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(54) Title: MOBILE PHONE BASED GLUCOSE SENSING AND ALERTING SYSTEM

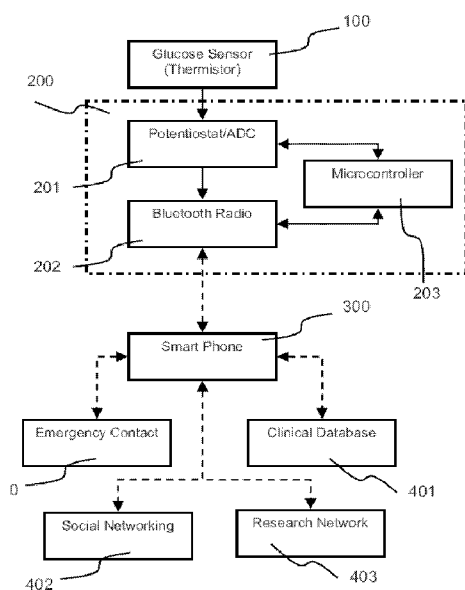


FIG. 1

(57) Abstract: A mobile system, such as a smart phone, is provided that is equipped with appropriate components and software. The mobile system receives data from a blood glucose sensor attached to a patient and processes the data and makes determination or prediction as to the patient's blood glucose level. When an abnormal level of blood glucose level is detected or predicted, the mobile system will alert the patient. In the event the alert is not responded to by the patient, the mobile system will transmit a warning signal to one or more preselected contacts, which warning signal optionally includes a GPS signal.

Mobile Phone Based Glucose Sensing and Alerting System

BACKGROUND OF THE DISCLOSURE

[0001] The disclosure relates systems and methods for monitoring a person's blood glucose level and alerting the person or appropriate contacts when the person's blood glucose level indicates a need for health care attention.

[0002] According to the American Diabetes Association, 23.7 million people in the United States have diabetes; and, with 1.6 million newly diagnosed cases each year, diabetes, already one of the most prevalent chronic diseases in the US, is on the rise.

[0003] An estimated 5-10% of diabetics have Type I diabetes, previously known as juvenile diabetes. In this particularly severe form, the body does not produce insulin, and Type I diabetes is fatal without insulin treatment. Intensive insulin therapy is key to managing this condition, and studies have shown that it significantly delays and prevents the progression of microvascular diseases such as retinopathy and microalbuminuria.

[0004] However, incidences of hypoglycemia pose a substantial hurdle to effective and safe intensive insulin therapy. One study shows that an attempt to achieve a near-normal glycemic profile led to a threefold increase in hypoglycemia. Therefore, frequent monitoring of blood glucose levels is a critical measure to reduce hypoglycemia incidences.

[0005] An additional benefit of frequent blood glucose measurements is that they provide critical data for determining the appropriate insulin dosage, and many algorithms that attempt to use continuously monitored glucose data to determine insulin dosage have been developed thus far, and these algorithm invariably relies on near-continuous glucose concentration data. Therefore, a sensor that is capable of providing

frequent, near-continuous monitoring of glucose concentration is necessary for improving diabetes management, especially for those with Type I diabetes. It has been well established that concentration of subcutaneous interstitial fluid closely follows the glucose concentration in the blood; therefore, a minimally invasive, subcutaneous glucose sensor can be used as a continuous glucose monitoring modality.

[0006] Currently there are three major subcutaneous continuous glucose monitoring systems (CGMS) each marketed by Medtronic Inc, Abbott Laboratories and Dexcom Inc. The duration of each sensor is between 3 and 7 days, and the price of each sensor is between \$40 and \$60, with the initial cost of the system between \$1,000 and \$1,339.

[0007] In addition to potentially prohibitive costs, the existing systems on the market are often inaccurate. A recent study found that half of hypoglycemia events, a potentially life-threatening condition, are missed by these systems, which imposes a substantial limitation on their efficacy.

[0008] In summary, there is an unmet need for a high-accuracy, low-cost alternative to current CGMS on the market.

SUMMARY OF THE DISCLOSURE

[0009] The present disclosure provides a mobile system, such as a smart phone equipped with appropriate components and software. The mobile system receives data from a blood glucose sensor attached to a patient and processes the data and makes determination or prediction as to whether the patient's blood glucose level is or will be too high (hyperglycemia) or too low (hypoglycemia), both of which indicate needs for health care attention. When hyperglycemia or hypoglycemia is detected or predicted, the mobile system will alert to the patient that appropriate actions are required. In the event the alert is not responded to by the patient, the mobile system will transmit a warning signal to one or more preselected contacts. The mobile system will then check

whether the contact responds to the warning signal and if he does not, then transmit a warning signal to another contact, or an emergency health care center, until it receives appropriate attention. In certain embodiments, the mobile system further transmits a global positioning system (GPS) to the contact to facilitate locating of the patient.

[0010] Thus, in one embodiment, the present disclosure provides a mobile system comprising a processor, a receiver, a transmitter and a storage medium in communication with the processor, the storage medium containing a set of processor executable instructions that, when executed by the processor, configure the receiver to receive a wireless data signal from a blood glucose sensor attached to a subject, determine whether the subject is in need of health care attention, and cause the transmitter to wirelessly transmit a warning signal to a remote wireless receiver if the subject is in need to health care attention.

[0011] In one aspect, the wireless data signal is a Bluetooth data signal.

[0012] In one aspect, the wireless data signal comprises a blood glucose level. In another aspect, the wireless data signal comprises raw blood glucose measurement data such as a raw electrical signal. A raw electrical signal can be an electrical signal or an actual glucose reading. In yet another aspect, the wireless data signal further comprises body temperature.

[0013] In one aspect, the receiver receives wireless data signals at a regular interval. In some aspects, the interval is from about 10 seconds to 10 minutes. In some aspects, the interval is about 1 minute.

[0014] A subject in need of health care attention can be a subject having a hyperglycemia level. Alternatively, a subject in need of health care attention is a subject having a hypoglycemia level.

[0015] In some aspects, the executable instructions are configured to predict a blood glucose level at a future time point. The health care attention, then, can be based on the predicted blood glucose level.

[0016] In one aspect, the executable instructions are configured to process raw blood glucose measurement data or to improve the accuracy of a blood glucose measurement.

[0017] The mobile system can further comprise a database for storing the wireless data signal or data converted from the wireless data signal.

[0018] In one aspect, the transmitting comprises voice calling. Alternatively, the transmitting comprises text messaging or a wireless web-based communication. In some aspects, the transmitter also transmits a global positioning system (GPS) signal to the remote receiver.

[0019] The remote receiver, in one aspect, comprises a phone, such as a home phone or a cell phone of a family member or a friend, a social networking site or a research network. Alternatively, the remote receiver is part of an emergency response system or a clinical database. In the event a remote receiver does not respond, the mobile system transmits an additional warning signal to a different remote server.

[0020] In one aspect, the mobile system further comprises a display for displaying blood glucose levels.

[0021] The mobile system can be configured to alert the subject when the blood glucose level that needs attention is determined. In one aspect, the alerting comprises a voice or vibration generator. In some aspects, if the subject fails to respond to the alert, the transmitter wirelessly transmits the warning signal to a remote receiver.

[0022] In any of the above aspect, the mobile system further comprises a blood glucose sensor for generating the wireless data signal. In some aspects, the blood

glucose sensor comprises a wireless transmitter. In one aspect, the wireless transmitter generates Bluetooth radio signal.

[0023] Another embodiment of the present disclosure provides a method for monitoring the blood glucose level in a subject with a mobile device comprising a processor, a receiver and a transmitter, the method comprising: receiving, through the receiver, a wireless data signal from a blood glucose sensor attached to a subject, determining whether the subject is in need of health care attention, and wirelessly transmitting, through the transmitter, a warning signal to a remote wireless receiver if the subject is in need of health care attention.

[0024] In one aspect, the wireless data signal is a Bluetooth data signal.

[0025] In one aspect, the wireless data signal comprises a blood glucose level. In another aspect, the wireless data signal comprises raw blood glucose measurement data such as a raw electrical signal. A raw electrical signal can be an electrical signal or an actual glucose reading. In yet another aspect, the wireless data signal further comprises body temperature.

[0026] In some aspects,, the wireless data signals are received at a regular interval. Such an interval, in one aspect, is from about 10 seconds to 10 minutes and in another aspect, is about 1 minute.

[0027] In any of the aspects of the method, a subject in need of health care attention is a subject in hyperglycemia. In another aspect, a subject in need of health care attention is a subject in hypoglycemia.

[0028] The determining of the method can also comprise predicting a blood glucose level at a future time point. When a blood glucose level is predicted, the prediction can be the basis for determining the need for health care attention is.

[0029] In another aspect, the determining comprises processing raw blood glucose measurement data or improving the accuracy of a blood glucose measurement.

[0030] In certain aspects, the method further comprises storing the wireless data signal or data converted from the wireless data signal in a database.

[0031] In one aspect, the transmitting comprises voice calling. In another aspect, the transmitting comprises text messaging or a wireless web-based communication. In yet another aspect, the method further comprises transmitting a global positioning system (GPS) signal to the remote receiver.

[0032] In some aspects, the remote receiver comprises a phone of a family member or a friend. In another aspect, the remote receiver is part of an emergency response system. In some aspects, the method further comprises transmitting an additional warning signal to a different remote server if the remote server does not respond.

[0033] In one aspect, the method further comprises displaying blood glucose levels on a display.

[0034] In one aspect, the method further comprises alerting the subject when the blood glucose level that needs attention is determined.

[0035] The alert component, in one aspect, comprises a voice or vibration generator. In another aspect, if the subject fails to respond to the alert, then the transmitter wirelessly transmits the warning signal to a remote receiver.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] The foregoing advantages and features of the disclosure will become apparent upon reference to the following detailed description and the accompanying drawings, of which:

[0037] FIG. 1 is a flow chart showing components and control of one embodiment of the presently disclosed mobile system; and

[0038] FIG. 2 illustrates the components of certain embodiments of the mobile system of the present disclosure and how the mobile system is used to provide monitoring and alerting.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0039] Various embodiments of the disclosure will be described in detail below, with reference to the accompanying drawings.

[0040] With reference to FIG. 1 and FIG. 2, a glucose sensor (100) is attached to a patient's skin, or preferably placed subcutaneously. In a broader sense, a glucose sensor further includes controller 200 for providing a power source and retrieve electric signal from the sensor. The glucose sensor 100 along with controller 200 are also known as a continuous glucose monitoring system (CGMS) although the present disclosure provides embodiments of such a CGMS with unique features and advantages not disclosed before.

[0041] Methods of preparing glucose sensors are known in the art and commercial glucose sensor approved by FDA are also available. A glucose sensor typically includes two or three electrodes coated with glucose oxidase.

[0042] It is discovered, however, body temperature correlates with blood glucose levels. Accordingly, in one embodiment, the glucose sensor of the present disclosure further includes a thermistor for measuring local body temperature.

[0043] In one embodiment, the glucose sensor is directly fixed on controller 200 of the CGMS. In such an embodiment, controller 200 can be affixed to the skin with an

adhesive base. In another embodiment, the glucose sensor is connected to controller 200 through a wire so that controller 200 can be conveniently anchored on a belt.

[0044] Referring to FIG. 1, controller includes one or more of the following components: a potentiostat with an optional automatic density control (ADC) (201), a wireless, e.g., Bluetooth, radio generator and transmitter (202) and a microcontroller (203). The potentiostat 201 is used to maintain suitable potentials on electrodes on the glucose sensor. The wireless/Bluetooth radio 202 generate a wireless/Bluetooth radio that includes data collected from the glucose sensor and transmits them to suitable receivers. The microcontroller 203 can be connected to both potentiostat 201 and wireless/Bluetooth radio 202 and contains processor and program code to operate the controller.

[0045] In some aspects, the controller further includes a storage unit such that raw data or processed data can be stored. This is useful in particular when the mobile system is temporarily out of range or out of battery. With the storage unit, the mobile system can retrieve the data that it has failed to retrieve.

[0046] Also contemplated in the present disclosure is a dual charger that can simultaneously charge the glucose sensor and the mobile system. The charger can be battery-powered and thus portable. In one aspect, the charger charges the glucose sensor wireless or with a wire attached to the sensor, such as to the controller. In another aspect, the charger also charges the mobile system to avoid power outage especially when the patient is potentially suffering an abnormal blood glucose level.

[0047] Upon collecting glucose data from the body, either in raw data format or processed, the CMGS can generate a wireless signal for transmission to remote wireless receivers. The transmission can be continuous, at a pre-determined interval, at an interval determined by the microcontroller, or upon request by a remote receiver. In one embodiment, the transmission is regular, from about every 1 second to about every 10 minutes, or alternatively from about every 2 seconds to about every 5 minutes, or

alternatively from about every 3 seconds to about 3 minutes. In some embodiments, the transmission takes place about every 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 40, 45, 50, or 60 seconds, or every 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 minutes.

[0048] An example of a remote receive that receives the wireless signal from the CGMS is a mobile system such as a cellular phone (300). In one embodiment, the mobile system includes a processor, a receiver, a transmitter and a storage medium in communication with the processor, the storage medium containing a set of processor executable instructions that, when executed by the processor, configure the receiver to receive a wireless data signal from a CGMS attached to a subject, determine whether the subject is in need of health care attention.

[0049] A subject in need of health care attention can be a subject having a hyperglycemia level or alternatively a hypoglycemia level.

[0050] In certain embodiments, the mobile system is configured to process the wireless signal received from the CGMS. Depending on the type of data, there are a wide range of algorithms available to conduct signal processing. In one embodiment, the mobile system is also configured to make a prediction based on historical data and/or dietary or other type of information entered into the mobile system by the subject. When a prediction is made, therefore, the need of health care attention can be based on the predicted glucose level, in order to prevent occurrence of adverse health conditions.

[0051] It is also contemplated that the mobile system includes a database for storing the wireless data signal or data converted from the wireless data signal. Such a database will be useful in making predictions or when presented to the subject or a health care professional, useful for assessing the subject's health condition or make future health care recommendations. Data stored in the database can be wirelessly transmitted to a clinical database (500) to facilitate emergency response or future health care.

[0052] In the event an abnormal glucose level, either hyperglycemia or hypoglycemia, is determined or predicted, the mobile system can display a warning signal or otherwise alert the subject that suitable care is needed. The alert, for example, can be in the form of a visual display, a flashing light, a warning sound, or a vibration signal. In one embodiment, the mobile system allows a certain period for the subject to respond. In case no proper response is received from the subject, the mobile system is configured to transmit a warning signal to a remote receiver to seek help.

[0053] In one aspect, the transmitting includes voice calling. Alternatively, the transmitting includes text messaging or a wireless web-based communication. The remote receiver, for example, is a phone (400) of a friend or family member and the contact can be stored in the mobile system and pre-selected by the subject.

[0054] The remote receiver will be given a time period to respond to the warning, either by answering the call or a return text or email message. In the event a proper response is not received by the mobile system, the mobile system will attempt to transmit a warning signal to another contact until a response is received. Any of remote receivers can also be a medical professional or an emergency service center (401) so that health care attention is ensured.

[0055] Alternatively, any of the remote receivers can be at a social networking site (402) so that the personal network of the subject can be properly notified, who can then provide appropriate help or contact emergency service center. Yet in another embodiment, the receiver can be a research network (403) or a clinical database (404) which collect such data for the purpose of conducting clinical research for benefit of the public and/or for the subject itself.

[0056] In some aspects, the transmitter also transmits a global positioning system (GPS) signal that is determined by a satellite or cellular tower (600) to the remote receiver. A GPS signal will enable the friend, family member, medical professional or emergency service center to easily locate the subject. This is particularly useful when

the subject is in serious medical condition can not himself or herself provide location information.

[0057] When the remote receiver is at a medical or emergency service center, the transmission can further include glucose level data received by the mobile system or data stored in the database of the mobile system. Such data will be useful in assessing the situation of the subject.

[0058] It is further contemplated in the present disclosure that in the event the mobile system fails to receive a signal from the glucose sensor, such as when the subject is out of range reachable by the wireless signal, the mobile system automatically starts a time out period. If during the time out period the mobile system fails to reconnect to the sensor, it sends out a warning signal. The duration of the time out period can be preset or adjusted by the subject. In one aspect, the time out can be disabled or terminated by the subject if the subject determines that he or she is safe without the monitoring, such as in a swimming pool.

[0059] The present disclosure is not to be limited in terms of the particular embodiments described in this application. Many modifications and variations can be made without departing from its spirit and scope, as will be apparent to those skilled in the art. Functionally equivalent methods and apparatuses within the scope of the disclosure, in addition to those enumerated herein, will be apparent to those skilled in the art from the foregoing descriptions. Such modifications and variations are intended to fall within the scope of the appended claims. The present disclosure is to be limited only by the terms of the appended claims, along with the full scope of equivalents to which such claims are entitled. It is to be understood that this disclosure is not limited to particular methods, reagents, compounds compositions or biological systems, which can, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting.

[0060] In addition, where features or aspects of the disclosure are described in terms of Markush groups, those skilled in the art will recognize that the disclosure is also thereby described in terms of any individual member or subgroup of members of the Markush group.

[0061] As will be understood by one skilled in the art, for any and all purposes, particularly in terms of providing a written description, all ranges disclosed herein also encompass any and all possible subranges and combinations of subranges thereof. Any listed range can be easily recognized as sufficiently describing and enabling the same range being broken down into at least equal halves, thirds, quarters, fifths, tenths, *etc.* As a non-limiting example, each range discussed herein can be readily broken down into a lower third, middle third and upper third, *etc.* As will also be understood by one skilled in the art all language such as "up to," "at least," "greater than," "less than," and the like include the number recited and refer to ranges which can be subsequently broken down into subranges as discussed above. Finally, as will be understood by one skilled in the art, a range includes each individual member. Thus, for example, a group having 1-3 particles refers to groups having 1, 2, or 3 particles. Similarly, a group having 1-5 particles refers to groups having 1, 2, 3, 4, or 5 particles, and so forth.

[0062] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

[0063] All references cited herein are incorporated by reference in their entireties and for all purposes to the same extent as if each individual publication, patent, or patent application was specifically and individually incorporated by reference in its entirety for all purposes.

WHAT IS CLAIMED IS:

1. A mobile system comprising:
 - a processor,
 - a receiver,
 - a transmitter, and
 - a storage medium in communication with the processor, the storage medium containing a set of processor executable instructions that, when executed by the processor,
 - configure the receiver to receive a wireless data signal from a blood glucose sensor attached to a subject,
 - determine whether the subject is in need of health care attention, and
 - cause the transmitter to wirelessly transmit a warning signal to a remote wireless receiver if the subject is in need to health care attention.
2. The mobile system of claim 1, wherein the wireless data signal is a Bluetooth data signal.
3. The mobile system of claim 1 or 2, wherein the wireless data signal comprises a blood glucose level.
4. The mobile system of claim 1 or 2, wherein the wireless data signal comprises raw blood glucose measurement data.
5. The mobile system of claim 3 or 4, wherein the wireless data signal further comprises body temperature.
6. The mobile system of any one of claims 1 to 5, wherein the receiver receives wireless data signals at a regular interval.
7. The mobile system of claim 6, wherein the interval is from about 10 seconds to 10 minutes.

8. The mobile system of claim 7, wherein the interval is about 1 minute.
9. The mobile system of any one of claims 1 to 8, wherein a subject in need of health care attention is a subject having a hyperglycemia level.
10. The mobile system of any one of claims 1 to 9, wherein a subject in need of health care attention is a subject having a hypoglycemia level.
11. The mobile system of any one of claims 1 to 10, wherein the executable instructions are configured to predict a blood glucose level at a future time point.
12. The mobile system of claim 11, wherein the health care attention is based on the predicted blood glucose level.
13. The mobile system of any one of claims 1 to 12, wherein the executable instructions are configured to process raw blood glucose measurement data or to improve the accuracy of a blood glucose measurement.
14. The mobile system of any one of claims 1 to 13, further comprising a database for storing the wireless data signal or data converted from the wireless data signal.
15. The mobile system of any one of claims 1 to 14, wherein the transmitting comprises voice calling.
16. The mobile system of any one of claims 1 to 14, wherein the transmitting comprises text messaging or a wireless web-based communication.
17. The mobile system of any one of claims 1 to 16, wherein the transmitter further transmits a global positioning system (GPS) signal to the remote receiver.
18. The mobile system of any one of claims 1 to 17, wherein the remote receiver comprises a phone of a family member or a friend, a social networking site, or a research network.

19. The mobile system of any one of claims 1 to 17, wherein the remote receiver is part of an emergency response system or a clinical database.
20. The mobile system of any one of claims 1 to 19, wherein the mobile system is configured to transmit an additional warning signal to a different remote server if the remote server does not respond.
21. The mobile system of any one of claims 1 to 20, further comprising a display for displaying blood glucose levels.
22. The mobile system of any one of claims 1 to 21, wherein the mobile system is configured to alert the subject when the blood glucose level that needs attention is determined.
23. The mobile system of claim 22, wherein the alerting comprises a voice or vibration generator.
24. The mobile system of claim 22 or 23, wherein the subject fails to respond to the alert before the transmitter wirelessly transmits the warning signal.
25. The mobile system of any one of claims 1 to 24, further comprising a blood glucose sensor for generating the wireless data signal.
26. The mobile system of claim 25, wherein the blood glucose sensor comprises a wireless transmitter.
27. The mobile system of claim 26, wherein the wireless transmitter generates Bluetooth radio signal.
28. A method for monitoring the blood glucose level in a subject with a mobile device comprising a processor, a receiver and a transmitter, the method comprising:
 - receiving, through the receiver, a wireless data signal from a blood glucose sensor attached to a subject,
 - determining whether the subject is in need of health care attention, and

wirelessly transmitting, through the transmitter, a warning signal to a remote wireless receiver if the subject is in need of health care attention.

29. The method of claim 28, wherein the wireless data signal is a Bluetooth data signal.
30. The method of claim 28 or 29, wherein the wireless data signal comprises a blood glucose level.
31. The method of claim 28 or 29, wherein the wireless data signal comprises raw blood glucose measurement data.
32. The method of claim 29 or 31, wherein the wireless data signal further comprises body temperature.
33. The method of any one of claims 28 to 32, wherein the wireless data signals are received at a regular interval.
34. The method of claim 33, wherein the interval is from about 10 seconds to 10 minutes.
35. The method of claim 34, wherein the interval is about 1 minute.
36. The method of any one of claims 28 to 35, wherein a subject in need of health care attention is a subject having a hyperglycemia level.
37. The method of any one of claims 28 to 36, wherein a subject in need of health care attention is a subject having a hypoglycemia level.
38. The method of any one of claims 28 to 37, wherein the determining comprises predicting a blood glucose level at a future time point.
39. The method of claim 37, wherein the health care attention is based on the predicted blood glucose level.

40. The method of any one of claims 28 to 39, wherein the determining comprises processing raw blood glucose measurement data or improving the accuracy of a blood glucose measurement.
41. The method of any one of claims 28 to 40, further comprising storing the wireless data signal or data converted from the wireless data signal in a database.
42. The method of any one of claims 28 to 41, wherein the transmitting comprises voice calling.
43. The method of any one of claims 28 to 42, wherein the transmitting comprises text messaging or a wireless web-based communication.
44. The method of any one of claims 28 to 41, further comprising transmitting a global positioning system (GPS) signal to the remote receiver.
45. The method of any one of claims 28 to 43, wherein the remote receiver comprises a phone of a family member or a friend.
46. The method of any one of claims 28 to 44, wherein the remote receiver is part of an emergency response system.
47. The method of any one of claims 28 to 46, further comprising transmitting an additional warning signal to a different remote server if the remote server does not respond.
48. The method of any one of claims 28 to 47, further comprising displaying blood glucose levels on a display.
49. The method of any one of claims 28 to 48, further comprising alerting the subject when the blood glucose level that needs attention is determined.
50. The method of claim 49, wherein the alert component comprises a voice or vibration generator.

51. The method of claim 49 or 50, wherein the subject fails to respond to the alert before the transmitter wirelessly transmits the warning signal.

drawing

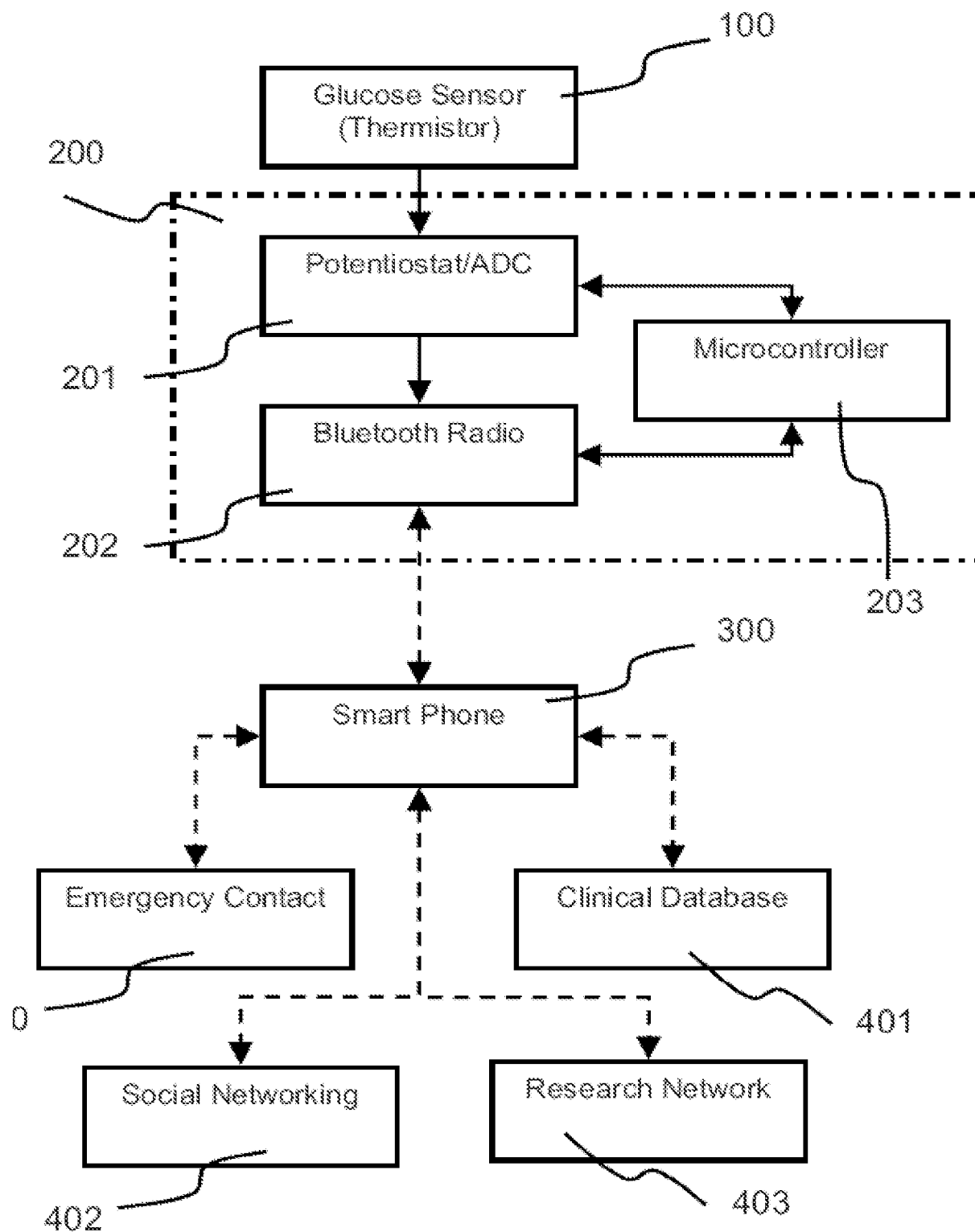


FIG. 1

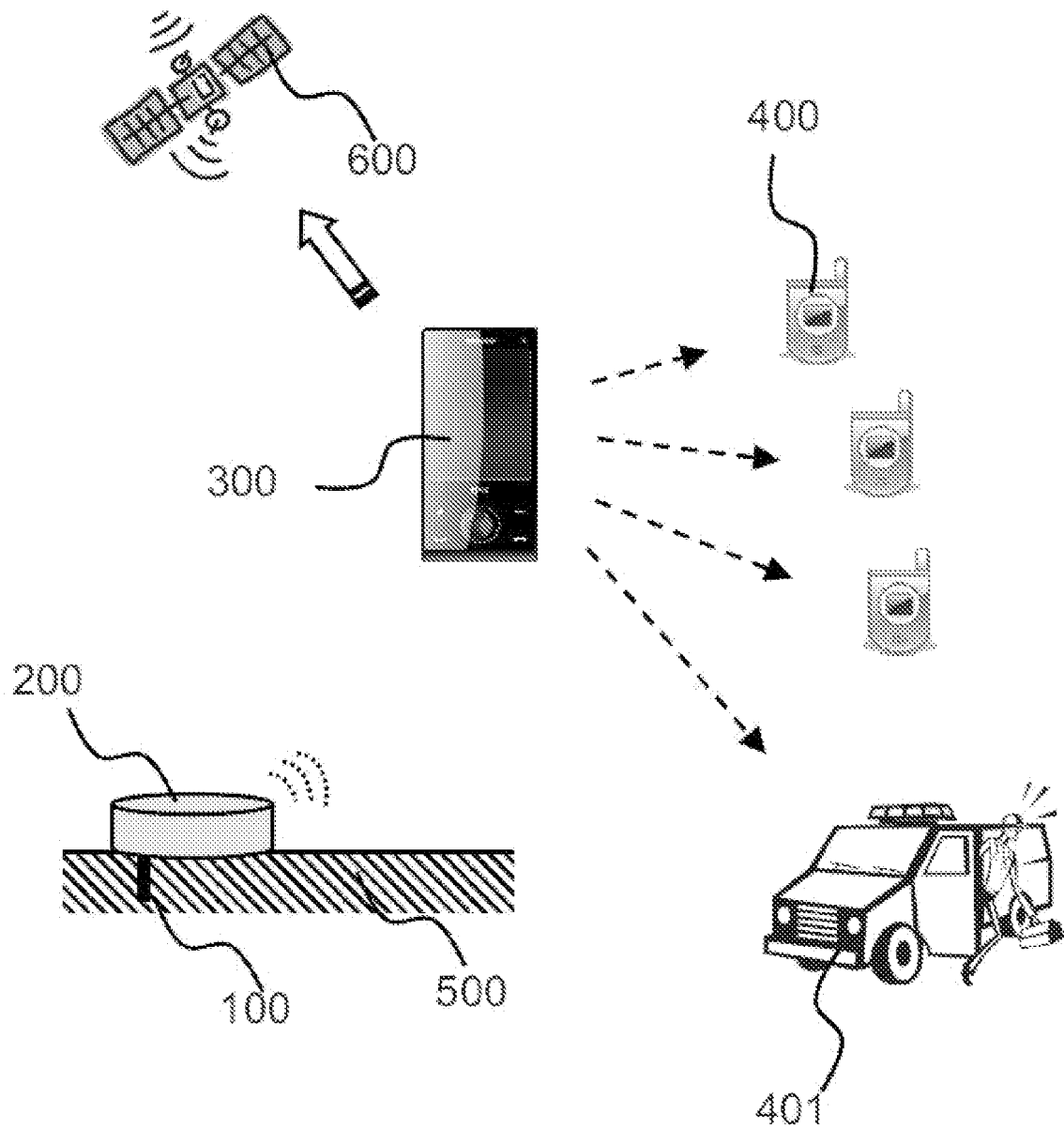


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/084288

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/46 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04L 12/-; H04L 29/-; H04Q 7/-; H04M; H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, IEEE, CNKI, CNPAT: mobile, wireless, blood w sugar, glucose, detect, inspect, warning, alert+, bluetooth, body w temperature, interval, sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN101841561 A (SICHUAN DONGLIN TECHNOLOGY CO., LTD.) 22 Sep. 2010 (22.09.2010) description page 2 line 28 - page 3 line 50, figure 1	1-51
A	CN1877335 A (LG ELECTRONICS CHINA RES. & DEV. CENT. CO., LTD.) 13 Dec. 2006 (13.12.2006) the whole document	1-51
A	WO2006036212 A2 (MEDTOX SCI. INC. et al.) 06 Apr. 2006 (06.04.2006) the whole document	1-51

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

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