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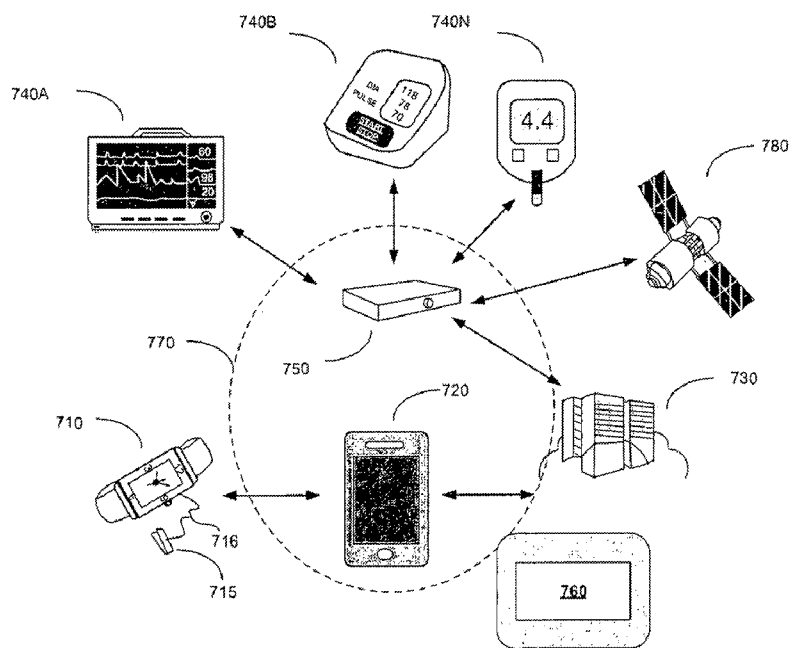


FIG. 7

(57) Abstract: In one aspect, a method of displaying patient information comprising, collecting vitals from plurality of patients and displaying pattern having plurality of clusters on display device, representing plurality of patients. Each cluster in plurality of clusters comprises a set of display segments representing a corresponding set of vitals collected from a patient. In an embodiment, the display segments are displayed to provide visually distinguishable tones indicating the different critical levels of respective vitals. In another embodiment, plurality of first set of vitals is collected from the corresponding plurality of wearable device which is attached to the body of plurality of patients. Also, plurality of first set of vitals is transferred to the corresponding plurality of mobile device which is in possession of plurality of patients. Further, plurality of the first set of vital is transferred from the mobile devices to a server forming the vitals.



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MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,  
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,  
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,  
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## **METHOD AND SYSTEM AND APPARATUS FOR PATIENT DATA COLLECTION AND MONITORING**

### **DESCRIPTION**

#### **FIELD OF INVENTION**

[0001] Embodiments of the present disclosure relate generally to computer systems and more specifically to a method, system and apparatus for patient data collection and monitoring.

#### **RELATED ART**

[0002] The term patient generally refers to a person requiring a care, monitoring and/or attention with respect to health and wellbeing. Several parameters referred to as vitals such as blood pressure, heart beat counts, sugar levels, as is well known are collected manually from the patients using respective gadgets/apparatus. The collected vitals are made available to the desired personnel likes of doctors, nurses, hospital staffs, and care takers associated to the patient. Often more number of patients are monitored simultaneously (as in a hospitals) by the same doctors, nurse, and care takers, hospitals (monitoring entity) or at least by any one of them. It is desirable to view/monitor/manage set of patients associated with the monitoring entity simultaneously, together and at a glance.

#### **SUMMARY**

[0003] In one aspect, a method of displaying patient information comprising, collecting vitals from plurality of patients and displaying a pattern having plurality of clusters on a display device, representing plurality of patients. Each cluster in plurality of clusters comprises a set of display segments representing a corresponding set of vitals collected from a patient. In an embodiment, the display segments are displayed to provide visually distinguishable tones indicating the different critical levels of respective vitals. In another embodiment, plurality of first set of vitals is collected from the corresponding plurality of wearable device which is attached to the body of plurality of patients. Also, plurality of first set of vitals is transferred to the corresponding plurality of mobile device which is in possession of plurality of patients. Further, plurality of the first set of vitals is transferred from the mobile devices to a server forming the vitals.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0004] FIG. 1 is an example display formed on a display device in one embodiment.

[0005] FIG. 2 illustrates an example cluster of a patient.

[0006] FIG. 3 is an example array of clusters of vitals of patients associated with a doctor.

[0007] FIG. 4 is an example effective warning score view of plurality of patients in one embodiment.

[0008] FIG. 5 is an example view provided on a display device in respect of a selected patient/cluster.

[0009] FIG. 6A is another example view on the display device in respect of a desired patient.

[0010] FIG. 6B illustrates another patient specific view that provide the information of the patient and the status of various data/vital collection devices associated to the selected patient.

[0011] FIG. 6C illustrates the relation between the color code and the range of vitals for reference.

[0012] FIG. 7 is a block diagram of a system illustrating the manner in which the vitals are collected to form clusters in an embodiment.

[0013] FIG. 8A is an example display on the mobile device that is in communication with the wearable device.

[0014] FIG. 8B and 8C illustrates mobile device views of such selected vitals (for example, pulse rate and oxygen saturation respectively).

[0015] FIG. 9A through 9C are the configuration features provided on the mobile device in one embodiment.

[0016] FIG. 9D and 9E illustrates the manner in which the wearable device and mobile device operate to take more accurate readings from the PSO2 clip.

[0017] FIG. 9F illustrates the manner in which the mobile device retrieves the data stored on the wearable device when the connection to the mobile device is lost.

[0018] FIG. 10 is a block diagram of a wearable device in one embodiment.

[0019] FIG. 11 illustrates the manner in which various sub modules which is kept selectively in the low power mode.

[0020] FIG. 12 is a block diagram illustrating the manner in which the mobile device operates to communicate and control the wearable device in one embodiment.

#### **DETAILED DESCRIPTION OF THE PREFERRED EXAMPLES**

[0021] FIG. 1 is an example display formed on a display device 100 in one embodiment. The display is shown comprising pattern 101 of clusters 110A-110N. Each cluster is shown comprising set of segments 120A-120K.

[0022] Each cluster 110A-110N represents set of vitals of a particular patient (distinctly different from other). The pattern 101 represents the arrangement of the clusters 110A-110N relating a patient association to one or more parameters. For example the association may be in terms of patient's physical location, criticality, importance, time relation, doctor, nurse, etc.

[0023] Thus, in one embodiment each row in the pattern 101 may represent the respective floor, block, ward of a hospital. Alternatively, each row may also represent different hospitals. As a further alternative, each row may also represent a doctor or a nurse.

[0024] The segments 120A-120K in each clusters represents a vitals of the patient. Thus, "K" number of vitals of the patients is presented in one cluster to simultaneously see/view the vitals of the patients. Such simultaneous viewing multiple vitals of multiple patients in accordance with pattern 101 enable quick and faster attention provided to patient's needs at least when managed and monitored en masse.

[0025] FIG. 2 illustrates an example cluster 110A of a patient. As shown there the cluster is comprised of vitals 210A-210D. Each vital 210A-210D respectively represents skin temperature, heart rate, oxygen saturation, and the pain level for example. The vitals may be arranged (within each cluster) in a circular, triangular or any other meaningful formation that provide visible distinction of each vitals. In one embodiment, the position of the vitals within the clusters indicates the type of vitals. The value of the vitals may be represented in the grey level and or color code. For example, in case of color coding, higher criticality may be represented in red tones and low criticality may be represented in green tone. Thus, providing the comprehensive visible display of vitals of plurality of patients. Alternatively, in case of grey level, higher grey scale may represent the high criticality while lower grey scale may represent the low criticality.

[0026] FIG. 3 is an example array of clusters of vitals of patients associated with a doctor. The array is shown comprising patients 310A-310E on row 301, and 310F-310J on row 302 associated to a doctor 320 from group of doctors 340. The row 301 and 302 respectively represents hospital 1 and hospital 2 in one embodiment and in an alternate embodiment, the row 301 and 302 represents different ward, floor or block within the hospital. As shown there, vitals 350A-350C of each patient 310A-310J is clustered into rectangular box for simultaneous viewing. The vitals 350A-350C are colors coded to indicate the criticality. The vital type is indicated with the respective graphics 371, 372, and 373. For example, as shown there the skin temperature is indicated with the graphical thermometer 371, Oxygen saturation is indicated with

the graphical blood droplet 372, and heart beat count is indicated with the graphical curve 373. Accordingly the user is able to quickly read and associate the vitals of patients en masse and provide attention and service accordingly. In one embodiment, an effective warning score is determined from the plurality of vitals in each cluster to present an effective warning score view of a plurality of patients. The effective warning may provide an early warning. As result, a single representation in terms of varying grey scale or differentiating colors are provided to represent the overall/effective/early warning or criticality level of the patient.

[0027] FIG. 4 is an example effective/early warning score view of plurality of patients in one embodiment. The array of patients 410 is represented by rectangular icons 450 (or any other shape). In that, each color 401- 404 indicates the range of the vitals that is calculated/determined based on a predetermined early warning score values. The color Green 401 indicates "Normal", the color Orange 402 indicates "abnormal" and the color Red 403 indicates that the patient is critical. The icon in the color grey 404 represents that the wearable or vital measurement device is not connected/enabled, for example. Similarly, other quick effective warning views indicating the different levels of attention may be deployed. For example, audio beepers, flickering of icons and such other audio visual effects may be incorporated to represent the effective warning score level. The manner in which the display device displays several details from top level effective warning view to the particular vital details of a desired patient is further described below.

[0028] In one embodiment the display device navigates from one view to another through filters and selections. For example, selection of a doctor 409 on the view 401 may navigate the user to view 301. Similarly, selection of a particular patient within the cluster may provide further details on each vital in a graphical form.

[0029] FIG. 5 is an example view provided on a display device in respect of a selected patient/cluster. As shown there the display view comprises Patient ID, patient Details, Vitals, Vitals over time period, and pain indication. The patient specific view 501 provides information on vitals in more detail along with the variations of the vital over a desired time period as shown.

[0030] FIG. 6A is another example view 601 on the display device in respect of a desired patient. As shown there, information on one of the vitals (pulse rate for example) of a desired patient is further elaborated and data collected at multiple time slots are enumerated for analysis of the user. Accordingly, the doctors, nurse, caretaker and any user may view the health information of one or more patients at different levels of details. FIG. 6B illustrates another

patient specific view 602 that provide the information of the patient and the status of various data/vital collection devices associated to the selected patient. FIG. 6C illustrates the relation between the color code and the range of vitals for reference. The manner in which the vitals are collected to form one or more views described above on the display device is further described below.

[0031] FIG. 7 is a block diagram of a system illustrating the manner in which the vitals are collected to form clusters in an embodiment. The block diagram is shown comprising wearable device 710, mobile device 720, server 730, legacy health monitoring devices 740A-740N, data aggregator 750, user display device 760, communication network 770 and GPS system 780. Each element is further described below.

[0032] The user display device 760 displays the views 101, 201, 301, 401, 501 and 601 and other information described with reference FIG 1-6. The display device 760 may comprise a Television, computer monitor, and other large screen display devices embodying suitable processor and drivers. In another embodiment, the display device may comprise mobile devices like, laptop, notebooks, tablets and mobile phones embodying corresponding set of software instructions to provide the views. GPS systems 780 provides the positioning and navigation aiding signal to determine the position of the one or more device incorporating corresponding hardware in it. For example, aggregator 750, wearable device 710 and mobile device 720 may comprise position deriving hardware to determine its position.

[0033] The legacy health monitoring devices 740A-740N comprises a BP (Blood Pressure) measuring device, ECG (electrocardiography/gram) recorder, Glucometer and other apparatus that are installed for measuring respective vitals at a central facility or around patient in an emergency ward of a hospital. The legacy health monitoring devices 740A-740N may comprise built in display devices to view the measured vitals on the spot and an electronic interface such as USB, serial bus etc., for providing the measured value to an external electronic device.

[0034] The data aggregator 750, collects the vitals measured on the legacy monitoring devices 740A-740N through one or more electronic interface such as USB, serial bus etc. the data aggregator is provided with electronic interface of different types in order to interface with larger number of different types of legacy health monitoring apparatus 740A-740N. The data aggregator 750 is deployed with suitable supporting processor and other hardware devices to receive the data in accordance with the respective protocols. For example, serial drivers, USB

drivers etc are deployed for transferring data on the respective interfaces. The data aggregator is also provided with memory and network interface to store the received vitals of a particular patient and transfer the same to the server 730 via communication network 770. The data aggregator may be deployed to provide a user interface to feed in the patient data and other legacy health monitoring apparatus information for configuration purpose using one or more known techniques.

[0035] The communication network 770 connects the elements 710-760 for transfer of data among them. The communication network 770 may comprise, GSM, 4G, Wi-Fi, internet, LAN and other data network suitable for data connectivity.

[0036] The server 730 receives the vitals over the communication network 770 from plurality of wearable devices 710, mobile device 720, and data aggregator 740 and generates one or more views described in sections above. The views are then sent to the display devices for display. Server may generate the views based on the user selection/input received on the display device and communicated to server via the communication network 770. The server 730 may be deployed on a standalone computer system, shared computer system, a cloud system, software as service (SaaS) or on any other computer infrastructure using a known ways.

[0037] The wearable device 710 collects vitals from the patient when worn on the body. The wearable device 710 is deployed with sensors to sense and measure the vitals such as skin temperature, heart rate, BP, blood oxygen level/oxygen saturation etc., when worn. The sensor is deployed on the wearable device to make appropriate contact with the body to measure the vitals. The wearable device comprises panic and emergency button for the patient to draw attention in the event of any emergency. In one embodiment, the wearable device communicates with the mobile device 720 and transfers the vital to the mobile device at a regular interval.

[0038] In one embodiment, the wearable device is shown comprising the oxygen saturation (SPO2) sensor clip 715 interfaced through the SPI cable 716. Accordingly, the clip may be removed when not needed and when the SPO2 needs to be monitored, the clip may be attached to the finger flexible through the extended cable 716. The wearable device detects the correct position of the finger on the clip to eliminate any sensor reading error.

[0039] In one embodiment, the wearable device stores the data measured when the connectivity to the network or to the associated mobile device is not available. The stored vitals are transferred to the mobile device when the connection is established with the mobile device.

[0040] The mobile device 720 receives the vitals from the wearable device and displays the vitals in a suitable format. Thus, mobile users may quickly determine the health condition of the corresponding one or more patient locally without having to connect server. Thus, patient may see, monitor, maintain the health and manage the wearable device through the mobile device. In one embodiment, mobile device may also provide a user interface to a patient to feed in other information such as pain level etc. The manner in which the mobile device may display health information for the use of patient and for local use by doctors/nurse or caretaker is further described below.

[0041] FIG. 8A is an example display on the mobile device 720 that is in communication with the wearable device 710. The view formed on the display is shown comprising vitals pulse/heart rate 810, oxygen saturation 820, skin temperatures 830 and pain score 840. The respective graphical indicators 801-804 matches to that of the graphical indicators on graphics 371, 372, and 373 described in above sections. As a result, the vitals collected on the wearable devices are readily viewed in real time on the mobile device that are associated or linked to corresponding wearable device. In addition, the mobile device provides for receiving user inputs. As shown the icons 891, 892, 893 respectively receive the request for caretaker or nurse attention, panic attention, and pain input. The icons 896 and 897 provide the status of the wearable device in respect of battery power and connectivity respectively. For example, the wearable device may be deployed with replaceable coin cells, accordingly, the icon 896 may represents the coin cell voltage level. The mobile device further provides views of particular vitals when selected by tapping on the vitals 810-840. FIG. 8B and 8C illustrates mobile device views of such selected vitals (for example, pulse rate and oxygen saturation respectively). As shown there the current measured value of the pulse rate and oxygen saturation are depicted in larger size covering substantially half the screen and the range of the selected vital over a period of time are displayed on the remaining part of the screen. The manner in which the mobile device 720 provides for associating and configuring the wearable device 710 is further described below.

[0042] FIG. 9A through 9C are the configuration features provided on the mobile device in one embodiment. In that FIG. 9A illustrates the manner in which a wearable device may be connected /associated to a mobile device. The listing 901 indicates the list of wearable device that are within the network communication (Bluetooth for example) and are available for connection. The wearable device 902 represents the connected wearable device or the wearable

device that is currently associated with the mobile device. Thus, it may be appreciated that the mobile device and wearable device may be selectively paired as and when required. The wearable device thus paired remains connected and exchange the vitals with the corresponding mobile device.

[0043] FIG. 9B illustrates the manner in which the wearable device may be configured to monitor for a time period. As shown there, the icon 911 and 912 receives the time period for which the pain needs to be managed and vitals need to be monitored. For example, as shown both monitoring is set to one hour. Accordingly, the wearable device activates the sensors to measure the vitals and transmit the same to the mobile (or store the value when the connection is not established) similarly, the mobile device will maintain the pain management profile active to receive user (in this case the patient) pain level.

[0044] FIG. 9C illustrates the manner in which the details of the patient, doctor in charge, care taker details, and the wearable device profile may be set on the mobile device. Thus, provide flexibility of associating a wearable device with the mobile device for combined use on ad-hoc basis. Further, hospitals may reuse the same infrastructure (wearable device and mobile device for example) time and again. The manner in which the wearable device may be implemented to measure the vitals and may be configured to operate in association with the mobile device is further described below.

[0045] FIG 9D and 9E illustrates the manner in which the wearable device and mobile device operate to take more accurate readings from the PSO2 clip 715. As shown in FIG. 9E, the mobile device 720 display warning to indicate the finger is not placed accurately in the clip 715 and enable the patient to place the finger accurately for retaking the measurement. IN figure 9E, mobile device 720 display messages indicating the measurement is being made and guide the patient to keep the hand immobile for accurate reading. Accordingly, the wearable device and mobile device operate interactively to take accurate PSO2 reading. FIG.9F illustrates the manner in which the mobile device retrieves the data stored on the wearable device when the connection to the mobile device 720 is lost. The mobile device presents the display as-shown to indicate that the vitals data that are stored in the wearable device is being updated/ restored. Mobile device may further save vitals for reference and upload the vital to the server as and when the connection is established with the server.

[0046] FIG. 10 is a block diagram of a wearable device in one embodiment. The wearable device is shown comprising skin temperature sensor 1010, optical biosensor 1020, panic button 1030, reset button 1040, power management subsystem 1050, wireless subsystem 1060, and processor 1070. In that, optical biosensor 1020 collects various measurements such as SpO<sub>2</sub>, pulse rate, etc. The optical biosensor 1020 may be implemented to with infrared LED, Red LED and/or photo diode as sensor front end and AFE4490 as signal processing front end. The optical biosensor or SPO<sub>2</sub> 1020 may be interfaced to the main wearable through a flexible and removable interface as shown with 716. The wireless subsystem 1060 connects with Mobile device and transfers the measured data between the Wearable device and rest of the world. In one embodiment the wireless subsystem 1060 comprise a Bluetooth RF frontend, Bluetooth (BLE) protocol Stack and a 2.5 GHz, band pass filter. The power management subsystem 1050 comprises battery management that manages the power drawn from a button cell such as CR2032. The panic button 1030 provides simple user interface for nurse call or emergency notification for caretaker or clinician. The processor 1070, controls the hardware and data collection from skin temperature sensor 1010, optical biosensor 1020, accelerometer, panic button 1030, reset button 1040, user interface LEDs and buttons for output and input respectively. The processor 1070 may further comprise memory to store the vitals when the wireless subsystem 1060 indicates no connectivity. Further, the wearable device may comprise memory chip (not shown) to store the measurements (vital). The wearable device comprises low power hardware for long battery life low, maintenance cost, simple mechanism to hold battery which can be easily replaced, Low maintenance effort by low skilled labour, Embedded Software integration for simple user interface via Smartphone/mobile device, 24 hrs vital data backup when wireless subsystem 1060 and mobile connection is not established.

[0047] In operation, Wearable device upon user input (reset), device is initialized. Embedded software is downloaded and executed by the processor 1070. The processor 1070 loads the BLE protocol s/w to the BLE device. Through mobile APP S/W interface user configuration is sent to the processor 1070 via BLE interface. The processor 1070 shuts down all devices until it is time for next measurement. When it is due for measurement, user is alerted for immobilizing the arm. H/W enables each peripheral device, takes measurement, aggregates data into user data structure and sent to mobile device via BLE. When the user wants to force a measurement, mobile device sends data collection intimation to wearable device. In other times, each of the hardware sub

modules are kept in low power mode for reducing the overall power consumption during idle time. As illustrated with reference to FIG.9D and 9E, the wearable device detects the inaccurate position of the figure with the PSO2 clip 1020/715 and sends a message to the mobile device. The mobile device then displays the warning as in FIG. 9D for example. Similarly, when the PSO2 measurement is in progress, the wearable device sends a signal/message to the mobile device indicating the status as measurement in progress. Accordingly, the mobile device 720 may display the status as in FIG. 9E for example. The manner in which various sub modules are kept in the low power mode selectively is illustrated in FIG.11. As shown, the example components forming the hardware of the wearable are selectively made active and sleep mode to provide longer battery life. Manner in which the mobile device is configured to operate with the wearable device is further described below.

[0048] FIG.12 is a block diagram illustrating the manner in which the mobile device operates to communicate and control the wearable device in one embodiment. In block 1201, the mobile device is configured with the frequency of reading the data from the wearable device and the phone numbers for contacting under emergency. In block 1202, the mobile device is enabled to send notification under present conditions arising out of vitals, panic button, battery level, wearable status etc. In block 1203A, the mobile device checks if the vitals received are out of bound. In block 1203B, the mobile device displays the vital in red if yes. In block 1204A, the mobile device checks if the panic button is pressed. If yes, in block 1204B, the mobile device blinks red alert and sends SMS to the concerned phone numbers. In block 1205A, the mobile device checks if the battery level in the wearable is low. If yes, in block 1205B, the mobile device sets alert notification. In block 1206A, the mobile device checks if the wearable is out of the range of the mobile device. If yes, in block 1206B the mobile device sets alert indicating the wearable device is disconnected. In block 1207, the mobile device checks whether the manual trigger button is pressed. In block 1208, the mobile device checks if the timer set is triggered. In block 1209, if yes for any one, the mobile device sends a request signal to the wearable device to send the details of the measured vitals. In response, the mobile device may receive data from the wearable device or the mobile device may resend the request after a pre-specified wait period or send an alert that the wearable device is not responding as in block 1210. Accordingly, the mobile device repeats the above actions. In one embodiment, the mobile device connects to the server 730 over GSM or other communication network and uploads the data so received from the wearable and also

received on the mobile device interface. Accordingly, the vital information and other patient related information is made available to other user through the server in the ways described in the sections above.

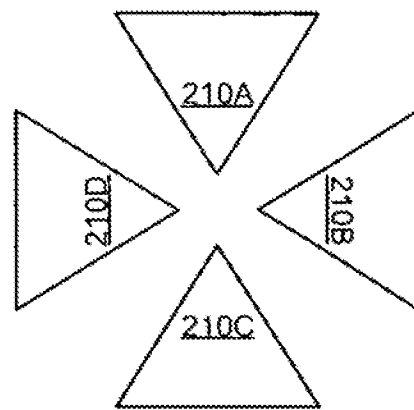
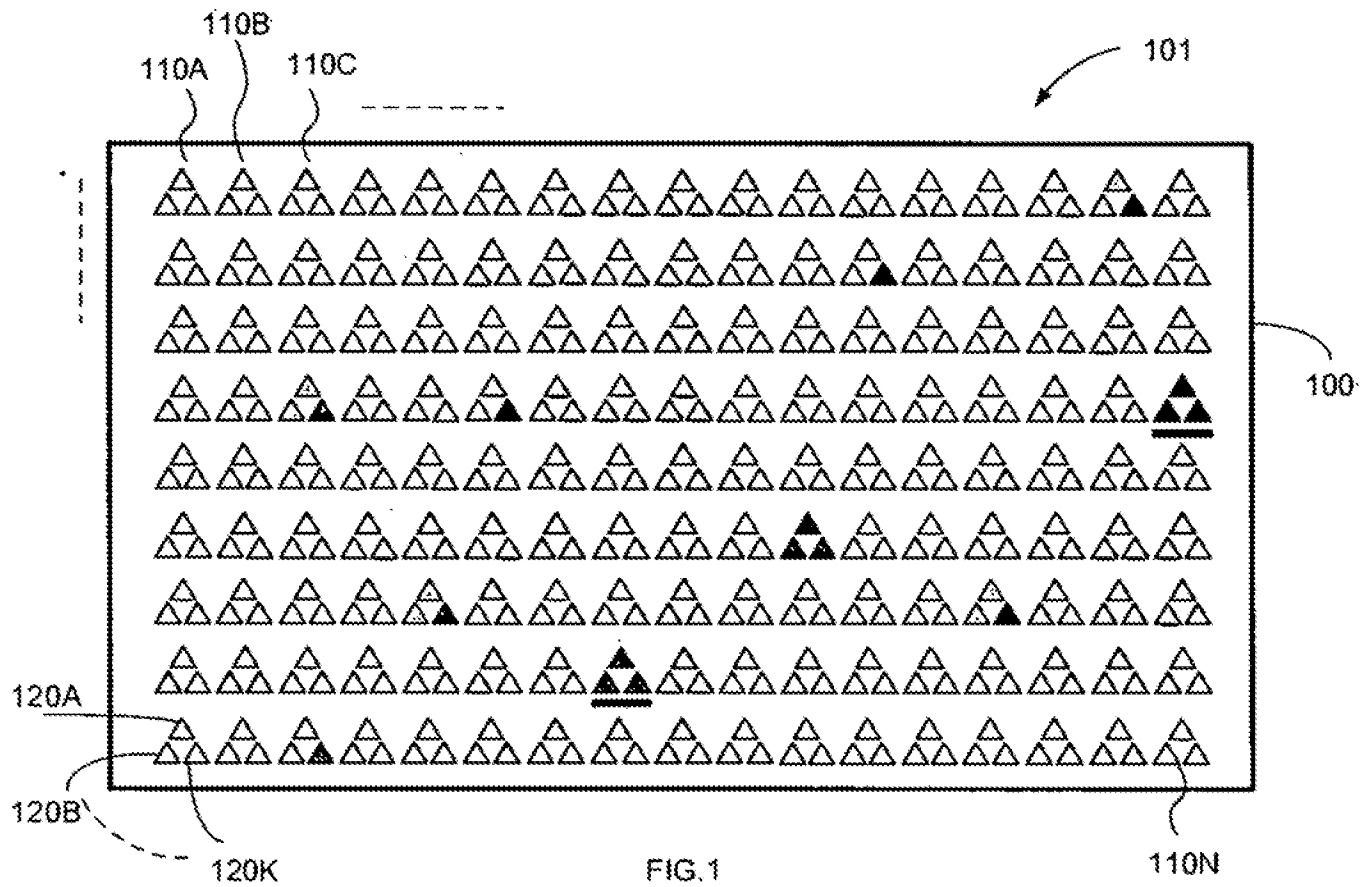
[0049] While various embodiments of the present disclosure have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-discussed embodiments, but should be defined only in accordance with the following claims and their equivalents.

## CLAIMS

I/We Claim,

1. A method of displaying patient information comprising:  
Collecting vitals from plurality of patients physically positioned for medical care; and  
Displaying on a display device a pattern comprising plurality of clusters representing corresponding plurality of patients, in that each cluster in the plurality of clusters comprising set of display segments representing a corresponding set of vitals collected from a patient in the plurality of patients, in that the display segments are displayed to provide visually distinguishable tones to indicate the different critical levels of the respective vitals such that, plurality of patient's health conditions are determined at a single glance to the display device.
2. The method of claim 1 further comprising:  
Collecting plurality of first set of vitals from the corresponding plurality of wearable device attached to the body of the plurality of patients;  
Transferring the plurality of the first set of vitals to corresponding plurality of mobile devices in possession of the plurality of patients; and  
transferring the plurality of the first set of vitals from the plurality of mobile devices to a server to form the vitals.
3. The method of claim 2 further comprising collecting a second set of vitals from a data aggregator connected to set of legacy health monitoring devices, wherein at least some vitals in the first set and the second set of vitals form the set of vitals represented on the segments within one cluster of the patient.
4. The method of claim 3, further comprising displaying first set of vitals and the second set of vitals on the mobile device that is in connection with the wearable device attached to the body of the patient for collecting the first set of vitals.
5. The method of claim 4, wherein the first set of vitals comprise skin temperature, pulse rate, and blood oxygen level.
6. The method of claim 5, wherein the second set of vitals comprises the ECG, glucometer blood pressure reading.

7. The method of claim 6, further comprising displaying each cluster effective health index with a single segment in that the tone of the single segment represent the effective health determined from the first set and the second set of vitals of a patient.
8. The method of claim 7, wherein the pattern comprising plurality of groups with each group corresponding to one parameter comprising floor of a hospital, ward of a hospital, hospital, doctor, nurse, criticality, emergency.
9. The method of claim 8, wherein a cluster is made part of the group based on the position information collected from at least one of wearable device, data aggregator and mobile device.
10. Method, system and apparatus providing one or more features as described in the paragraphs of this specification.



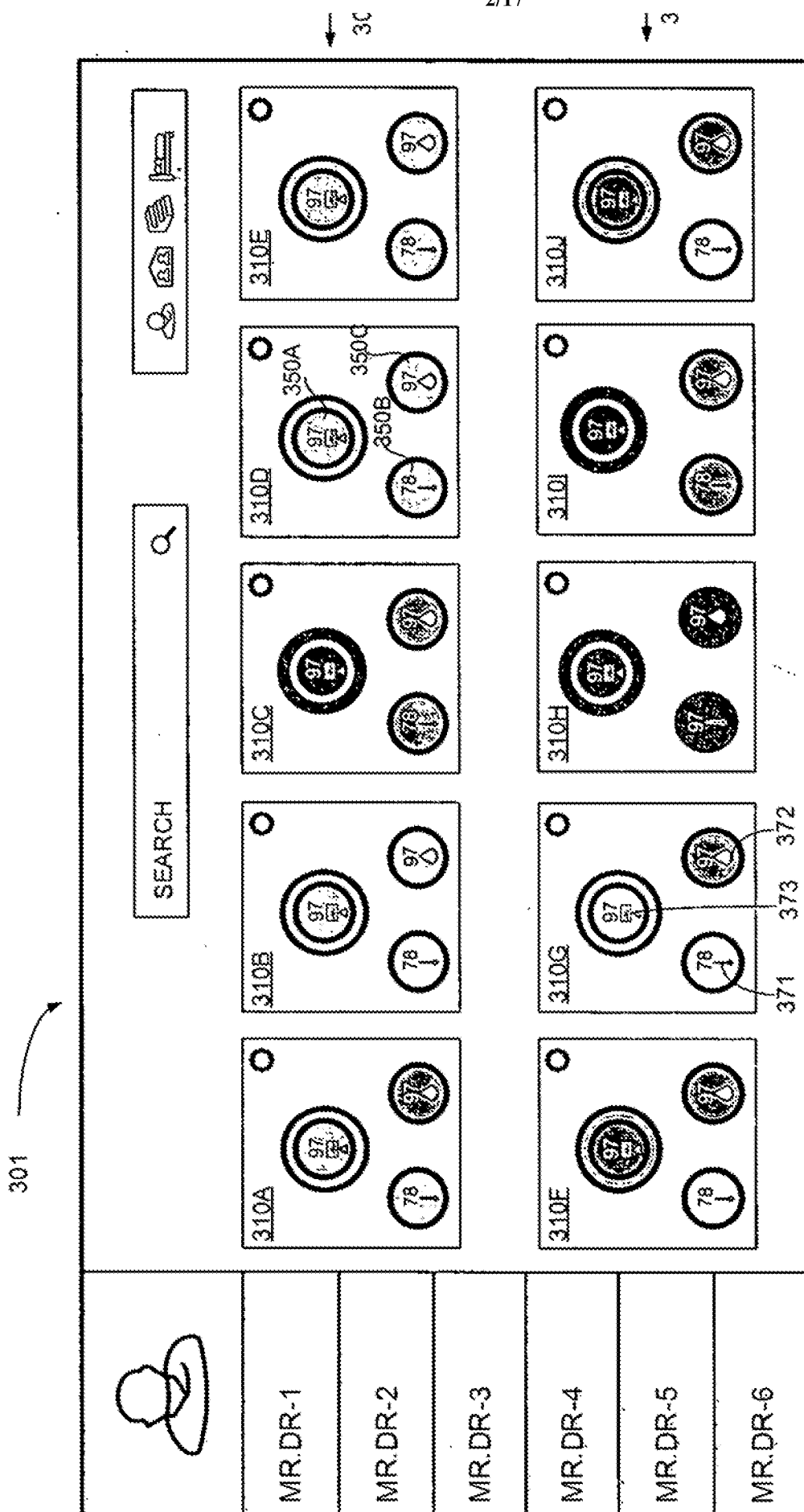


FIG.3

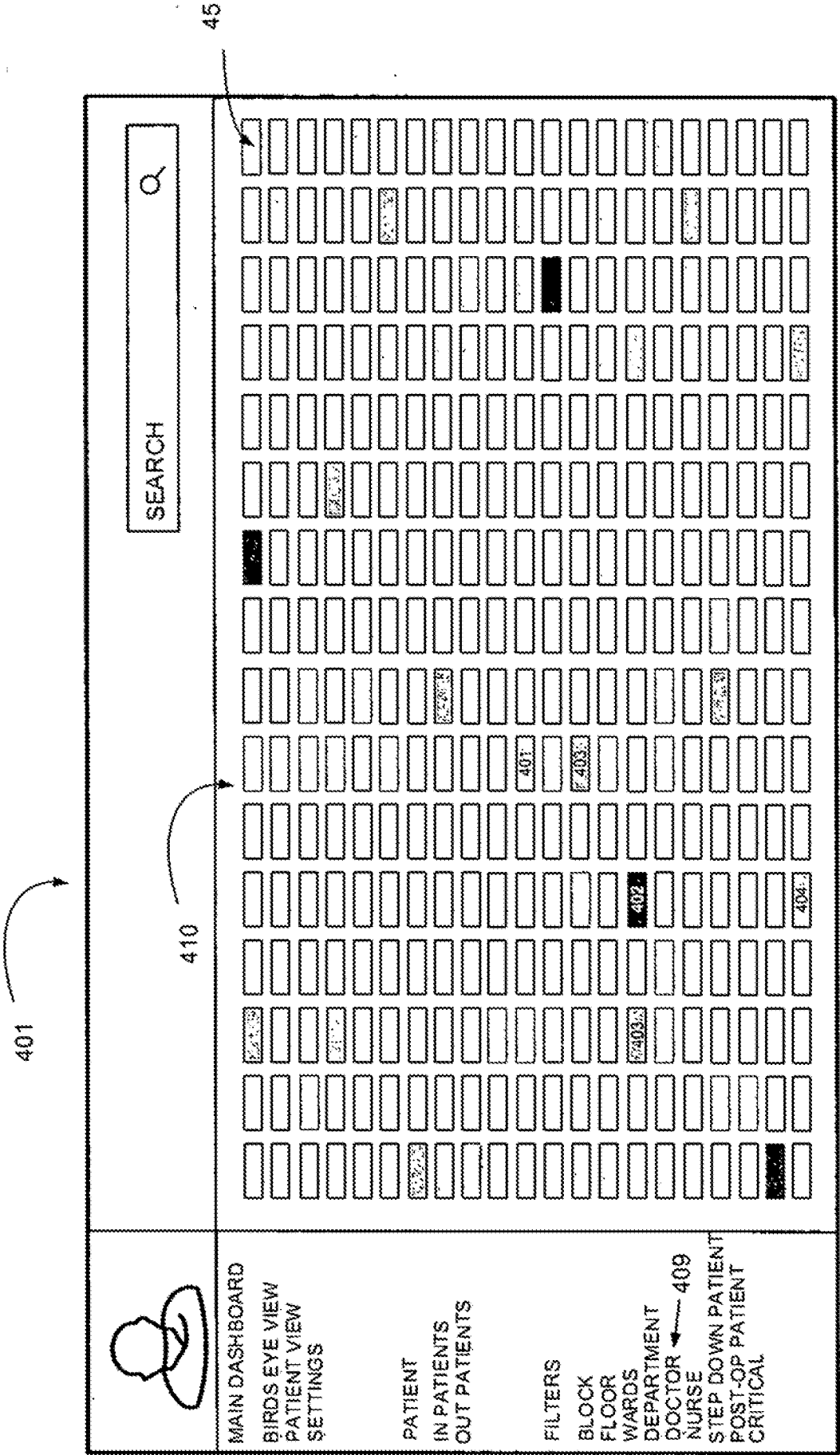


FIG.4

501

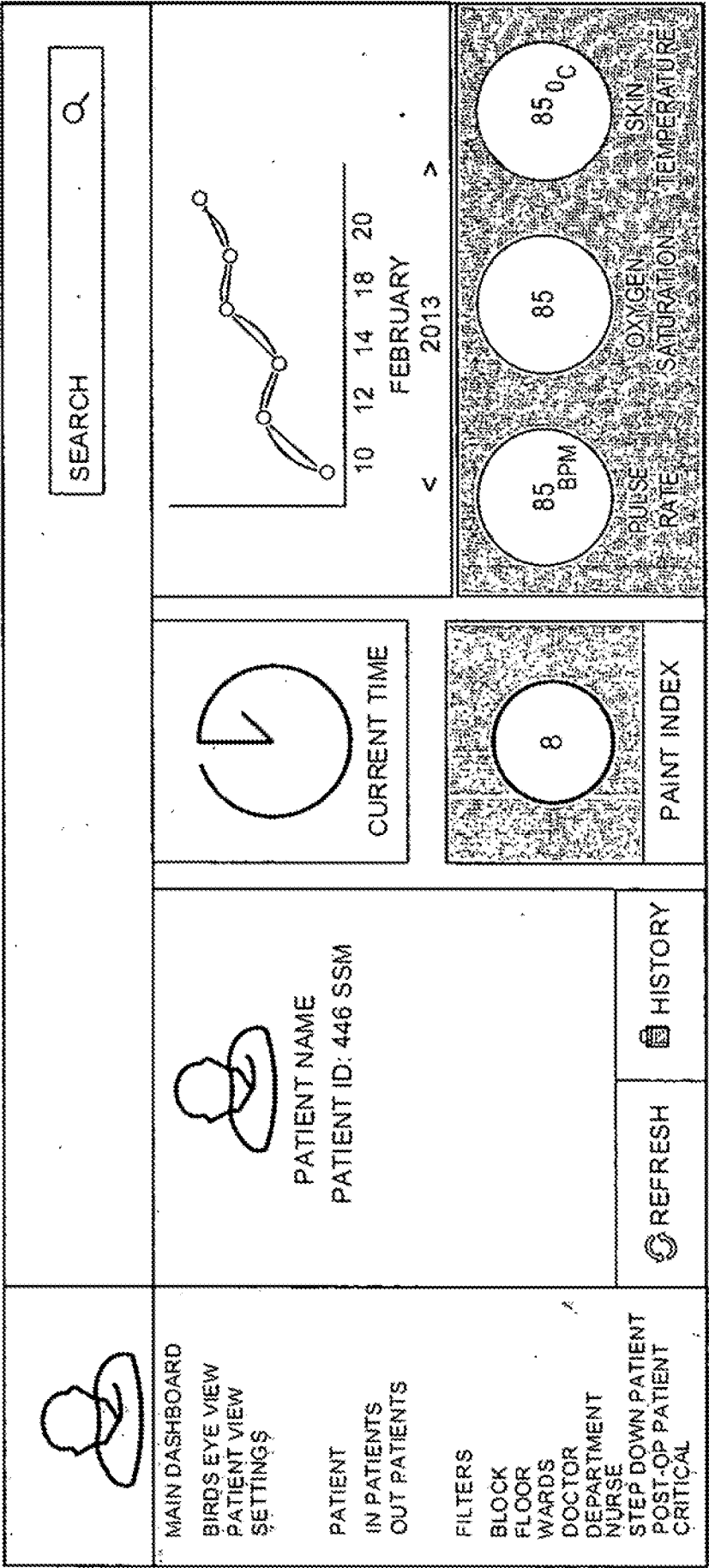
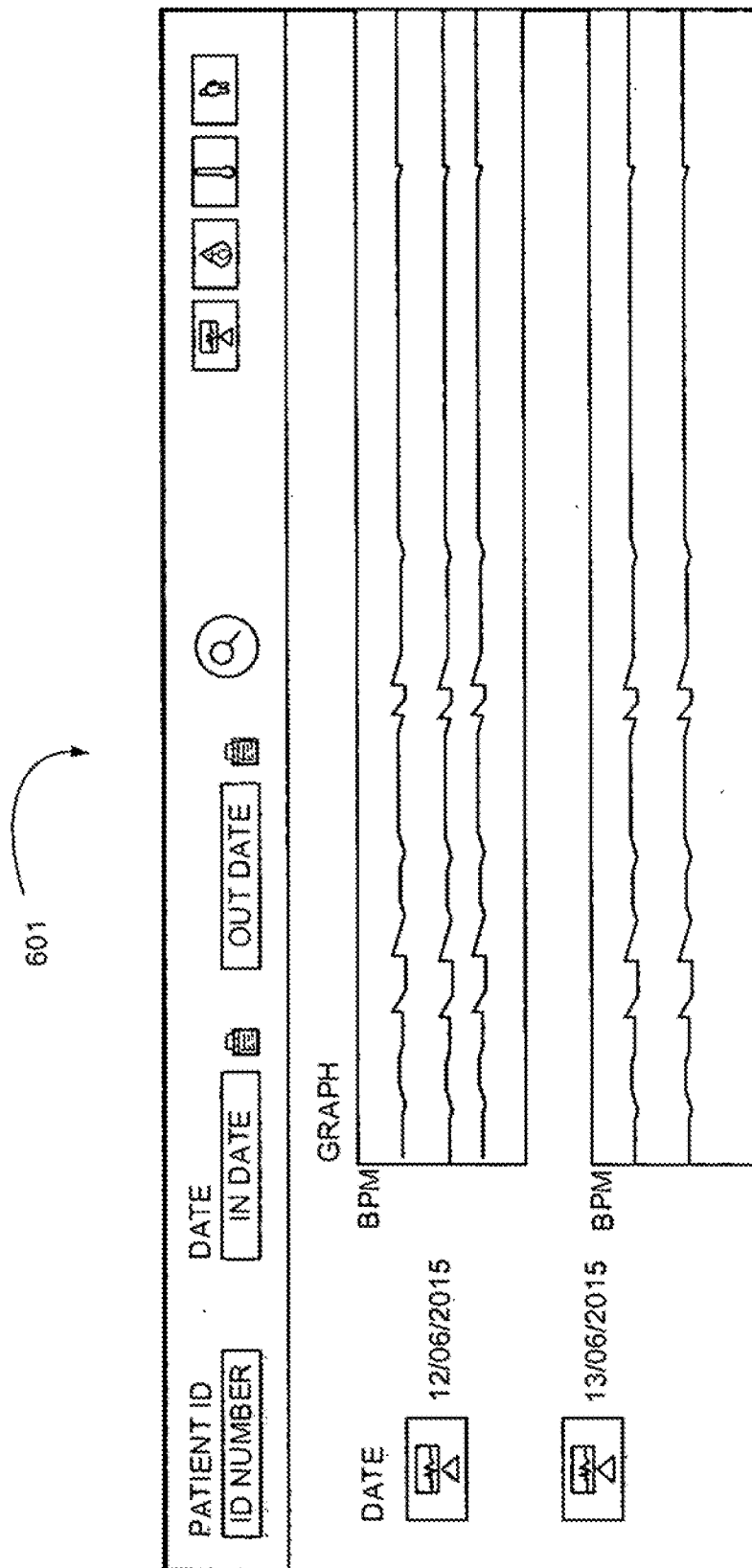


FIG.5



400

602



| USER PROFILE            |              | EMERGENCY NUMBERS:   |  | BAND PROFILE FOR THE PATIENT:       |  |
|-------------------------|--------------|----------------------|--|-------------------------------------|--|
| USER ID: PATIENT NUMBER |              |                      |  | PANIC MODE: ON                      |  |
| NAME:                   | PATIENT NAME | NAME<br>NUMBER ONE   |  | PAIN<br>MANAGEMENT: OFF             |  |
| AGE:                    | NUMBER       | NAME<br>NUMBER TWO   |  | VITALS<br>MANAGEMENT: ON            |  |
| GENDER:                 | GENDER       | NAME<br>NUMBER THREE |  | VITALS FREQUENCY<br>RANGE:          |  |
| EMAIL:                  | MAIL ID      |                      |  | PAIN INDEX MONITORING<br>FREQUENCY: |  |
| MOBILE:                 | NUMBER       |                      |  |                                     |  |
| PIN:                    | PIN NUMBER   |                      |  |                                     |  |
|                         |              |                      |  | <div>CANCEL</div> <div>SEND</div>   |  |

FIG.6B

|                                                                                                                                                                                                                                                                                                                                                                              |                               |              |              |              |              |              |              |              |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <div><div><div></div></div></div>                                                                                                                                                                                                                                                                                                                                            | <div>SEARCH</div> <div></div> |              |              |              |              |              |              |              |              |
| <div>MAIN DASHBOARD</div> <div>BIRDS EYE VIEW</div> <div>PATIENT VIEW</div> <div>SETTINGS</div> <div>PATIENT</div> <div>IN PATIENTS</div> <div>OUT PATIENTS</div> <div>FILTERS</div> <div>BLOCK</div> <div>FLOOR</div> <div>WARDS</div> <div>DOCTOR</div> <div>DEPARTMENT</div> <div>NURSE</div> <div>STEP DDWN PATIENT</div> <div>POST-OP PATIENT</div> <div>CRITICAL</div> | PHYSIOLOGICAL<br>PARAMETERS   | <div>3</div> | <div>2</div> | <div>1</div> | <div>0</div> | <div>1</div> | <div>1</div> | <div>2</div> | <div>3</div> |
| Heart Rate                                                                                                                                                                                                                                                                                                                                                                   | < 30                          | < 40         | 41-50        | 51-100       | 101-110      | 111-130      | > 130        |              |              |
| Oxygen Saturation                                                                                                                                                                                                                                                                                                                                                            | < 85                          | > 85         | > 90         | > 95         | -            | -            | -            |              |              |
| Skin Temperature                                                                                                                                                                                                                                                                                                                                                             | -                             | ≤ 35         | 35.1-36      | 36.1-38      | 38.1-38.5    | ≥ 38.6       | -            |              |              |
| Pain Score                                                                                                                                                                                                                                                                                                                                                                   | Severe                        | Moderate     | Mild         | None         | -            | -            | -            |              |              |
| Systolic BP                                                                                                                                                                                                                                                                                                                                                                  | < 45%                         | < 30%        | 15% down     | Normal       | 15% up       | 30% up       | > 45%        |              |              |
| Respiration Rate                                                                                                                                                                                                                                                                                                                                                             | < 8                           | -            | 8-11         | 12-20        | 21-25        | 26-30        | > 30         |              |              |
| Level of Consciousness                                                                                                                                                                                                                                                                                                                                                       | -                             | -            | -            | Alert        | Voice        | Pain         | Unconscious  |              |              |
| Urine Output                                                                                                                                                                                                                                                                                                                                                                 | < 80                          | 80-119       | 120-200      | > 200        | > 800        | -            | -            |              |              |

FIG.6C

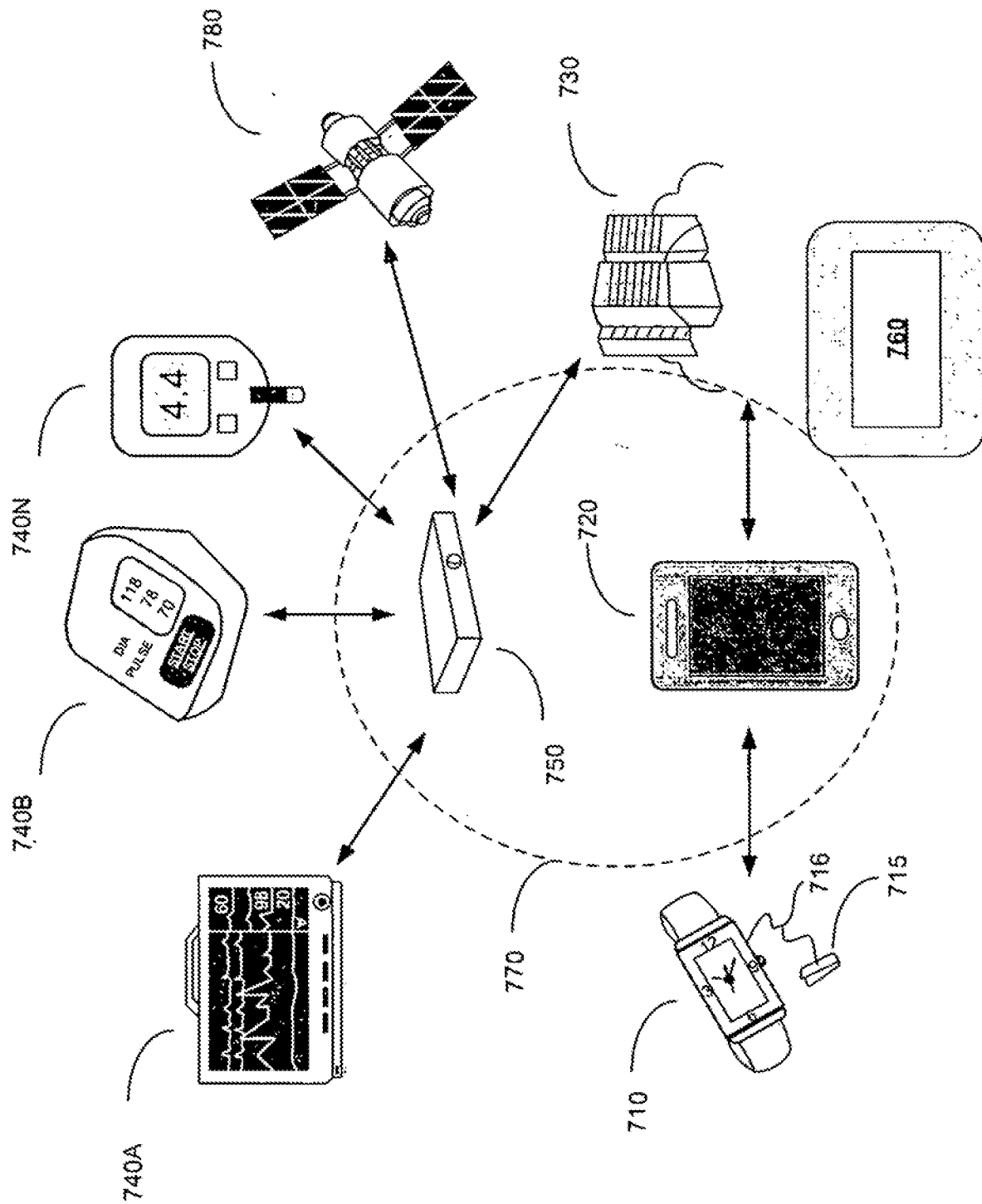


FIG. 7

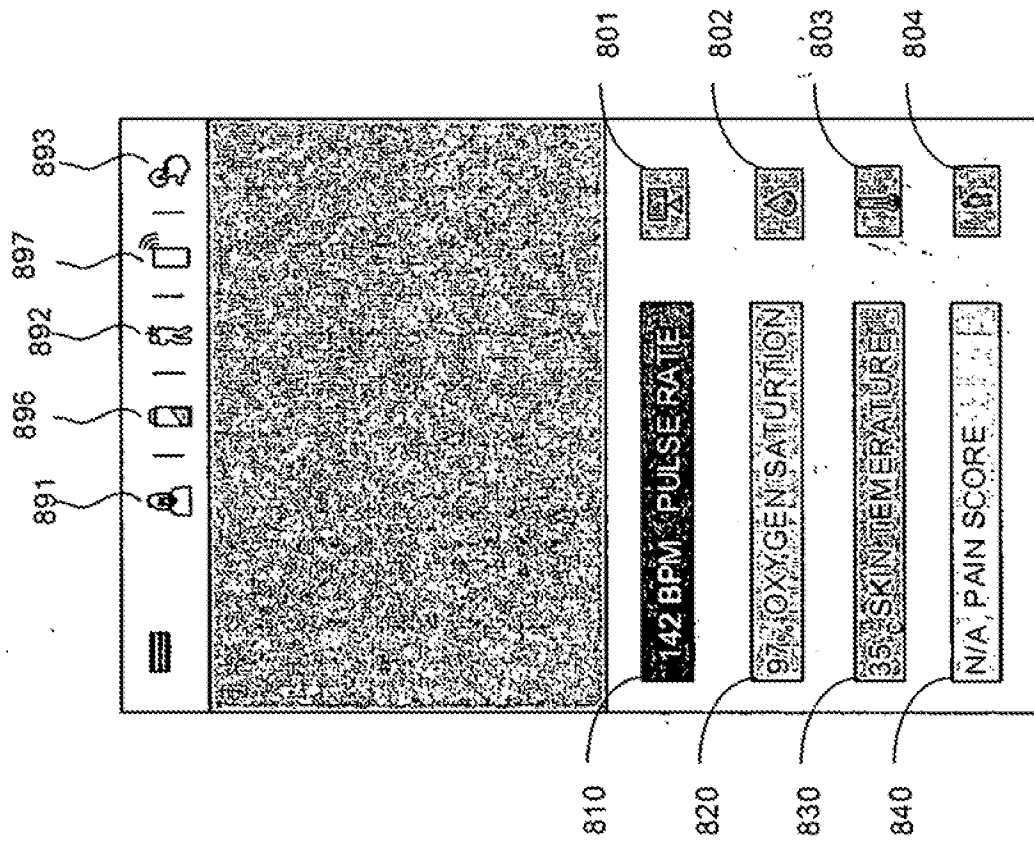


FIG. 8A

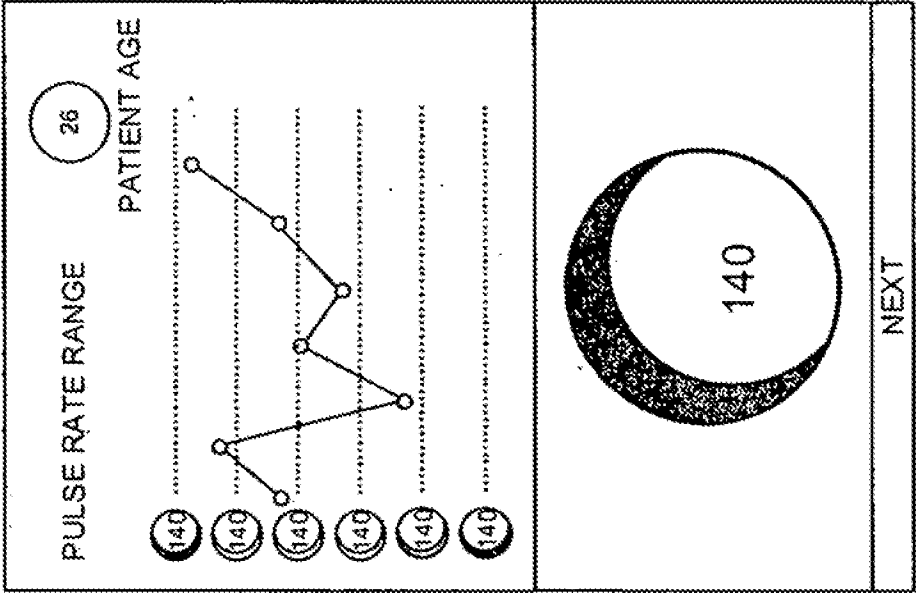


FIG.8B

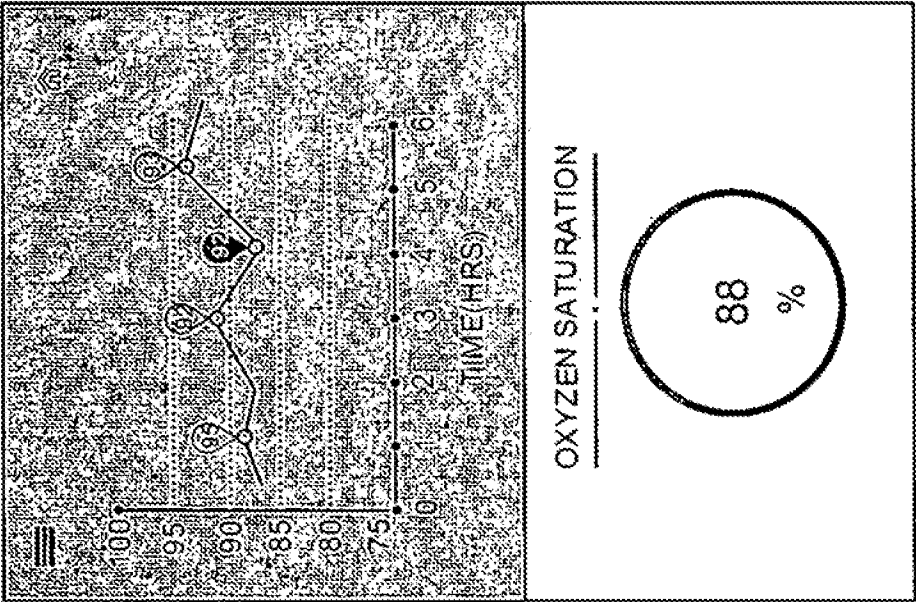


FIG.8C

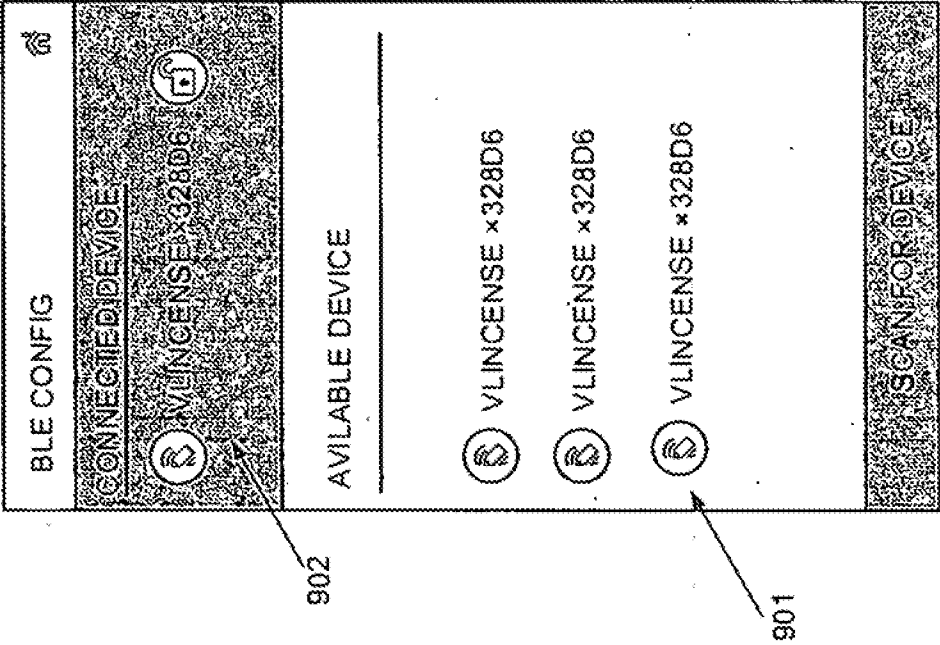


FIG. 9A

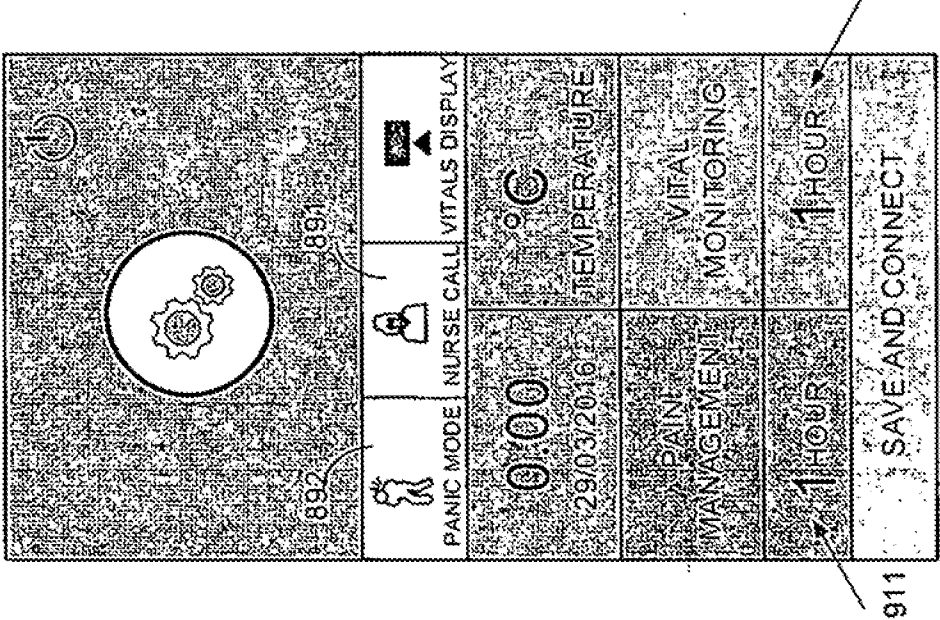


FIG. 9B

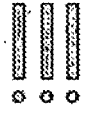
| PATIENT MANAGEMENT                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                              |                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>   </div>                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                              |                                                                                                                                                                                                                                                                                                                                                |
| <div>    </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                              |                                                                                                                                                                                                                                                                                                                                                |
| <div> <input type="text"/> <input type="button" value="Q"/> </div>                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     | <div> <input type="text"/> <input type="button" value="Q"/> </div>                           |                                                                                                                                                                                                                                                                                                                                                |
| DOCTOR IN-CHARGE                                                                                                                                                                                                                                                         | PATIENT PROFILE                                                                                                                                                                                                                                                                                                                                                                                                                     | EMERGENCY NUMBERS                                                                            | BAND PROFILE FOR THE PATIENT                                                                                                                                                                                                                                                                                                                   |
| <div>NAME</div> <div>SPECIALITY</div> <div>+91</div> <div>CITICALITY</div> <div> <input checked="" type="checkbox"/> LOW                     <input checked="" type="checkbox"/> HIGH                 </div>                                                             | <div>NAME</div> <div>AGE</div> <div>GENDER</div> <div> <input checked="" type="checkbox"/> MALE                     <input checked="" type="checkbox"/> FEMALE                     <input type="checkbox"/> OTHER                 </div> <div>E-MAIL</div> <div>+91</div> <div>PIN</div> <div> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> </div> | <div>NAME</div> <div>+91</div> <div>NAME</div> <div>+91</div> <div>NAME</div> <div>+91</div> | <div>PANIC MODE</div> <div>PAIN MANAGEMENT</div> <div>VITALS MANAGEMENT</div> <div>PAIN INDEX MONITORING <input type="text" value="2"/></div> <div>FREQUENCY</div> <div>VITAL MONITORING <input type="text" value="4"/></div> <div>FREQUENCY</div> <div> <input type="button" value="LOAD DATA"/> <input type="button" value="SUBMIT"/> </div> |

FIG.9C

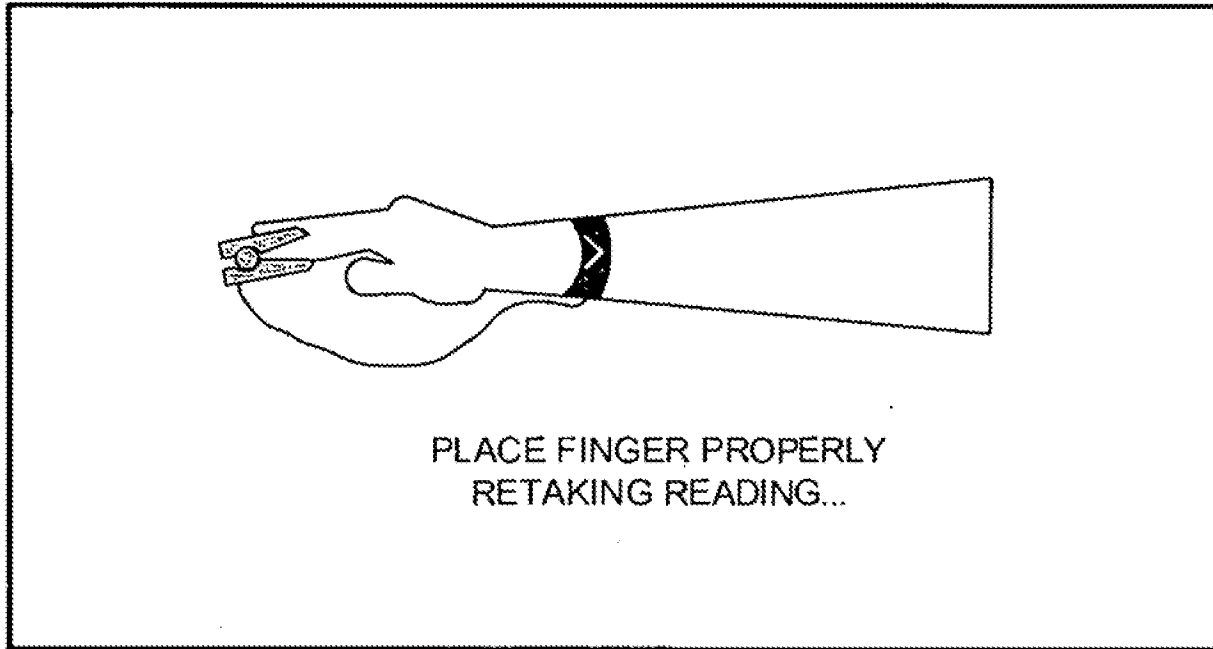


FIG.9D

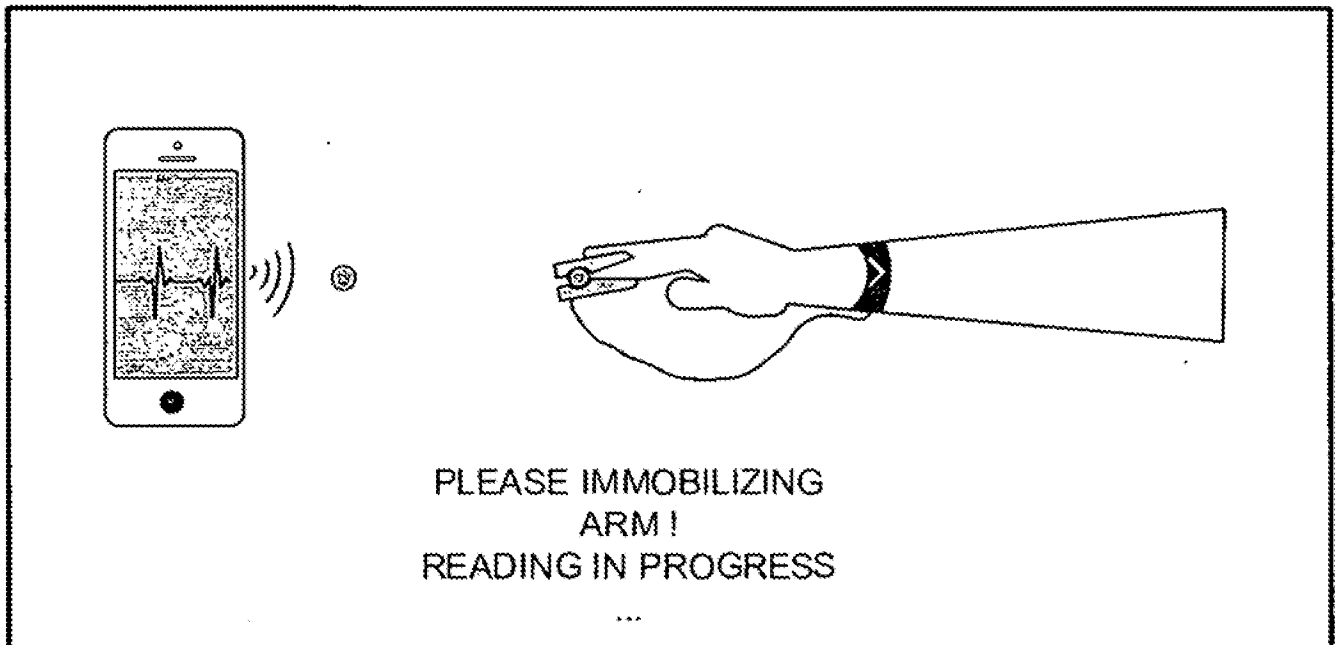


FIG.9E

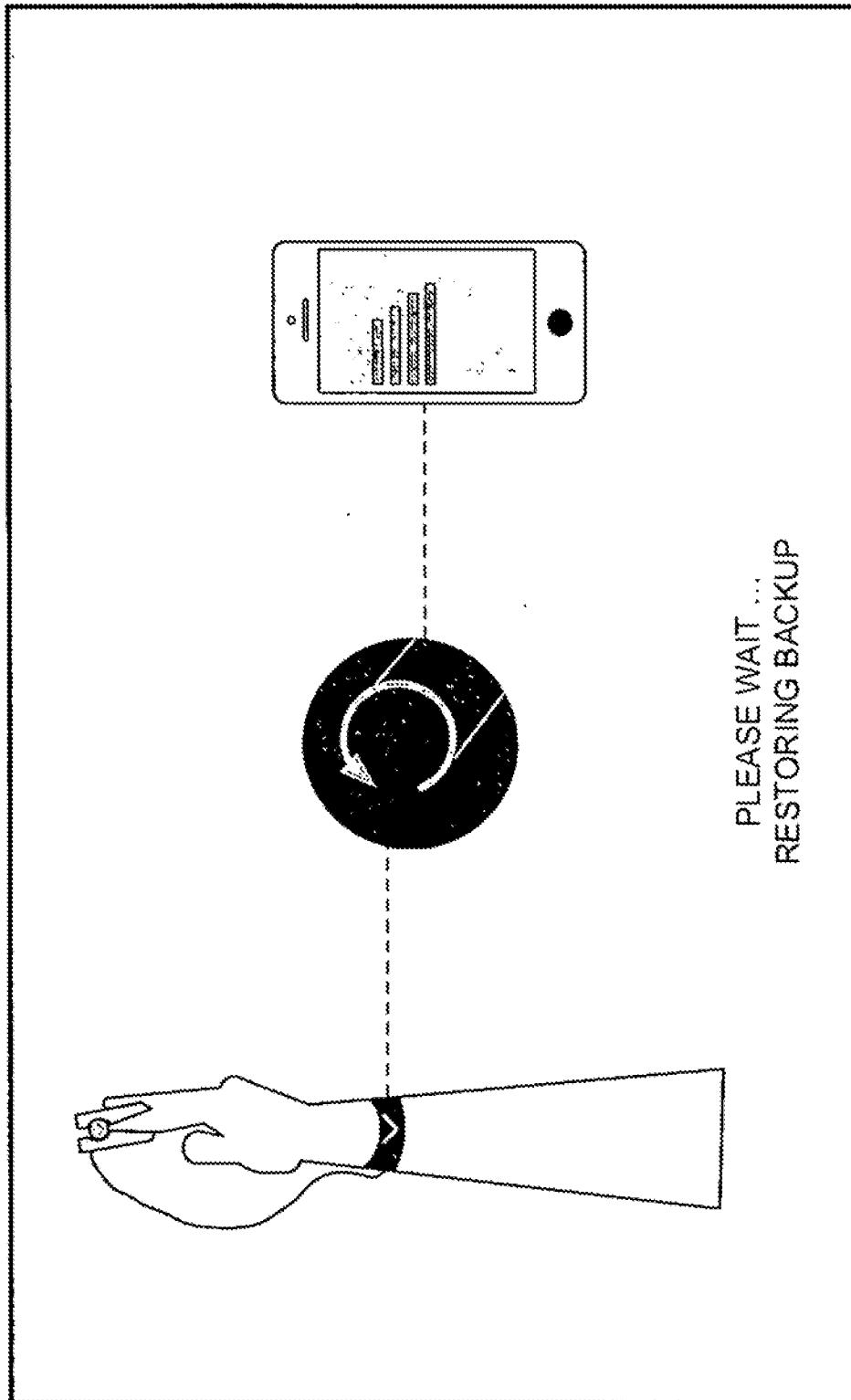


FIG.9F

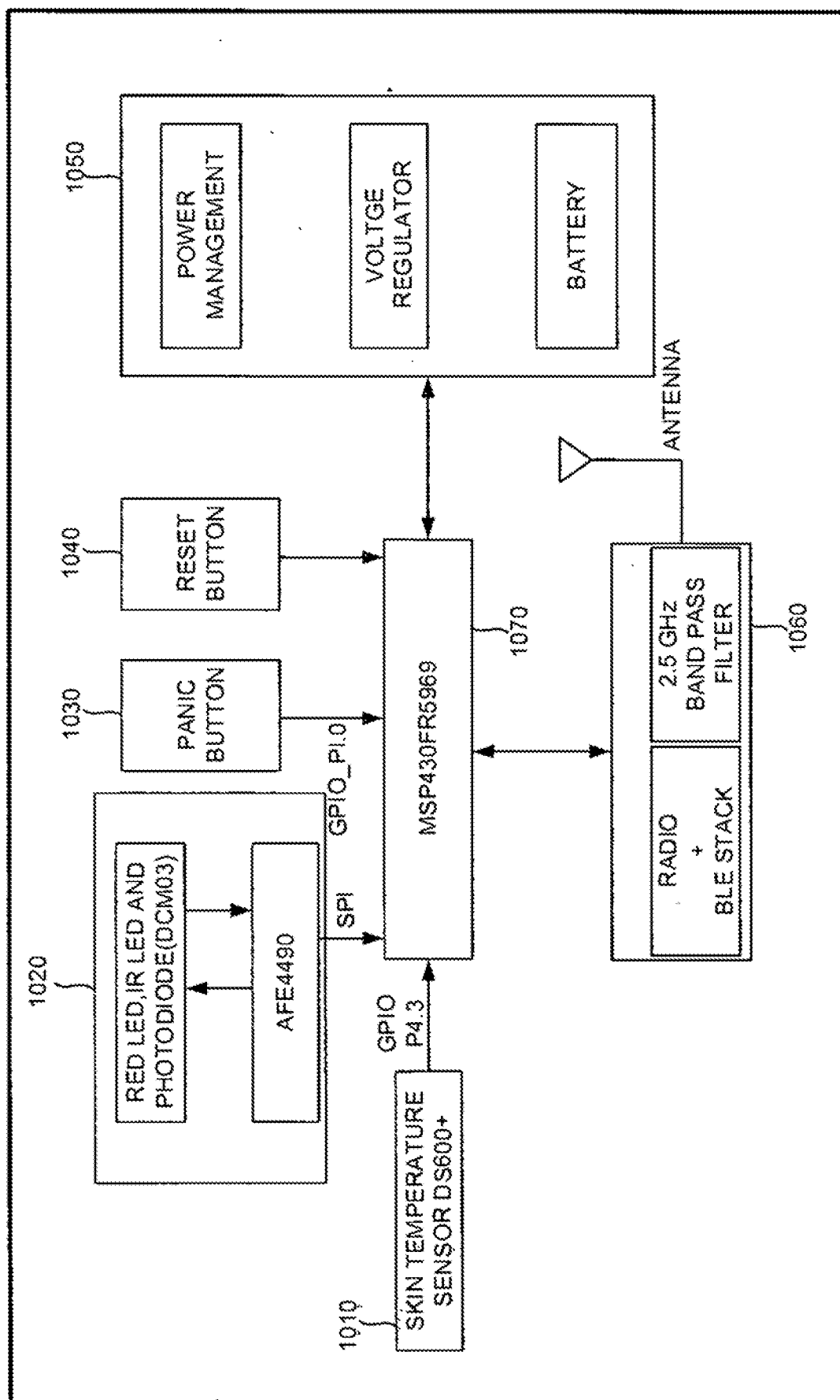


FIG. 10

| No | HW Components      | Alert               | Alert             | Real Time           | Real Time         | Data Logging        | Data Logging      |
|----|--------------------|---------------------|-------------------|---------------------|-------------------|---------------------|-------------------|
|    | <u>Power Modes</u> | <u>Working Mode</u> | <u>Sleep Mode</u> | <u>Working Mode</u> | <u>Sleep Mode</u> | <u>Working Mode</u> | <u>Sleep Mode</u> |
| 1  | DC-DC              | Active              | Active            | Active              | Active            | Active              | Active            |
| 2  | MSP430FR8969       | Active              | LPM3              | Active              | LPM3              | Active              | LPM3              |
| 3  | AFE4490            | Active              | AFE PDN           | Active              | AFE PDN           | Active              | AFE PDN           |
| 4  | LED - RED          | ON                  | OFF               | ON                  | OFF               | ON                  | OFF               |
| 5  | LED - IR           | ON                  | OFF               | ON                  | OFF               | ON                  | OFF               |
| 6  | Accelerometer      | Active              | Standby           | Active              | OFF               | Active              | OFF               |
| 7  | Temperature Sensor | Active              | Shutdown          | Active              | Shutdown          | Active              | Shutdown          |
| 8  | CC2541             | Active(Tx)          | PM3               | Active(Tx)          | PM3               | Active(Tx)          | PM3               |

FIG.11

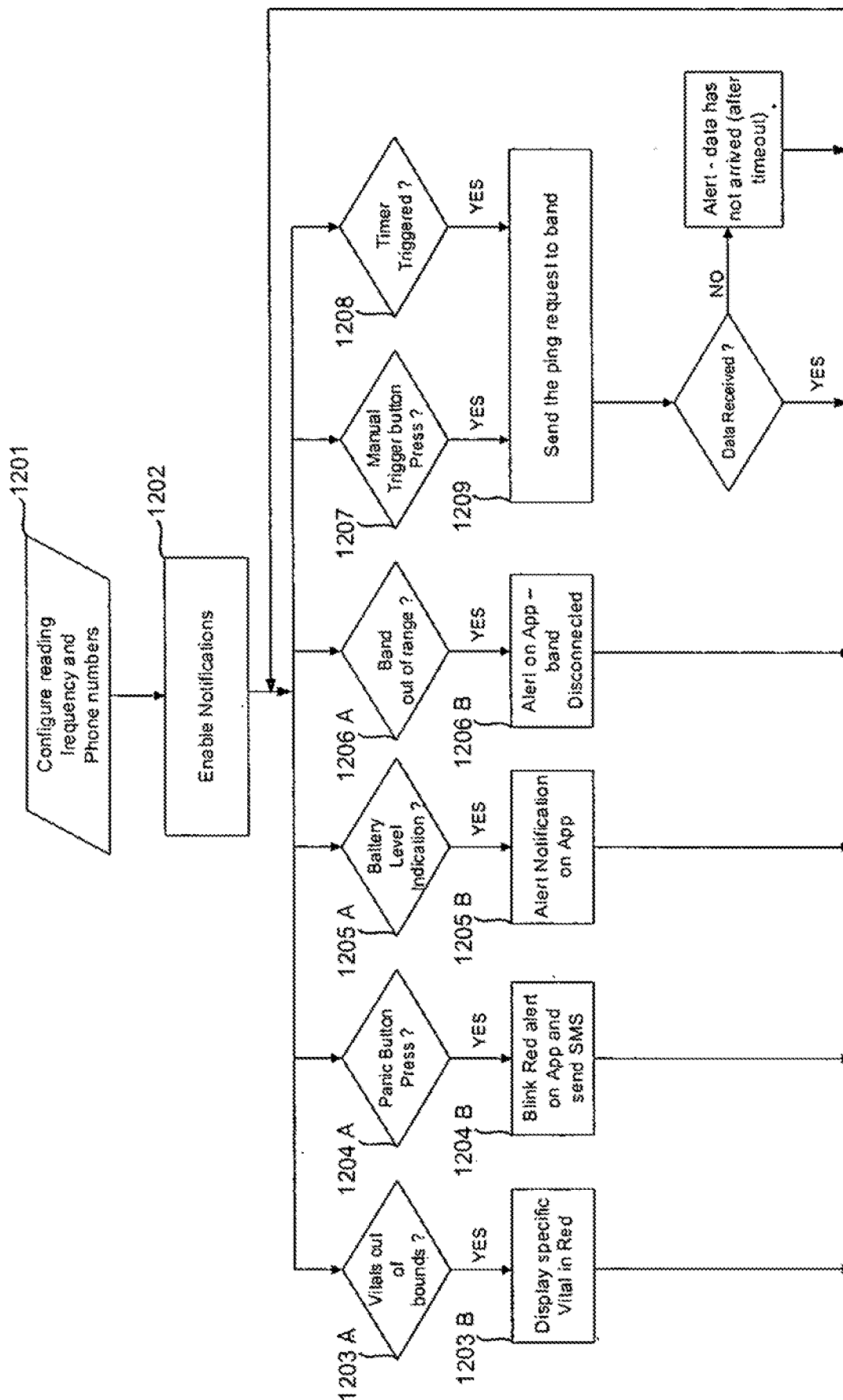


FIG. 12

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IN2017/000100

## A. CLASSIFICATION OF SUBJECT MATTER

A61B5/00, G06Q50/24, G06Q50/22, G06F19/00 Version=2017.01

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)

A61B, G06Q, G06F

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)

Databases: Patseer, IPO Internal Database

Keywords: display, patient vital data, collection, monitoring, cluster

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                         | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | US 7778851 B2 (I.M.D. SOFT LTD.) 17 August 2010 (17-08-2010) Abstract; Claims 1, 10, 19, 27; Column 2 line 51-Column 3 line 38, Column 9 line 22-Column 11 line 67<br>-----                                                                                                                                                                                                                | 1-10                  |
| Y         | US 5572422 A (KABUSHIKI KAISHA TOSHIBA) 5 November 1996 (05-11-1996) Abstract; Claims 1, 7, 12; Figure 7; Column 1 line 66-Column 2 line 57, Column 7 line 65-Column 9 line 7<br>-----                                                                                                                                                                                                     | 1-10                  |
| Y         | "Identification of complex metabolic states in critically injured patients using bioinformatic cluster analysis" by MITCHELL J COHEN et al., 2 February 2010 (02-02-2010), URL: <a href="https://ccforum.biomedcentral.com/articles/10.1186/cc8864">https://ccforum.biomedcentral.com/articles/10.1186/cc8864</a> (retrieved on 12-07-2017) Abstract; Figures 1-6; whole document<br>----- | 1-10                  |
| Y         | US 5262944 A (HEWLETT-PACKARD COMPANY) 16 November 1993 (16-11-1993) Abstract; Claims 1, 8, 12, 15, 17; Column 3 line 3-Column 4 line 2<br>-----                                                                                                                                                                                                                                           | 1-10                  |

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

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

21-07-2017

Date of mailing of the international search report

21-07-2017

Name and mailing address of the ISA/

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Plot No.32, Sector 14, Dwarka, New Delhi-110075  
Facsimile No.

Authorized officer

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Telephone No. +91-1125300200

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/IN2017/000100

| Citation      | Pub.Date   | Family           | Pub.Date   |
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|               |            | US 2011004489 A1 | 06-01-2011 |
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|               |            | US 5781890 A     | 14-07-1998 |
| US 5262944 A  | 16-11-1993 | DE 69328649 T2   | 31-08-2000 |
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|               |            | JP 3449745 B2    | 22-09-2003 |