

REHABILITATION SUPPORT AND MAINTENANCE SYSTEM

FIELD OF THE INVENTION

[0001] The present disclosure relates to a rehabilitation support and maintenance system which supports a rehabilitation walking using the brace or artificial leg of a rehabilitation patient who has a disability in walking, and also an analysis mechanism that analyzes information from the brace or artificial leg, and which enables a maintenance on the brace or the artificial leg.

BACKGROUND

[0002] Conventionally, a rehabilitation patient who has a disability in walking attaches a brace to a leg, and carries out a rehabilitation walking with the support to a leg being aided by the brace. In recent years, in order to allow an individual rehabilitation patient to appropriately carry out a rehabilitation walking, a sensor, etc., is attached to the brace, and data on the individual rehabilitation patient is obtained so as to reflect the obtained data on the adjustment of the brace. Rehabilitation apparatuses that obtain the rehabilitation patient data are known.

[0003] According to the rehabilitation apparatus disclosed in Patent Document 1, the brace includes a pair of support members placed at respective sides of the joint of a rehabilitation patient, a first arm and a second arm rotatable relative to the respective support members, a coupling member that couples the support members, a belt for fastening to a leg, and pads provided at the respective internal sides of the support members, the first arm, and the second arm. An acceleration sensor and a pressure sensor are provided on the pad, acceleration by a motion of the knee of the rehabilitation patient, and pressures applied to the knee, the thigh, and the lower extremity, etc., from the brace are detected and recorded in recording medium, and are output from external output means. Next, using the data output by the external output means, the way of walking and the change thereof are grasped in a medium-to-long stage, and thus the brace is adjusted to the optimal state.

[0004] According to the walking evaluation system disclosed in Patent Document 2, separately from a brace or a shoe to be attached to a foot, a walking evaluation aid attached to the brace or to the sole of the shoe is

provided. The walking evaluation aid includes load sensors provided at the forefoot portion and the hind feet portion of the sole, and a wireless circuit unit which transmits load information, sets a threshold at a terminal that receives the load information, and output alert sound, vibration, light, etc., when the threshold is exceeded. Moreover, a computer connected via a network sets the threshold and analyzes the data, thereby presenting medical profession's comments.

[0005] The biological-body state monitoring device disclosed in Patent Document 3 includes a foot pressure sensor unit which is provided at the sole of a foot, and which detects a time-associated change in pressure, a position detecting unit that detects the position information on a person subjected to the monitoring, and a biological-body information collecting device which is formed in footwear shape, and which includes a transmitting unit. The biological-body state is defined based on the collected data for the purpose of monitoring.

[0006] Meanwhile, a durable life is defined by the Ministry of Health, Labour and Welfare for the purpose of appropriate utilization of braces and artificial legs. For example, the durable life of the foot portion of an artificial leg is defined as 18 months, and the durable life of a knee joint is defined as three years. However, since the utilization frequency differs rehabilitation patient by rehabilitation patient, in the case of a patient who walks many times in a normal life not only the rehabilitation, and in the case of a patient who is usually bedridden and walks only when carrying out the rehabilitation, although the durable life of the foot portion of the artificial leg is commonly 18 months, the load applied to the artificial leg differs.

[0007] Moreover, a rehabilitation is divided into several stage depending on the progress of the rehabilitation, and for example, there are an acute stage, a convalescence stage, a maintenance stage (living stage), and a termination stage, etc. It is expected that the rehabilitation effect improves when a rehabilitation patient increases activities (e.g., a number of steps in walking) in accordance with each stage.

[0008] In general, in an acute stage, the activities are little, but increases as becoming to the convalescence stage and the maintenance stage. In the convalescence stage and in the maintenance stage, since the motion of a rehabilitation patient's leg becomes dynamic and quick,

even if the rehabilitation patient attaches an external aid or a footwear-like attachment to a brace or to an artificial leg and the weight thereof increases, the rehabilitation patient can carry out a rehabilitation walking, and can measure the number of steps in walking by an
5 acceleration sensor that is generally applied in the number of steps measurement. Conversely, in the acute stage, since the motion of the rehabilitation patient's leg is sickly, and is slow in a shuffling state, when the rehabilitation patient attaches the external aid or the footwear-like attachment to the brace or to the artificial leg and the weight thereof
10 increases, it becomes difficult for such a patient to carry out a rehabilitation walking, and thus the number of steps in walking cannot be measured by an acceleration sensor.

[0009] Regarding these technical problems, although the rehabilitation apparatus of Patent Document 1 obtains information on the
15 acceleration and on the pressure from the brace, such an apparatus is to grasp the way of walking and the change thereof in a medium-to-long term so as to adjust the brace to the suitable state for the rehabilitation patient, but cannot accomplish the improvement in the maintenance characteristics by detecting an appropriate durable life of the brace.
20 Moreover, it is not a brace of a foot portion but is a brace of a leg, such an apparatus cannot appropriately detect the number of steps by the rehabilitation patient in a shuffling state at an acute stage.

[0010] Although the walking evaluation system of Patent Document 2 can evaluate how the rehabilitation patient puts some muscle to the foot
25 by setting the threshold at the terminal that receives the load information and by outputting alert sound, vibration, light, etc., when the threshold is exceeded, such a system cannot accomplish the improvement in the maintenance characteristics by detecting an appropriate durable life of the brace. Furthermore, since it is necessary to attach the separate
30 walking evaluation aid to the brace or to the footwear of the rehabilitation patient, the foot becomes heavy, making it difficult for such a patient to carry out the rehabilitation walking, and thus the appropriate number of steps in walking by the rehabilitation patient at the acute stage in the shuffling state cannot be detected.

35 [0011] Although the biological-body state monitoring device of Patent Document 3 determines the biological-body state based on data collected

from the footwear-like biological-body information collecting device, such a device cannot accomplish the improvement in the maintenance characteristics by detecting an appropriate durable life of the brace. Furthermore, it is a footwear-like shape, and thus a rehabilitation patient at an acute stage cannot carry out a rehabilitation by wearing such a device.

[0012] [Patent Documents]

[Patent Document 1] WO 2012/086202 A

[Patent Document 2] JP 2017-158909 A

10 [Patent Document 3] JP 2004-305469 A

SUMMARY OF THE INVENTION

[0013] In view of the foregoing, an objective of the present disclosure is to provide a rehabilitation support and maintenance system which detects a number of steps in walking at the time of a rehabilitation by a brace or an artificial leg mainly utilized by a rehabilitation patient at an acute stage, and which can support the rehabilitation walking and enables a maintenance on the brace or on the artificial leg in accordance with an individual rehabilitation patient based on the utilization frequency of the brace or the artificial leg.

20 [0014] A rehabilitation support and maintenance system supports a rehabilitation walking using a brace or an artificial leg of a rehabilitation patient and an analysis mechanism that analyzes information from the brace or the artificial leg, in which:

the brace or the artificial leg includes:

25 a foot portion located at a foot of the rehabilitation patient;
a sole portion which is provided at the foot portion and which contacts a floor or a ground; and

a number-of-steps counter which is provided at the sole portion and which counts a number of steps in walking by the rehabilitation patient,

the number-of-steps counter includes:

a first sensor which is provided at a back side of the sole portion and which detects pressure;

35 a second sensor which is provided at a front side of the sole portion and which detects pressure; and

a control circuit board which is connected to the first sensor and to the second sensor, counts the number of steps as one step when the pressure of the first sensor and the pressure of the second sensor exceed a predetermined value, temporarily stores number-of-steps information, and transmits unique ID information and the number-of-steps information,

the analysis mechanism includes:

a data collecting terminal which is separate from the brace or the artificial leg, receives and temporarily stores the ID information and the number-of-steps information;

a server which is connected to the data collecting terminal via a network, receives, stores and analyzes the temporarily-stored ID information and number-of-steps information; and

a display terminal which is connected to the server and which displays an analysis result,

the number-of-steps counter transmits the temporarily-stored number-of-steps information at a predetermined clock time,

the analysis mechanism further includes a setting terminal which sets the predetermined clock time and which is connected to the data collecting terminal so as to be freely detachable, and

the setting terminal transmits the predetermined clock time to the control board via the data collecting terminal so as to set the predetermined clock time.

[0015] Preferably, a rehabilitation support and maintenance system supports a rehabilitation walking using a brace or an artificial leg of a rehabilitation patient and an analysis mechanism that analyzes information from the brace or the artificial leg, in which:

the brace or the artificial leg includes:

a foot portion located at a foot of the rehabilitation patient;

a sole portion which is provided at the foot portion and which contacts a floor or a ground; and

a number-of-steps counter which is provided at the sole portion and which counts a number of steps in walking by the rehabilitation patient,

the number-of-steps counter includes:

a first sensor which is provided at a back side of the sole portion and which detects pressure; and

a control circuit board which is connected to the first sensor, counts the number of steps as one step when the pressure of the first sensor exceeds a predetermined value, temporarily stores number-of-steps information, and transmits unique ID information and the number-of-steps information,

the analysis mechanism includes:

a data collecting terminal which is separate from the brace or the artificial leg, receives and temporarily stores the ID information and the number-of-steps information;

a server which is connected to the data collecting terminal via a network, receives, stores and analyzes the temporarily-stored ID information and number-of-steps information; and

a display terminal which is connected to the server and which displays an analysis result,

the number-of-steps counter transmits the temporarily-stored number-of-steps information at a predetermined clock time,

the analysis mechanism further includes a setting terminal which sets the predetermined clock time and which is connected to the data collecting terminal so as to be freely detachable, and

the setting terminal transmits the predetermined clock time to the control board via the data collecting terminal so as to set the predetermined clock time.

[0016] Preferably, the first sensor includes: crocodile hardware that is formed in a crocodile-mouth-like shape so as to be openable and closable; a push-up member which is provided at the crocodile hardware and which pushes the crocodile member in an opening direction; and a counting button which is provided at the crocodile hardware and which becomes ON when the crocodile hardware is opened or is closed.

[0017] Preferably, the analysis mechanism further includes an individual viewing terminal which is connected to the server via the network and which is for viewing the analysis result.

[0018] Preferably, the server calls the ID information and the number-of-steps information, and when the number-of-steps information is lower than a predetermined value, creates and transmits information

for notifying the rehabilitation patient of a fact that the number of steps in rehabilitation walking does not reach an aiming number of steps in rehabilitation walking so as to support a rehabilitation activity, and for indicating that there is a leeway until a maintenance cycle of the brace or the artificial leg based on a number of steps condition, and the display terminal receives and displays the information for notifying the rehabilitation patient of the fact that the number of steps in rehabilitation walking does not reach the aiming number of steps so as to support the rehabilitation activity, and indicating that there is a leeway until the maintenance cycle of the brace or the artificial leg based on the number of steps information.

[0019] Preferably, the server calls the ID information and the number-of-steps information, and when the number-of-steps information exceeds a predetermined value, creates and transmits information for notifying the rehabilitation patient of a fact that the number of steps in rehabilitation walking has reached an aiming number of steps in rehabilitation walking and of a rehabilitation activity is fairly progressing so as to support the rehabilitation activity, and for indicating that a maintenance cycle of the brace or the artificial leg is coming based on a number of steps condition, and the display terminal receives and displays the information for notifying the rehabilitation patient of the fact that the number of steps in rehabilitation walking has reached the aiming number of steps and the rehabilitation activity is fairly progressing so as to support the rehabilitation activity, and indicating that the maintenance cycle of the brace or the artificial leg is coming based on the number of steps information.

[0020] Preferably, the server calls the ID information and the number-of-steps information, and when the number-of-steps information is not lower than a predetermined value, the number-of-steps information does not exceed the predetermined value, and a number of utilization days of the brace or the artificial leg exceeds a predetermined number of days, creates and transmits information indicating that a maintenance cycle of the brace or the artificial leg is coming based on a number of days condition, and the display terminal receives and displays the information indicating that the maintenance cycle of the brace or the artificial leg is coming based on the number of days information.

[0021] Preferably, the setting terminal connected to the data collecting terminal via a wireless LAN standard or the network.

[0022] The number of steps in rehabilitation walking is detected by the brace or the artificial leg utilized by a rehabilitation patient mainly in an acute stage, and a support for a rehabilitation walking in accordance with each rehabilitation patient, and a maintenance on the brace or the artificial leg are enabled based on the utilization frequency thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

10 [0023] FIG. 1 is an explanatory diagram of a rehabilitation support and maintenance system according to the present disclosure;

FIG. 2 is an explanatory diagram of a brace according to the present disclosure;

15 FIG. 3 is an explanatory diagram of a number-of-steps counter according to the present disclosure;

FIG. 4 is an action diagram of a rehabilitation while receiving an aid by a care worker;

20 FIG. 5 is an action diagram of a rehabilitation support system of a comparative example, and of a rehabilitation support and maintenance system according to an embodiment;

FIG. 6 is a flowchart from counting of a number of steps in walking by a brace or an artificial leg to an analysis result display by an analysis mechanism;

25 FIG. 7 is a flowchart of a maintenance by a rehabilitation support and maintenance system according to the present disclosure;

FIG. 8 is an explanatory diagram of a number-of-steps counter according to another aspect of the present disclosure;

30 FIG. 9 is an action diagram of a rehabilitation support and maintenance system provided with a number-of-steps counter according to another aspect of the embodiment; and

FIG. 10 is a flowchart from counting of a number of steps in walking by a brace or an artificial leg provided with a number-of-steps counter to storing of an ID and number-of-steps information by a server according to another aspect.

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DETAILED DESCRIPTION OF THE EMBODIMENTS

[0024] Embodiments of the present disclosure will be described below with reference to the accompanying drawings. Note that the explanatory diagram of a rehabilitation support and maintenance system is to conceptually (exemplarily) illustrate an example rehabilitation using a brace.

[0025] [Embodiments]

As illustrated in FIG. 1, a rehabilitation support and maintenance system 10 supports a rehabilitation walking using a brace 20 of a rehabilitation patient 11, and an analysis mechanism 40 that analyzes number-of-steps information from the brace 20.

[0026] The rehabilitation patient 11 is a patient at an acute stage, grabs a parallel bar 13 (illustrating only one at the depthwise side in the figure), and for example, is carrying out a rehabilitation walking on a floor 12 within a rehabilitation facility like a hospital. The brace 20 includes a number-of-steps counter 21 (see FIG. 3) that counts the number of steps (the activity amount) by the rehabilitation patient 11, and transmits unique ID information to the brace 20 and number-of-steps information to the analysis mechanism 40 at a predetermined clock time. Note that although the rehabilitation patient 11 is carrying out the rehabilitation walking while grabbing the parallel bar 13 in an embodiment, the present disclosure is not limited to this case, and it may be an assisted walking with a care worker 15 (see FIG. 4).

[0027] Next, the hardware structure of the analysis mechanism 40 will be described.

The analysis mechanism 40 includes a data collecting terminal 41 which receives ID information set for each brace 20 and the number-of-steps information from the brace 20, and which temporarily stores those pieces of information, a server 42 which is connected to the data collecting terminal 41 via a network 50, receives, stores and analyzes the temporarily stored ID information and number-of-steps information, and a display terminal 43 which is connected to the server 42, and which displays an analysis result.

[0028] Moreover, the server 42 is connected to an on-site LAN 44, is connected to a mobile terminal 46 in the on-site LAN 44 via a transmitting and receiving device 45, and can display the analysis result on the mobile terminal 46. Furthermore, an external viewing terminal 47 can be

connected to the server 42 via the network 50, enabling an operation to view the analysis result from the individual viewing terminal 47. Note that an ID and a password may be set for the connection to the mobile terminal 46 and to the viewing terminal 47.

5 [0029] Moreover, a setting terminal 48 that sets a predetermined clock time is connected to the data collecting terminal 41 so as to be freely detachable, and the predetermined clock time is transmitted and set to the number-of-steps counter 21 via the data collecting terminal 41 by the setting terminal 48. Regarding the predetermined clock time, when, for
 10 example, 11:00 PM is set, the pieces of number-of-steps information of a day is collectively transmitted within a time slot at which no rehabilitation walking is being carried out. Note that although the setting terminal 48 is attachable and detachable relative to the data collecting terminal 41 by a wired scheme, the present disclosure is not
 15 limited to this case, the setting terminal 48 may be connected to the data collecting terminal 41 by a wireless LAN standard, such as a so-called WiFi or Bluetooth (registered trademark), or by the networks 50, to set the predetermined clock time.

[0030] Next, the hardware structure of the brace 20 will be described.

20 As illustrated in FIG. 2, the brace 20 is to be attached to the lower extremity (the leg) 14 of the rehabilitation patient 11 (see FIG. 1). The brace 20 includes a foot portion 22 in a footwear shape located at the foot of the rehabilitation patient 11, a strap 23 provided at the foot portion 22, a pair of lower support pillars 24 provided on the strap 23 so as to be
 25 pivotable, and a pair of upper support pillars 26 provided at the respective top ends of the lower supports 24 so as to be pivotable around respective axes 25.

[0031] The pair of lower support pillars 24 is coupled to each other by a woodruff member 27 at the back side, and is fastened to the lower leg by
 30 a cuff band 28. The pair of upper support pillars 26 is coupled to each other by a woodruff member 29 at the back side, and is fastened to the thigh via a thigh corset 31. An assistance band 32 that can be grabbed by the care worker 15 is provided at the front side of the pair of upper support pillars 26. A knee pad 33 that holds the knee is provided near the axes
 35 25 of the brace 20.

[0032] As illustrated in FIGS. 3A and 3B, the brace 20 includes the foot portion 22, a sole portion 34 which is provided at the foot portion 22 and which contacts the floor 12 (see FIG. 1), and the number-of-steps counter 21 which is provided in the sole portion 34 and which counts the number of steps by the rehabilitation patient 11 in walking.

[0033] The number-of-steps counter 21 includes a first sensor 35 which is provided at the back side of the sole portion 34, and which detects pressure, a second sensor 36 which is provided at the front side of the sole portion 34, and which detects pressure, and a control circuit board 37 which is connected to the first sensor 35 and to the second sensor 36, counts the number of steps as one step when the pressure of the first sensor 35 and the pressure of the second sensor 36 exceed a predetermined value, temporarily stores the number-of-steps information, and transmits the unique ID information and the number-of-steps information.

[0034] The sole portion 34 is a soft material, such as a rubber, a sponge, a synthetic resin, or leather, or a laminated combination thereof, and the first sensor 35 and the second sensor 36 are provided in respective positions which are in the sole portion 34 and which enable such sensors to detect pressure by the contact of the leg to the ground. The first sensor 35 and the second sensor 36 are, for example, load cells, and when the sole portion 34 is a single rubber, the first sensor 35 and the second sensor 36 can be placed between the top face of the sole portion and an insole, and the first sensor 35 and the second sensor 36 can be placed between a sponge and a leather or between the sponge and the insole when the sole portion 34 includes the sponge and the leather that are laminated to each other. Moreover, a recess may be provided in a part of the sole portion 34, and the control circuit board 37 can be placed in such a recess. Moreover, the control circuit board 37 of the number-of-steps counter 21 is provided with a transceiver unit, and it is set to transmit the number-of-steps information stored temporarily at a predetermined clock time.

[0035] Next, an action of a rehabilitation with an aid by the care worker 15 will be described.

As illustrated in FIG. 4, when the injury of a lower leg 14 of the rehabilitation patient 11 is serious, or when a rehabilitation walking by the patient alone is difficult at the acute stage, the care worker 15 aids the

rehabilitation patient 11, and the care worker 15 lifts up the assistance band 32 of the brace 20, thereby assisting the rehabilitation walking by the rehabilitation patient 11. In this case, also, the rehabilitation patient 11 causes the leg to contact the floor 12, and the first sensor 35 and the
5 second sensor 36 detect the respective predetermined pressures, and thus the number of steps is counted.

[0036] Next, an action of a rehabilitation support system 100 according to a comparative example will be described.

As illustrated in FIG. 5A, the rehabilitation support system
10 100 of the comparative example includes a brace 101 attached to the leg of the rehabilitation patient 11, an acceleration sensor mechanism 102 which is provided at a band of the brace 101 near the knee, detects acceleration, and transmits acceleration data, and an acceleration data collecting terminal 103 that receives and collects the acceleration data.

[0037] According to the rehabilitation support system 100 of the
15 comparative example, the rehabilitation stage of the rehabilitation patient 11 is, for example, convalescence and maintenance stages, the motion of the leg is muscular and quick, and a foot portion 104 is sufficiently moved and lifted, and thus the acceleration sensor mechanism 102 that detects
20 the acceleration can count the number of steps. When, however, the rehabilitation stage of the rehabilitation patient 11 that is an acute stage or when the injury is serious, etc., since the motion of the leg is not muscular and slow, the acceleration sensor mechanism 102 is sometimes unable to detect the number of steps. Hence, the number of steps in
25 rehabilitation walking cannot be precisely counted, and it is difficult to appropriately perform a rehabilitation support and a maintenance on the brace 101.

[0038] An action of the rehabilitation support and maintenance
30 system 10 of the embodiment which addresses such technical problems will be described.

[0039] As illustrated in FIG. 5B, according the rehabilitation support and maintenance system 10 of the embodiment, for example, the
rehabilitation stage of the rehabilitation patient 11 is an acute stage, the motion of the leg is not muscular, and is slow in a shuffling state, and thus
35 the moved amount of the foot portion 22 is little. Even if the motion of the leg is not muscular and is slow in a shuffling stage, and thus the

movement of the foot portion 22 is little, the number-of-steps counter 21 can detect the pressures by two sensors that are the first sensor 35 and the second sensor 36 provided at respective flexible material portions of the sole portion 34 (see FIG. 3), thereby precisely counting the number of steps in rehabilitation walking.

[0040] Furthermore, according to the rehabilitation support and maintenance system 10 of the embodiment, the pieces of number-of-steps information of a day is temporarily stored at the sensor-side (the control circuit board 37), is transmitted to the data collecting terminal 41 at the scheduled time, and is subjected to a data analysis by the server 42 (see FIG. 1). This enables appropriate rehabilitation support and maintenance on the brace 20.

[0041] Next, a flow from counting of a number of steps in walking by the brace or the artificial leg to an analysis result display by the analysis mechanism will be described.

[0042] As illustrated in FIG. 6A, the rehabilitation support and maintenance system 10 determines in STEP (STEP will be denoted as S in the figure) 1 whether or not the first sensor 35 becomes ON in the brace 20 by the rehabilitation patient 11 taking a step of walking (a first determination step). When the determination in STEP 1 is YES, it is determined in STEP 2 whether or not the second sensor 36 is ON (a second determination step). When the determination in STEP 1 is NO, the process returns to STEP 1 and the system becomes a standby state.

[0043] When the determination in STEP 2 is YES, the number-of-steps counter 21 (the control circuit board 37) counts the number of steps as one step in STEP 3 (a counting step). When the determination in STEP 2 is NO, the process returns to STEP 2, and the system becomes a standby state.

[0044] The pieces of number-of-steps information of a day are temporarily stored at the sensor-side (the control circuit board 37) together with the ID for each brace 20 in STEP 4 (a number-of-steps information storing step). The ID and the number-of-steps information are transmitted in STEP 5 to the data collecting terminal 41 via a Network of a wireless LAN standard, such as WiFi or Bluetooth (registered trademark) from the sensor side (the control circuit board 37) at a clock time defined for each day (e.g., 11:00 p.m.) (a data collecting

step), and the ID and the number-of-steps information are transmitted to the server 42 via the network 50, such as the Internet or an on-site LAN (a server transmission step).

[0045] The server 50 receives the ID and the number-of-steps
 5 information in STEP 6 (a server reception step), and in STEP 7, the server 50 stores (saves) the ID and the number-of-steps information (a data storing step), and furthermore, the server 50 accumulates the daily number-of-steps information for each ID, and analyzes the distribution of the number of steps, the total number of steps, etc., for each time, for each
 10 day, for each week, for each week day, for each month, or until a predetermined time point based on the number of elapsed days (data analyzing step).

[0046] As illustrated in FIG. 6B, in STEP 8, the display terminal 43 accesses the server 42 to call out the ID and the number-of-steps
 15 information (analysis information) (a data calling step), and displays the analysis result in the form of a table on the display terminal 43 in STEP 9 or displays the analysis result in the form of a graph in STEP 10 (a displaying step).

[0047] Note that the access to the server 50 is not limited to from the
 20 display terminal 43, but an access from the mobile terminal 46 via the on-site LAN with a login ID and a password, and an access from the viewing terminal 47 via the Internet with a login ID and a password are also available.

[0048] Next, a flow to a display of maintenance information will be
 25 described.

As illustrated in FIG. 7, the ID and the number-of-steps information at the server 42 is checked at a predetermined timing (a daily predetermined clock time, a predetermined week day, an access timing to the server 42, an arbitrary timing, etc.) in STEP 11 (a data checking step).
 30 It is determined in STEP 12 whether or not the number of steps is less than a predetermined value (a lower limit number of steps determining step). When the determination in STEP 12 is YES, since a rehabilitation is not carried out frequently, in STEP 13, maintenance information that prompts a rehabilitation and indicating that there is a leeway until a
 35 maintenance on the brace 20 is created (a maintenance information

creating step). When the determination in STEP 12 is NO, the process progresses to STEP 17.

[0049] It is determined in STEP 17 whether or not the number of steps exceeds the predetermined value (an upper limit number of steps determining step). When the determination in STEP 17 is YES, in STEP 13, the maintenance information indicating that the rehabilitation is carried out well and should be carried out at this rate (depending on the amount of rehabilitation, a load by the rehabilitation may increase, and thus it is necessary to pay attention to the physical condition), and indicating that a maintenance is necessary (depending on the situation, the maintenance cycle is coming) is created. When the determination in STEP 17 is NO, the process progresses to STEP 18.

[0050] It is determined in STEP 18 whether or not a predetermined number of days has elapsed (a number of days determining step). When the determination in STEP 18 is YES, in STEP 13, the maintenance information in accordance with the rehabilitation state based on the number of steps and on the number of elapsed days is created. When the determination in STEP 18 is NO, the process returns to STEP 12.

[0051] Subsequent to STEP 13, in STEP 14, the maintenance information is transmitted to at least any one of the display terminal 43, the mobile terminal 46, and the viewing terminal 47 (a maintenance information transmitting step). In STEP 15, any one of the display terminal 43, the mobile terminal 46, or the viewing terminal 47 receives the maintenance information (a maintenance information receiving step). In STEP 16, the maintenance information is displayed (a maintenance information displaying step).

[0052] As described above, in the maintenance on the brace 20 (or the artificial leg), when the number of steps in walking is less than the predetermined number of steps, there are some possible reasons such that: the rehabilitation patient 11 cannot take steps in walking due to the poor physical condition; the brace 20 (the artificial leg) does not match, and thus the patient does not take steps in walking; the sensor is defective; and the brace 20 (artificial leg) is defective, which does not allow the patient to take steps in walking, etc. Hence, a follow-up to the user of the brace 20 (the artificial leg) is necessary to find the reason, but the maintenance enables such a follow-up to the rehabilitation patient 11

(user). Moreover, when the number of steps in walking is greater than the predetermined number of steps in walking, since the rehabilitation patient 11 walks actively, the maintenance can be carried out in such a way that the activity of the rehabilitation patient 11 does not exceed the durability of each component of the brace 20 (the artificial leg).

Furthermore, by setting the predetermined number of days (e.g., 18 months), a specific announcement for the maintenance cycle can be given.

[0053] Next, a number-of-steps counter according to another aspect will be described.

As illustrated in FIG. 8A, the brace 20 includes the foot portion 22, the sole portion 34 which is provided at the foot portion 22 and which contacts the floor 12 (see FIG. 1), and the number-of-steps counter 21 which is provided in the sole portion 34 and which counts the number of steps in walking by the rehabilitation patient 11. A general insole 38 is placed in the foot portion 22, a perforated sponge 39 for embedding a sensor, etc. is placed below such insole, and the first sensor 35 and the control circuit board 37 are placed in the perforated sponge 39.

[0054] The number-of-steps counter 21 includes the first sensor 35 which is provided at the back side of the sole portion 34 and which detects pressure, and the control circuit board 37 which is connected to the first sensor 35, counts the number of steps as one step when the pressure at the first sensor 35 exceeds a predetermined value, temporarily stores such number of steps as the number-of-steps information, and transmits the unique ID information and the number-of-steps information.

[0055] As illustrated in FIG. 8B, the first sensor 35 includes crocodile hardware 35a which is formed in a shape like a crocodile mouth, and which is openable and closable via a hinge, a push-up member 35b which is placed between the upper side part of the crocodile hardware 35a and the lower side part thereof, and which pushes the crocodile hardware 35a so as to be opened, and a counting button 35c which is provided at the lower side part of the crocodile hardware 35a, and which becomes ON when the crocodile hardware 35a is closed or opened. Moreover, the first sensor 35 includes a button depressing protrusion 35d which is provided at the upper side part of the crocodile hardware 35a and at the position facing the counting button 35c, and which is to depress the counting button 35c, and a stopper 35e which is provided at the lower side part of

the crocodile hardware 35a, and which regulates the movement of the crocodile hardware 35a in the closing direction.

[0056] The counting button 35c becomes ON when the crocodile hardware 35a is closed and when the button depressing protrusion 35d depresses such button, which causes the number of steps to be counted as one step. Note that the counting button 35c may count the number of steps as one step when the crocodile hardware 35a is closed and the button depressing protrusion 35d depresses such button, and then the crocodile hardware 35a is opened and the button depressing protrusion 35d is released from such button. Moreover, according to the embodiment, although the push-up member 35b is a compression spring, the present disclosure is not limited to this case, it may be a plate spring, an elastic member like rubber, and furthermore, the folded portion of the crocodile hardware 35a may have elasticity, and it is not limited to any particular one as far as it can push up the crocodile hardware 35a in the opened direction. Note that according to the embodiment, although the crocodile hardware 35a is openable and closable via the hinge, a structure in which the push-up member 35b and the counting button 35c may be provided between the upper member and the lower member separated from each other in the vertical direction without a hinge may be employed.

[0057] As illustrated in FIG. 8C, the perforated sponge 39 in which an opening 39a is formed is placed below the insole 38 that is stepped by a foot 14, the first sensor 35 is placed in the opening 39a, and the control circuit board 37 is connected to the first sensor 37. According to the embodiment, although the control circuit board 37 is placed so as to be apart from the crocodile hardware 35a of the first sensor 35, the present disclosure is not limited to this case, and the control circuit board 37 may be built in the crocodile hardware 35a. Note that, according to the embodiment, although the first sensor 35 and the counting button 35c, etc., are provided at the crocodile hardware 35a, the present disclosure is not limited to this case, and without providing the crocodile hardware 35a, a load cell and a simple pressure sensor may be merely provided in the sole portion 34 or below the insole 38, and the type of the first sensor 35 is not limited to any particular type as far as it can detect the pressure by the leg 14 or the steps thereof in walking. Furthermore, without providing the crocodile hardware 35a, a flexible member in a soap-box shape (a

rectangular solid shape) may be provided at the sole portion 34 in the lengthwise direction (longitudinal direction), and such a member in a soap-box shape may slide when stepped and depressed by the foot 14 to cause the sensor to be turned ON.

5 [0058] As illustrated in FIG. 9, according to the rehabilitation support and maintenance system 10 of the embodiment, for example, the rehabilitation stage of the rehabilitation patient 11 is an acute stage, the motion of the leg is sickly, and is slow in a shuffling state, and the moving amount of the foot portion 22 is little. Even if the motion of the leg is
10 sickly and is in a shuffling state, and the movement of the foot portion 22 is slow, the number-of-steps counter 21 can detect pressure by the one first sensor 35 provided in a flexible material portion of the sole portion 34 (see FIG. 3), thereby precisely counting the number of steps in rehabilitation walking. Even if the rehabilitation patient walks in a
15 shuffling state, by putting the body weight on the leg, since the crocodile hardware 35a (see FIG. 8) is closed and the counting button 35c becomes ON, the number of steps by the patient in the rehabilitation walking can be precisely counted.

[0059] Next, A description will be given of a flow from the counting of
20 the number of steps by a brace or an artificial leg that includes the number-of-steps counter 21 to the analysis result display by an analysis mechanism according to another aspect.

[0060] As illustrated in FIG. 10, according to the rehabilitation support and maintenance system 10, when the rehabilitation patient 11
25 takes a step in walking in STEP 21, predetermined load is applied to the first sensor 35 in the brace 20. It is determined in STEP 22 whether or not the counting button 35c of the first sensor 35 is ON (a first determining step). When the determination in STEP 22 is YES, the number-of-steps counter 21 (the control circuit board 37) counts the
30 number of steps as one step in STEP 23 (a counting step). When the determination in STEP 22 is NO, the process returns to STEP 22, and the system becomes a standby state.

[0061] The pieces of number-of-steps information of a day are temporarily stored at the sensor (the control circuit board 37) side
35 together with the ID for each brace 20 in STEP 24 (a number-of-steps information storing step). The ID and the number-of-steps information

are transmitted in STEP 25 to the data collecting terminal 41 via a network with a wireless LAN standard, such as WiFi or Bluetooth (registered trademark) from the sensor (the control circuit board 37) side at a clock time set day by day (e.g., 11:00 P.M.) (a data collecting step), and
 5 the ID and the number-of-steps information are transmitted to the server 42 via the network 50, such as the Internet or the on-site LAN (a server transmission step).

[0062] The server 50 receives the ID and the number-of-steps information in STEP 26 (a server reception step), the server 50 stores
 10 (saves) the ID and the number-of-steps information in STEP 27 (a data storing step), and furthermore, the server 50 accumulates the daily number-of-steps information for each ID, and analyzes the distribution of the number of steps, the total number of steps, etc., for each time, for each day, for each week, for each week day, for each month, or until a
 15 predetermined time point based on the number of elapsed days (data analyzing step).

[0063] Next, actions and effects of the rehabilitation support and maintenance system 10 as described above will be described.

According to the embodiment of the present disclosure, the
 20 brace 20 and the artificial leg includes the foot portion 22, the sole portion 34, and the number-of-steps counter 21. Since the number-of-steps counter 21 includes the first sensor 35 which is provided at the back side of the base 41, detects pressure, and counts the number of steps as one step when the pressure of the first sensor 35 exceeds the predetermined
 25 value. Hence, even if the rehabilitation patient 11 is at an acute stage and the motion of the leg is slow and sickly in shuffling state, the pressure when the foot contacts a floor is detected, enabling a precise counting of the number of steps.

[0064] Moreover, according to the embodiment of the present
 30 disclosure, the analysis mechanism 40 includes the data collecting terminal 41 which receives the ID information and the number-of-steps information from the number-of-steps counter 21, and which temporarily stores those pieces of information, and the server 42 which receives the ID information and the number-of-steps information from the data collecting
 35 terminal 41, and which analyzes those pieces of information. Hence, the maintenance cycle can be grasped based on the number of steps, a support

for a suitable rehabilitation walking for each rehabilitation patient 11 can be accomplished, and the maintenance on the brace 20 or on the artificial leg can be carried out based on the utilization frequency.

[0065] Furthermore, according to the embodiment of the present disclosure, since the pieces of number-of-steps information of, for example, a day are collectively transmitted from the number-of-steps counter 21 to the data collecting terminal 41 at a predetermined clock time, in comparison with frequent communications, the power consumption of a battery by communication can be reduced. Still further, in comparison with frequent transmissions, transmission and reception errors can be suppressed, and thus data transmission and reception are stabilized. This enables a creation of precise information on a support for a rehabilitation walking and on a maintenance on the brace 20 or on the artificial leg.

[0066] Yet still further, according to the embodiment of the present disclosure, the data transmitting time from the number-of-steps counter 21 to the data collecting terminal 41 can be freely set by the setting terminal 48, a clock time that is easy to collect the number-of-steps information can be set for each rehabilitation patient 11. This enables a creation of precise information on a support for a rehabilitation walking and on a maintenance on the brace 20 or on the artificial leg.

[0067] Moreover, the first sensor 35 includes the crocodile hardware 35a, the push-up member 35b that pushes the crocodile hardware 35a in the opening direction, and the counting button 35c that becomes ON when the crocodile hardware is closed or is opened. Since the push-up member 35b that pushes the crocodile hardware 35a in the opening direction is provided, unless force that is equal to or greater than the predetermined value is applied, the crocodile hardware 35a is not closed. Hence, even if the rehabilitation patient 11 walks in a shuffling state, when such a patient applies the body weight to the foot, the crocodile hardware 35a is closed and the counting button 35c becomes ON. Accordingly, the number of steps in rehabilitation walking by the patient can be precisely counted.

[0068] Furthermore, according to the embodiment of the present disclosure, since the individual viewing terminal 47 can be connected to the server 42 via the network 50, for example, a login to the server 42 from

a remote place is enabled using an ID and a password to view the analysis result. This enables a creation of information on a support for the rehabilitation walking, and on the maintenance on the brace 20 or on the artificial leg. Hence, the information on the support for the

5 rehabilitation walking, and on the maintenance on the brace 20 or on the artificial leg can be created even at home or at a rehabilitation facility apart from a hospital, thereby improving the user-friendliness.

[0069] Still further, according to the embodiment of the present disclosure, the server 42 calls the ID information and the number-of-steps
10 information, and creates the maintenance information when the number-of-steps information is lower than the predetermined value. Hence, by notifying the rehabilitation patient 11 of the fact that the number of steps does not reach the aiming number of steps to support the rehabilitation activity, such a patient can be notified of the maintenance
15 information indicating that, for example, there is a leeway until the maintenance cycle of the brace 20 or the artificial leg based on the number of steps condition.

[0070] Yet still further, according to the embodiment of the present disclosure, the server 42 calls the ID information and the number-of-steps
20 information, and creates the maintenance information when the number-of-steps information exceeds the predetermined value. Hence, by notifying the rehabilitation patient 11 of the fact that the number of steps has reached the aiming number of steps, and the rehabilitation activity is fairly progressing so as to support the rehabilitation activity,
25 such a patient can be notified of the maintenance information indicating that, for example, the maintenance cycle for the brace 20 or for the artificial leg is coming based on the number of steps condition.

[0071] Moreover, according to the embodiment of the present disclosure, the server 42 calls the ID information and the number-of-steps
30 information, and creates and transmits the maintenance information when the number-of-steps information is not lower than the predetermined value, the number-of-steps information does not exceed the predetermined value, and the predetermined number of days has been elapsed. Hence, the maintenance information can be given which
35 indicates that the maintenance cycle for the brace or for the artificial leg is coming based on the number of days condition.

[0072] Furthermore, the data transmission clock time from the number-of-steps counter 21 to the data collecting terminal 41 can be freely set by the setting terminal 48 via the wireless LAN standard or via the network 50. Accordingly, by setting such a time to a time that is easy to collect the number-of-steps information for each rehabilitation patient 11, the precise information can be created which is on a support for the rehabilitation walking and on a maintenance on the brace 20 or on the artificial leg

[0073] Note that according to the embodiment, although an example case in which the brace 20 is utilized has been described, the present disclosure is not limited to this case, and an artificial leg may be adopted. In this case, the number-of-steps counter 21 is provided at the foot portion of the artificial leg. Moreover, according to the embodiment, although the floor 12 in a facility is a rehabilitation site, the present disclosure is not limited to this case, and the floor 12 of house or a ground surface (a road surface) may be adopted.

[0074] That is, as far as the actions and the advantageous effects of the present disclosure are achievable, the present disclosure is not limited to the embodiment.

[0075] [Industrial Applicability]

The technology according to the present disclosure is suitable for a rehabilitation support and maintenance system which supports a rehabilitation walking using the brace or artificial leg of a rehabilitation patient, and the analysis mechanism that analyzes the information from the brace or from the artificial leg, and which carries out the maintenance on the brace or on the artificial leg.

What is claimed is:

1. A rehabilitation support and maintenance system that supports a rehabilitation walking using a brace or an artificial leg of a rehabilitation patient and an analysis mechanism that analyzes information from the brace or the artificial leg,
 - wherein the brace or the artificial leg comprises:
 - a foot portion located at a foot of the rehabilitation patient;
 - a sole portion which is provided at the foot portion and which contacts a floor or a ground; and
 - a number-of-steps counter which is provided at the sole portion and which counts a number of steps in walking by the rehabilitation patient,
 - wherein the number-of-steps counter comprises:
 - a first sensor which is provided at a back side of the sole portion and which detects pressure;
 - a second sensor which is provided at a front side of the sole portion and which detects pressure; and
 - a control circuit board which is connected to the first sensor and to the second sensor, counts the number of steps as one step when the pressure of the first sensor and the pressure of the second sensor exceed a predetermined value, temporarily stores number-of-steps information, and transmits unique ID information and the number-of-steps information,
 - wherein the analysis mechanism comprises:
 - a data collecting terminal which is separate from the brace or the artificial leg, receives and temporarily stores the ID information and the number-of-steps information;
 - a server which is connected to the data collecting terminal via a network, receives, stores and analyzes the temporarily-stored ID information and number-of-steps information; and
 - a display terminal which is connected to the server and which displays an analysis result,
 - wherein the number-of-steps counter transmits the temporarily-stored number-of-steps information at a predetermined clock time,

wherein the analysis mechanism further comprises a setting terminal which sets the predetermined clock time and which is connected to the data collecting terminal so as to be freely detachable, and

wherein the setting terminal transmits the predetermined clock time to the control board via the data collecting terminal so as to set the predetermined clock time.

2. A rehabilitation support and maintenance system that supports a rehabilitation walking using a brace or an artificial leg of a rehabilitation patient and an analysis mechanism that analyzes information from the brace or the artificial leg,

wherein the brace or the artificial leg comprises:

a foot portion located at a foot of the rehabilitation patient;

a sole portion which is provided at the foot portion and which contacts a floor or a ground; and

a number-of-steps counter which is provided at the sole portion and which counts a number of steps in walking by the rehabilitation patient,

wherein the number-of-steps counter comprises:

a first sensor which is provided at a back side of the sole portion and which detects pressure; and

a control circuit board which is connected to the first sensor, counts the number of steps as one step when the pressure of the first sensor exceeds a predetermined value, temporarily stores number-of-steps information, and transmits unique ID information and the number-of-steps information,

wherein the analysis mechanism comprises:

a data collecting terminal which is separate from the brace or the artificial leg, receives and temporarily stores the ID information and the number-of-steps information;

a server which is connected to the data collecting terminal via a network, receives, stores and analyzes the temporarily-stored ID information and number-of-steps information; and

a display terminal which is connected to the server and which displays an analysis result,

wherein the number-of-steps counter transmits the temporarily-stored number-of-steps information at a predetermined clock time,

5 wherein the analysis mechanism further comprises a setting terminal which sets the predetermined clock time and which is connected to the data collecting terminal so as to be freely detachable, and

wherein the setting terminal transmits the predetermined clock time to the control board via the data collecting terminal so as to set the predetermined clock time.

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3. The rehabilitation support and maintenance system according to claim 2, wherein the first sensor comprises:

15 crocodile hardware that is formed in a crocodile-mouth-like shape so as to be openable and closable;

a push-up member which is provided at the crocodile hardware and which pushes the crocodile member in an opening direction; and

a counting button which is provided at the crocodile hardware and which becomes ON when the crocodile hardware is opened or is closed.

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4. The rehabilitation support and maintenance system according to any one of claims 1 to 3, wherein the analysis mechanism further comprises an individual viewing terminal which is connected to the server via the network and which is for viewing the analysis result.

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5. The rehabilitation support and maintenance system according to any one of claims 1 to 4, wherein:

the server calls the ID information and the number-of-steps information, and when the number-of-steps information is lower than a predetermined value, creates and transmits information for notifying the rehabilitation patient of a fact that the number of steps in rehabilitation walking does not reach an aiming number of steps in rehabilitation walking so as to support a rehabilitation activity, and for indicating that there is a leeway until a maintenance cycle of the brace or the artificial leg
35 based on a number of steps condition, and

the display terminal receives and displays the information for notifying the rehabilitation patient of the fact that the number of steps in rehabilitation walking does not reach the aiming number of steps so as to support the rehabilitation activity, and indicating that there is a leeway
5 until the maintenance cycle of the brace or the artificial leg based on the number of steps information.

6. The rehabilitation support and maintenance system according to any one of claims 1 to 5, wherein:

10 the server calls the ID information and the number-of-steps information, and when the number-of-steps information exceeds a predetermined value, creates and transmits information for notifying the rehabilitation patient of a fact that the number of steps in rehabilitation walking has reached an aiming number of steps in rehabilitation walking
15 and of a rehabilitation activity is fairly progressing so as to support the rehabilitation activity, and for indicating that a maintenance cycle of the brace or the artificial leg is coming based on a number of steps condition, and

the display terminal receives and displays the information for
20 notifying the rehabilitation patient of the fact that the number of steps in rehabilitation walking has reached the aiming number of steps and the rehabilitation activity is fairly progressing so as to support the rehabilitation activity, and indicating that the maintenance cycle of the brace or the artificial leg is coming based on the number of steps
25 information.

7. The rehabilitation support and maintenance system according to any one of claims 1 to 6, wherein:

the server calls the ID information and the number-of-steps
30 information, and when the number-of-steps information is not lower than a predetermined value, the number-of-steps information does not exceed the predetermined value, and a number of utilization days of the brace or the artificial leg exceeds a predetermined number of days, creates and transmits information indicating that a maintenance cycle of the brace or
35 the artificial leg is coming based on a number of days condition, and

the display terminal receives and displays the information indicating that the maintenance cycle of the brace or the artificial leg is coming based on the number of days information.

- 5 8. The rehabilitation support and maintenance system according to any one of claims 1 to 7, wherein the setting terminal connected to the data collecting terminal via a wireless LAN standard or the network.