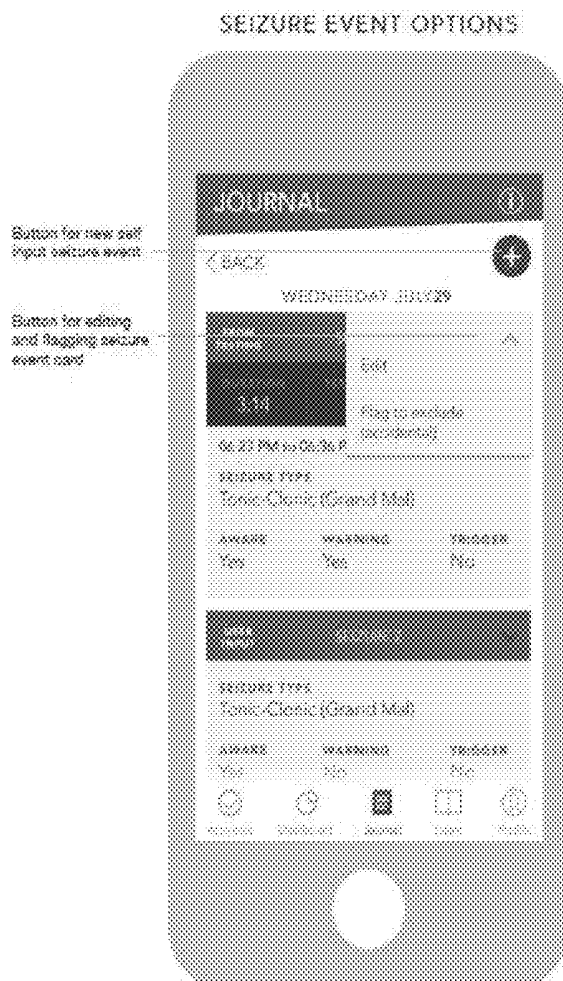




US 20170095194A1

(19) **United States**(12) **Patent Application Publication**
Krauss et al.(10) **Pub. No.: US 2017/0095194 A1**(43) **Pub. Date: Apr. 6, 2017**(54) **SYSTEM AND METHOD FOR SEIZURE
DETECTION AND RESPONSIVITY TESTING**(52) **U.S. CL.**
CPC *A61B 5/4094* (2013.01); *A61B 5/0022*
(2013.01); *A61B 5/0205* (2013.01); *A61B*
5/746 (2013.01); *A61B 5/02438* (2013.01)(71) Applicant: **THE JOHNS HOPKINS
UNIVERSITY**, Baltimore, MD (US)(72) Inventors: **Gregory Krauss**, Baltimore, MD (US);
Nathan Crone, Silver Spring, MD (US)(57) **ABSTRACT**(21) Appl. No.: **15/284,695**(22) Filed: **Oct. 4, 2016****Related U.S. Application Data**(60) Provisional application No. 62/237,029, filed on Oct.
5, 2015.**Publication Classification**(51) **Int. Cl.**
A61B 5/00 (2006.01)
A61B 5/0205 (2006.01)

The present invention is directed to a computer application for seizure detection using biometric data and responsivity testing. The computer application collects biometric data and responsiveness test results from biometric sensors and an interactive user interface in order to identify and confirm seizures and monitor for severity, duration, and permit logging and notification. The computer application collects data such as heart rate, movement, and responsivity testing results. The computer application facilitates caregiver notification of seizures at or before seizure onset if the user has a warning aura and/or during prolonged or severe seizures (e.g. long duration or convulsive movements).



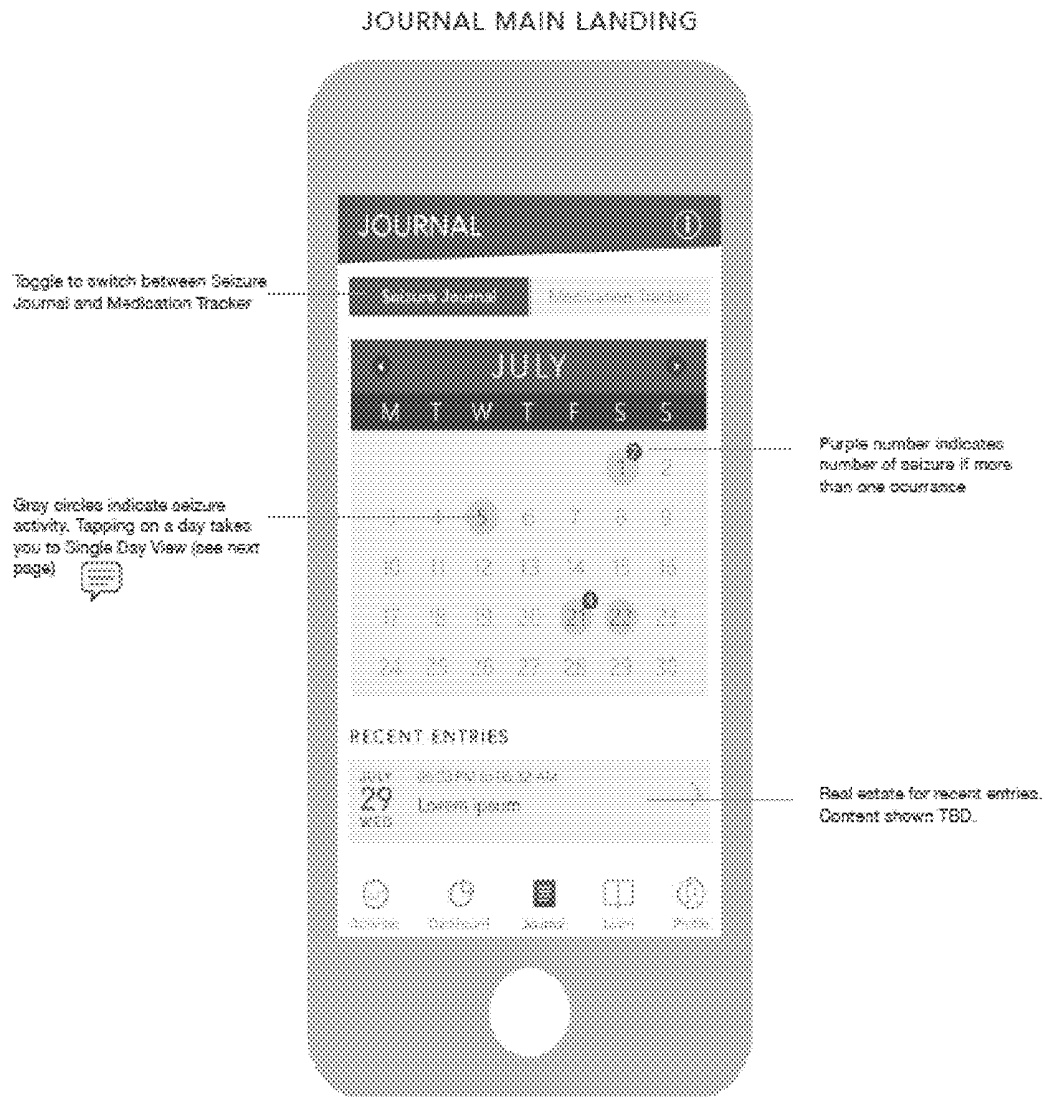


FIG. 1



FIG. 2A

FIG. 2B



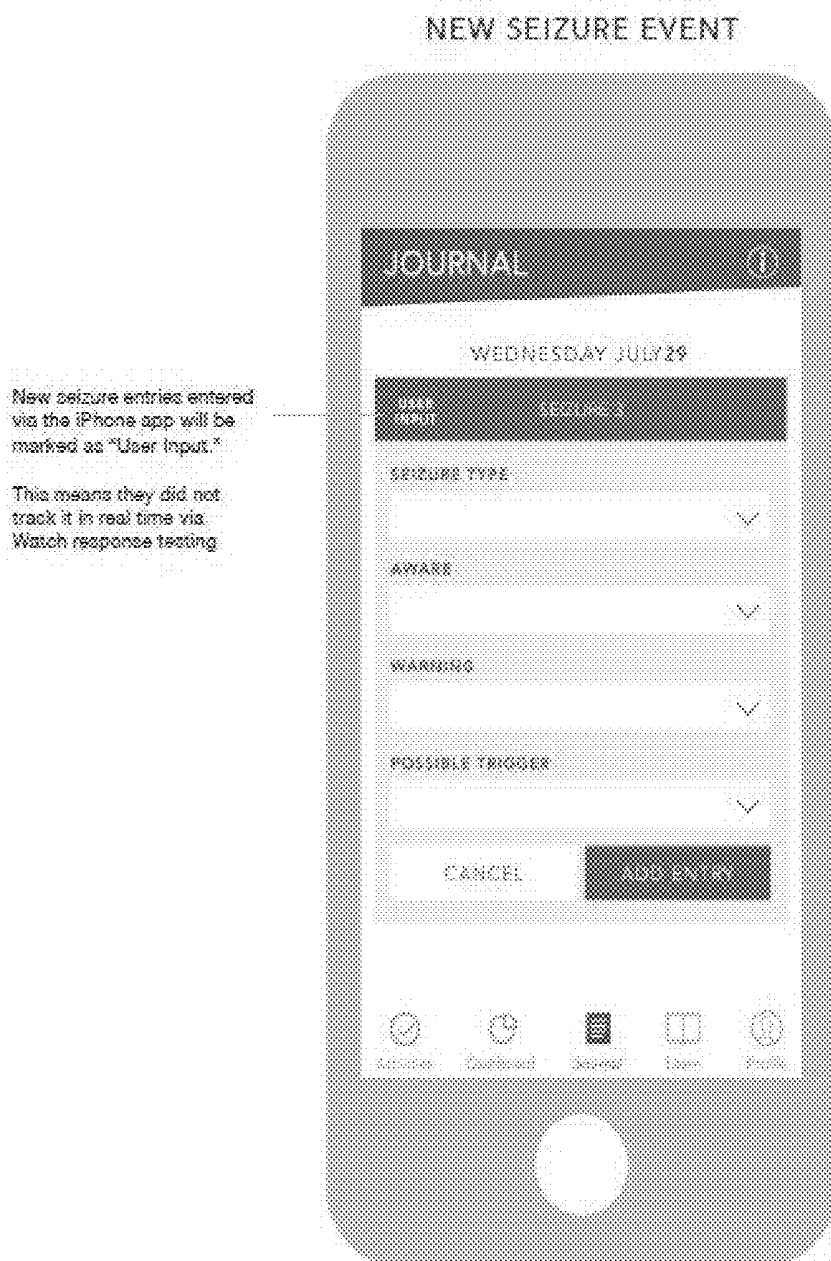
FIG. 3A

FIG. 3B



FIG. 4A

FIG. 4B



MEDICATION TRACKER MAIN
(ASSUMES NEW USER SCENARIO)

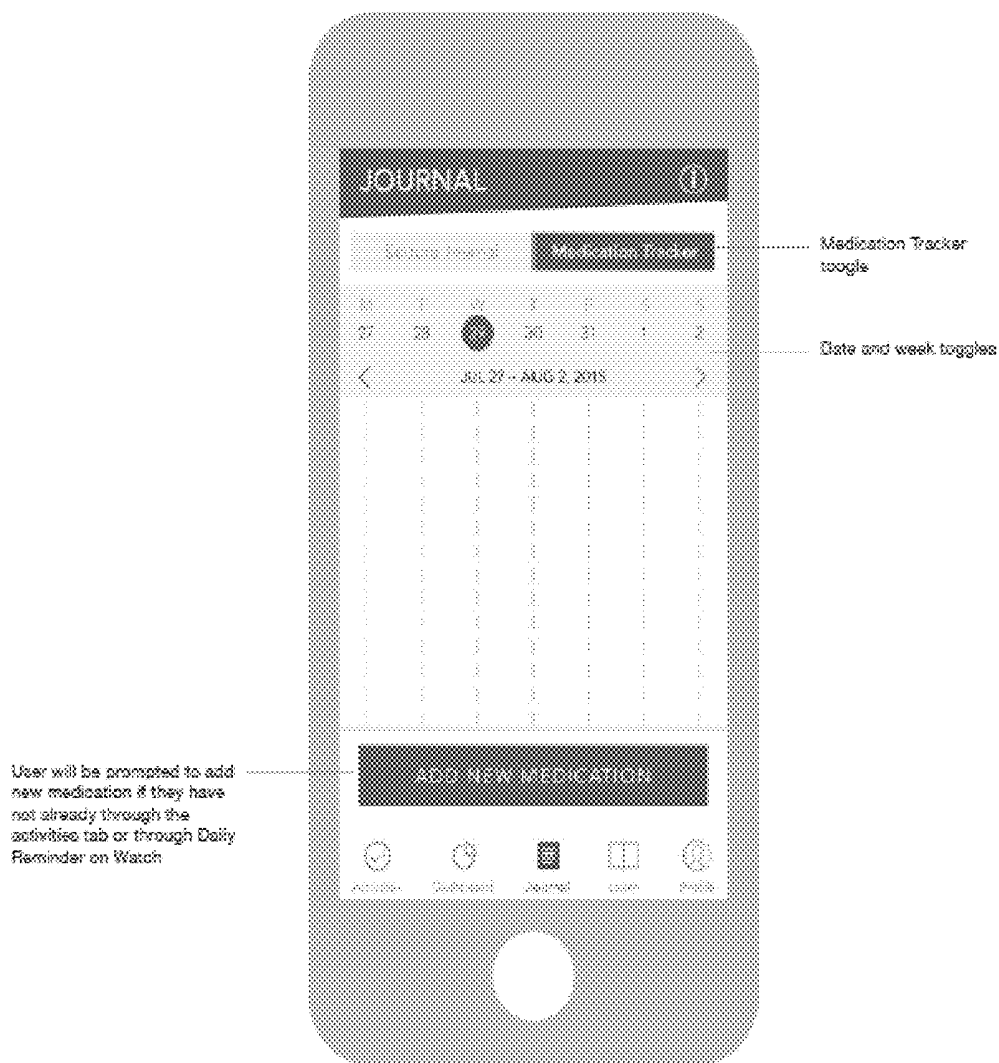


FIG. 6



FIG. 7A

FIG. 7B

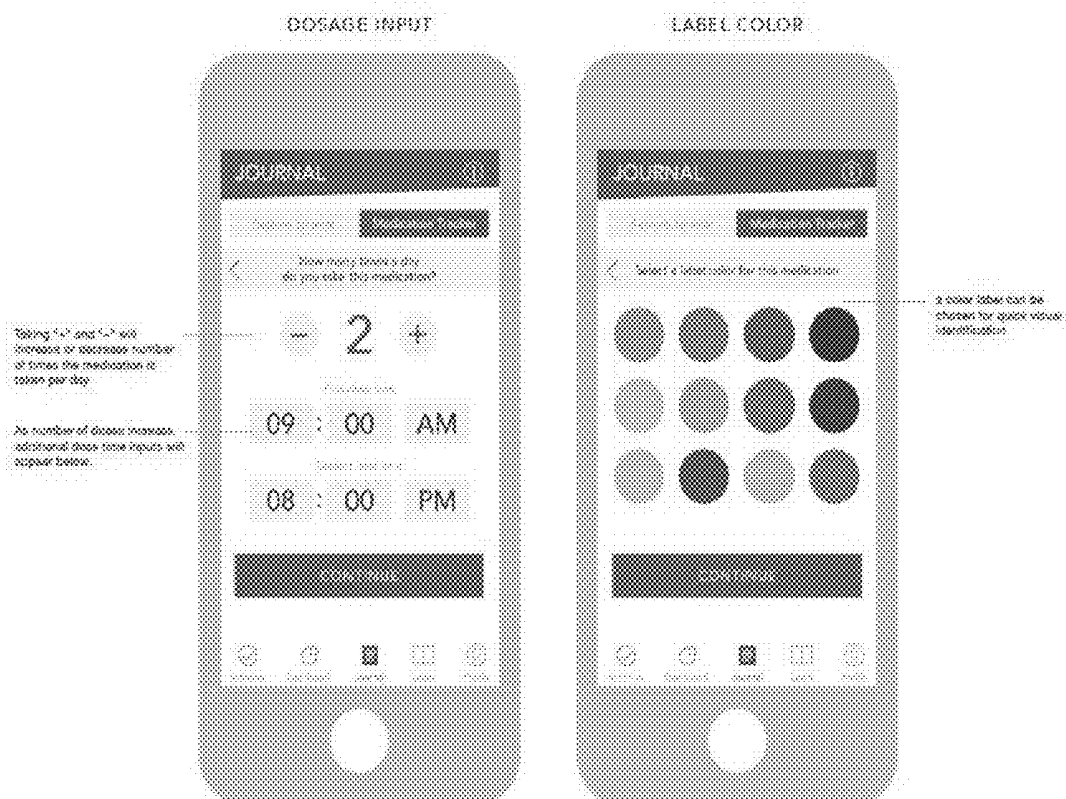


FIG. 8A

FIG. 8B



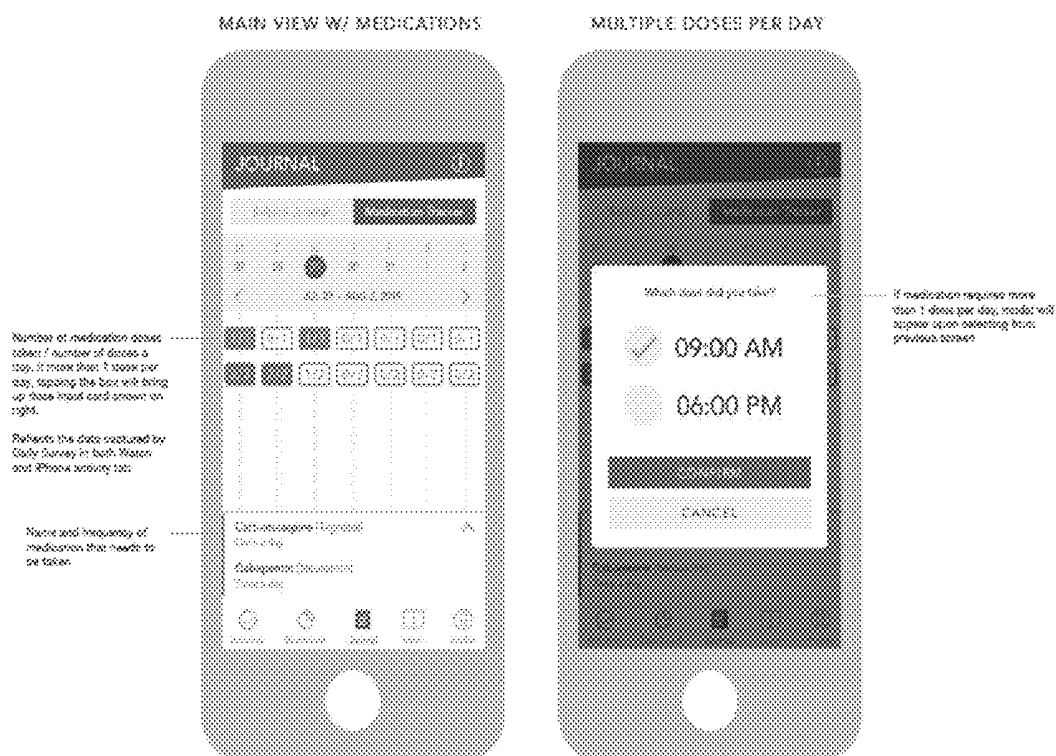


FIG. 10A

FIG. 10B

NEW AND EDITING MEDICATION

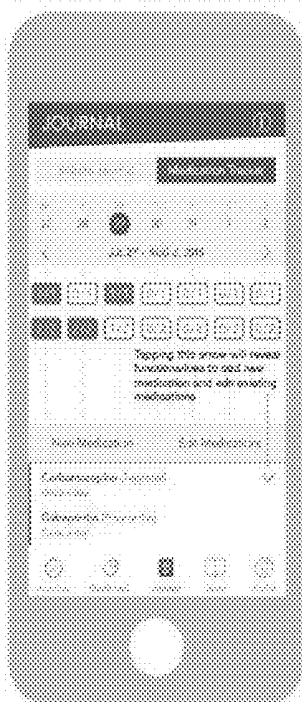


FIG. 11A

MULTIPLE DOSES PER DAY

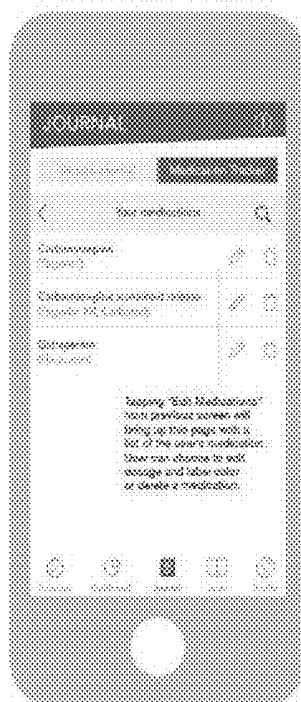
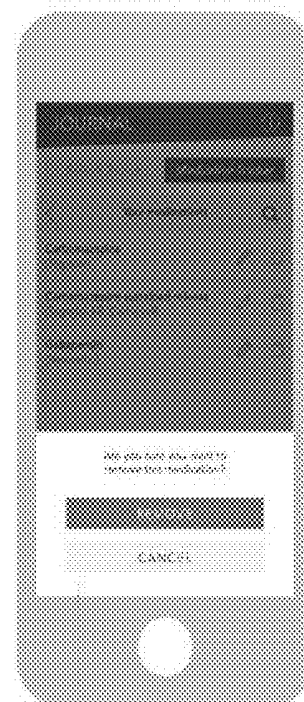


FIG. 11B

MULTIPLE DOSES PER DAY



If user taps on medication icon, they will have to decide if remove medication?

FIG. 11C

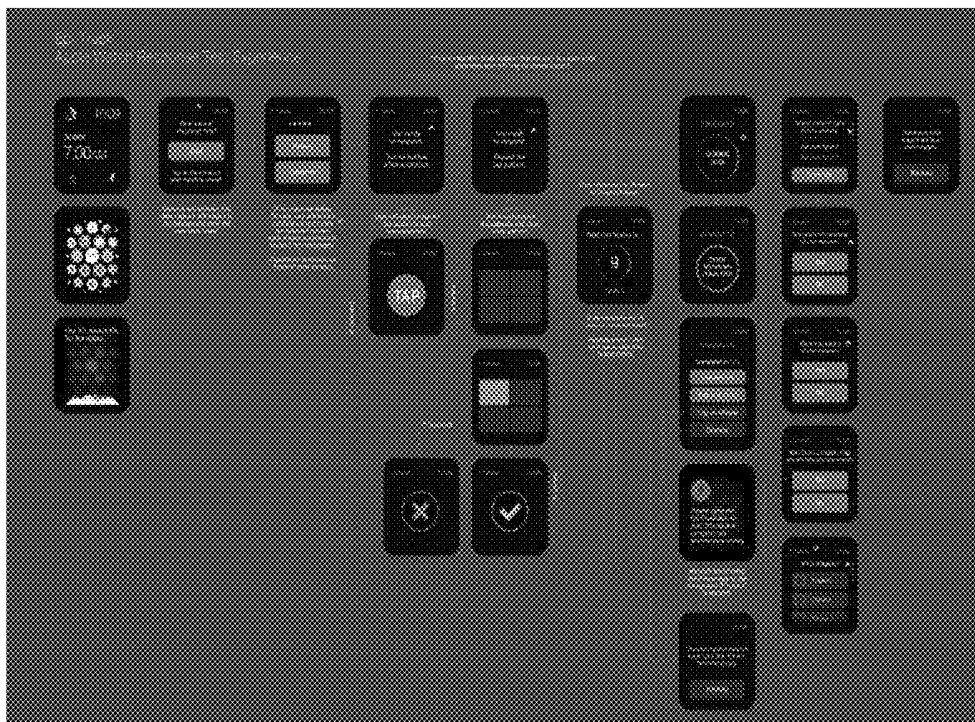


FIG. 12



FIG. 13

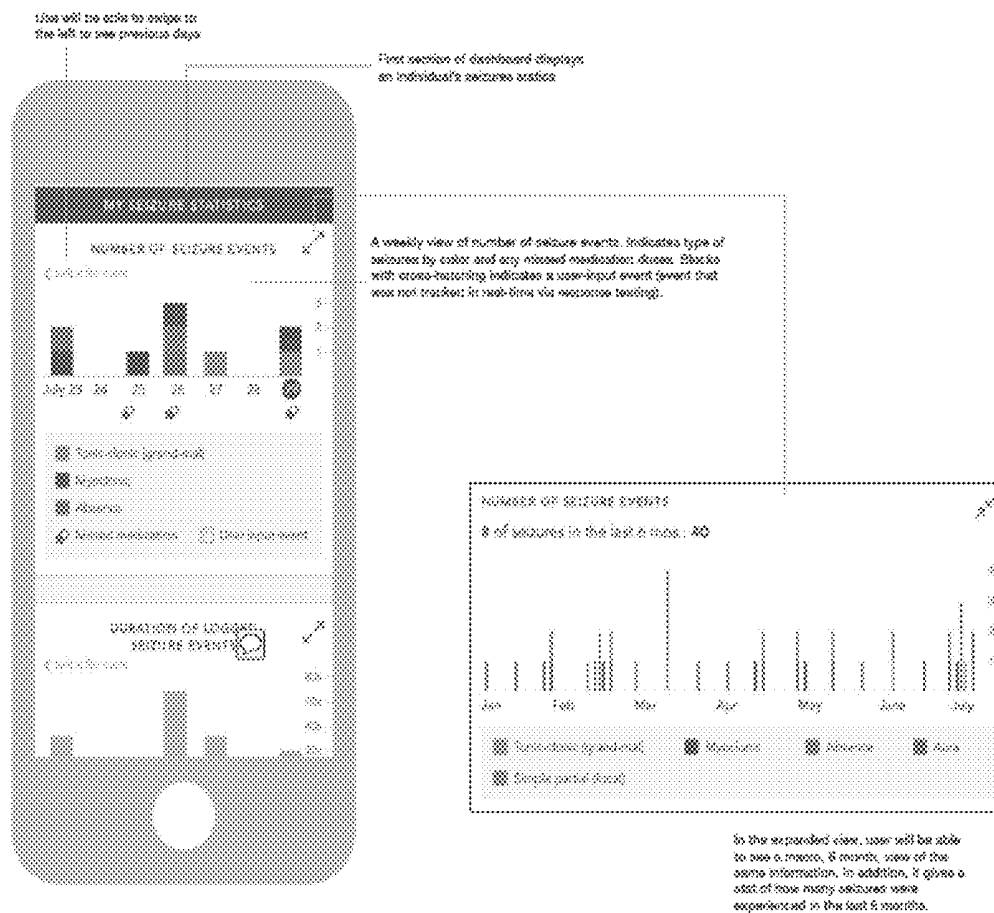


FIG. 14

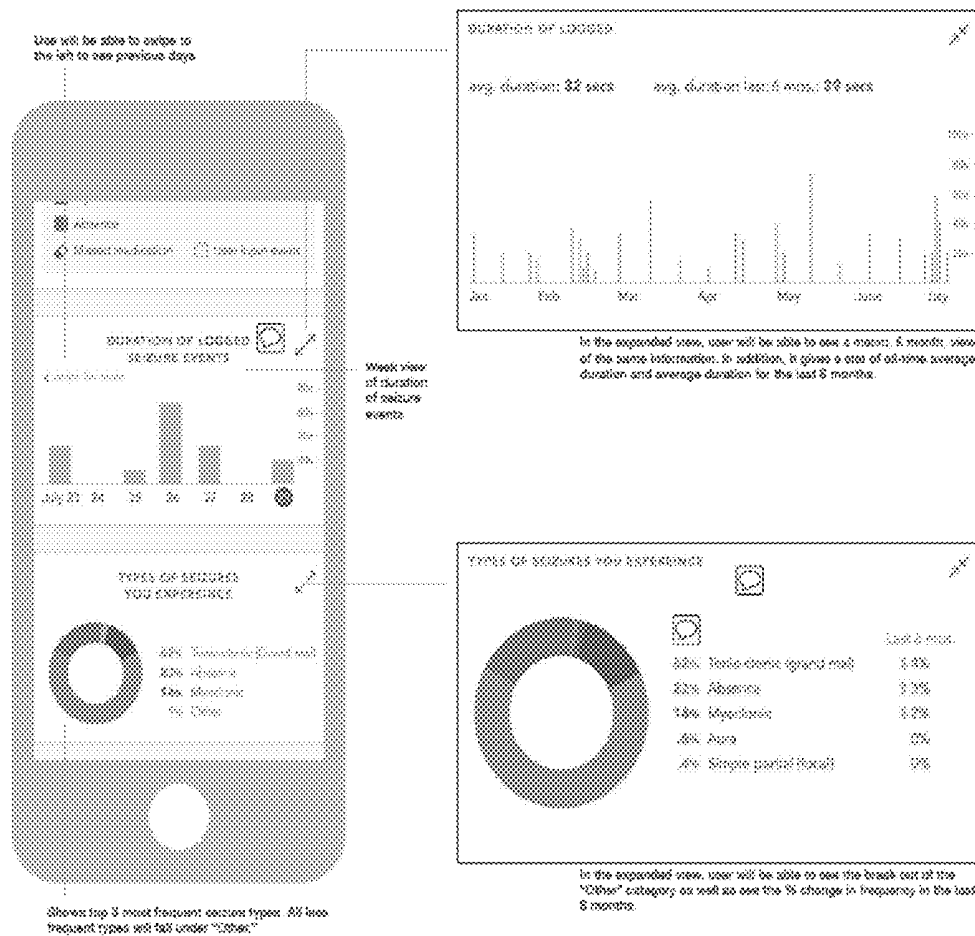


FIG. 15

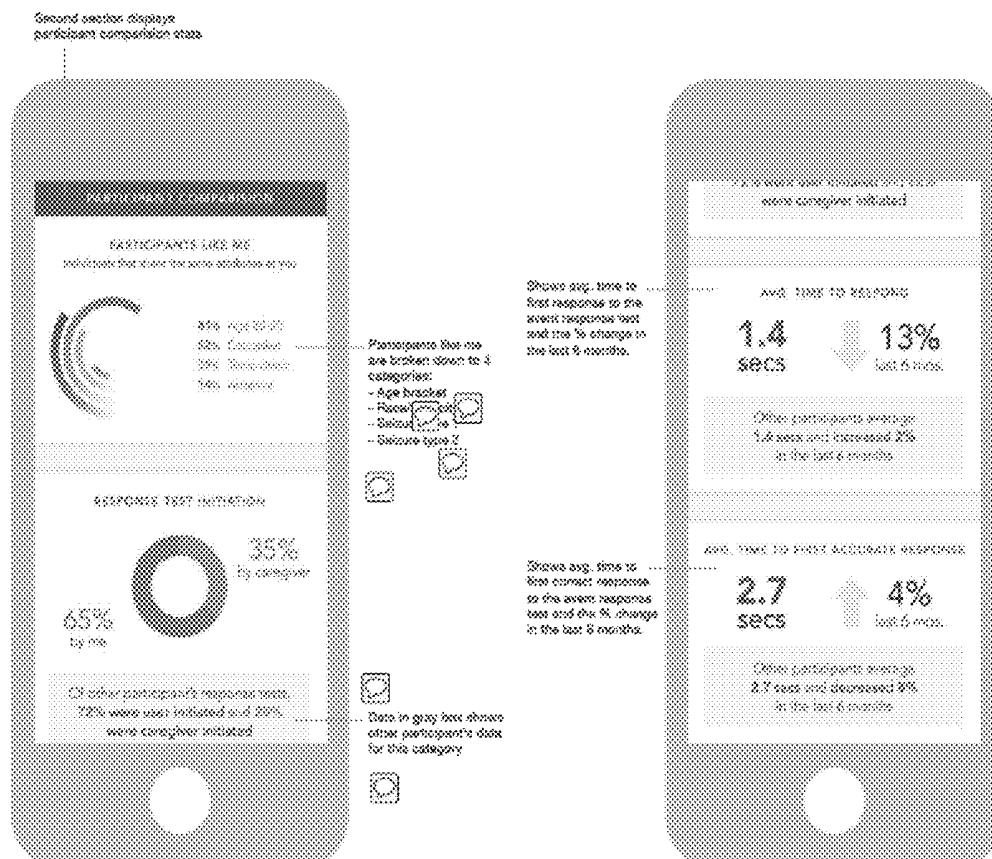


FIG. 16

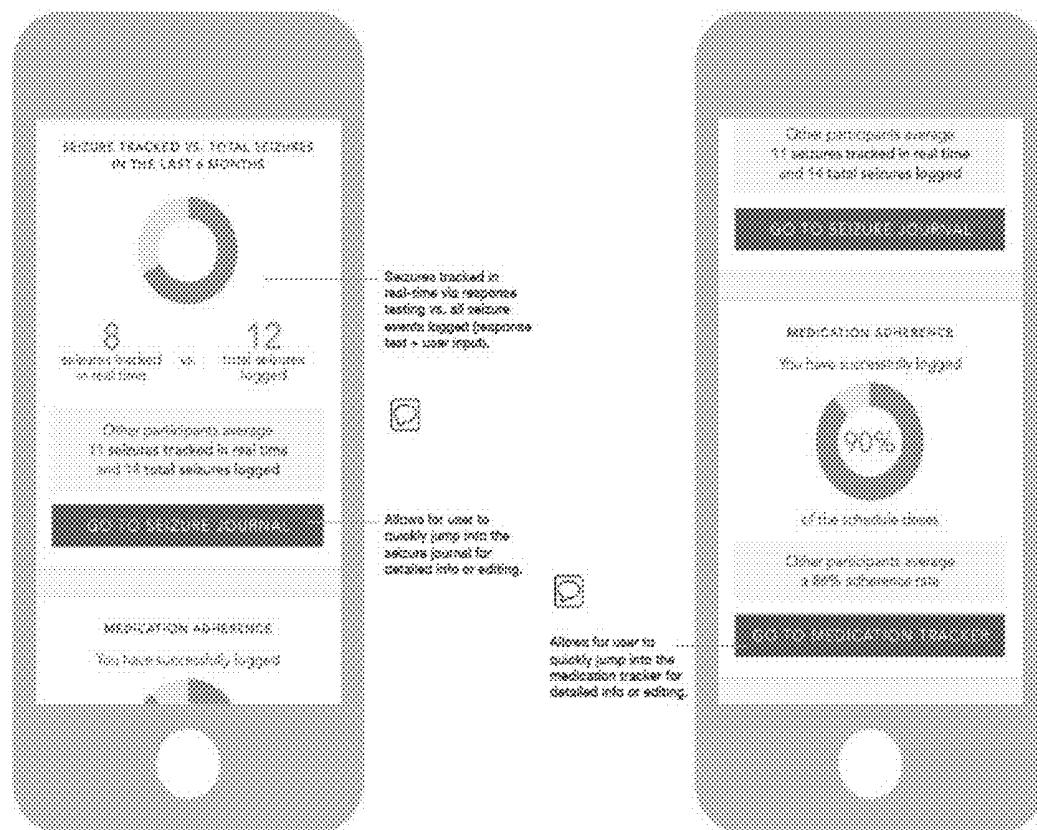


FIG. 17

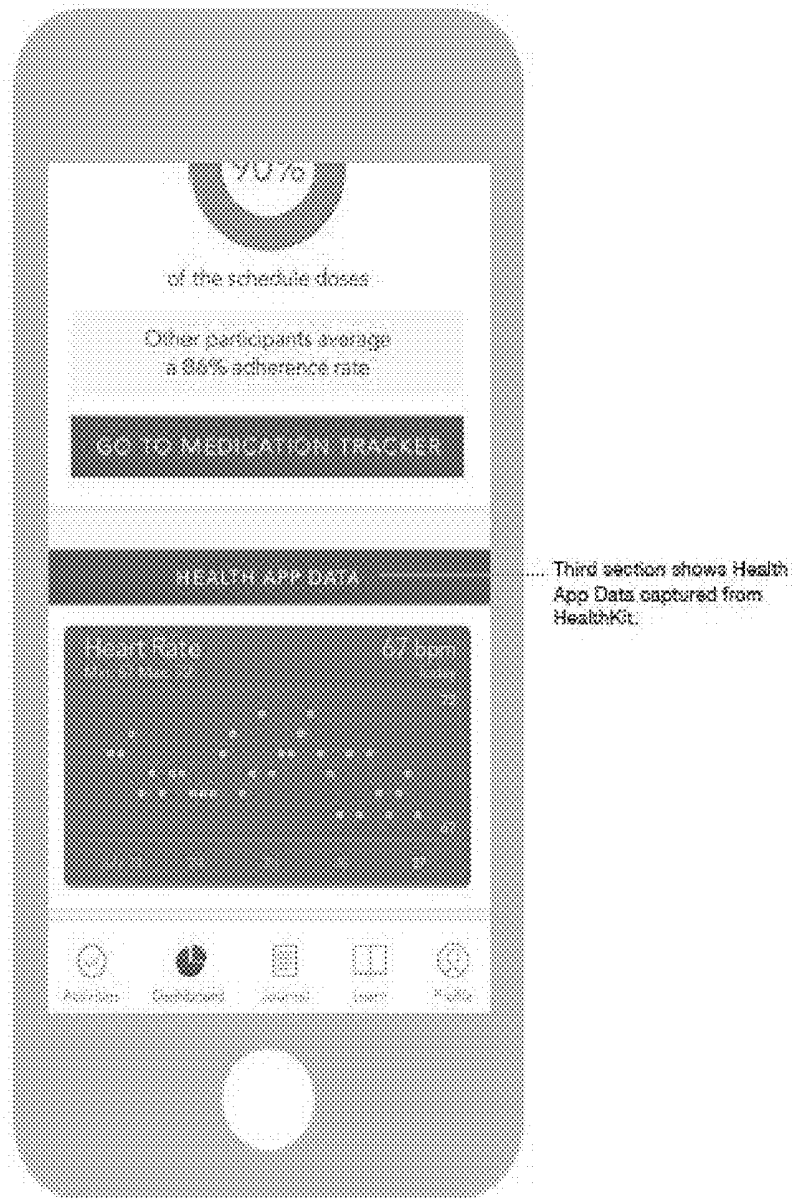


FIG. 18

SYSTEM AND METHOD FOR SEIZURE DETECTION AND RESPONSIVITY TESTING

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/237,029 filed on Oct. 5, 2015, which is incorporated by reference, herein, in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to a medical computer application. More particularly, the present invention relates to a system and method for seizure detection and responsivity testing.

BACKGROUND OF THE INVENTION

[0003] Seizures can result from a number of causes. Epilepsy is a group of neurological diseases characterized by epileptic seizures. Epileptic seizures are defined as episodes of neurological impairment that vary from brief and nearly undetectable to long periods of vigorous shaking and unresponsiveness. In epilepsy, seizures tend to recur, and have no immediate underlying cause. This can make these seizures difficult to track and predict, leaving patients potentially vulnerable during an episode.

[0004] The cause of most cases of epilepsy is unknown, although some people develop epilepsy as the result of brain injury, stroke, brain tumor, or congenital brain malformations. Genetic mutations are linked to a small proportion of the disease. Epileptic seizures are the result of excessive and abnormal cortical nerve cell activity in the brain. A key component in the diagnosis of most types of epileptic seizure is the occurrence of a brief lapse of normal behavioral responses to environmental stimuli. However, seizures rarely occur in the presence of medical personnel that can objectively assess this. As a result, the diagnosis typically relies on first or second hand reports of seizure events by untrained medical personnel. As a result, the diagnosis is often made provisionally and involves ruling out other conditions that might cause similar symptoms. Epilepsy can often be confirmed with an electroencephalogram (EEG) but a normal test does not rule out the condition in all cases. For these reasons, it would be useful to have an app on a device worn by patients that would test their responsiveness during episodes that are provisionally diagnosed as epileptic seizures.

[0005] Seizures are unpredictable and can occur when patients do not have immediate access to care. Because of their unpredictable and potentially dangerous nature, it would be advantageous to provide a computer application that can detect and monitor seizures and allow for a caregiver to be contacted.

SUMMARY OF THE INVENTION

[0006] The foregoing needs are met by the present invention directed to a method of tracking seizures and responsiveness in a user that includes gathering real-time data from a smart wearable positioned on a body of the user. The smart wearable includes sensors to gather heart rate, an accelerometer, and a gyroscope. The method includes gathering personal data from the user including sleeping and eating habits and gathering real-time responses to surveys and tests

when the user is experiencing seizure symptoms. The method includes transmitting the real-time data, the personal data, and the real-time responses to a computing device for processing information regarding the user's seizure. The method also includes transmitting an alert that the user is experiencing a seizure to a contact selected by the user.

[0007] In accordance with an aspect of the present invention, the method includes transmitting the alert to the contact after ten minutes of the user experiencing the seizure. The method includes repeating gathering real-time responses to prompts on the wearable until the user stops experiencing the seizure. The method includes gathering trigger data from the user. Additionally, the method includes providing a journal feature to the user for recording information related to the seizure including triggers and medication adherence. The method also includes using a non-transitory computer readable medium programmed for executing the method.

[0008] In accordance with an aspect of the present invention, a system for tracking seizures includes a device configured to record user movement and heart rate for a predetermined period. The system also includes a non-transitory computer readable medium (ntcrm) programmed for prompting the user to confirm the user wants to track a seizure. The nterm is programmed for presenting the user with a memory game to test responsiveness and recording responsiveness of the user. The nterm is also programmed for prompting the user to complete a post-seizure survey and recording the user's post seizure responses. Additionally, the nterm is programmed for transmitting an alert that the user is having a seizure to a predetermined contact and transmitting user movement, heart rate, responsiveness and survey responses to a care provider.

[0009] In accordance with another aspect of the present invention, the system includes transmitting the alert to the contact depending on the duration and severity of the user's seizure, determined by the user's responses to tests and surveys and by the application's analysis of biometric data. The system includes repeating gathering real-time responses to surveys and tests until the user stops experiencing the seizure and gathering trigger data from the user and relating this to seizure occurrence for subsequent modification of lifestyle, medication adherence, and other habits. The system includes providing a journal feature to the user for recording information related to the seizure including triggers and medications and transmitting an alert if the user has been experiencing a seizure for a time period greater than a predetermined period of time. Additionally, the system includes transmitting an alert to a predetermined care giver if the user is non-responsive to prompts.

[0010] In accordance with still another aspect of the present invention, a non-transitory computer readable medium (ntcrm) includes prompting the user to confirm the user wants to track a seizure. The nterm includes presenting the user with a memory game to test responsiveness and recording responsiveness of the user. The nterm is programmed for prompting the user to complete a post-seizure survey and recording the user's post seizure responses. The nterm is also programmed for transmitting an alert that the user is having a seizure to a predetermined contact and transmitting user movement, heart rate, responsiveness and survey responses to a care provider.

[0011] In accordance with yet another aspect of the present invention, the nterm is programmed for transmitting the alert to the contact depending on the duration and severity of the

user's seizure, determined by the user's responses to tests and surveys and by the application's analysis of biometric data. The nterm is programmed for repeating gathering real-time responses to surveys and tests until the user stops experiencing the seizure. The nterm is programmed for recording trigger data from the user and relating this to seizure occurrence for subsequent modification of lifestyle, medication adherence, and other habits. An alert is transmitted if the user has been experiencing a seizure for a time period greater than a predetermined period of time. An alert is also transmitted to a predetermined care giver if the user is non-responsive to prompts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The accompanying drawings provide visual representations, which will be used to more fully describe the representative embodiments disclosed herein and can be used by those skilled in the art to better understand them and their inherent advantages. In these drawings, like reference numerals identify corresponding elements and:

[0013] FIG. 1 illustrates an exemplary screen shot of a main landing page for a journal feature according to an embodiment of the computer application of the present invention.

[0014] FIG. 2A illustrates an exemplary screen shot of a single day view for a journal feature according to an embodiment of the computer application of the present invention.

[0015] FIG. 2B illustrates an exemplary screen shot of a single day view with information for seizure triggers for a journal feature according to an embodiment of the computer application of the present invention.

[0016] FIG. 3A illustrates an exemplary screen shot of seizure event options for a journal feature according to an embodiment of the computer application of the present invention.

[0017] FIG. 3B illustrates an exemplary screen shot of a flagged seizure event for a journal feature according to an embodiment of the computer application of the present invention.

[0018] FIG. 4A illustrates an exemplary screen shot of editing a seizure event for a journal feature according to an embodiment of the computer application of the present invention.

[0019] FIG. 4B illustrates an exemplary screen shot of editing seizure events with triggers for a journal feature according to an embodiment of the computer application of the present invention.

[0020] FIG. 5 illustrates an exemplary screen shot of creating a new seizure event for a journal feature according to an embodiment of the computer application of the present invention.

[0021] FIG. 6 illustrates an exemplary screen shot of a medication tracker main menu for a journal feature according to an embodiment of the computer application of the present invention.

[0022] FIG. 7A illustrates an exemplary screen shot of adding a medication for a journal feature according to an embodiment of the computer application of the present invention.

[0023] FIG. 7B illustrates an exemplary screen shot of a medication search for a journal feature according to an embodiment of the computer application of the present invention.

[0024] FIG. 8A illustrates an exemplary screen shot of a dosage input for a journal feature according to an embodiment of the computer application of the present invention.

[0025] FIG. 8B illustrates an exemplary screen shot of a label color selection for the new medication for a journal feature according to an embodiment of the computer application of the present invention.

[0026] FIG. 9 illustrates an exemplary screen shot of a successfully added medication for a journal feature according to an embodiment of the computer application of the present invention.

[0027] FIG. 10A illustrates an exemplary screen shot of a main view of the medication tracker feature with added medications for a journal feature according to an embodiment of the computer application of the present invention.

[0028] FIG. 10B illustrates an exemplary screen shot of dosages for a journal feature according to an embodiment of the computer application of the present invention.

[0029] FIG. 11A an exemplary screen shot of medication tracking functionality for a journal feature according to an embodiment of the computer application of the present invention.

[0030] FIG. 11B illustrates an exemplary screen shot of editing a medication for a journal feature according to an embodiment of the computer application of the present invention.

[0031] FIG. 11C illustrates an exemplary screen shot of deleting a medication for a journal feature according to an embodiment of the computer application of the present invention.

[0032] FIG. 12 illustrates a flow diagram of an exemplary user experience for using the computer application according to an embodiment of the present invention.

[0033] FIG. 13 illustrates an exemplary screen shot for a dashboard feature according to an embodiment of the computer application of the present invention.

[0034] FIGS. 14-18 illustrates an exemplary screen shot and schematic diagram for a user's seizure statistics according to an embodiment of the computer application of the present invention.

DETAILED DESCRIPTION

[0035] The presently disclosed subject matter now will be described more fully hereinafter with reference to the accompanying Drawings, in which some, but not all embodiments of the inventions are shown. Like numbers refer to like elements throughout. The presently disclosed subject matter may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Indeed, many modifications and other embodiments of the presently disclosed subject matter set forth herein will come to mind to one skilled in the art to which the presently disclosed subject matter pertains, having the benefit of the teachings presented in the foregoing descriptions and the associated Drawings. Therefore, it is to be understood that the presently disclosed subject matter is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims.

[0036] The present invention is directed to a computer application for seizure detection using biometric data and responsivity testing. The computer application collects bio-

metric data and responsiveness test results from biometric sensors and an interactive user interface in order to identify and confirm seizures and monitor for severity, duration, and permit logging and notification. The computer application collects data such as heart rate, movement, and responsivity testing results. The computer application facilitates caregiver notification of seizures at or before seizure onset if the user has a warning aura and/or during prolonged or severe seizures (e.g. long duration or convulsive movements).

[0037] The computer application is reliant on data collected from sensors in a device such as a smart watch or other suitable smart wearable known to or conceivable by one of skill in the art. The smart watch or smart wearable can include sensors including but not limited to, at least a pulse sensor, an accelerometer, a gyroscope, and a user interface for providing user input and receiving feedback from the user. The pulse sensor can take the form of a photo plethysmography sensor. The photo plethysmography sensor can take the form of laser emitting diode (LED) and a photodiode. The LEDs can emit colored light, such as green colored light, or infrared light. In addition, the device can include wearable wireless EEG sensors/amplifiers as another source of biometric data for seizure detection. The accelerometer and gyroscope can take the form of any suitable accelerometer or gyroscope known to or conceivable by one of skill in the art. The smart watch or wearable can also incorporate a global positioning system (GPS) tracker or can be configured to communicate with the GPS tracker in the user's smartphone, phablet, tablet, or other GPS enabled device. The user interface can be a touchscreen or can include buttons or other means for the user to respond to prompts that test the user's responsivity. The smart watch or smart wearable can also include Bluetooth, wi-fi, cellular network enabling technology or other suitable means for communicating information to the user's smartphone, a caregiver's smartphone, or other hub for information regarding the user's health.

[0038] The computer application uses the sensors in the device such as the smart watch or smart wearable to collect data on heart rate, which is increased in a majority of seizures. The accelerometer and gyroscopes collect movement data, in order to identify seizure-type movements and falls. The user interface collects responsivity data from the user, with prompts and questions regarding the user's seizure episode. The data collected can be used for the purposes of identifying seizures, determining the severity of seizures, alerting caregivers, gathering information regarding the user's personal seizure history, and research purposes.

[0039] In one embodiment, the computer application in conjunction with the smart watch or wearable allows the user to trigger the continuous collection of movement and heart rate data for up to 10 minutes whenever the user has a seizure. The computer application tests the user's ability to respond to vibration or other prompts on the smart watch or wearable after report of a seizure. The computer application also gives the user the option to send a text message to someone (like a caregiver) reporting the onset of a seizure when you activate the app. The user is prompted by the application to answer a few questions every day to see if the user has had any seizures or missed taking medication. The computer application also allows the user to keep and review a log of seizures and medications, to view a summary of information gathered, and to access educational resources

about seizures and their management. Baseline information about health, wellness, and potential seizure triggers can also be collected.

[0040] The computer application can prompt the user to complete a number of surveys, tests, and questionnaires that will be described in further detail herein. Surveys can include initial health surveys, post-seizure surveys, daily surveys, and surveys directed to other subject matter. The surveys can include questions regarding seizures, other medical conditions or health information that may impact the occurrence or treatment of seizures. Notifications to respond to surveys can be sent via the smart watch or wearable or via smartphone, or other computing device. The responses can be transmitted back to a health care professional via a server and a suitable network connection. The information collected in these surveys can be used to further tailor the computer application for use in tracking seizures for the specific user and for all users. For instance, a trigger factor for the user could be determined using the information collected by the application. During the seizure, the user's health metrics and movements are also passively tracked by the sensors in the smart watch or wearable. The metrics are reported to the health care provider via a network connection and also possible saved for research purposes. The metrics are recorded for a 10 minute period and the user is prompted for responses during that 10 minute period. Seizure symptoms that exceed the 10 minute period can be indicative of a serious problem. If the seizure symptoms continue on longer than the 10 minute period, the user can have a designated emergency contact or emergency care provider to be contacted to provide the user with immediate assistance.

[0041] The computer application is also configured to collect baseline data from the user. For instance, when the user starts using the computer application the user may be prompted to play a brief memory game to compare the results to those collected during a seizure. The user's heart rate at rest is collected for a period of approximately 5 minutes, and the user's heart rate during a stress condition, such as exercise, may also be collected.

[0042] When a user is wearing the smart watch or wearable equipped with the computer application of the present invention, the user can either actively engage the computer application to track the seizure at onset of warning signs such as aura, or the seizure symptoms can trigger activation of the tracking function of the application. After the application has been triggered, the user is asked to respond to prompts and play a brief memory game, while experiencing the seizure. The user is also asked to complete a survey after the seizure is completed.

[0043] The data gathered from the user's interactions with the computer application during and after seizure, such as survey, sensor data, and behavioral responses, is recorded and transmitted to the caregiver, a physician, and/or a server for further processing and research. The data is combined with other similar data from other users. The personal nature of the data is protected by anonymous codes or other anonymizers applied for tracking the data.

[0044] The computer application can also be configured to access health and personal information provided to other applications on the smart watch or wearable or paired smartphone or computing device. Permission for access to this information can be requested by the computer application before the information is accessed. This data includes but is not limited to body measurements (body mass index,

body fat percentage, height, body mass, lean body mass, and weight), fitness identifiers (step count, distance walking/running, distance cycling, basal energy burned, active energy burned, flights climbed, Nike Fuel data, other wearable data), vital signs identifiers (heart rate, body temperature, blood pressure systolic, blood pressure diastolic, respiratory rate, results identifiers, oxygen saturation, peripheral perfusion index, blood glucose, number of times fallen, electrodermal activity, inhaler usage, blood alcohol content, forced vital capacity, forced expiratory volume, peak expiratory flow rate, nutrition identifiers, dietary biotin, dietary caffeine, dietary calcium, dietary calcium, dietary carbohydrates, dietary chloride, dietary chromium, dietary copper, dietary energy consumed, dietary fat monounsaturated, dietary fat polyunsaturated, dietary saturated fat, dietary fiber, dietary folate, dietary iodine, dietary iron, dietary magnesium, dietary manganese, dietary molybdenum, dietary niacin, dietary pantothenic acid, dietary phosphorus, dietary potassium, dietary protein, dietary riboflavin, dietary selenium, dietary sodium, dietary sugar, dietary thiamin, dietary vitamin A, dietary vitamin B12, dietary vitamin B6, dietary vitamin C, dietary vitamin D, dietary vitamin E, dietary vitamin K, dietary zinc, dietary water, and UV exposure), category type identifiers (sleep analysis, sedentary state, cervical mucus quality, ovulation test result, menstrual flow, vaginal spotting, and sexual activity), characteristics identifiers (biological sex, blood type, date of birth, Fitzpatrick skin type, and skin tone on a range from I to VI. A way to classify the typical response of different types of skin to ultraviolet (UV) light.), correlation identifiers (blood pressure, food, workout identifier), and additional information such as bedtime and wakeup time.

[0045] In use, the computer application is opened on the smart watch or wearable to start recordings of movements and heart rate for the next 10 minutes. A family member or other caregiver may do this part of the task for the user, if the user is unable. The user responds to prompts on the smart watch or wearable to confirm that the user wants to log a seizure and to send a notification about it. The user plays a brief memory game to test responsiveness. If the user cannot complete the game, it will be repeated until the user is able to complete the game. Five minutes after the user completes the game, the user will be asked to complete the brief post-seizure survey (see above). If the user was unable to play the game at all, the user will be asked to complete the survey after 30 minutes. The duration of these seizure tracking tasks will depend on the duration of the seizure and how long it takes for the user to recover. The user may not be able to respond to any of the prompts for responsiveness testing or the post-seizure survey. If this happens or the user is unable to open the app at the start of the seizure, the user may log the seizure after it is over in the seizure diary functionality of the computer application.

[0046] In some instances, the present invention includes responsiveness testing during seizure tracking, where patients are asked to do brief cognitive tasks to determine whether they have altered awareness as part of a seizures; the testing occurs intermittently during the seizures and allows determination of the degree and duration of altered awareness. This function is important to identifying seizures and their duration and has applications such as determining driving safety for the patient.

[0047] The computer application can ask the user what types of seizures the user has had in the past. Descriptions

of the seizures can also be made available to the user via the application. Seizure types include Generalized tonic-clonic (grand mal) (TC), Complex partial (focal dyscognitive) with or without aura (CPS), Simple partial (focal) (SPS), Aura, Absence (petit mal) (ABS), Atonic (drop attack) (ATO), Tonic (TON), Myoclonic (MYO). In conjunction with the information about the types of seizures experienced, the user is also prompted to provide information about the frequency and duration of the seizures by type. Ranges can be provided in order to make the questions easier for the user to answer. The user is asked to provide medication inventory, formulation, dosing information, and side effects experienced as a result of medication. The user can be asked for information related to causes of the user's particular seizures.

[0048] An exemplary survey follows:

[0049] Time to log your seizure and medication

[0050] Button: Dismiss

[0051] 1. Did you experience any seizures in last 24 hours?

[0052] Button: Yes [move to question 2]

[0053] Button: No [move to question 7]

[0054] Cancel [if selected, copy reads: Please fill out the survey in the activities tab of the Epi-Track iPhone app. Button: Dismiss]

[0055] 2. How many seizures did you have?

[0056] 1-?

[0057] Button: Continue [move to question 3]

[0058] 3. Select seizure type of the first seizure.

[0059] SPS

[0060] CPS

[0061] TC

[0062] TON

[0063] ATO

[0064] ABS

[0065] MYO

[0066] Button: Continue [move to question 4]

[0067] 4. Did you have a warning of this seizure?

[0068] Button: Yes [move to question 5]

[0069] Button: No [move to question 5]

[0070] 5. Were you dazed or confused at the time of the seizure?

[0071] Button: Yes [move to question 6]

[0072] Button: No [move to question 6]

[0073] 6. What possibly triggered the first seizure event? [tap all that apply]

[0074] Missed pill(s)

[0075] Stress

[0076] Lack of sleep

[0077] Fever, infection

[0078] Overexertion

[0079] Head trauma

[0080] Menstrual cycle

[0081] Diet

[0082] Button: Continue [move to question 7]

[0083] Interstitial Screen if medications have not been set up:

[0084] To start tracking medications, please visit the app on your iPhone to set up medication.

[0085] Button: Dismiss

[0086] 7. Did you take all your medication(s) in the last 24 hours? [Yes, No]

[0087] Button: Yes [move to final screen]

[0088] Button: No [move to question 8]

[0089] 8. Which medication(s) did you miss? [tap all that apply]

[0090] [List of user's specified medications]

[0091] An exemplary baseline test follows:

[0092] Practice Mode

[0093] I am the

[0094] Button: Patient

[0095] Button: Caregiver

[0096] Practice Mode

[0097] Get ready to respond.

[0098] Tap on button when prompted.

[0099] Test 1:

[0100] Practice Mode

[0101] TAP

[0102] Practice Mode

[0103] Get ready to respond.

[0104] Repeat the tap pattern.

[0105] Test 2:

[0106] Practice Mode

[0107] [Squares]

[0108] [If either test is incorrect]

[0109] Practice Mode

[0110] Next test begins in

[0111] [Countdown]

[0112] [If both tests are correct, and baseline is complete]

[0113] Practice Completed

[0114] Button: Retry

[0115] Button: Finish

[0116] [If both tests are correct, and baseline is NOT complete]

[0117] Practice Completed

[0118] Button: Retry

[0119] Button: Start Baseline Test

[0120] An exemplary post seizure survey follows:

[0121] 1. Select seizure type of this seizure.

[0122] SPS

[0123] CPS

[0124] TC

[0125] TON

[0126] ATO

[0127] ABS

[0128] MYO

[0129] Button: Continue

[0130] 2. Did you have a warning of this seizure?

[0131] Button: Yes

[0132] Button: No

[0133] 3. Were you aware at the time of the first seizure?

[0134] Button: Yes

[0135] Button: No

[0136] 4. Was there a trigger that set off this seizure?

[0137] Button: Yes [move to question 5]

[0138] Button: No [push to final screen]

[0139] 5. What possibly triggered the first seizure event? [tap all that apply]

[0140] Missed pill(s)

[0141] Stress

[0142] Lack of sleep

[0143] Fever, infection

[0144] Overexertion

[0145] Head trauma

[0146] Menstrual cycle

[0147] Diet

[0148] Button: Continue [move to question 7]

[0149] The computer application also includes a feature for the user to record data in a journal. The journal allows the user to view all information regarding recorded seizures. The calendar allows for the user to view days when a seizure occurred and also deep dive into a specific seizure occurrence.

[0150] An exemplary tracking and response text experience follows:

[0151] Seizure tracking: Start tracking your episode.

[0152] Button: Start

[0153] Tap on the crown of your watch to cancel

[0154] I am the

[0155] Button: Patient

[0156] Button: Caregiver

[0157] Response Testing:

[0158] Start seizure response test?

[0159] Button: Start

[0160] Tap on the crown of your watch to cancel

[0161] I am the

[0162] Button: Patient

[0163] Button: Caregiver

[0164] Get ready to respond.

[0165] Tap on button when prompted.

[0166] Test 1:

[0167] TAP

[0168] Get ready to respond.

[0169] Repeat the tap pattern.

[0170] Test 2:

[0171] [Squares]

[0172] [If either test is incorrect]

[0173] Next test begins in

[0174] [Countdown]

[0175] Completion:

[0176] [If both tests are correct]

[0177] Congrats!

[0178] Sending Data

[0179] Congrats!

[0180] Event Recording Completed

[0181] Congrats!

[0182] Completed in [TIME]

[0183] Button: Log Seizure

[0184] Button: Log in 5 Min.

[0185] Button: Log on iPhone

[0186] Button: Dismiss

[0187] [if log on iPhone is selected]

[0188] Please open the Epi-Track app on your iPhone and complete the post-seizure survey.

[0189] [if Dismiss is selected]

[0190] You can log this seizure event at a later time in the iPhone app.

[0191] Button: Dismiss

[0192] FIG. 1 illustrates an exemplary screen shot of a main landing page for a journal feature according to an embodiment of the computer application of the present invention. FIG. 1 shows a toggle to switch between the seizure journal and the medication tracker. Circles around a date on the calendar indicate that activity occurred on that date. Tapping on the date takes the user to a single day view (further illustrated in FIG. 2A). Numbers alongside the date indicate the number of seizures that occurred on that date, if more than one. The screen also shows recent activity.

[0193] FIG. 2A illustrates an exemplary screen shot of a single day view for a journal feature according to an embodiment of the computer application of the present invention. FIG. 2A shows a single day view that is selected from the calendar. The single day view is shown as a card. The card indicates whether it was a seizure recorded from response testing during the seizure event or later logged by the user or caregiver. If the card was recorded from response testing during the seizure it will list the duration of the seizure, the number of test cycles executed by the user and whether the computer application was launched by the user or the caregiver. The card also includes information about the type of seizure, as illustrated in FIG. 2A. FIG. 2B illustrates an exemplary screen shot of a single day view with information for seizure triggers for a journal feature according to an embodiment of the computer application of the present invention. FIG. 2B adds to the information of FIG. 2A and includes the information related to possible triggers for the seizure event.

[0194] FIG. 3A illustrates an exemplary screen shot of seizure event options for a journal feature according to an embodiment of the computer application of the present invention. FIG. 3A illustrates the button for new self-input seizure events and the buttons for editing and flagging seizure event cards. FIG. 3B illustrates an exemplary screen shot of a flagged seizure event for a journal feature according to an embodiment of the computer application of the present invention. As illustrated in FIG. 3B, the flagged event has a flag indication on the card screen. The flag can be toggled on an off by the user, as necessary.

[0195] FIG. 4A illustrates an exemplary screen shot of editing a seizure event for a journal feature according to an embodiment of the computer application of the present invention. FIG. 4B illustrates an exemplary screen shot of editing seizure events with triggers for a journal feature according to an embodiment of the computer application of the present invention. FIGS. 4A and 4B illustrate editing a seizure event and editing a seizure event with triggers. Once the editing mode has been entered the editable fields become active. If the user indicates possible triggers, a trigger checklist will appear, as in FIG. 4B.

[0196] FIG. 5 illustrates an exemplary screen shot of creating a new seizure event for a journal feature according to an embodiment of the computer application of the present invention. As illustrated in FIG. 5 the manual seizure entries are marked as user input. The user can add information about the seizure using the menus on the page.

[0197] FIG. 6 illustrates an exemplary screen shot of a medication tracker main menu for a journal feature according to an embodiment of the computer application of the present invention. The medication tracker includes a feature for the user to select in order to add a new medication to the calendar. The user is prompted to add new medications, if they have not already done so through the activities tab or through the daily reminder watch.

[0198] FIG. 7A illustrates an exemplary screen shot of adding a medication for a journal feature according to an embodiment of the computer application of the present invention. FIG. 7B illustrates an exemplary screen shot of a medication search for a journal feature according to an embodiment of the computer application of the present invention. Medications can be searched in a list view, selected from the alphabetical list and added to the medication tracker.

[0199] FIG. 8A illustrates an exemplary screen shot of a dosage input for a journal feature according to an embodiment of the computer application of the present invention. FIG. 8B illustrates an exemplary screen shot of a label color selection for the new medication for a journal feature according to an embodiment of the computer application of the present invention. The medication tracker also includes a feature for adding a dosage for the medication and labeling the medication with a color, for easy identification throughout the computer application.

[0200] FIG. 9A illustrates an exemplary screen shot of a main view of the medication tracker feature with added medications for a journal feature according to an embodiment of the computer application of the present invention, and FIG. 9B illustrates an exemplary screen shot of dosages for a journal feature according to an embodiment of the computer application of the present invention. This feature allows for dosages to be tracked. This feature also allows the user to view all dosages to confirm that medication is being taken according to instructions.

[0201] FIG. 10A an exemplary screen shot of medication tracking functionality for a journal feature according to an embodiment of the computer application of the present invention; FIG. 10B illustrates an exemplary screen shot of editing a medication for a journal feature according to an embodiment of the computer application of the present invention; and FIG. 10C illustrates an exemplary screen shot of deleting a medication for a journal feature according to an embodiment of the computer application of the present invention. Medications and dosages can also be edited, as illustrated in FIGS. 10A-10C.

[0202] FIG. 11 illustrates an exemplary screen shot of a successfully added medication for a journal feature according to an embodiment of the computer application of the present invention. After a medication has been successfully added the user is given the opportunity to return to the home screen or add another medication.

[0203] FIG. 12 illustrates a flow diagram of an exemplary user experience for using the computer application according to an embodiment of the present invention. The flow chart includes exemplary screen shots from a smart wearable for logging a seizure with the computer application.

[0204] FIG. 13 illustrates an exemplary screen shot for a dashboard feature according to an embodiment of the computer application of the present invention, and FIGS. 14-18 illustrates an exemplary screen shot and schematic diagram for a user's seizure statistics according to an embodiment of the computer application of the present invention. These figures show that the user is provided with graphical representations of the user's seizures and also comparison of the user to other users of the computer application.

[0205] The computer application can also be configured to communicate with a contact such as a caregiver, physician, or emergency medical contact. In such an embodiment, if the user has been experiencing a seizure that extends beyond 10 minutes, one of these contacts can be alerted in order to secure potentially life-saving assistance for the user of the computer application. The alert can be configured to appear on the contact's phone or computer. This can be done with a corresponding application on the contact's telephone. Alternately, an alert can pop up on the contact's phone using an emergency alert function of the device.

[0206] It should be noted that the computer application is programmed onto a non-transitory computer readable

medium that can be read and executed by any of the computing devices mentioned in this application, such as smart watches, smart wearables, smart phones, tablets, phablets, laptop computers, personal computers, servers etc. The non-transitory computer readable medium can take any suitable form known to one of skill in the art. The non-transitory computer readable medium is understood to be any article of manufacture readable by a computer. Such non-transitory computer readable media includes, but is not limited to, magnetic media, such as floppy disk, flexible disk, hard, disk, reel-to-reel tape, cartridge tape, cassette tapes or cards, optical media such as CD-ROM, DVD, blu-ray, writable compact discs, magneto-optical media in disc, tape, or card form, and paper media such as punch cards or paper tape. Alternately, the program for executing the method and algorithms of the present invention can reside on a remote server or other networked device. Any databases associated with the present invention can be housed on a central computing device, server(s), in cloud storage, or any other suitable means known to or conceivable by one of skill in the art. All of the information associated with the application is transmitted either wired or wirelessly over a network, via the internet, cellular telephone network, or any other suitable data transmission means known to or conceivable by one of skill in the art.

[0207] The many features and advantages of the invention are apparent from the detailed specification, and thus, it is intended by the appended claims to cover all such features and advantages of the invention which fall within the true spirit and scope of the invention. Further, since numerous modifications and variations will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation illustrated and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed is:

1. A method of tracking seizures in a user comprising: gathering real-time data from a smart wearable positioned on a body of the user, wherein the smart wearable includes sensors to gather heart rate, an accelerometer, and a gyroscope; gathering information about medication adherence to relate to the occurrence of seizures; gathering personal data from the user including sleeping and eating habits; gathering real-time responses to surveys and tests when the user is experiencing seizure symptoms; transmitting the real-time data, the personal data, and the real-time responses to a computing device for processing information regarding the user's seizure; and transmitting an alert that the user is experiencing a seizure to a contact selected by the user.
2. The method of claim 1 further comprising transmitting the alert to the contact depending on the duration and severity of the user's seizure, determined by the user's responses to tests and surveys and by the application's analysis of biometric data.
3. The method of claim 1 further comprising repeating gathering real-time responses to surveys and tests until the user stops experiencing the seizure.
4. The method of claim 1 further comprising gathering trigger data from the user and relating this to seizure occurrence for subsequent modification of lifestyle, medication adherence, and other habits.

5. The method of claim 1 further comprising providing a journal feature to the user for recording information related to the seizure including triggers and medications.

6. The method of claim 1 further comprising transmitting an alert if the user has been experiencing a seizure for a time period greater than a predetermined period of time.

7. The method of claim 1 further comprising using a non-transitory computer readable medium programmed for executing the method.

8. A system for tracking seizures comprising:

a device configured to record user movement and heart rate for a predetermined period;

a non-transitory computer readable medium programmed for:

prompting the user to confirm the user wants to track a seizure;

presenting the user with a memory game to test responsiveness;

recording responsiveness of the user;

prompting the user to complete a post-seizure survey;

recording the user's post seizure responses;

transmitting an alert that the user is having a seizure to a predetermined contact; and

transmitting user movement, heart rate, responsiveness and survey responses to a care provider.

9. The system of claim 8 further comprising transmitting the alert to the contact depending on the duration and severity of the user's seizure, determined by the user's responses to tests and surveys and by the application's analysis of biometric data.

10. The system of claim 8 further comprising repeating gathering real-time responses to surveys and tests until the user stops experiencing the seizure.

11. The system of claim 8 further comprising gathering trigger data from the user and relating this to seizure occurrence for subsequent modification of lifestyle, medication adherence, and other habits.

12. The system of claim 8 further comprising providing a journal feature to the user for recording information related to the seizure including triggers and medications.

13. The system of claim 8 further comprising transmitting an alert if the user has been experiencing a seizure for a time period greater than a predetermined period of time.

14. The system of claim 8 further comprising transmitting an alert to a predetermined care giver if the user is non-responsive to prompts.

15. A non-transitory computer readable medium comprising:

prompting the user to confirm the user wants to track a seizure;

presenting the user with a memory game to test responsiveness;

recording responsiveness of the user;

prompting the user to complete a post-seizure survey;

recording the user's post seizure responses;

transmitting an alert that the user is having a seizure to a predetermined contact; and

transmitting user movement, heart rate, responsiveness and survey responses to a care provider.

16. The non-transitory computer readable medium of claim 15 further comprising transmitting the alert to the contact depending on the duration and severity of the user's seizure, determined by the user's responses to tests and surveys and by the application's analysis of biometric data.

17. The non-transitory computer readable medium of claim 15 further comprising repeating gathering real-time responses to surveys and tests until the user stops experiencing the seizure.

18. The non-transitory computer readable medium of claim 15 further comprising gathering trigger data from the user and relating this to seizure occurrence for subsequent modification of lifestyle, medication adherence, and other habits.

19. The non-transitory computer readable medium of claim 15 further comprising transmitting an alert if the user has been experiencing a seizure for a time period greater than a predetermined period of time.

20. The non-transitory computer readable medium of claim 15 further comprising transmitting an alert to a predetermined care giver if the user is non-responsive to prompts.

* * * * *

专利名称(译)	用于癫痫发作检测和响应度测试的系统和方法		
公开(公告)号	US20170095194A1	公开(公告)日	2017-04-06
申请号	US15/284695	申请日	2016-10-04
[标]申请(专利权)人(译)	约翰霍普金斯大学		
申请(专利权)人(译)	约翰·霍普金斯大学		
当前申请(专利权)人(译)	约翰·霍普金斯大学		
[标]发明人	KRAUSS GREGORY		
发明人	KRAUSS, GREGORY CRONE, NATHAN		
IPC分类号	A61B5/00 A61B5/0205		
CPC分类号	A61B5/4094 A61B5/0022 A61B5/11 A61B5/746 A61B5/02438 A61B5/0205 A61B5/6898 G06F19/00 G16H40/67		
优先权	62/237029 2015-10-05 US		
外部链接	Espacenet USPTO		

摘要(译)

本发明涉及一种使用生物特征数据和响应度测试进行检测检测的计算机应用。计算机应用程序从生物特征传感器和交互式用户界面收集生物特征数据和响应性测试结果，以便识别并确认发作并监测严重性，持续时间以及允许记录和通知。计算机应用程序收集心率，运动和响应度测试结果等数据。如果用户具有警告气氛和/或长时间或严重的癫痫发作（例如长时间或惊厥的运动），则计算机应用程序便于照料者通知癫痫发作期间或之前的癫痫发作。

