 12

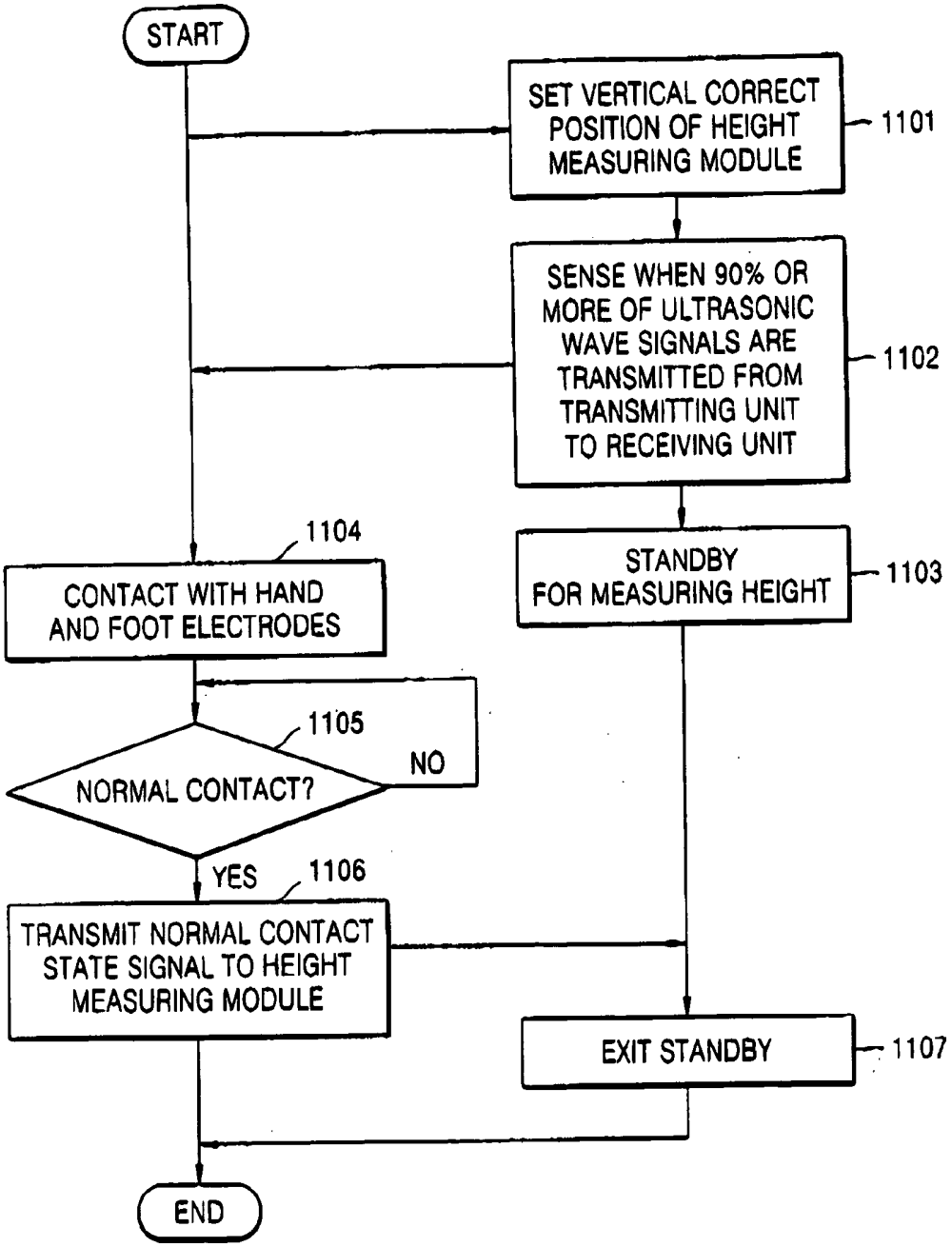

START
SET VERTICAL CORRECT POSITION OF HEIGHT MEASURING MODULE
1101
SENSE WHEN 90% OR MORE OF ULTRASONIC WAVE SIGNALS ARE TRANSMITTED FROM TRANSMITTING UNIT TO RECEIVING UNIT
1102
STANDBY FOR MEASURING HEIGHT
1103
1104
CONTACT WITH HAND AND FOOT ELECTRODES
1105
NORMAL CONTACT?
NO
YES
1106
TRANSMIT NORMAL CONTACT STATE SIGNAL TO HEIGHT MEASURING MODULE
EXIT STANDBY
1107
END

FIG. 13

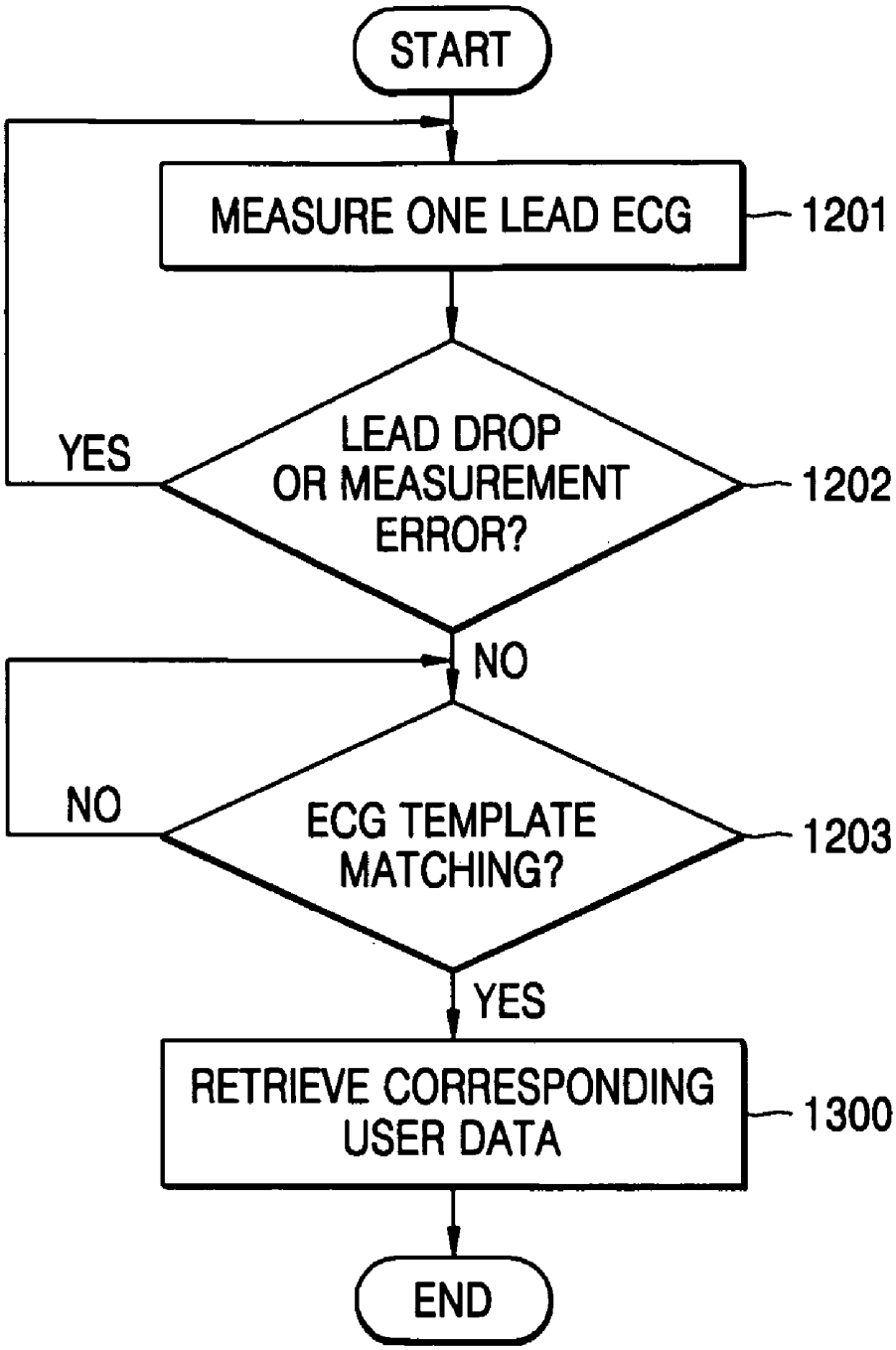

START
MEASURE ONE LEAD ECG
1201
LEAD DROP OR MEASUREMENT ERROR?
1202
YES
NO
ECG TEMPLATE MATCHING?
1203
NO
YES
RETRIEVE CORRESPONDING USER DATA
1300
END

FIG. 14

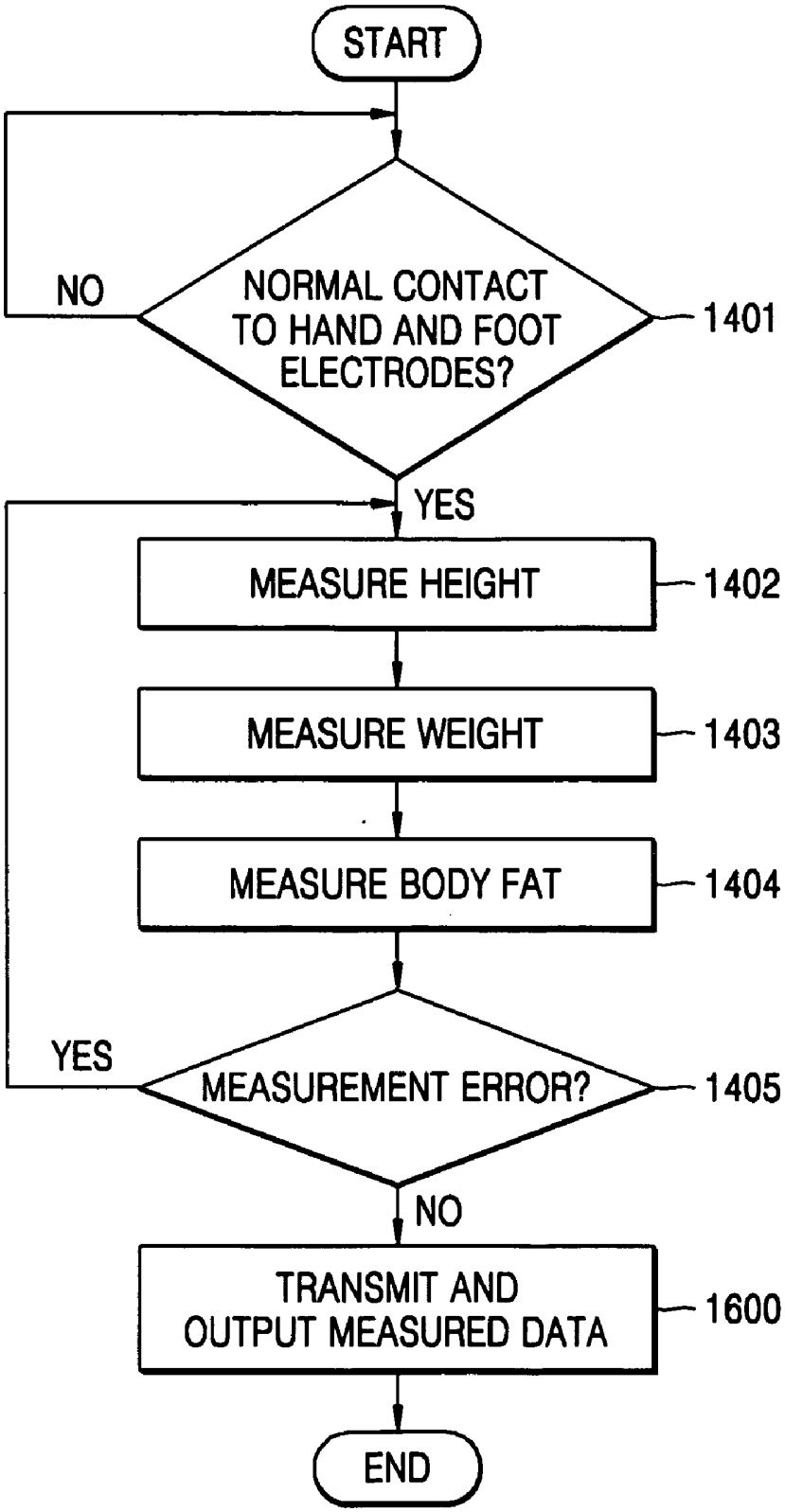

START
NORMAL CONTACT TO HAND AND FOOT ELECTRODES?
1401
NO
YES
MEASURE HEIGHT
1402
MEASURE WEIGHT
1403
MEASURE BODY FAT
1404
MEASUREMENT ERROR?
1405
YES
NO
TRANSMIT AND OUTPUT MEASURED DATA
1600
END

FIG. 15

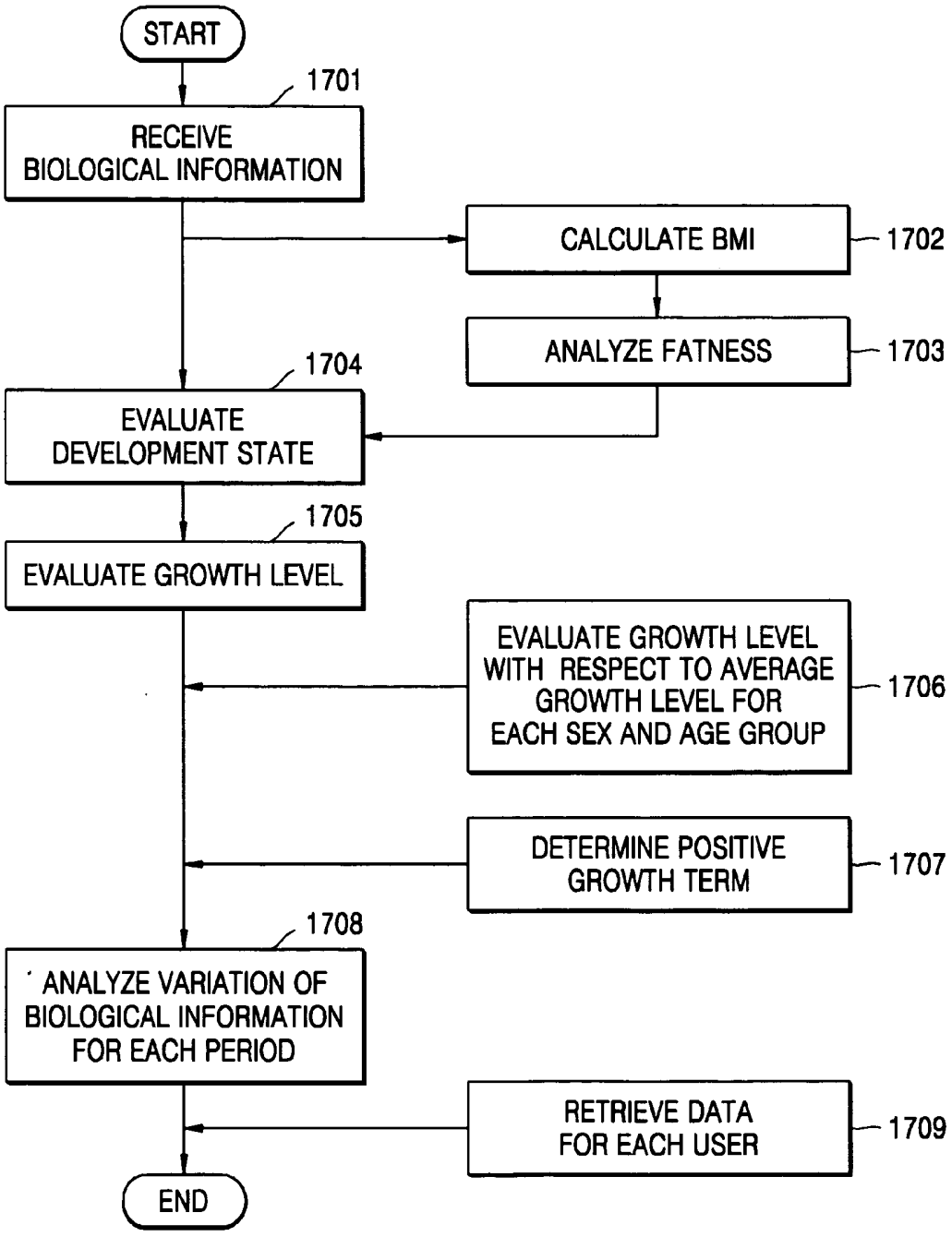

START
1701
RECEIVE BIOLOGICAL INFORMATION
CALCULATE BMI
1702
ANALYZE FATNESS
1703
1704
EVALUATE DEVELOPMENT STATE
1705
EVALUATE GROWTH LEVEL
EVALUATE GROWTH LEVEL WITH RESPECT TO AVERAGE GROWTH LEVEL FOR EACH SEX AND AGE GROUP
1706
DETERMINE POSITIVE GROWTH TERM
1707
1708
ANALYZE VARIATION OF BIOLOGICAL INFORMATION FOR EACH PERIOD
RETRIEVE DATA FOR EACH USER
1709
END

FIG. 16

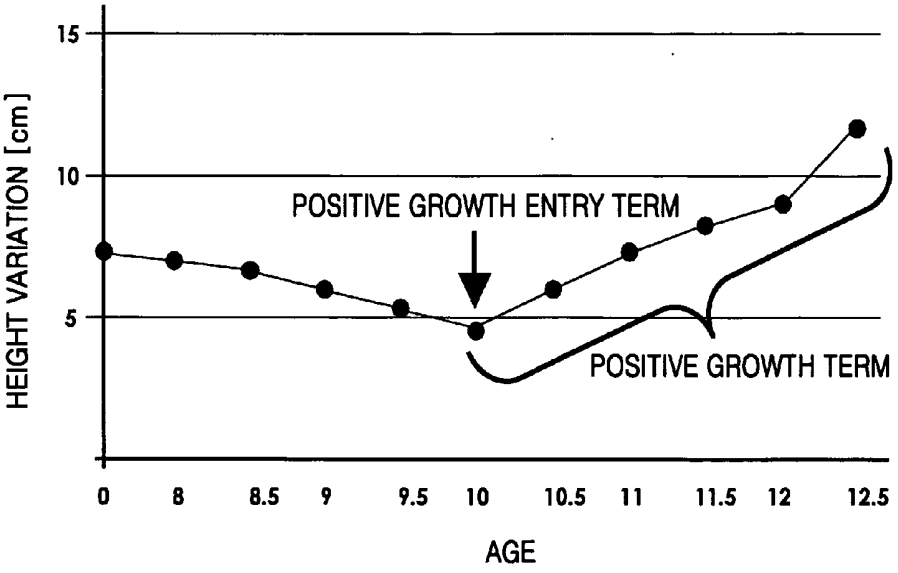
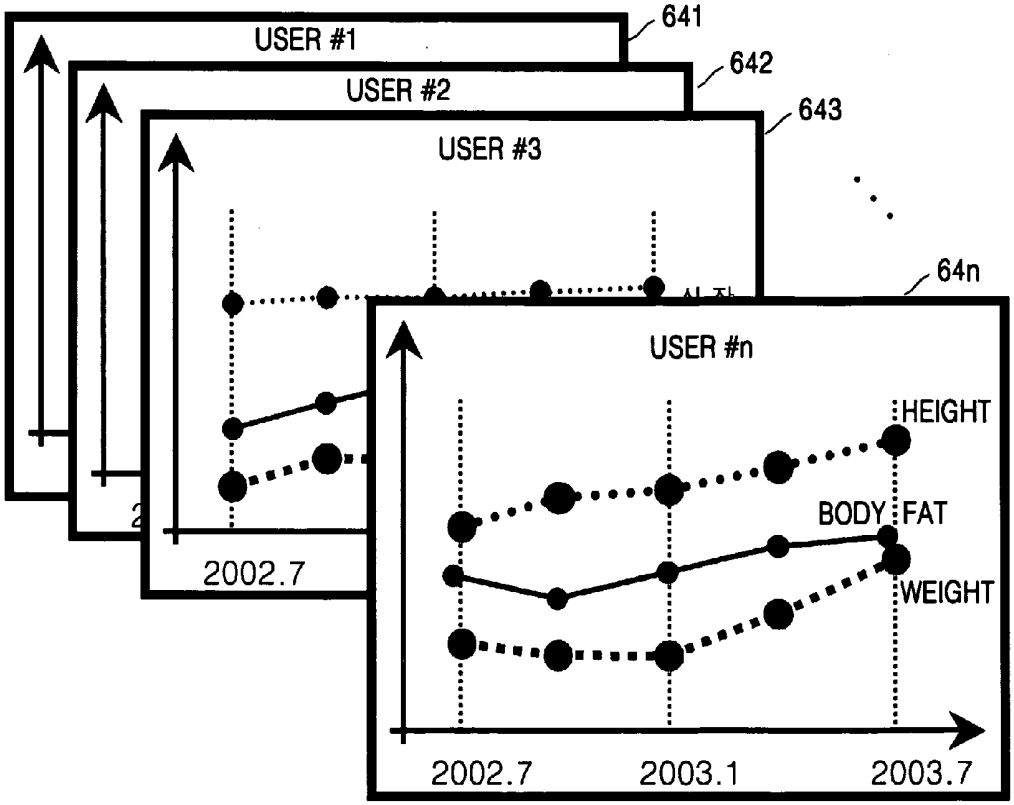

15
10
5
HEIGHT VARIATION [cm]
POSITIVE GROWTH ENTRY TERM
POSITIVE GROWTH TERM
0
8
8.5
9
9.5
10
10.5
11
11.5
12
12.5
AGE

FIG. 17


641
USER #1
642
USER #2
643
USER #3
64n
USER #n
HEIGHT
BODY FAT
WEIGHT
2002.7
2002.7
2003.1
2003.7

SYSTEM AND METHOD FOR MANAGING GROWTH AND DEVELOPMENT OF A USER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an apparatus and a method for measuring biological information. More particularly, the present invention relates to an apparatus and a method for measuring and managing biological information associated with growth and development of a user, e.g., a child.

[0003] 2. Description of the Related Art

[0004] In general, biological information reflecting degrees of growth of people, e.g., children, include, e.g., height, weight, and the like, and biological information reflecting development states of people, e.g., children, include factors such as data on fatness, etc., which is obtained by measuring body fat of a person, e.g., a child. The data such as height, weight, and the like, which are used as barometers for evaluating a growth degree, are the most basic biological information reflecting the growth degrees of a human body. The body fat data, which is used as a barometer for evaluating a development state, is widely used as a parameter reflecting nutritive conditions of a human body. For example, the body fat data is also important as a parameter for managing personal appearance, i.e., being thin or obese, and can be also used for diagnosing the development of children and the nutritive conditions of people, e.g., children, the elderly or the infirm.

[0005] Generally, biological information can be obtained by measuring growth data and development data with individual measuring modules. However, conventional biological information measuring apparatuses are only to supply the biological information, such as weight, height, body fat, etc., individually, and not comprehensively. More specifically, conventional biological information measuring apparatuses do not supply the health data for managing growth and development states of children for periods of time (e.g., daily, weekly, monthly, etc.) and do not provide solutions, e.g., customized exercise data, diet, rest, etc., suitable for the development states of the individual.

[0006] Further, since most biological information measuring apparatuses operate manually, there are disadvantages in that a certain degree of error always exists. Furthermore, since conventional measuring apparatuses occupy large spaces, there is a disadvantage in that it is difficult to move and store the measuring apparatuses.

SUMMARY OF THE INVENTION

[0007] The present invention is therefore directed to an apparatus and a method for measuring and managing biological information associated with growth and development of an individual user, e.g., a child, which substantially overcome one or more of the problems due to the limitations and disadvantages of the related art.

[0008] It is a feature of an embodiment of the present invention to provide a system and a method for managing growth and development of a user, e.g., a child, the system and the method comprehensively supplying data on a growth and development state of the child and solutions such as exercise, rest, diet, etc., suitable for a current condition of the child by collecting and analyzing biological information, e.g., height, weight, body fat, etc., of the child and showing time-sequential transition results in the same kind of biological information of the child, the data having been stored for a predetermined period.

[0009] It is another feature of an embodiment of the present invention to provide a system and a method for managing growth and development of a user, e.g., a child, which may be easily used at any location since a space for a biological signal measuring device is minimized to facilitate portability and storage of the biological signal measuring device.

[0010] It is still another feature of an embodiment of the present invention to provide a computer readable recording medium on which a program for executing the method with a computer is recorded.

[0011] At least one of the above features and other advantages may be provided by a system for managing growth and development of a user, the system including a biological information measuring module for acquiring at least two biological signals to be used for analyzing growth and development of the user, and for identifying the user by analyzing at least one biological signal of the at least two acquired biological signals, and a biological information processing module for evaluating a development state and a growth level of the user according to the biological signals, for storing and managing personal data and the results of the evaluation of the user.

[0012] The system may further include a data center for receiving biological information, the personal data, and the result of the evaluation of the development state and the growth level of the user from the biological information processing module, for analyzing information required for a health condition and health care of the user, and for supplying the health-relevant information of the user at predetermined periods.

[0013] The biological information measuring module may include a height measuring module for measuring a height of the user using ultrasonic waves, and an integrated identification-weight-body fat module for measuring an electrocardiogram, a weight, and a bioelectric impedance of the user, for identifying the user by analyzing the measured electrocardiogram, and for analyzing a body fat value from the bioelectric impedance.

[0014] The height measuring module may include a height data acquiring unit for applying the ultrasonic waves to a head portion of the user and for sensing ultrasonic waves reflected from the head portion of the user, an analog-to-digital converter for converting the sensed ultrasonic waves into digital data, a control unit for calculating the height of the user based on the digitized ultrasonic wave data, and a data transmitting unit for transmitting the calculated height data to the biological information processing module.

[0015] The identification-weight-body fat measuring module may include an identification module for identifying the user by comparing the measured electrocardiogram with previously-registered electrocardiogram templates, and a weight-body fat measuring module for measuring the weight and the bioelectric impedance of the user and for analyzing the body fat value from the measured bioelectric impedance.

[0016] The weight-body fat measuring module may include hand electrodes for contacting hands of the user and for acquiring the electrocardiogram and bioelectric impedance signal, foot electrodes for contacting feet of the user and for acquiring the electrocardiogram and bioelectric impedance signal, a load cell for contacting the feet of the user and acquiring a weight signal, a weight measuring unit for amplifying the weight signal acquired by the load cell, a body fat measuring unit for measuring the bioelectric impedance signal by flowing a predetermined amount of current through the hand electrodes and the foot electrodes and measuring voltages across the electrodes, and for amplifying the measured bioelectric impedance signal, an analog-to-digital converter for converting the amplified weight signal and the amplified bioelectric impedance signal into digital weight data and digital bioelectric impedance data, respectively, a control unit for calculating the weight of the user by averaging the digital weight data, and for calculating the body fat by analyzing the digital bioelectric impedance data, and a data transmitting/receiving unit for transmitting the weight and the body fat data calculated by the control unit to the biological information processing module and for receiving the personal data of the user from the biological information processing module.

[0017] The identification module may include an electrocardiogram measuring unit for amplifying the electrocardiogram acquired through the hand electrodes and the foot electrodes, wherein the electrocardiogram amplified by the electrocardiogram measuring unit are compared with the electrocardiogram templates in the control unit in order to identify the user, and the personal data is received by the data transmitting/receiving unit.

[0018] The biological information processing module may include a data receiving unit for receiving wirelessly the biological information transmitted from the biological information measuring module, a data storage unit for storing the received biological information for the user, a data operation unit for analyzing the biological information, for evaluating the development state and the growth level, and for analyzing tendencies of variations in growth and development of the user by period, a data display unit for outputting the analyzed result to the user, a digital input and output controller for controlling the data input and output of the data receiving unit, the data storing unit, the data operation unit, and the data display unit, and a power supply unit for supplying electric power to the biological information processing module.

[0019] The biological information processing module may further include a data transmitting unit for transmitting the biological information, the personal data, and the evaluated result of the development state and the growth level of the user to the data center, and a data receiving unit for receiving the health-relevant data supplied from the data center and for providing the health-relevant data to the user.

[0020] The biological information processing module may be provided in one selected from the group including a stand-alone type device, a personal computer, a mobile phone, a wrist watch, and a personal digital assistant.

[0021] The data center may include a health care database for storing the health care data for the user, and the health care data may be supplied to the biological information processing module by one selected from the group including a voice message, a short message service, and an electronic mail.

[0022] At least one of the above features and other advantages may be provided by a method of managing growth and development of a user, the method including determining whether the user is positioned at a correct position for measurement of biological information, identifying the user based on at least one biological signal acquired from an integrated identification-weight-body fat measuring module, retrieving previously registered data of the identified user and measuring biological information of the user, transmitting the measured biological information to a biological information processing module, and evaluating a development state and a growth level of the user in response to the biological information and storing the result of the evaluation of the user.

[0023] The method may further include transmitting the biological information, personal data, and the result of the evaluation of the development state and growth level of the user to a data center, and receiving and analyzing the biological information, the personal data, and the result of the evaluation of the development state and growth level of the user, and supplying the analyzed health-relevant information at a series of predetermined periods to the biological information processing module.

[0024] Evaluating the development state and a growth level of the user may include calculating a body mass index based on the biological information and analyzing a weight and a fatness based on a body mass index table, analyzing the weight and the fatness of the user based on bioelectric impedance measured from the user when the fatness is above a predetermined value, evaluating the growth level of the user based on average heights and average weights for each sex and age, determining a positive growth entry term and a positive growth term in consideration of an increment rate in height of the user, and analyzing variation of the biological information by period by analyzing a tendency of the analyzed results for a predetermined period.

[0025] After an age of the user is over six years old, the positive growth entry term may be represented by an inflection point where a slope of a height increment rate curve for a period of the latest six months is converted into a positive (+) value from a negative (−) value or zero (0).

[0026] The positive growth term may be a term when the slope of the curve maintains the positive slope for six months or longer or when the slope of the curve becomes steeper with respect to the positive growth entry term.

[0027] At least one of the above features and other advantages may be provided by a computer readable recording medium on which a program for executing any of the above-described methods is recorded.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The above and other features and advantages of the present invention will become more apparent to those of ordinary skill in the art by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[0029] **FIG. 1** illustrates a diagram of a system for managing growth and development of a user, e.g., a child, according to an exemplary embodiment of the present invention;

[0030] **FIG. 2** is a block diagram schematically illustrating a configuration of the system shown in **FIG. 1**;

[0031] **FIG. 3** is a block diagram illustrating in detail a height measuring module shown in **FIGS. 1 and 2**;

[0032] **FIG. 4** illustrates a diagram of an identification-weight-body fat measuring module shown in **FIGS. 1 and 2**;

[0033] **FIG. 5** is a block diagram illustrating in detail a configuration of the identification-weight-body fat measuring module shown in **FIGS. 1 and 2**;

[0034] **FIG. 6** is a block diagram illustrating a configuration of biological information processing module according to an embodiment of the present invention;

[0035] **FIG. 7** is a block diagram illustrating an overall configuration of a system for managing growth and development of a child to which the biological information processing module shown in **FIG. 6** is applied;

[0036] **FIG. 8** is a block diagram illustrating a configuration of a biological information processing module according to another embodiment of the present invention;

[0037] **FIG. 9** is a block diagram illustrating a configuration of a fatness and nutritive condition managing system and health information managing system to which the biological information processing module shown in **FIG. 8** is applied;

[0038] **FIG. 10** illustrates a data flow between the biological information processing module and a data center shown in **FIG. 9**;

[0039] **FIG. 11** is a flowchart illustrating a method of measuring and analyzing growth and development of a user, e.g., a child, according to an exemplary embodiment of the present invention;

[0040] **FIG. 12** is a flowchart illustrating in detail an operation of determining a correct position of a user shown in **FIG. 11**;

[0041] **FIG. 13** is a flowchart illustrating in detail an operation of identifying a user shown in **FIG. 11**;

[0042] **FIG. 14** is a flowchart illustrating in detail an operation of measuring biological information shown in **FIG. 11**;

[0043] **FIG. 15** is a flowchart illustrating in detail an operation of processing and analyzing data shown in **FIG. 11**;

[0044] **FIG. 16** is a graph illustrating an operation of determining a positive growth term shown in **FIG. 15**; and

[0045] **FIG. 17** illustrates screens for analyzing growth and development of a user, e.g., a child, according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0046] Korean Patent Application No.10-2004-0007232, filed on Feb. 4, 2004, in the Korean Intellectual Property Office, and entitled: "System and Method for Managing Growth and Development of a Child," is incorporated by reference herein in its entirety.

[0047] The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the concept of the invention to those skilled in the art. Like reference numerals and characters indicate like elements throughout.

[0048] **FIG. 1** illustrates a diagram of a system **1000** for managing growth and development of a user, e.g., a child, according to an exemplary embodiment of the present invention. **FIG. 2** is a block diagram schematically illustrating a configuration of the system **1000** shown in **FIG. 1**.

[0049] Referring to **FIGS. 1 and 2**, the system **1000** for managing growth and development of a user, e.g., a child, generally includes a biological information measuring module **100** and a biological information processing module **500**. The biological information measuring module **100** may include a height measuring module **200** and an identification-weight-body fat measuring module **300**. The identification-weight-body fat measuring module **300** may include an identification module **320** and a weight-body fat measuring module **340**. Since each of these modules may have a radio communication port, they are able to communicate with each other wirelessly when physically separated from one another.

[0050] The height measuring module **200** included in the biological information measuring module **100** measures a height of a user using ultrasonic waves, and transmits, e.g., wirelessly, the measured results by user to the biological information processing module **500**. The identification-weight-body fat measuring module **300** analyzes electrocardiogram (ECG) signals acquired from hand electrodes **341** in contact with palms of the user and foot electrodes **342** in contact with soles of both feet of the user, while or before measuring the height with the height measuring module **200**. In addition, the identification-weight-body fat measuring module **300** identifies the user. Then, weight and body fat of the identified user are comprehensively measured, and the measured results for each user are transmitted, e.g., wirelessly, to the biological information processing module **500**. In this case, because the identification is automatically recognized through each of the analyzed ECG signals and information on the recognized user is transmitted to the biological information processing module **500**, it is not necessary for a user to input individual data for registering whenever biological information is measured. Consequently, the biological information processing module **500** can systematically manage growth and development data for each user, including health-relevant information on the corresponding user.

[0051] The biological information processing module **500** receives the biological information transmitted from the biological information measuring module **100**, e.g., via the radio communication port, analyzes the biological information, i.e., height, weight, body fat data, evaluates a development state and a growth level of the user, and analyzes growth and development variations for a series of predetermined periods. Then, the received biological information and the analyzed results are stored and managed in a

predetermined storage area. The biological information processing module **500** may be a stand-alone type device, or may be embodied in a personal computer (PC), a mobile phone, a wrist watch, a personal digital assistant (PDA), or other similar device.

[**0052**] The system **1000** for managing growth and development of a user, e.g., a child, is portable and detachable and suitable for use at any location, e.g., at home or while traveling. Particularly, since the system **1000** may perform a function of measuring and managing data of children, it is constructed such that a basic measuring procedure is easy and simple and various biological information can be processed quickly and accurately through a batch procedure. Further, the system **1000** manages health-relevant data, e.g., fatness and nutritive condition, etc., for each user and each period, as well as managing growth and development of a child. Accordingly, the system can comprehensively supply additional information, e.g., health information, exercise information, diet, etc. for each period to each individual user, as will be further described in connection with **FIG. 9**. As noted above, the system is equally applicable to adults.

[**0053**] **FIG. 3** is a detailed block diagram of the height measuring module shown in **FIGS. 1 and 2**. The height measuring module **200**, which uses an ultrasonic wave sensor, is portable and can be easily set-up. For example, the height measuring module **200** may be placed virtually anywhere on a ceiling to measure a user's height.

[**0054**] Referring to **FIG. 3**, the height measuring module **200** may include a height data acquiring unit **210**, an analog-to-digital converter (ADC) **220**, a control unit **230**, a height measuring signal receiving unit **240**, and a height measurement data transmitting unit **250**.

[**0055**] The height data acquiring unit **210** irradiates a user's head with ultrasonic waves using the Doppler effect and then senses the reflected ultrasonic waves. The height data acquiring unit **210** may include an ultrasonic wave generating unit **212** for irradiating the user with ultrasonic waves and an ultrasonic wave receiving unit **214** for receiving the ultrasonic waves reflected from the user.

[**0056**] The received analog-type ultrasonic waves acquired from the height data acquiring unit **210** are converted into a digital ultrasonic wave data by the ADC **220**. The digital ultrasonic wave data is input to the control unit **230**. The control unit **230** may include one of a microprocessor, a central processing unit (CPU), a digital signal processor (DSP), and another corresponding processor. The control unit **230** responds to height measuring signals received from the height measuring signal receiving unit **240** and the ultrasonic wave data, and calculates a user's height. After a user is positioned in a predetermined measuring position, the calculated user height is obtained by subtracting a distance from the ceiling to a top of the user's head from a distance from the ceiling to an upper surface of the identification-weight-body fat measuring module **300**, which is positioned vertically below the height data acquiring unit **210**. After the user's height is calculated by the control unit **230**, it is transmitted, e.g., wirelessly, to the biological information processing module **500** by the height measurement data transmitting unit **250**.

[**0057**] As described above, since the height measuring module **200** measures a user's height without contacting the user through the use of ultrasonic waves, errors and disadvantages can be reduced, as compared to a manual measurement. Also, a space occupied by the height measuring device may be reduced.

[**0058**] **FIG. 4** illustrates a diagram of the identification-weight-body fat measuring module shown in **FIGS. 1 and 2**. **FIG. 5** is a detailed block diagram illustrating a configuration of the identification-weight-body fat measuring module shown in **FIGS. 1 and 2**.

[**0059**] Referring to **FIGS. 4 and 5**, the identification-weight-body fat measuring module **300** is able to measure a user's weight, body fat, and ECG signals all at once. A load cell **343** for measuring weight is included in a main body of the identification-weight-body fat measuring module **300**. Further, two foot electrodes **342** for measuring body fat are at a top portion of the main body of the identification-weight-body fat measuring module **300**, and two hand electrodes **341** for measuring body fat are removably attached to two corners of the main body of the identification-weight-body fat measuring module **300**.

[**0060**] The foot electrodes **342** are fixed to the top portion of the main body of the identification-weight-body fat measuring module **300**, but the hand electrodes **341** are wired to the main body of the identification-weight-body fat measuring module **300** to provide flexibility of movement during a measurement. More specifically, when a user pulls the hand electrodes **341**, a wire extends from the main body to each of the hand electrodes **341** so that the user may raise the hand electrodes **341** to the user's side. Further, when the user releases the hand electrodes **341**, the wires connecting the hand electrodes **341** are retracted into the main body of the identification-weight-body fat measuring module **300** in order for the hand electrodes **341** to return to the corner positions of the main body.

[**0061**] The hand electrodes **341** and the foot electrodes **342** are commonly used for measuring body fat and ECG. When a user steps on the foot electrodes **342** and grasps the hand electrodes **341**, the identification-weight-body fat measuring module **300** identifies the user by measuring the ECG signal before measuring the biological signals. The identification-weight-body fat measuring module **300** then measures a weight of the identified user and a bioelectric impedance input from the hand electrodes **341** and the foot electrodes **342**. The measured biological signals are then transmitted, e.g., wirelessly, to the biological information processing module **500**.

[**0062**] More specifically, the identification-weight-body fat measuring module **300** performs substantially simultaneously operations of identifying a user by measuring the ECG signal, measuring a user's weight, and measuring the user's bioelectric impedance using electrodes in contact with the user's hands and feet, all while the height measuring module **200** is measuring the user's height.

[**0063**] The weight-body fat measuring module **340** may include the hand electrodes **341**, the foot electrodes **342**, the load cell **343**, a weight measuring unit **344**, a body fat measuring unit **345**, an ADC **346**, a control unit **347**, and a measurement data transmitting/receiving unit **348**. An identification module **320** may include an ECG measuring unit **322**, and shares the hand and foot electrodes **341**, **342** as ECG electrodes in order to process the ECG signal acquired

from the ECG measuring unit **322** by sharing the ADC **346**, the control unit **347**, and the measurement data transmitting/receiving unit **348**.

[**0064**] An operation performed in each module will now be described in greater detail.

[**0065**] First, the identification module **320** transmits an amplified ECG signal to the ADC **346** after amplifying by a predetermined magnitude the ECG signal input from the hand electrodes **341** and the foot electrodes **342** through the ECG measuring unit **322**. An ECG record method used for measuring the ECG signal may be performed through electrodes of a right hand and a left hand by a first standard limb lead, may be performed through electrodes of a right hand and a left foot by a second standard limb lead, and may be performed through electrodes of a left hand and a left foot by a third standard limb lead.

[**0066**] After receiving the digitized ECG signals from the ADC **346**, the control unit **347** analyzes the ECG signal, and identifies the user by comparing the analyzed ECG signal with ECG templates of registered user's. When the input ECG signal is equal to one of the registered ECG signals, the control unit **347** retrieves the identified user's personal data, e.g., a user's name, birth date, sex, blood type, basic medical history, and the like, which are stored in the biological information processing module **500** through the measurement data transmitting/receiving unit **348**. As a result, biological information, e.g., fat condition information and nutritive condition information, can be measured without repetitively inputting information required for managing the user's growth and development, e.g., data regarding the user's name, birth date, sex, blood type, basic medical history, etc. In this case, combined information of weight, bioelectric impedance, body fat, etc., as well as the ECG signal acquired from the user, may be also used as information for identifying a user.

[**0067**] Next, an operation of each functional block constituting the weight-body fat measuring module **340** will be described.

[**0068**] The weight measuring unit **344** receives a user's weight data sensed by the load cell **343** when a user steps onto the identification-weight-body fat measuring module **300**, amplifies the received data, and transmits the amplified data to the ADC **346**. At this time, data used for measuring weight is data acquired during the few seconds before the user's hands contact the hand electrodes **341** after the user steps onto the identification-weight-body fat measuring module **300**. The control unit **347** receives the digitized weight data from the ADC **346**, calculates an average of the received weight data, and outputs the average as the user's weight. Further, the output weight data are transmitted, e.g., wirelessly, to the biological information processing module **500** through the measurement data transmitting/receiving unit **348**.

[**0069**] When a user contacts both foot electrodes **342** and both hand electrodes **341** of the identification-weight-body fat measuring module **300**, the body fat measuring unit **345** measures the bioelectric impedance of the user. A bioelectric impedance measuring method is a method of estimating a water amount, a muscle amount, a fat amount, etc., of a human body by measuring electric resistance or impedance of the human body when the human body contacts the electrodes **341** and **342** and a weak alternating current flows through the human body. The body fat measuring unit **345** may include a current source **3451** for flowing a predetermined current between the two electrode pairs **341** and **342**, a voltage meter **3452** for measuring a voltage between the two electrode pairs **341** and **342**, and an amplifier **3453** for amplifying the voltage measured in the voltage meter **3452**. Bioelectric impedance data measured in the body fat measuring unit **345** is amplified by the amplifier **3453** and is transmitted to the ADC **346**. A control unit **347** receives digitized bioelectric impedance data from the ADC **346** and analyzes body fat components from the received bioelectric impedance data. The analyzed body fat data is transmitted, e.g., wirelessly, to the biological information processing module **500** through the measurement data transmitting/receiving unit **348**.

[**0070**] **FIG. 6** is a block diagram illustrating a configuration of a biological information processing module according to an embodiment of the present invention. **FIG. 7** is a block diagram illustrating an overall configuration of the system to which the biological information processing module shown in **FIG. 6** is applied.

[**0071**] Referring to **FIG. 6**, the biological information processing module **500** may include a data receiving unit **510**, a data storage unit **520**, a data operation unit **530**, a data display unit **540**, a digital input and output (digital **10**) unit **550**, and a power supply unit **570**. The biological information processing module **500** analyzes, stores, and manages the biological information transmitted, e.g., wirelessly, from the biological information measuring module **100**.

[**0072**] The data receiving unit **510**, which receives the biological information from the biological information measuring module **100**, may have a radio data receiver for receiving the biological information wirelessly from the biological information measuring module **100**. The data storage unit **520** sorts and stores the biological information received from the data receiving unit **510** for each user. The data operation unit **530** analyzes growth and development data of a user, e.g., a child, through a statistical process and a predetermined analyzing algorithm of the received biological information. The analyzed results by the data operation unit **530** are transmitted to the data storage unit **520** and are stored for each user, and the analyzed results or the biological information stored in the data storage unit **520** are supplied to the user by the data display unit **540**. The data display unit **540** may have a speaker (not shown) for outputting relevant data audibly and a display device, e.g., liquid crystal display (LCD), or the like, for outputting the analyzed biological information visually. The digital **10** unit **550** controls input/output of the data receiving unit **510**, the data storage unit **520**, the data operation unit **530**, and the data display unit **540**. The power supply unit **570** supplies electric power required by the biological information processing module **500**.

[**0073**] Referring to **FIG. 7**, the biological information processing module **500** together with the biological information measuring module **100** is included in the system **1000**. The biological information processing module **500** receives, e.g., wirelessly, analyzes, and manages for each user the biological information of height, weight, body fat, etc. measured by the biological information measuring module **100**. The biological information processing module **500**

may be embodied in an exclusive platform, i.e., a stand alone type, for managing the user's growth and development information, or may alternatively be embodied in a mobile phone, a PDA, or a wrist-watch typed potable terminal, etc.

[0074] As a configuration and function of the growth and development managing system **1000** is extended so that the biological information processing module **500** can remotely interact with a data center (see **700** of **FIG. 9**) as well as the biological information measuring module **100**, the system can supply fatness and nutritive condition managing services and health information managing services for any individual.

[0075] The configuration of the biological information processing module having such extended functions will now be described.

[0076] **FIG. 8** is a block diagram illustrating a configuration of the biological information processing module according to another embodiment of the present invention. **FIG. 9** is a block diagram illustrating a configuration of a fatness and nutritive condition managing system and a health information managing system to which the biological information processing module shown in **FIG. 8** is applied.

[0077] Referring to **FIG. 8**, the biological information processing module **600** performs functions of analyzing the biological information transmitted, e.g., wirelessly, from the biological information measuring module **100** to manage fatness and nutritive conditions, and of storing and managing health care information for each user transmitted, e.g., wirelessly, from the data center (see **700** of **FIG. 9**). The biological information processing module **600** may include a data receiving unit **610**, a data storage unit **620**, a data operation unit **630**, a data display unit **640**, a digital **10** unit **650**, a data transmitting unit **660**, and a power supply unit **670**.

[0078] The data receiving unit **610** may include a biological information receiving unit **612** and a health information receiving unit **614**. The data receiving unit **610** receives the biological information transmitted from the biological information measuring module **100** and the health care information for each user transmitted from the data center **700** of **FIG. 9**. The data storage unit **620** may include a biological information storage unit **622** and a health information storage unit **624**. The data storage unit **620** stores the biological information and the health care information for each user received from the biological information receiving unit **612** and the health information receiving unit **614**. Particularly, since a user identification function is provided to the fatness and nutritive condition managing system **1000'** to which the biological information processing module **600** is applied and a health information managing system **2000**, the data storage unit **620** manages the biological information and the health care information for each user according to a user recognition result.

[0079] The data operation unit **630** analyzes a fatness and nutritive condition management information of a user, e.g., a child, through a statistical process and a predetermined analysis algorithm on the received biological information. The analyzed results are then transmitted to the data storage unit **620**, are stored for each user, and are transmitted, e.g., wirelessly, to the data center through the digital **10** unit **650** and the data transmitting unit **660**. Alternatively, the analyzed results or the biological information stored to the data storage unit **620** may be supplied directly to a user through the data display unit **640**. The data display unit **640** may have a speaker (not shown) to output related information audibly and a display device, e.g., an LCD, etc., to output the analyzed biological information visually.

[0080] The data transmitting unit **660** may include a biological information transmission unit **662** and transmits the analyzed results of the biological information to the data center **700** of **FIG. 9**. The digital **10** unit **650** controls the input/output of the data receiving unit **610**, the data storage unit **620**, the data operation unit **630**, the data display unit **640**, and the data transmitting unit **660**. The power supply unit **670** supplies electric power required by the biological information processing module **600**.

[0081] As described above, the biological information processing module **600** shown in **FIG. 8** performs functions of processing and managing biological information for each user as in the biological information processing module **500** shown in **FIG. 6** and may perform additional functions of exchanging and managing health information, such as customized health information for each predetermined period for each user based on height, weight, body fat, etc., with the data center **700**, which may be remotely located. Therefore, the module can systematically supply the growth and development data for each user, including health-relevant information, on a corresponding user.

[0082] Referring to **FIG. 9**, the biological information processing module **600** together with the biological information measuring module **100** is included in the fatness and nutritive condition managing system **1000'**, and the biological information processing module **600** is also included in the health information managing system **2000**. The biological information processing module **600** receives, analyzes, and manages for each user biological information related to height, weight, body fat, etc. measured from the biological information measuring module **100**. Further, the biological information processing module **600** together with the data center **700** is included in the health information managing system **2000**. The biological information processing module **600** analyzes, stores, and manages the biological information transmitted, e.g., wirelessly, from the biological information measuring module **100**, and stores and manages the health care information for each user transmitted, e.g., wirelessly, from the data center **700**. The biological information processing module **600** may be embodied in an exclusive platform, i.e., a stand alone type, a mobile phone, a PDA, a wrist-watch typed potable terminal, etc. for managing the user growth and development data or fat and nutritive management data and health-relevant information.

[0083] The data center **700** may be remotely situated from the biological information processing module **600**. The data center **700** may include a health care data database **720**, and stores the health-relevant information for each user to a database.

[0084] **FIG. 10** is a diagram illustrating data flow between the biological information processing module **600** and the data center **700** shown in **FIG. 9**.

[0085] Referring to **FIG. 10**, the data center **700** analyzes the health care information of a user for each period, e.g., daily, weekly, monthly, based on the biological information,

e.g., height, weight, body fat data, and the user personal information, e.g., sex, age, basic medical history, transmitted from the biological information processing module **600**, performs statistical processes and analytic algorithms on the health care information and the user personal information, and then separates the performed results for each user and stores the separated results to the health care information database **720**. Further, the data center **700** can make the biological information processing module **600** integrally supply the health care information to a user by transmitting back the health care information for each user stored in the health care information database **720** to the biological information processing module **600**. The health care information may be supplied as a voice message, a short message service (SMS), an e-mail, etc., to a user or a user may retrieve relevant data by logging in the data center **700**.

[**0086**] **FIG. 11** is a flowchart illustrating a growth and development measuring and analyzing method to be performed in a system **1000** for managing growth and development of a child, according to an exemplary embodiment of the present invention.

[**0087**] Referring to **FIG. 11**, the system **1000** for managing growth and development of a child determines, in operation **1100**, whether a user is standing in a correct position for the measurement of the biological information. In operation **1200**, the system **1000** identifies a user by acquiring an ECG signal from the user through the integrated identification-weight-body fat measuring module **300**. At this time, a combination of weight information, bioelectric impedance information, body fat information, etc. acquired from the user, as well as the ECG signal, may be used in the identification process. After a user is identified, in operation **1300**, the registered data related to the user is retrieved, and thus a pre-process for measurement is completed.

[**0088**] Next, in operation **1400**, biological information, e.g., height, weight, body fat data, etc., is measured by the biological information measuring module **100**. In operation **1500**, it is determined whether there is an error in the measured biological information. When there is an error in the measured biological information, the process returns to operation **1400** and the biological information is measured again. When there is no error in the measured biological information, in operation **1600**, the measured biological information is transmitted, e.g., wirelessly, to the biological information processing module **500**.

[**0089**] Next, in operation **1700**, after the biological information processing module **500** processes and analyzes the biological information transmitted from the biological information measuring module **100**, the analyzed results are stored for each user in operation **1800**. The analyzed results stored in operation **1800** may be stored for each user in the biological information processing module **500**, and may be stored to a database at the data center **700**. In operation **1900**, such biological information stored for each user is output to a user in a voice message, a SMS, an e-mail, etc., through the biological information processing module **500**. Additionally, a user may retrieve relevant data by logging into the data center **700**.

[**0090**] **FIG. 12** is a detailed flow chart for determining whether a user is standing at a correct position shown in **FIG. 11**.

[**0091**] Referring to **FIG. 12**, in operation **1101**, the system **1000** sets a vertical correct position of the height measuring module **200** for determining whether a user is standing at a correct position. The vertical correct position setting process performed in operation **1101** is a process of normally implementing the ultrasonic wave generating unit **212** and the ultrasonic wave receiving unit **214** on the ceiling and the floor, respectively, of a room for measuring height and is performed during initialization of the system **1000**.

[**0092**] Next, in operation **1102**, when 90% or more of ultrasonic wave signals generated from the ultrasonic wave generating unit **212** is sensed in the ultrasonic wave receiving unit **214**, it is determined that the height measuring module **200** is functioning normally.

[**0093**] When, in operation **1102**, it is determined that the height measuring module **200** is functioning normally, in operation **1103**, a process of measuring height is on standby, and, in operation **1104**, the user's hands and feet contact the hand and the foot electrodes **341** and **342**, respectively, of the integrated identification-weight-body fat measuring module **300**. Then, in operation **1105**, it is determined whether the contact state of electrodes is normal by confirming whether the hand and foot electrodes **341** and **342** of the identification-weight-body fat measuring module **300** are normally contacted to a user's hands and feet. For example, if four or eight electrodes normally contact a user's hands and feet when measuring body fat, a voltage drop starts from a saturated bioelectric impedance. The contact state of the electrodes is determined to be normal if there is no abnormality a few seconds after the start of the voltage drop.

[**0094**] After operation **1105** and when the contact state of electrodes is determined to be normal, in operation **1106**, the integrated identification-weight-body fat measuring module **300** transmits signals that the contact state of the electrodes is normal to the ultrasonic wave generating unit **212** in the height measuring module **200**. In operation **1107**, the height measuring module **200** in a standby mode for measurement exits the standby mode and completes preparation for measurement.

[**0095**] **FIG. 13** is a detailed flow chart illustrating a user identifying process shown in **FIG. 11**.

[**0096**] Referring to **FIG. 13**, in order to identify a user, in operation **1201**, the identification-weight-body fat measuring module **300** in the system **1000** measures an ECG signal through the hand electrodes **341** and the foot electrodes **342** contacted to the user's hands and feet, respectively. In operation **1202**, it is determined whether leads connected to the hand and foot electrodes **341**, **342** are dropped or there is an error in the measurement of the ECG signal. When there is an error in measuring the ECG signal, the process returns to operation **1201** and the ECG signal is measured again. When there is no error in the measurement of the ECG signal, it is determined in operation **1203** whether there is a correspondence with a previously stored ECG template by comparing the ECG signals measured from the ECG measuring unit **322**.

[**0097**] In this case, the ECG templates to be used for identifying a user may be stored to a personal data storage unit in the identification-weight-body fat measuring module **300**, or may be remotely stored at the biological information

processing module **500** or the data center **700** depending on the system configuration. In the present invention, the personal data storage unit may interact with the biological information measuring module **100** by implementing the personal data storage unit in the biological information processing module **500**. More specifically, the personal data storage unit may be included in an integrated form to the biological information processing module **500**, or may be embodied in a portable electronic record media, e.g., an electronic record card.

[**0098**] Next, in operation **1300**, when there is a corresponding ECG template, the identification-weight-body fat measuring module **300** retrieves the corresponding user's data, e.g., name, birth date, sex, blood type, basic medical history, etc. from the biological information processing module **500**.

[**0099**] That is, in order to identify a user, the identification-weight-body fat measuring module **300** records ECG data acquired for a predetermined time by the standard limb lead of ECG, and the identification process is completed by retrieving the most interrelated user health information record through an operation to compare the recorded user ECG data with the previously input ECG templates for each user.

[**0100**] The ECG recording for identification continues for about twenty seconds to thirty seconds during which time a heart beat fluctuates between twenty and thirty times. When the recording is completed, the interrelationship is analyzed using a training algorithm such as a template matching and neural network, etc. QRS onset, P duration, QRS duration, R duration, S duration, ST slope, QRS p-p amplitude, T amplitude, and ST amplitude, etc. may be used as ECG matching parameters for the template matching. The ECG signal, however, is just an exemplary signal adapted for use in a user recognition method. Weight, bioelectric impedance, body fat information, and so on acquired from the user may be also used in connection with user recognition, as well as the ECG signal.

[**0101**] According to a user recognition method of the present invention, whenever biological information is measured, a user is automatically identified by the ECG signal, and health-relevant information as well as the growth and development information of each identified user, can be systematically managed without requiring additional input of a user's personal data.

[**0102**] **FIG. 14** is a detailed flow chart illustrating the biological information measuring process shown in **FIG. 11**.

[**0103**] Referring to **FIG. 14**, in order to measure the biological information, in operation **1401**, the identification-weight-body fat measuring module **300** in the system **1000** determines whether a contact state of the hand electrodes **341** and the foot electrodes **342**, which are contacted to a user's hands and feet, respectively, is normal. When there is an error in the contact state of the hand or foot electrodes **341** and **342**, a simple voice message requesting another measurement is output. When the contact state of the hand and foot electrodes **341** and **342** is normal, in operation **1402**, the user's height is measured by the height measuring module **200** mounted on the ceiling. In operation **1403**, the user's weight is measured by the identification-weight-body fat measuring module **300**.

[**0104**] In operation **1404**, after a bioelectric impedance is measured from the hand and foot electrodes **341** and **342** contacted to the user's hands and feet, respectively, body fat is calculated using the measured bioelectric impedance, height information measured in operation **1402** and weight information measured in operation **1403**.

[**0105**] Then, in operation **1405**, it is determined whether there was a measurement error. When no measurement error is detected, in operation **1600**, the measured data is transmitted, e.g., wirelessly, to the biological information processing module **500**.

[**0106**] **FIG. 15** is a detailed flow chart illustrating the data processing and analyzing process shown in **FIG. 11**.

[**0107**] Growth and development evaluation performed by the system **1000** is divided into a development state evaluation, a growth level evaluation, a positive growth entry term and positive growth term determination, and an analysis of variation transition in growth and development for each period as shown in Table 1.

TABLE 1

Data processing	Method
Evaluation of development state	1) weight analysis and fatness determination by BMI calculation (weight (kg)/ square of height (m)); weight analysis and fatness determination based on BMI table by sex and age of corresponding year 2) fatness determination by bioelectric impedance measuring method
Analysis of growth level evaluation	express the difference based on average height and weight by sex and age as percentage * growth level versus average height by sex and age = {(average height by sex and age-user's height)/(average height by sex and age)}*100 * growth level versus average weight by sex and age = {(average weight by sex and age-user's weight)/(average weight by sex and age)}*100
Determination of positive growth entry term and positive growth term	* the inflection point portion where the slope of a height increment rate curve in the past six months, after age six years, is converted to positive (+) from negative (−) or zero (0) is determined to be a positive growth entry term, and based on this, when the slope of an increment rate curve maintains a positive slope for six months or longer or becomes a steeper positive slope, it is determined to be a positive growth term.
Analysis of variation in biological information and development state for each period	Variation is output as a graph over a predetermined period by cumulatively summing weight, height, body fat percentage, and fatness data for each period.

[**0108**] Referring to **FIG. 15**, in order to evaluate the growth and development of children as shown in Table 1, in operation **1701**, the biological information processing module **500** in the system **1000** receives the biological information, i.e., weight, body fat, height, etc., measured from the identification-weight-body fat measuring module **300**. In operation **1702**, the biological information processing module **500** calculates Body Mass Index (BMI) using Equation **1**:

$$\text{BMI}=\text{weight } (kg)/\text{square of height } (m) \quad (1)$$

[0109] After BMI is calculated, in operation **1703**, weight and a degree of fatness are analyzed based on a BMI table for sex and age. The BMI table used at this time may be replaced with an updated BMI table for the current year.

[0110] Table 2 shows an exemplary BMI table.

TABLE 2

Age	Overweight		Obese	
4	male	17.56	Male	19.29
	female	17.28	Female	19.15
6	male	17.56	Male	19.78
	female	17.34	Female	19.65
8	male	18.44	Male	21.60
	female	18.35	Female	21.57
10	male	19.84	Male	24.00
	female	19.86	Female	24.11
12	male	21.22	Male	26.02
	female	21.68	Female	26.67
14	male	22.62	Male	27.63
	female	23.34	Female	28.57
16	male	23.90	Male	28.88
	female	24.37	Female	29.43
18	male	25.00	Male	30.00
	female	25.00	Female	30.00
18 or older	25 to 29		30 > BMI	

[0111] The analysis of fatness of a child performed in operation **1703** is largely divided into determination of fatness based on the BMI table and determination of fatness based on the bioelectric impedance. More specifically, in operation **1703**, after an initial determination of fatness based on the BMI table, determination of fatness based on the bioelectric impedance is selectively performed, so that more correct fatness information of a user can be obtained.

[0112] In a bioelectric impedance measuring method, a minute current, of which a user cannot sense, is flowed to the user's hands and feet after four electrodes are attached, typically on an ankle, a foot, a wrist, and a hand, to detect a voltage from the wrist and the ankle. Then, the method calculates a body fat percentage based on an electric conductivity, using the measured voltage, of a human organ.

[0113] It is known that the bioelectric impedance measuring method has a high interrelation (r=0.90-0.94) with the body fat percentage obtained through an underwater weight measuring method. However, because of a feature of a body fat percentage equation, the body fat percentage of a thin person tends to be overestimated. Therefore, in order to solve such a problem, the present invention determines fatness once again based on the bioelectric impedance of a user having been determined to be overweight or obese by the BMI, thereby enhancing reliability of health information on the user development state.

[0114] Next, after the fatness is analyzed, in operation **1704**, the user development state is evaluated based on the analyzed result. In operation **1704**, subjects are divided in three groups having low, normal, and high body fat percentage, to determine the development state of users belonging to each group.

[0115] Table 3 shows definitions of three groups based on the body fat percentage.

TABLE 3

Body fat percentage	Group to be evaluated
less than 10%	Low
10% to 14%	Normal
15% or more	High

[0116] Next, in operation **1705**, evaluation of a user's growth level is performed. In operation **1706**, the user's growth level versus average growth by sex and age is evaluated. The evaluation of the growth level performed in operation **1706** is divided into evaluation of the growth level versus average height by sex and age and evaluation of the growth level versus average weight by sex and age, and both evaluations are calculated by the following equations, respectively.

$$\text{Growth level vs. average height by sex and age} = \{(\text{average height by sex and age} - \text{user's height})/(\text{average height by sex and age})\} * 100(\%) \quad (2)$$

$$\text{Growth level vs. average weight by sex and age} = \{(\text{average weight by sex and age} - \text{user's weight})/(\text{average height by sex and age})\} * 100(\%) \quad (3)$$

[0117] As described in Equations 2 and 3, in operation **1706**, average growth information (height, and weight) and a user's growth information are compared and the compared result is represented by a percentage, so that the growth level is evaluated.

[0118] Next, in operation **1707**, it is determined whether the growth level corresponds to a positive growth term.

[0119] **FIG. 16** is a graph illustrating the positive growth term determining process shown in **FIG. 15**.

[0120] Referring to **FIG. 16**, when a slope of a height increment rate curve for the most recent 6 month period after a user's age reaches six years is converted to a positive (+) value from a negative (−) value or zero (0), the inflection point portion is determined to be a positive growth entry term, and based on this, when the slope of the curve maintains the positive slope for six months or longer or changes to be more steeply positive, it is determined to be a positive growth term.

[0121] Referring back to **FIG. 15**, after a positive growth term is determined, in operation **1708**, a variation in biological information and development state for each period is analyzed. In operation **1709**, data for the corresponding user are retrieved.

[0122] That is, in analyzing biological information for a user, the system **1000** does not only support analysis of instant data, but also stores the analyzed results on the development state and growth level for the user. The system **1000** then cumulatively sums the analyzed results for each period and each user, and analyzes the variations of the accumulated results.

[0123] **FIG. 17** is a diagram illustrating growth and development analysis displays according to an exemplary embodiment of the present invention.

[0124] Referring to **FIG. 17**, the system **1000** provides tendencies in the changes of the biological information for each period for each user and the analyzed results thereof. Further, the system provides health information related to

the tendencies as well as an exercise prescription, diet information, etc., required for each user. Furthermore, the system can interact with the data center **700** to manage the health information remotely, so that it is possible to provide information on exercise at a sports center, information related to disease at specialized medical clinics, and be incorporated into a function of making a doctor appointment.

[**0125**] As described above, the system **1000** for managing growth and development of a child collects and analyzes biological information, e.g., height, weight, body fat, etc., for a user, and shows time sequential changes of the same kind of biological information which have been stored for a predetermined period for a user, **641**, **642**, **643**, . . . , **64***n*, so that the system can comprehensively provide information on a child's growth and development state and information on a solution, e.g., exercise, rest, diet, etc., for an undesirable condition that is suitable for each situation when encountered. Such health information management can be expanded to adults as well as children. Furthermore, the system can minimize a size of device and space required for measuring biological signals, whereby portability and storage of the system are facilitated, so that the system can easily be used at home or while traveling.

[**0126**] The present invention can also be embodied as computer readable codes on a computer readable recording medium. The computer readable recording medium may be any data storage device that can store data which can be thereafter read by a computer system. Examples of the computer readable recording medium may include read-only memory (ROM), random-access memory (RAM), CD-ROMs, magnetic tapes, floppy disks, optical data storage devices, and carrier waves such as data transmission through the Internet. The computer readable recording medium may also be distributed over network coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

[**0127**] Exemplary embodiments of the present invention have been disclosed herein, and although specific terms are employed, they are used and are to be interpreted in a generic and descriptive sense only and not for purpose of limitation. Accordingly, it will be understood by those of ordinary skill in the art that various changes in form and details may be made without departing from the spirit and scope of the present invention as set forth in the following claims.

What is claimed is:

1. A system for managing growth and development of a user, the system comprising:

a biological information measuring module for acquiring at least two biological signals to be used for analyzing growth and development of the user, and for identifying the user by analyzing at least one biological signal of the at least two acquired biological signals; and

a biological information processing module for evaluating a development state and a growth level of the user according to the biological signals, for storing and managing personal data and the results of the evaluation of the user.

2. The system as claimed in claim 1, further comprising a data center for receiving biological information, the personal data, and the result of the evaluation of the development state and the growth level of the user from the biological information processing module, for analyzing information required for a health condition and health care of the user, and for supplying the health-relevant information of the user at predetermined periods.

3. The system as claimed in claim 1, wherein the biological information measuring module comprises:

a height measuring module for measuring a height of the user using ultrasonic waves; and

an integrated identification-weight-body fat module for measuring an electrocardiogram, a weight, and a bioelectric impedance of the user, for identifying the user by analyzing the measured electrocardiogram, and for analyzing a body fat value from the bioelectric impedance.

4. The system as claimed in claim 3, wherein the height measuring module comprises:

a height data acquiring unit for applying the ultrasonic waves to a head portion of the user and for sensing ultrasonic waves reflected from the head portion of the user;

an analog-to-digital converter for converting the sensed ultrasonic waves into digital data;

a control unit for calculating the height of the user based on the digitized ultrasonic wave data; and

a data transmitting unit for transmitting the calculated height data to the biological information processing module.

5. The system as claimed in claim 3, wherein the identification-weight-body fat measuring module comprises:

an identification module for identifying the user by comparing the measured electrocardiogram with previously-registered electrocardiogram templates; and

a weight-body fat measuring module for measuring the weight and the bioelectric impedance of the user and for analyzing the body fat value from the measured bioelectric impedance.

6. The system as claimed in claim 5, wherein the weight-body fat measuring module comprises:

hand electrodes for contacting hands of the user and for acquiring the electrocardiogram and bioelectric impedance signal;

foot electrodes for contacting feet of the user and for acquiring the electrocardiogram and bioelectric impedance signal;

a load cell for contacting the feet of the user and acquiring a weight signal;

a weight measuring unit for amplifying the weight signal acquired by the load cell;

a body fat measuring unit for measuring the bioelectric impedance signal by flowing a predetermined amount of current through the hand electrodes and the foot electrodes and measuring voltages across the electrodes, and for amplifying the measured bioelectric impedance signal;

an analog-to-digital converter for converting the amplified weight signal and the amplified bioelectric impedance signal into digital weight data and digital bioelectric impedance data, respectively;

a control unit for calculating the weight of the user by averaging the digital weight data, and for calculating the body fat by analyzing the digital bioelectric impedance data; and

a data transmitting/receiving unit for transmitting the weight and the body fat data calculated by the control unit to the biological information processing module and for receiving the personal data of the user from the biological information processing module.

7. The system as claimed in claim 6, wherein the identification module comprises an electrocardiogram measuring unit for amplifying the electrocardiogram acquired through the hand electrodes and the foot electrodes,

wherein the electrocardiogram amplified by the electrocardiogram measuring unit are compared with the electrocardiogram templates in the control unit in order to identify the user, and the personal data is received by the data transmitting/receiving unit.

8. The system as claimed in claim 1, wherein the biological information processing module comprises:

a data receiving unit for receiving wirelessly the biological information transmitted from the biological information measuring module;

a data storage unit for storing the received biological information for the user;

a data operation unit for analyzing the biological information, for evaluating the development state and the growth level, and for analyzing tendencies of variations in growth and development of the user by period;

a data display unit for outputting the analyzed result to the user;

a digital input and output controller for controlling the data input and output of the data receiving unit, the data storing unit, the data operation unit, and the data display unit; and

a power supply unit for supplying electric power to the biological information processing module.

9. The system as claimed in claim 2, wherein the biological information processing module further comprises;

a data transmitting unit for transmitting the biological information, the personal data, and the evaluated result of the development state and the growth level of the user to the data center; and

a data receiving unit for receiving the health-relevant data supplied from the data center and for providing the health-relevant data to the user.

10. The system as claimed in claim 1, wherein the biological information processing module is provided in one selected from the group consisting of a stand-alone type device, a personal computer, a mobile phone, a wrist watch, and a personal digital assistant.

11. The system as claimed in claim 2, wherein the data center comprises a health care database for storing the health care data for the user, and the health care data is supplied to the biological information processing module by one selected from the group consisting of a voice message, a short message service, and an electronic mail.

12. A method of managing growth and development of a user, the method comprising:

determining whether the user is positioned at a correct position for measurement of biological information;

identifying the user based on at least one biological signal acquired from an integrated identification-weight-body fat measuring module;

retrieving previously registered data of the identified user and measuring biological information of the user;

transmitting the measured biological information to a biological information processing module; and

evaluating a development state and a growth level of the user in response to the biological information and storing the result of the evaluation of the user.

13. The method as claimed in claim 12, further comprising:

transmitting the biological information, personal data, and the result of the evaluation of the development state and growth level of the user to a data center; and

receiving and analyzing the biological information, the personal data, and the result of the evaluation of the development state and growth level of the user, and supplying the analyzed health-relevant information at a series of predetermined periods to the biological information processing module.

14. The method as claimed in claim 12, wherein evaluating the development state and a growth level of the user comprises:

calculating a body mass index based on the biological information and analyzing a weight and a fatness based on a body mass index table;

analyzing the weight and the fatness of the user based on bioelectric impedance measured from the user when the fatness is above a predetermined value;

evaluating the growth level of the user based on average heights and average weights for each sex and age;

determining a positive growth entry term and a positive growth term in consideration of an increment rate in height of the user; and

analyzing variation of the biological information by period by analyzing a tendency of the analyzed results for a predetermined period.

15. The method as claimed in claim 14, wherein after an age of the user is over six years old, the positive growth entry term is represented by an inflection point where a slope of a height increment rate curve for a period of the latest six months is converted into a positive (+) value from a negative (−) value or zero (0).

16. The method as claimed in claim 14, wherein the positive growth term is a term when the slope of the curve maintains the positive slope for six months or longer or when the slope of the curve becomes steeper with respect to the positive growth entry term.

17. A computer readable recording medium on which a program for executing a method according to claim 12 is recorded.

18. A computer readable recording medium on which a program for executing a method according to claim 13 is recorded.

19. A computer readable recording medium on which a program for executing a method according to claim 14 is recorded.

20. A computer readable recording medium on which a program for executing a method according to claim 15 is recorded.

21. A computer readable recording medium on which a program for executing a method according to claim 16 is recorded.

* * * * *

专利名称(译)	用于管理用户的成长和发展的系统和方法		
公开(公告)号	US20050171451A1	公开(公告)日	2005-08-04
申请号	US11/049946	申请日	2005-02-04
[标]申请(专利权)人(译)	YEO HYUNG SOK 王海金桑 金庆皓 李贞焕		
申请(专利权)人(译)	YEO亨SOK 王海金生先生 金庆皓 李贞焕		
当前申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
[标]发明人	YEO HYUNG SOK WHANG JIN SANG KIM KYUNG HO LEE JEONG HWAN		
发明人	YEO, HYUNG-SOK WHANG, JIN-SANG KIM, KYUNG-HO LEE, JEONG-HWAN		
IPC分类号	A61B5/00 A61B5/0402 A61B5/0452 A61B5/05 A61B5/053 A61B5/107 A61B5/117 G06F19/00 G06Q50/22 A61B5/04		
CPC分类号	A61B5/0002 A61B5/0402 A61B5/4872 A61B5/1072 A61B5/117 A61B5/0537 A61B5/1171		
优先权	1020040007232 2004-02-04 KR		
外部链接	Espacenet USPTO		

摘要(译)

在用于管理用户（例如，儿童）的成长和发育的系统和方法中，该系统包括生物信息测量模块，用于获取至少两个生物信号，用于分析用户的成长和发育，并用于识别用户通过分析至少两个获取的生物信号的至少一个生物信号和生物信息处理模块，用于根据生物信号评估用户的发育状态和生长水平，用于存储和管理个人数据以及对用户的评价。