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(54) **SYSTEM FOR SELECTING AN AUDIO FILE USING MOTION SENSOR DATA**

SYSTEM ZUR AUSWAHL EINER AUDIODATEI UNTER VERWENDUNG VON SENSORDATEN

SYSTÈME POUR SÉLECTIONNER UN FICHIER AUDIO À L'AIDE DES DONNÉES DE CAPTEUR DE MOUVEMENT

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- **WIJNALDA G ET AL: "A PERSONALIZED MUSIC SYSTEM FOR MOTIVATION IN SPORT PERFORMANCE", IEEE PERVASIVE COMPUTING, IEEE SERVICE CENTER, LOS ALAMITOS, CA, US, vol. 4, no. 3, 1 July 2005 (2005-07-01), pages 26-32, XP002393734, ISSN: 1536-1268, DOI: 10.1109/MPRV.2005.47**
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Description

[0001] The present invention relates to a system and method for selecting an audio file using motion sensor data.

[0002] There are more than six million people worldwide with Parkinson's disease (PD). People with PD suffer from dysfunction of the basal ganglia and this dysfunction leads to the debilitating symptoms experienced by people with PD, including decreased walking velocity, developing a shuffling walk and episodes where walking may freeze completely, known as freezing of gait (FOG).

[0003] US 2007/0254271 relates to an apparatus, method, and software product used to sense a repetitive motion, such as walking, running, or tapping. A rate of the repetitive motion is determined and a piece of music is selected and played to match or approximate the rate of the repetitive motion, so that the repetitive motion and the music are substantially in harmony.

[0004] US 2013/0228063 relates to a repetitive motion pacing system for pacing a user that comprises a user profile database that contains a plurality of user-defined parameters that include at least a pre-selected interval type, a pre-selected interval profile, and a target tempo value for a repetitive motion activity.

[0005] US2013/0041617 relates to a sensing unit adapted to be attachable to a shoe of a user, the sensing unit including a first sensor adapted to monitor an movement of a foot of the user while the user is in motion, the first sensor comprising a gyroscopic sensor, processing means for determining a first performance characteristic of the user based upon an output from the first sensor, the first performance characteristic comprising a foot strike location of a foot of the user upon striking a ground surface, and transmitting means for transmitting a data package representative of the performance characteristic to a remote receiver.

[0006] The article by Wijnalda G et al. in IEEE Persuasive Computing, vol. 4, no. 3, 1st July 2005, pages 26-23 relates to a personalized music system for motivation in sport performance which helps exercisers select music that suits their training program, reflects and guides sports performance and collects data for adapting training programs and music selections.

[0007] CN 201631999 relates to an automatic detecting and alarming device in a gate ball hitting against a goal post comprising a three-dimensional motion sensor, a first sensitivity adjustment circuit, a signal processing module and an alarming module, wherein three-dimensional motion sensor as the signal input of the device senses a vibration signal after the gate ball hits against the goal post; the signal output terminal of the three-dimensional motion sensor is connected with the signal input terminal of the first sensitivity adjustment circuit; the signal output terminal of the first sensitivity adjustment circuit is connected with the signal input terminal of the signal processing module; and the signal output terminal of the signal processing module is connected with the signal input terminal of the alarming module.

[0008] US 2008/092723 relates to an electronic music stand for displaying at least one sheet of music for a musician. The electronic music stand includes a housing, at least one power source to provide power to the electronic music stand, a display, at least one memory element, at least one processor, and at least one interface. The interface includes at least one motion sensor and/or pedal actuator to provide the musician with the ability to change to the different one of the at least one sheet of music during the performance so that the musician is free of physical contact with display of the electronic music stand.JP 2007716519 relates to a wake-up system for an input device having a circuit board inside it with a motion sensor mounted on the printed circuit board inside the input device.

[0009] US 2005/128067 relates to adjustment of the sensitivity of a motion sensor or detector in a security system by a remotely-transmitted signal, such as from a user interface device in the security system. The sensitivity can be adjusted by adjusting a pulse count, optical gain, or electrical or optical sensitivity of the motion sensor.

[0010] US2010/075806 discloses a method and system for evaluating movement of a user and providing biofeedback including setting a reference point for movement by the user, whereby the reference point corresponds to a reference rhythm, providing the reference rhythm to the user to assist the user in maintaining the reference point, sensing the user's movement, comparing the user's movement to the reference point movement, and alerting the user that the user's movement is away from the reference point by modifying the reference rhythm to a modified rhythm. The user's movement is corrected after receiving the alert.

[0011] It is an object of the present invention to provide a system for overriding the dysfunction of the basal ganglia in the brain of a PD sufferer and to generate and deliver to the PD sufferer auditory cues for overcoming PD symptoms externally so as to improve the quality of walking and prevent freezing episodes. Further aspects of the present invention will become apparent from the ensuing description which is given by way of example only.

[0012] The invention is defined in claim 1. Further aspects and preferred embodiments are defined in the appended claims. Aspects, embodiments and examples of the present disclosure which do not fall under the scope of the appended claims do not form part of the invention and are merely provided for illustrative purposes. Furthermore, the methods presented in the present description are provided for illustrative purposes only and do not form part of the present invention.

[0013] In one aspect of the invention, the step of setting a sensitivity level for the motion sensors comprises calibrating the motion sensors to detect steps of a user according to one or more of stride length, speed and cadence. The ability to adapt the sensitivity of the motion

sensors in this way ensures that the present invention may be adapted to the specific gait requirements of a user so that steps having a smaller (or indeed larger) amplitude and/or stride length from a pre-determined level may be correctly sensed, which is important for patients suffering from Parkinson's disease.

[0014] Preferably, the step of setting a sensitivity level for the motion sensors is performed automatically by the mobile computing device.

[0015] Preferably, the method comprises the further step of: using the motion sensors to detect a change in the motion of the user, and using the detected change of motion to determine whether the user is suffering from a motion event relating to Parkinson's disease.

[0016] Such a step involves detecting the deceleration rate of motion of the user, and then comparing the detected deceleration rate to a predetermined range of deceleration rates and if the detected deceleration rate falls within the predetermined range recording motion data relating to the detected deceleration. Such a motion event would indicate that the user has suffered a true Parkinson's freezing event, or alternatively if the detected deceleration rate falls outside the predetermined range, that the user has stopped stepping for other reasons not related to Parkinson's disease.

[0017] In another aspect of the invention, the step of generating a metronome beat file is performed at a remote computing device or by the mobile computing device.

[0018] Preferably, the step of computing a metronome beat based on the step data comprises a step of applying a multiplication factor to the step data obtained before a metronome beat file is generated.

[0019] Preferably, the metronome beat and predefined beat parameter is measured in beats per minute.

[0020] Preferably, a plurality of audio files, each having a different predefined beat parameter, is stored in storage means of the mobile computing device or a remote external storage means.

[0021] Alternatively, the audio files are stored in storage means of a remote computing device.

[0022] In another aspect of the invention, the audio files have beat parameters in the range of 5 beats per minute to 300 beats per minute, although it will be understood that audio files may be provided in any range as required or as desired.

[0023] In another aspect of the invention, the motion sensors comprise an accelerometer and/or a gyroscope.

[0024] Preferably, the mobile computing device is a mobile phone with a computing processor, such as a smart phone or other computing device, such as a laptop or a PC, a wrist or smart watch, or an external device, such as an accelerometer, a pedometer or other external device having computer processor means.

[0025] Preferably, the remote computing device is a computer server.

[0026] According to a further aspect of the invention, there is provided a system for selecting an audio file using motion data from a mobile computing device connected to or held by a user, the system comprising:

at least one mobile computing device comprising or coupled to motion sensors;
means for setting a sensitivity level for the motion sensors such that the motion sensors are operable to detect when a step is taken by the user;
means for obtaining motion data from the motion sensors;
means for computing from the motion data step data based on a number of steps taken by a user in a specific period of time;
means for computing a metronome beat based on the step data and generating a metronome beat file;
means for selecting a stored audio file having a predefined beat parameter matching the metronome beat of the metronome beat file, and
audio output means for playing the audio file so that the audio file is heard by the user.

[0027] Preferably, the means for setting a sensitivity level for the motion sensors comprises means for calibrating the motion sensors to detect steps of a user according to one or more of stride length, speed and cadence.

[0028] Preferably, the system comprises means for setting a sensitivity level for the motion sensors is performed automatically by the mobile computing device.

[0029] Preferably, the motion sensors are operable to detect a change in the motion of the user, whereby the detected change of motion is used to determine whether the user is suffering from a motion event relating to Parkinson's disease.

[0030] Preferably, the motion sensors are operable to detect deceleration of motion of the user, the system comprising means for comparing the detected deceleration to a predetermined range and if the detected deceleration falls within the predetermined range the system is operable to record motion data relating to the detected deceleration.

[0031] Preferably, the system comprises means for generating a metronome beat file at a remote computing device or by the mobile computing device.

[0032] Preferably, the system comprises means for applying a multiplication factor to the step data obtained before a metronome beat file is generated.

[0033] Preferably, the metronome beat and predefined beat parameter is measured in beats per minute.

[0034] Preferably, the system comprises storage means for storing a plurality of audio files, each having a different predefined beat parameter.

[0035] Preferably, the system comprises means for receiving audio files at or downloading audio files to the mobile computing device.

[0036] Preferably, the system comprises means for transmitting the step data and/or metronome beat to a remote computing device.

[0037] Preferably, the system comprises an accelerometer and/or a gyroscope to detect the motion of the user.

[0038] Preferably, the accelerometer comprises means to detect 3-axis acceleration, deceleration or movement of the user.

[0039] Preferably, the mobile computing device is a mobile phone with a computing processor, such as a smart phone, or other computing device, such as a laptop or a PC, a wrist or smart watch, or an external device, such as an accelerometer

Detailed Description of the Invention

[0040] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a flow diagram of the steps in a method for selecting an audio file and delivering the audio file to a mobile computing device according to the invention;

Fig. 2 is a stylised schematic of a system for selecting an audio file and delivering the audio file to a mobile computing device;

Figs. 3 to 18 are screen displays of a user interface for an implementation on a mobile computing of the method according to Fig. 1.

[0041] Referring to the drawings, and initially to Fig. 1, there is a flow diagram 1 showing the steps in a method for selecting an audio file from a mobile computing device connected to or held by a user, the computing device having or being communicatively coupled with motion sensors.

[0042] A plurality of audio files, each having audio content with a different predefined beat parameter, is stored optionally in a compressed format, and on storage means or in a library of the mobile computing device. The audio files may be downloaded to the mobile computing device from a remote computing device. Alternatively, the audio files may be stored in storage means of the remote computing device. The audio files may be, for example, in MP3 format or other audio format, and have beat parameters in the range of 5 beats per minute to 300 beats per minute, although it will be understood that audio files may be provided in any range of beats per minute as required or as desired.

[0043] At step 1 the mobile computing device is caused to move as a result of the user walking while the mobile computing device is connected to them in such a way that motion sensors of the mobile computing device may detect the motion of the user and generate motion data based on user movement. The motion sensors comprise or are provided as an accelerometer or other means operable to detect 3-axis acceleration or movement of the user.

[0044] At step 2, step data is computed from the motion data based on a number of steps taken by the user in a specific period of time, such as one, two, three, four or more minutes. At the conclusion of this initial specific period of time for collecting motion data a loud audible beeping sound may be triggered to let the user know that the initial period of time has passed.

[0045] At step 3, optionally, the step of computing the step data further comprises a step of calibrating the accelerometer according to one or more of reduced stride length, speed and cadence. This optional step uses the 3-axis (or X, Y, Z co-ordinates) of the accelerometer. The X, Y, Z, co-ordinates are identified and movement calibration is honed for specific gait issues that day, for example, reduced stride length, speed or cadence to enhance accuracy of system analysis. These adjustments allow for the system to not over or underestimate user movement which differs from an average healthy person who does not have PD. Standard settings may overestimate patients cadence (steps/min) and therefore must be adjusted daily to the user's PD symptoms and so may be performed at different times, such as first thing in the morning, in order to adapt the sensitivity of the mobile computing device.

[0046] Accordingly the present invention comprises a step of setting a sensitivity level for the motion sensors which comprises calibrating the motion sensors to detect steps of a user according to one or more of stride length, speed and cadence. The ability to adapt the sensitivity of the motion sensors in this way ensures that the present invention may be adapted to the specific gait requirements of a user so that steps having a smaller (or indeed larger) amplitude and/or stride length from a pre-determined level may be correctly sensed, which is important for patients suffering from Parkinson's disease. Such a step of setting a sensitivity level for the motion sensors may also be performed automatically by the mobile computing device.

[0047] At step 4, a metronome beat based on the step data is computed by recording the total number of steps walked in two minutes and the average number of steps per minute. To this step data, and in order to prescribe a user's optimum metronome beat for a day, one of the following computations is applied:

1. average baseline steps/min x 1.1, or
2. average baseline steps/min x 0.9

[0048] The standard algorithm applied will be the average baseline steps/min x1.1. However this may be adapted to average baseline steps/min x 0.9 if the clinician remotely monitoring the user considers that this is desirable, such as due to a decreased stride length, to address gait deterioration in the user.

[0049] The patient will then be provided with their individually prescribed metronome beat, in beats per

minute, for the day and, at step 5, a metronome beat file is generated. The metronome beat file may be generated by the mobile computing device or at a remote computing device to which the motion and/or step data has been transmitted from the mobile computing device. It will be understood that the metronome beat file thus encodes data or tags relating to the step data, including the metronome beat computed according to the above algorithm.

[0050] At step 6, a stored audio file having a predefined beat parameter in beats per minute matching the metronome beat of the metronome beat file is automatically selected. For example, if the metronome file generated includes a metronome beat computed as above of sixty beats per minute, then the audio file selected also has audio content including a metronome beat of sixty beats per minute. The sound wave of the audio file selected will match the metronome beat which has already been calculated in calibration.

[0051] At step 7, the audio file selected is played via audio output means so that the user may hear it. The audio output means may be provided as a speaker of the mobile computing device, a headphone system coupled to the mobile computing device, and/or as a separate audio output device adapted for the user. In this way the user receives via audio output means an individually prescribed metronome beat prescription as a treatment to override the dysfunction of the basal ganglia in the brain and generate the correct impulses (auditory cues) for overcoming symptoms externally so as to improve the quality of walking and prevent freezing episodes.

[0052] At step 8, the motion sensors of the mobile computing device again detect the motion of the user in response to the treatment provided at step 7, and this data is transmitted to the remote computer server, such as via a cloud computing network arrangement for review by qualified physiotherapists to identify deteriorations in real time and recommend the next steps to take in furthering treatment for the user.

[0053] The present invention may also use the motion sensors to detect a change in the motion of the user, and then use the detected change of motion to determine whether the user is suffering from a motion event relating to Parkinson's disease. Such a step involves detecting the deceleration rate of motion of the user, and then comparing the detected deceleration rate to a predetermined range of deceleration rates and if the detected deceleration rate falls within the predetermined range recording motion data relating to the detected deceleration. Such a motion event would indicate that the user has suffered a true Parkinson's freezing event, or alternatively if the detected deceleration rate falls outside the predetermined range, that the user has stopped stepping for other reasons not related to Parkinson's disease. The ability to utilise motion sensors such as are an accelerometer to detect deceleration rate would allow detection of a "true Parkinson's freeze" (a known Parkinson's symptom) as opposed to a standard stop. Such a "true Parkinson's freeze" would be sensed by the motion sensors as an immediate stop with limited deceleration, whereas a standard stop would be sensed by the motion sensors as having a gradual deceleration before coming to a stop.

[0054] The present invention also includes an automated voice training program. In operation, the patient is provided a word which they say aloud, and the sound has to reach a certain decibel level (such as that of average speech, which is 60db). When the patient reaches this decibel level they will be provided further words, one at a time, until they have said ten words reaching 60db each time. They will complete this training daily. Such training is very important since sufferers of Parkinson's disease lose their voice and as their voice quietens over time they perceive that they are shouting, when in fact they are whispering or talking at a normal level. This automated speech training will improve patient's speech by training patients to speak at the correct decibel levels.

[0055] Turning to Fig. 2 there is shown a system for implementing the method according to the present invention.

[0056] The system 10 comprises at least one mobile computing device 12, such as a smart phone or other computing device, such as a laptop or a PC, a wrist or smart watch, or an accelerometer or pedometer having computer processor means, and motion sensors 14 or motion detecting means integrated therein or associated therewith, and processor means 16 for obtaining motion data from the motion sensors and computing from the motion data step data based on a number of steps taken by a user in a specific period of time. Although Fig. 2 shows one mobile computing device 12, it will be understood that the present invention may comprise a plurality of such devices 12 coupled to a remote server computer 22 via internet 24.

[0057] The processor means 16 is further operable for computing a metronome beat based on the step data and generating a metronome beat file, and also for selecting from storage means 18 of the mobile computing device 12 a stored audio file having a predefined beat parameter matching the metronome beat of the metronome beat file.

[0058] The mobile computing device further comprises audio output means 20 for playing the audio file so that it may be heard by a user. It will be understood that the audio output means 20 may be a speaker integrated with the mobile computing device 12, or a headphone system coupled with the mobile computing device 12, and/or as a separate external audio output device adapted for the user to hear the audio file as it is being played. The present invention also envisages, as a mobile computing device, a pedometer having computer processor means and audio output means.

[0059] The present invention is implemented by computer software which is downloaded to mobile computing device 12 from a remote server computer 22 via a wired or wireless computer network, such as internet 24. The computer software implementing the present invention may be provided as a software application or app which when downloaded may be run on the processor means

16.

[0060] An exemplary implementation of the present invention will now be described with reference to Fig. 3 to 16 which show screen displays of a user interface for an implementation on a mobile computing of the method according to Fig. 1.

[0061] As shown in Fig. 3 and 4, at screen's 30, 32 a user's walking is monitored and recorded and the sensitivity of their mobile computing device is adapted or calibrated to their walking through a sensitivity bar operable for setting a sensitivity level for the motion sensors. Such a sensitivity comprises means for calibrating the motion sensors to detect steps of a user according to one or more of stride length, speed and cadence. The ability to adapt the sensitivity of the motion sensors in this way ensures that the present invention may be adapted to the specific gait requirements of a user so that steps having a smaller (or indeed larger) amplitude and/or stride length from a pre-determined level may be correctly sensed, which is important for patients suffering from Parkinson's disease. Such a step of setting a sensitivity level for the motion sensors may also be performed automatically by the mobile computing device.

[0062] Fig. 5 shows a username and password screen 34, which when correctly filled in by a user will then provide access to the present invention via an app on their mobile phone. Each day the present invention may assess their mobility and prescribe the optimum metronome therapy based on their performance that day, the options for which are shown in Fig. 6 as screen 36.

[0063] Fig. 7 shows a screen 40 via which a user may set up medication reminders so that set reminders will appear automatically, as shown in screen 42 in Fig. 8.

[0064] Figs. 9 to 11 show screens 43, 44, 45 prompting a user to carry out a two minute walk test. In the instance shown the user is prompted to walk for two minutes with the app running on a mobile computing device at their waist band. The average number of steps per minute is also recorded. A computation is then applied to the results of this test to prescribe optimum metronome beat for that day to generate the required metronome beat file, the computation being one of:

1. average baseline steps/min x 1.1, or
2. average baseline steps/min x 0.9

[0065] Fig. 12 shows screen 46 displaying the individually prescribed metronome beat for the day. In the instance shown the metronome beat has been calculated as 43.

[0066] A stored audio file having a predefined beat parameter in beats per minute matching the metronome beat of the metronome beat file is selected. For example, the metronome file generated in the present example includes a metronome beat computed as 43 beats per minute then the audio file selected also has a metronome beat of 43 beats per minute.

[0067] As shown in Fig. 13, screen 48 is displayed so that the user is prompted to move their feet in time with the audio file selected.

[0068] The audio file selected is played via a speaker of the mobile computing device so that the user may hear it and walk in time with the beat of the audio file. In this way the user has received via a speaker of the mobile computing device an individually prescribed metronome beat prescription as a treatment to override the dysfunction of the basal ganglia in the brain and generate the correct impulses (auditory cues) for overcoming symptoms externally so as to improve the quality of walking and prevent freezing episodes.

[0069] As shown in Figs. 14 and 18, screen 50, the user may be provided with one or more ten minute metronome therapy sessions each day. An anytime option is also provided in which they can use a daily metronome beats prescription as needed. As shown in Fig. 15, screen 52, users may view their progress via reports that are displayed. Such reports may also be transmitted by email. A warning screen, such as that of Fig. 16, screen 54 may be displayed. Fig. 17 shows a home screen 55 for application software executing the present invention.

[0070] The present invention provides a technology solution delivered through a smart phone or other mobile computing device that improves the gait of people with PD. The user's daily mobility is assessed through a mobile computing device app and then calculates the required individually prescribed treatment for each user. The treatment is then delivered through audio output means, such as speakers of the mobile computing device in the form of auditory cueing.

[0071] The present invention provides an automated system which is made available to users via application software downloaded to a mobile computing device, such as a smart phone. Using the internal mobility sensors of a mobile computing device the present invention is operable to calculate automatically the required metronome therapy level and critically prescribe an audio cue designed specifically for that patient's current condition. This treatment is then delivered as an automatic audio track via the app and plays through the audio system of the mobile computing device. This mobility data is then sent to a remote computing server via wired or wireless connectivity means where it is assessed and the above specialised algorithms are applied.

[0072] The present invention has been shown to reduce episodes of freezing of gait (FOG), improves stride length, walking speed, reduces symptoms and improves overall quality of life.

[0073] Aspects of the present invention have been described by way of example only and it should be appreciate that additions and/or modifications may be made thereto without departing from the scope thereof as defined in the appended claims.

Claims

1. A system (10) for providing metronome therapy for a user by selecting an audio file from a plurality of stored audio files each having predefined beat parameters using motion data from a mobile computing device (12) connected to or held by a user, the system comprises:

   at least one mobile computing device (12) having motion sensors (14), wherein the motion sensors (14) are operable to detect deceleration of motion of the user;
   means for setting a sensitivity level for the motion sensors (14) such that the motion sensors (14) are operable to detect cadence of movement of the user when the user is stepping;
   means (16) for obtaining motion data from the motion sensors (14); and **characterized by** a sensitivity bar operable to adjust the sensitivity level of the motion sensors depending upon said cadence of movement by calibrating the motion sensors to detect steps of a user according to said cadence of movement;
   means for using the motion sensors (14) to detect deceleration in said cadence of movement of the user,
   means for comparing the detected deceleration to a predetermined range and if the detected deceleration falls within the predetermined range of decelerations that are attributable to Parkinson's disease the system is operable to generate and record motion data relating to the detected deceleration;
   means for computing from the motion data step data based on a number of steps taken by a user in a specific period of time;
   means for computing an individually prescribed metronome beat for the user by applying a multiplication factor to the step data and generating a metronome beat file from the individually prescribed metronome beat;
   means for automatically selecting a stored audio file having a predefined beat parameter matching the metronome beat of the metronome beat file, and
   audio output means (20) for providing the metronome therapy to the user by playing the audio file so that the audio file is heard by the user.

2. The system (10) for selecting an audio file as claimed in Claim 1, comprising means for generating a metronome beat file at a remote computing device or by the mobile computing device.

3. The system for selecting an audio file as claimed in Claim 2, in which the sensitivity level for the motion sensors (14) is set automatically by the mobile computing device.

4. The method or system (10) for selecting an audio file as claimed in any one of Claims 1 to 3, in which the metronome beat and predefined beat parameter are measured in beats per minute.

5. The system (10) for selecting an audio file as claimed in any one of Claims 1 to 4, further comprising storage means (18) for storing a plurality of audio files, each having a different predefined beat parameter.

6. The system (10) for selecting an audio file as claimed in any one of Claims 1 to 5, comprising means for receiving audio files at or downloading audio files to the mobile computing device (12) and/or means for transmitting the step data and/or metronome beat to a remote computing device.

7. The system (10) for selecting an audio file as claimed in any one of Claims 1 to 6, comprising an accelerometer and/or a gyroscope to detect motion of the user, preferably wherein the accelerometer comprises means to detect 3-axis acceleration, deceleration or movement of the user.

Patentansprüche

1. System (10) zum Bereitstellen von Metronomtherapie an einen Benutzer durch Auswählen einer Audiodatei aus einer Mehrzahl gespeicherter Audiodateien, die jeweils vordefinierte Taktparameter aufweisen, unter Verwendung von Bewegungsdaten von einer mobilen Rechenvorrichtung (12), die mit einem Benutzer verbunden ist oder von einem Benutzer gehalten wird, wobei das System folgendes umfasst:

   mindestens eine mobile Rechenvorrichtung (12) mit Bewegungssensoren (14), wobei die Bewegungssensoren (14) so funktionsfähig sind, dass sie eine Bewegungsverlangsamung des Benutzers erkennen;
   Mittel zum Einstellen eines Empfindlichkeitswertes für die Bewegungssensoren (14), so dass die Bewegungssensoren (14) so funktionsfähig sind, dass sie die Bewegungskadenz des Benutzers erkennen, wenn der Benutzer geht;
   Mittel (16) zum Erhalten von Bewegungsdaten von den Bewegungssensoren (14);
   und **gekennzeichnet durch**
   einen Empfindlichkeitsbalken, der so funktionsfähig ist, dass er den Empfindlichkeitswert der Bewegungssensoren abhängig von der Bewegungskadenz anpasst, indem die Bewegungssensoren so kalibriert werden, dass sie schritte eines Benutzers gemäß der Bewegungskadenz

erkennen;
Mittel zur Verwendung der Bewegungssensoren (14) zur Erkennung einer Verlangsamung der Bewegungskadenz des Benutzers;
Mittel zum Vergleichen der erkannten Verlangsamung mit einem vorbestimmten Bereich, und wenn die erkannte Verlangsamung in den vorbestimmten Bereich von Verlangsamungen fällt, die der Parkinson-Krankheit zugeordnet werden können, das System so funktionsfähig ist, dass es Bewegungsdaten in Bezug auf die erkannte Verlangsamung erzeugt und aufzeichnet;
Mittel zum Berechnen von Schrittdaten aus den Bewegungsdaten auf der Basis einer Anzahl durch einen Benutzer getätigter Schritte innerhalb eines bestimmten Zeitraums;
Mittel zum Berechnen eines individuell Metronomtakts für den Benutzer durch Anwendung eines Multiplikationsfaktors auf die Schrittdaten und Erzeugen einer Metronomtakt-Datei anhand des individuell verordneten Metronomtakts;
Mittel zum automatischen Auswählen einer gespeicherten Audiodatei mit einem vordefinierten Taktparameter, der mit dem Metronomtakt der Metronomtakt-Datei übereinstimmt; und
Audioausgabemittel (20) zur Bereitstellung der Metronomtherapie an den Benutzer durch Wiedergabe der Audiodatei, so dass die Audiodatei von dem Benutzer gehört wird.

2. System (10) zum Auswählen einer Audiodatei nach Anspruch 1,
das Mittel zum Erzeugen einer Metronomtakt-Datei an einer entfernten Rechenvorrichtung oder durch die mobile Rechenvorrichtung umfasst.

3. System zum Auswählen einer Audiodatei nach Anspruch 2,
wobei der Empfindlichkeitswert für die Bewegungssensoren (14) durch die mobile Rechenvorrichtung automatisch eingestellt wird.

4. Verfahren oder System (10) zum Auswählen einer Audiodatei nach einem der Ansprüche 1 bis 3,
wobei der Metronomtakt und die vordefinierten Taktparameter in Schlägen pro Minute gemessen werden.

5. System (10) zum Auswählen einer Audiodatei nach einem der Ansprüche 1 bis 4, wobei dieses ferner ein Speichermittel (18) zum Speichern einer Mehrzahl von Audiodateien umfasst, die jeweils einen anderen vordefinierten Taktparameter aufweisen.

6. System (10) zum Auswählen einer Audiodatei nach einem der Ansprüche 1 bis 5, wobei dieses Mittel zum Empfangen von Audiodateien an der mobilen Rechenvorrichtung (12) oder zum Herunterladen von Audiodateien auf die mobile Rechenvorrichtung umfasst und/oder Mittel zum Übermitteln der Schrittdaten und/oder des Metronomtakts an eine entfernte Rechenvorrichtung.

7. System (10) zum Auswählen einer Audiodatei nach einem der Ansprüche 1 bis 6, wobei dieses einen Beschleunigungsmesser und/oder ein Gyroskop umfasst, um die Bewegung des Benutzers zu erkennen, wobei der Beschleunigungsmesser vorzugsweise Mittel zur Erkennung von 3-Achsen-Beschleunigung, -Verlangsamung oder -Bewegung des Benutzers umfasst.

Revendications

1. Système (10) pour fournir une thérapie par métronome à un utilisateur en sélectionnant un fichier audio à partir d'une pluralité de fichiers audio stockés ayant chacun des paramètres de battement prédéfinis en utilisant des données de mouvement provenant d'un dispositif informatique mobile (12) connecté à ou tenu par un utilisateur, le système comprenant :

au moins un dispositif informatique mobile (12) ayant des capteurs de mouvement (14), les capteurs de mouvement (14) permettant de détecter une décélération du mouvement de l'utilisateur ;
un moyen pour régler un niveau de sensibilité pour les capteurs de mouvement (14) de sorte que les capteurs de mouvement (14) permettent de détecter la cadence de mouvement de l'utilisateur lorsque l'utilisateur marche ;
un moyen (16) pour obtenir des données de mouvement à partir des capteurs de mouvement (14) ; et **caractérisé par**
une barre de sensibilité permettant d'ajuster le niveau de sensibilité des capteurs de mouvement en fonction de ladite cadence de mouvement en étalonnant les capteurs de mouvement pour détecter les pas d'un utilisateur en fonction de ladite cadence de mouvement ;
un moyen pour utiliser les capteurs de mouvement (14) pour détecter une décélération dans ladite cadence de mouvement de l'utilisateur,
un moyen pour comparer la décélération détectée à une plage prédéfinie et si la décélération détectée se situe dans la plage prédéfinie de décélérations qui sont attribuables à la maladie de Parkinson, le système permettant de générer et d'enregistrer des données de mouvement concernant la décélération détectée ;
un moyen pour calculer à partir des données de

mouvement des données de pas basées sur le nombre de pas d'un utilisateur pendant une période de temps spécifique ;
un moyen pour calculer un battement de métronome prescrit individuellement pour l'utilisateur en appliquant un facteur de multiplication aux données de pas et en générant un fichier de battement de métronome à partir du battement de métronome prescrit individuellement ;
un moyen pour sélectionner automatiquement un fichier audio stocké ayant un paramètre de battement prédéfini correspondant au battement de métronome du fichier de battement de métronome, et
un moyen de sortie audio (20) pour fournir la thérapie par métronome à l'utilisateur en lisant le fichier audio de sorte que le fichier audio soit entendu par l'utilisateur.

2. Système (10) pour sélectionner un fichier audio selon la revendication 1, comprenant un moyen pour générer un fichier de battement de métronome sur un dispositif informatique distant ou par le dispositif informatique mobile.

3. Système de sélection d'un fichier audio selon la revendication 2, le niveau de sensibilité des détecteurs de mouvement (14) étant réglé automatiquement par le dispositif informatique mobile.

4. Procédé ou système (10) pour sélectionner un fichier audio selon l'une quelconque des revendications 1 à 3, le battement de métronome et le paramètre de battement prédéfini étant mesurés en battements par minute.

5. Système (10) pour sélectionner un fichier audio selon l'une quelconque des revendications 1 à 4, comprenant en outre un moyen de stockage (18) pour stocker une pluralité de fichiers audio, chacun ayant un paramètre de rythme prédéfini différent.

6. Système (10) pour sélectionner un fichier audio selon l'une quelconque des revendications 1 à 5, comprenant un moyen pour recevoir des fichiers audio ou télécharger des fichiers audio sur le dispositif informatique mobile (12) et/ou un moyen pour transmettre les données de pas et/ou le battement de métronome à un dispositif informatique distant.

7. Système (10) pour sélectionner un fichier audio selon l'une quelconque des revendications 1 à 6, comprenant un accéléromètre et/ou un gyroscope pour détecter le mouvement de l'utilisateur, de préférence l'accéléromètre comprenant un moyen pour détecter une accélération, une décélération ou un mouvement sur 3 axes de l'utilisateur.

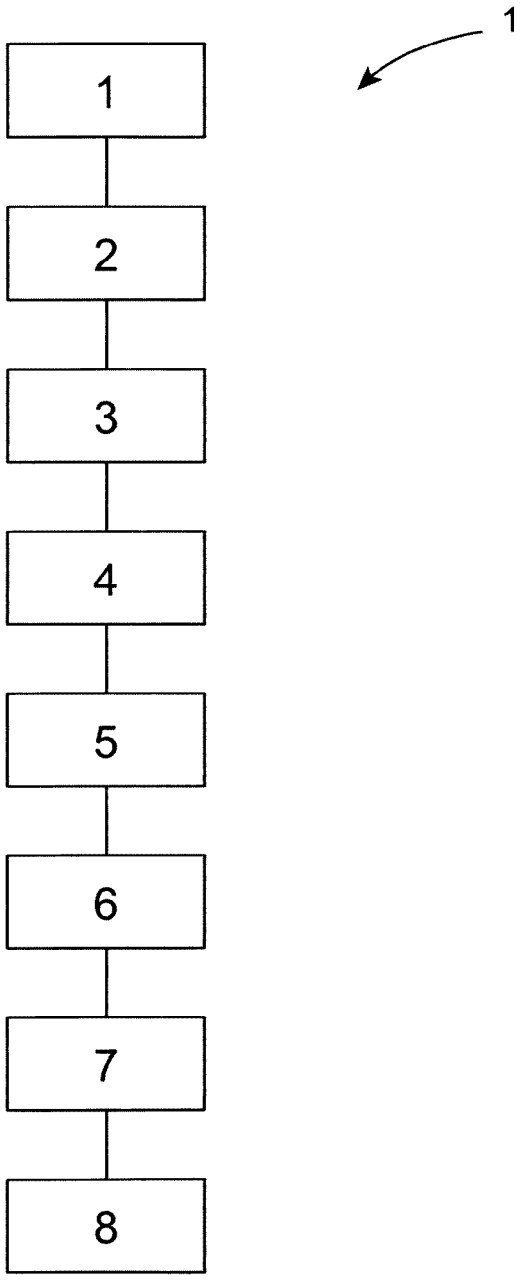

FIG. 1

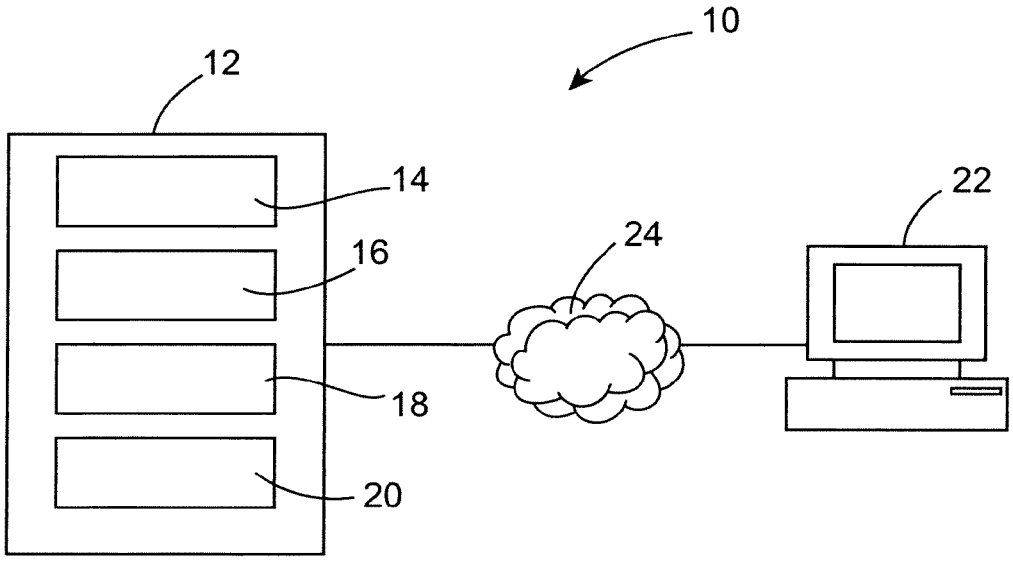

FIG. 2

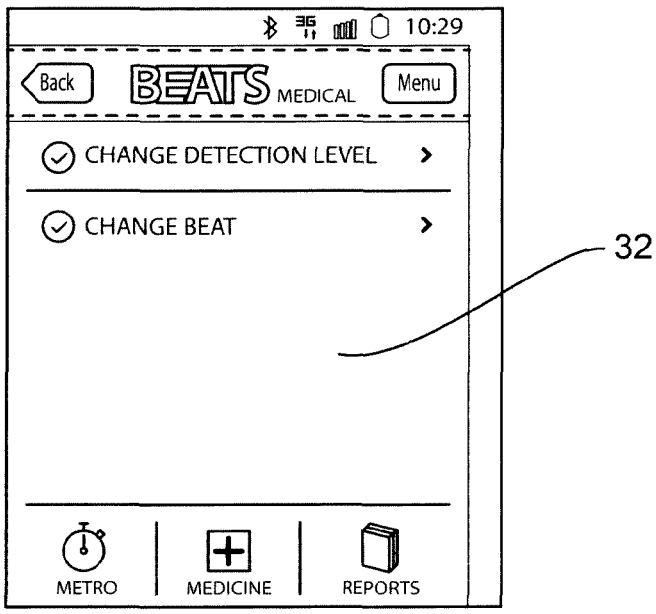
10:29
Back
BEATS MEDICAL
Menu
CHANGE DETECTION LEVEL
CHANGE BEAT
32
METRO
MEDICINE
REPORTS

FIG. 3

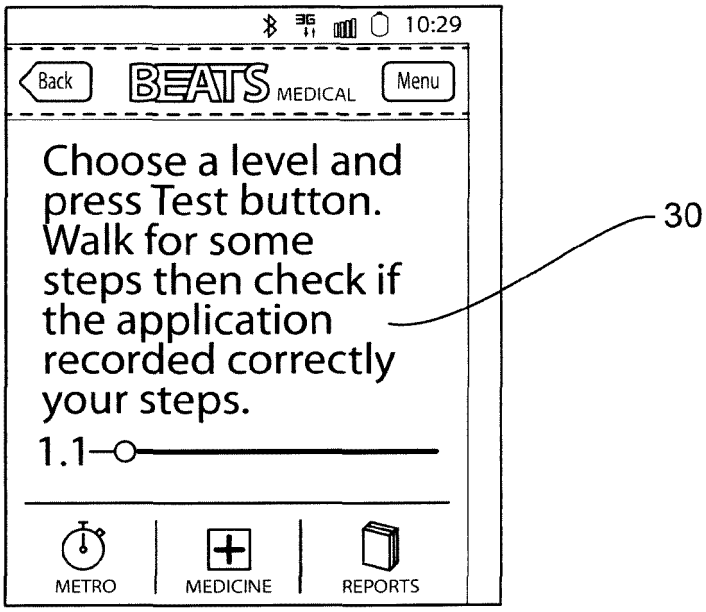
10:29
Back
BEATS MEDICAL
Menu
Choose a level and press Test button. Walk for some steps then check if the application recorded correctly your steps.
1.1
METRO
MEDICINE
REPORTS
30

FIG. 4

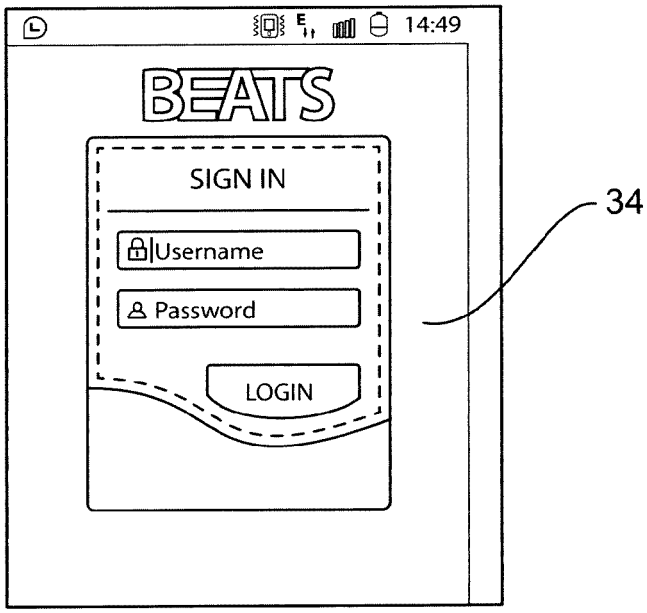

FIG. 5

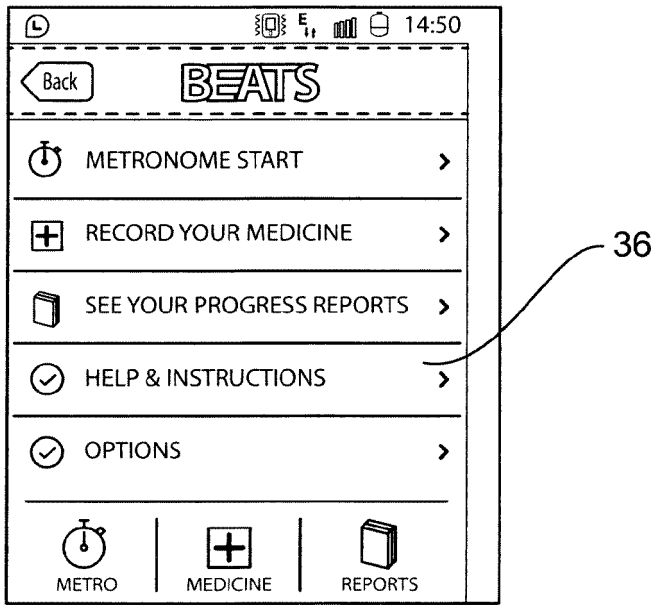
14:50
Back
BEATS
METRONOME START
RECORD YOUR MEDICINE
SEE YOUR PROGRESS REPORTS
HELP & INSTRUCTIONS
OPTIONS
METRO
MEDICINE
REPORTS
36

FIG. 6

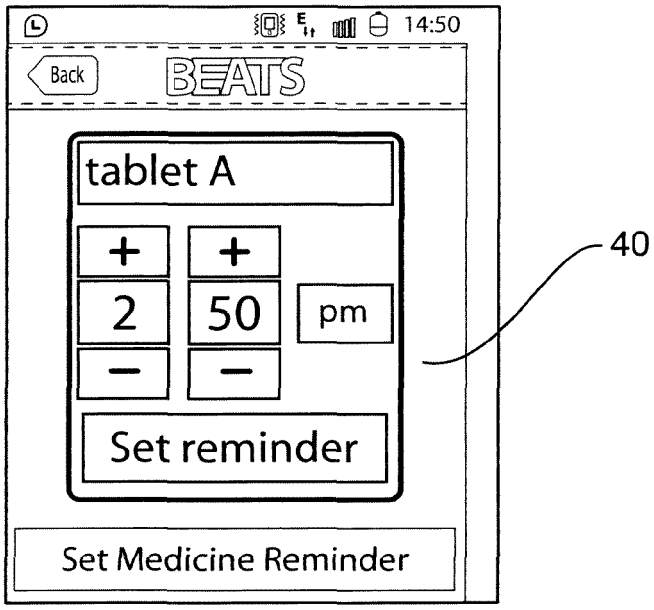
14:50
Back
BEATS
tablet A
+
+
2
50
pm
−
−
Set reminder
Set Medicine Reminder
40

FIG. 7

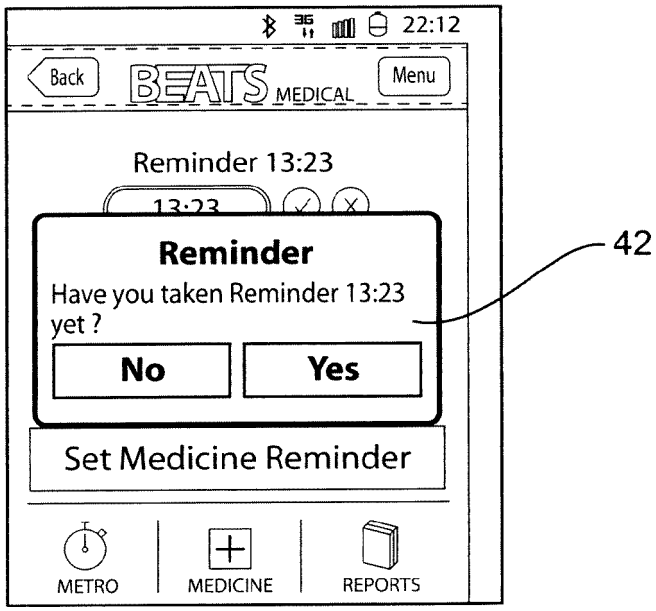
22:12
Back
BEATS MEDICAL
Menu
Reminder 13:23
13:23
Reminder
Have you taken Reminder 13:23 yet ?
No
Yes
42
Set Medicine Reminder
METRO
MEDICINE
REPORTS

FIG. 8

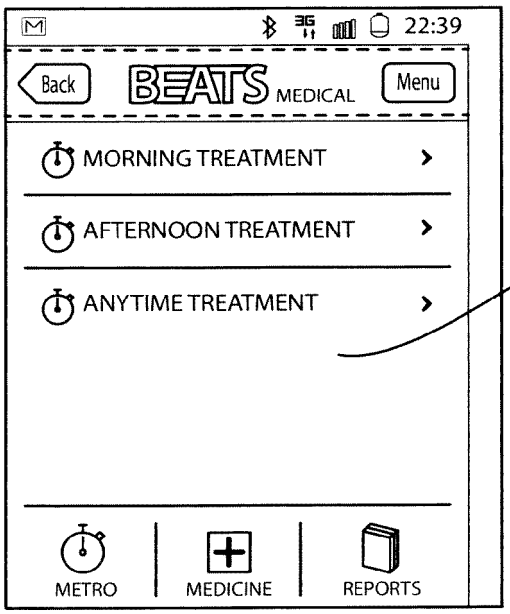
22:39
Back
BEATS MEDICAL
Menu
MORNING TREATMENT
AFTERNOON TREATMENT
ANYTIME TREATMENT
43
METRO
MEDICINE
REPORTS

FIG. 9

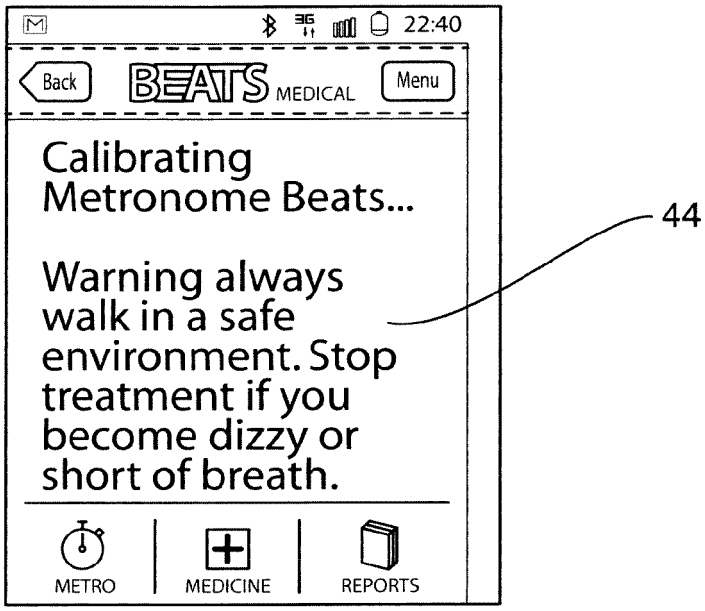
22:40
Back
BEATS MEDICAL
Menu
Calibrating Metronome Beats...
Warning always walk in a safe environment. Stop treatment if you become dizzy or short of breath.
METRO
MEDICINE
REPORTS
44

FIG. 10

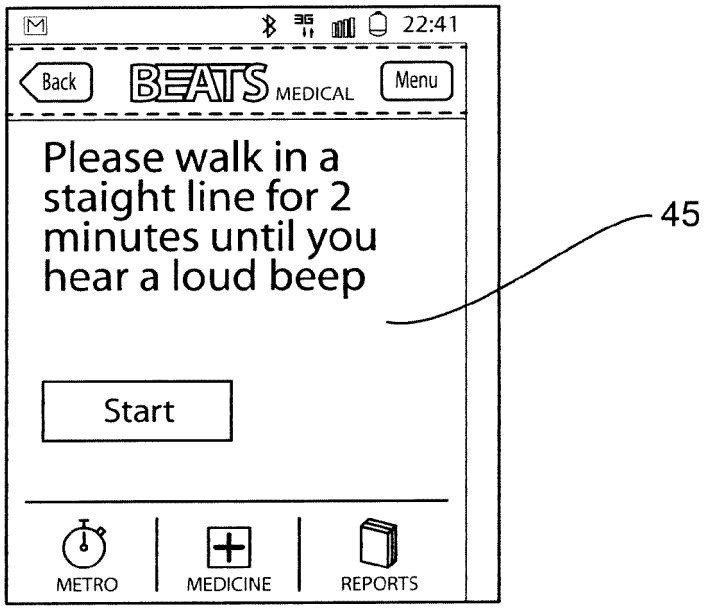
22:41
Back
BEATS MEDICAL
Menu
Please walk in a staight line for 2 minutes until you hear a loud beep
45
Start
METRO
MEDICINE
REPORTS

FIG. 11

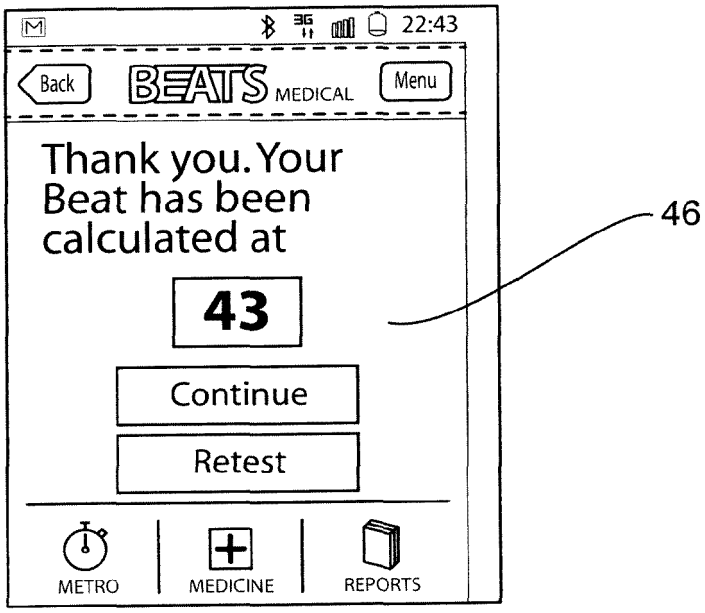
22:43
Back
BEATS MEDICAL
Menu
Thank you. Your Beat has been calculated at
43
Continue
Retest
METRO
MEDICINE
REPORTS
46

FIG. 12

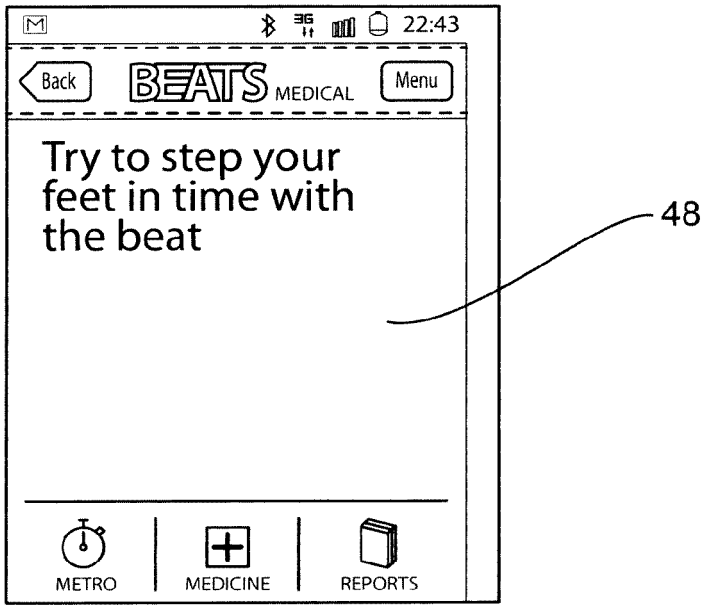
22:43
Back
BEATS MEDICAL
Menu
Try to step your feet in time with the beat
48
METRO
MEDICINE
REPORTS

FIG. 13

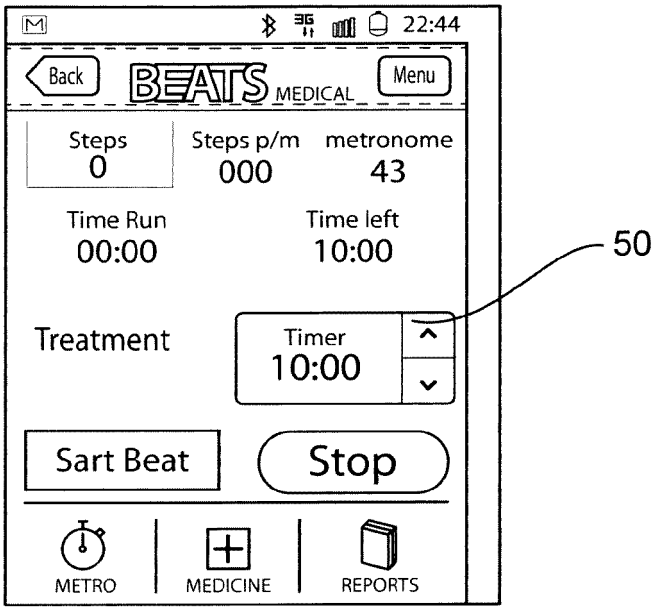
22:44
Back
BEATS MEDICAL
Menu
Steps
0
Steps p/m
000
metronome
43
Time Run
00:00
Time left
10:00
Treatment
Timer
10:00
Sart Beat
Stop
METRO
MEDICINE
REPORTS
50

FIG. 14

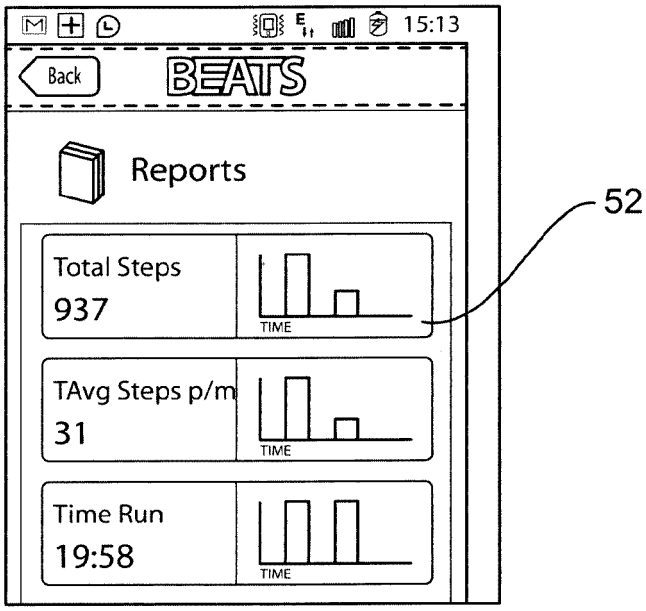
15:13
Back
BEATS
Reports
Total Steps
937
TIME
TAvg Steps p/m
31
TIME
Time Run
19:58
TIME
52

FIG. 15

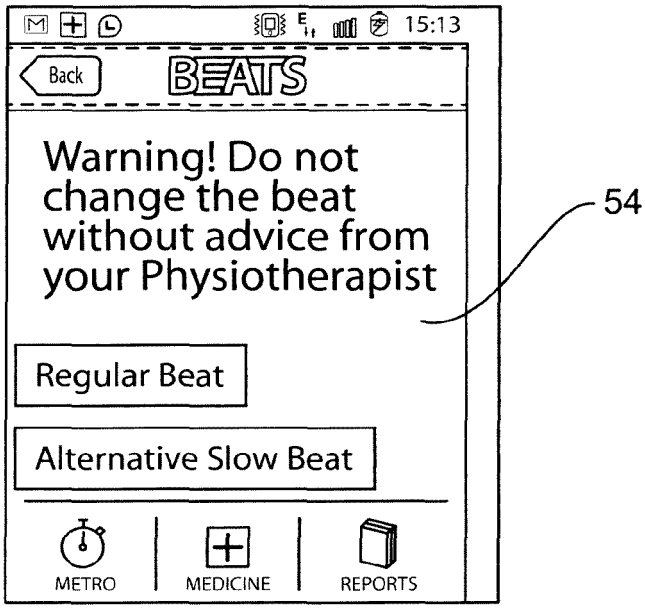
15:13
Back
BEATS
Warning! Do not change the beat without advice from your Physiotherapist
54
Regular Beat
Alternative Slow Beat
METRO
MEDICINE
REPORTS

FIG. 16

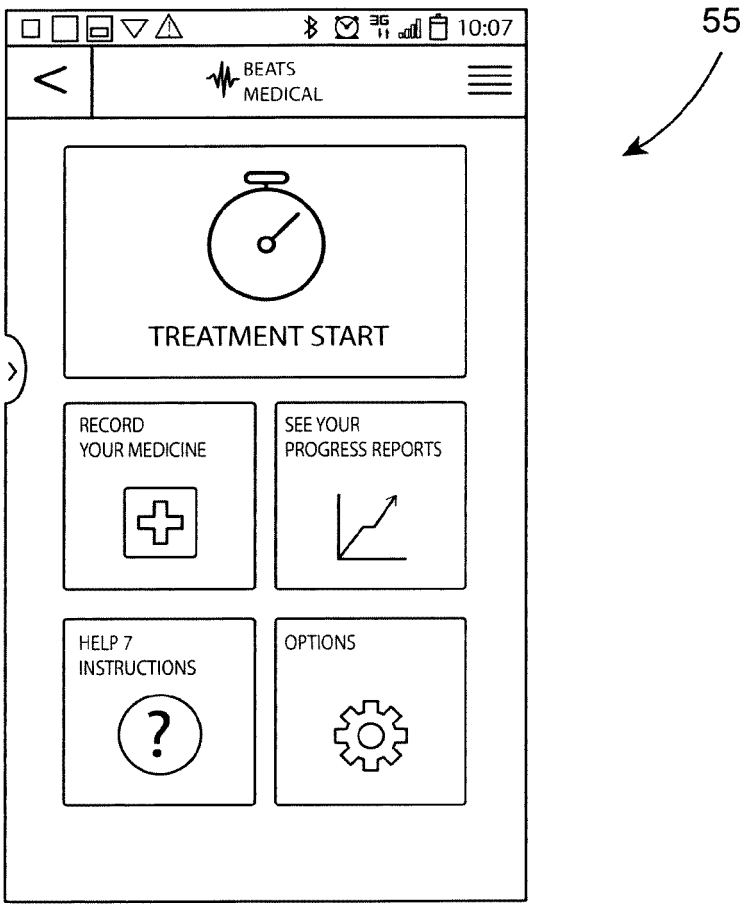
55
10:07
BEATS
MEDICAL
TREATMENT START
RECORD
YOUR MEDICINE
SEE YOUR
PROGRESS REPORTS
HELP 7
INSTRUCTIONS
OPTIONS

FIG. 17

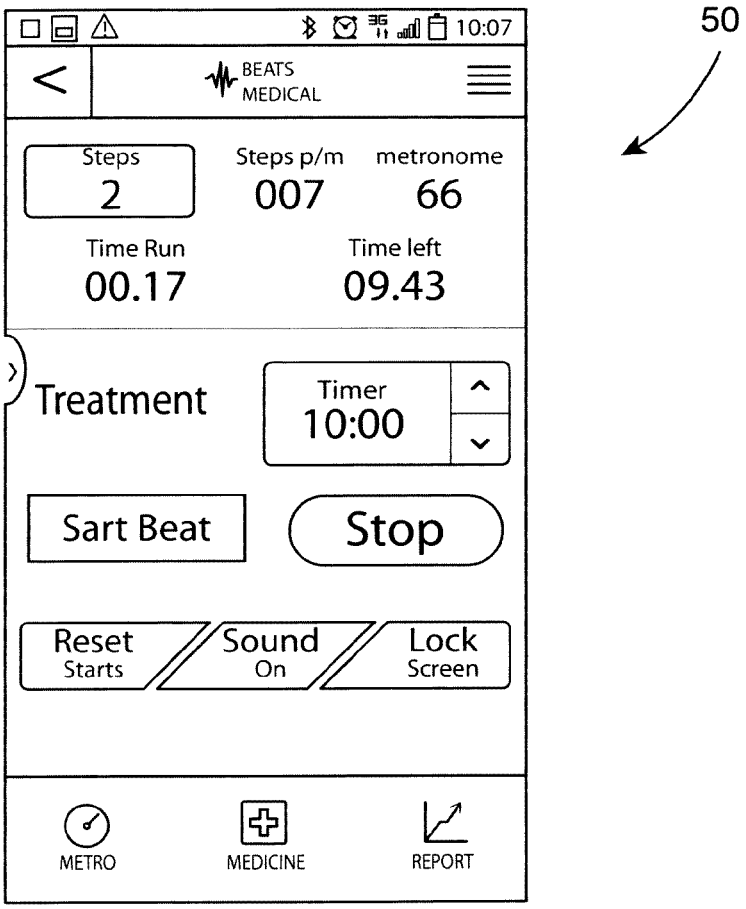
50
10:07
BEATS
MEDICAL
Steps
2
Steps p/m
007
metronome
66
Time Run
00.17
Time left
09.43
Treatment
Timer
10:00
Sart Beat
Stop
Reset
Starts
Sound
On
Lock
Screen
METRO
MEDICINE
REPORT

FIG. 18

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	使用运动传感器数据选择音频文件的系统		
公开(公告)号	EP3065836B1	公开(公告)日	2019-09-18
申请号	EP2014815245	申请日	2014-11-10
[标]申请(专利权)人(译)	BEATS医疗		
申请(专利权)人(译)	BEATS医药有限		
[标]发明人	CLANCY CIARA LOURDA CLANCY CIANAN COLM CHEW WUI MEI		
发明人	CLANCY, CIARA LOURDA CLANCY, CIANAN COLM CHEW, WUI MEI		
IPC分类号	A63B69/00 A61B5/00 G06F17/00 G01H7/00		
CPC分类号	A61B5/112 A61B5/6898 G10H1/40 G10H2220/395 G10H2230/015 G10H2240/135 A61B5/0022 A61B5/4082 A61B5/7282 A61B2560/0223 A61B2562/0219 G06F3/0346 G06F3/162 G10H1/0008 G10H2220/086		
代理机构(译)	麦克拉克伦 & DONALDSON		
优先权	2013192205 2013-11-08 EP		
其他公开文献	EP3065836A1		
外部链接	Espacenet		

摘要(译)

本发明涉及一种用于使用运动数据来选择音频文件的系统和方法，该运动数据来自与用户连接或由用户持有的移动计算设备，该移动计算设备包括运动传感器。该方法包括以下步骤：移动移动计算设备，从运动传感器获得运动数据，基于用户在特定时间段内采取的步数，从运动数据中计算步数据，并基于用户计算节拍器节拍。步骤数据并生成节拍器节拍文件，选择具有与节拍器节拍文件的节拍器节拍匹配的预定义节拍参数的存储的音频文件，并播放音频文件。本发明提供了一种技术解决方案，该技术解决方案是通过诸如智能电话之类的移动计算设备，或诸如膝上型计算机或PC，腕部或智能手表，或加速度计，计步器或具有计算机的其他外部计算设备之类的其他计算设备来交付的。处理器意味着可以改善帕金森氏病患者的步态。在使用中，通过移动计算设备上的应用软件来评估用户的日常移动性，该移动计算设备可用于计算用户所需的单独处方治疗。然后，以节拍器治疗的形式通过移动计算设备的扬声器进行治疗，节拍器治疗是听觉提示的形式，用于治疗患有帕金森氏病的人。

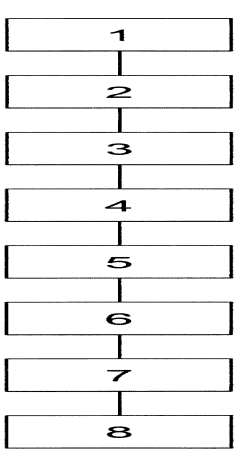

FIG. 1