

SYSTEM, DEVICE, AND METHOD FOR BALANCING USER

TECHNICAL FIELD

The present disclosure relates to a gaiter system. More particularly, the present disclosure relates to system, device, and method for balancing a user.

5 BACKGROUND

Exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons, to aid growth and improve strength, prevent aging, develop muscles and the cardiovascular systems, weight loss and improve health.

- 10 Conditions such as paralysis are when one cannot be able to move certain parts of the body. Such conditions are due to brain nerve problems. Paralysis comes in many different forms and can be temporary, permanent, or even come and go.

Paralysis is because of a birth defect or sudden injury often cannot feel or move anything at all in their affected body parts. Medical conditions include multiple

- 15 sclerosis (MS), might feel tingling, or muscle weakness.

Many commercial products are available in the market, which include a wearable robotic exoskeleton that is worn by the user for providing powered hip and knee motion. This enables individuals with spinal cord injury (SCI) to stand upright, walk, turn, and climb. There are many limitations associated with the wearable
20 robotic device as it does not balance the weight of the person.

Therefore, there is a need to overcome the limitations related with the weight balancing for any person who are not able to walk and exercise.

SUMMARY

- 25 In one aspect of the present disclosure, a gaiter system for balancing a user is provided.

The gaiter system includes one or more sensors that are configured to sense signals representing one or more parameters associated with the user. The gaiter system further includes a weight balancing device that is coupled with the one or more sensors and configured to: (i) receive the one or more parameters and (ii) compare

the one or more parameters with a desired pattern associated with the user to determine a required input based on the comparison of the one or more parameters with the desired pattern. The weight balancing device includes a pneumatic assembly that is adapted to generate the required input to match the desired pattern.

- 5 In some aspects of the present disclosure, the gaiter system further includes a harness that is coupled to the weight balancing device and adapted to hold the user in the gaiter system.

In some aspects of the present disclosure, the weight balancing device further includes one or more actuators that are coupled with the pneumatic assembly such
10 that the pneumatic assembly moves the one or more actuators from a first position to a second position to generate the required input.

In some aspects of the present disclosure, the weight balancing device further includes a processing unit that is configured to (i) determine the required input based on the desired pattern and (ii) trigger the pneumatic assembly to match the
15 desired pattern.

In some aspects of the present disclosure, at least one sensor of the one or more sensors is positioned in each of (i) the harness, (ii) the weight balancing device, and (iii) the pneumatic assembly.

In some aspects of the present disclosure, the gaiter system further includes a rope
20 that is coupled to the harness and the one or more actuators through a first set of pulleys and a second set of pulleys such that the one or more actuators adjust tension of the rope.

In second aspect of the present disclosure, a weight balancing device of a gaiter system is provided.

- 25 The weight balancing device includes one or more actuators mounted on a mounting plate. The weight balancing device further includes a pneumatic assembly that is coupled with the mounting plate configured to lift the mounting plate. The weight balancing device further includes a processing unit configured to actuate the one or more actuators and the pneumatic assembly, wherein actuation
30 of the one or more actuators adjusts a tension of a rope that is connected to a harness

of the gaiter system and triggering of the pneumatic assembly matches a desired pattern associated with the user.

In some aspects of the present disclosure, the processing unit is configured to (i) determine a required input based one or more parameters received from one or more sensors and (ii) generates the required input to trigger one or more actuators to adjust the tension of the rope and the pneumatic assembly to match the desired pattern associated with the user.

In some aspects of the present disclosure, the one or more actuators and the pneumatic assembly together matches the desired pattern associated with the user by adjusting tensioning of the rope.

In third aspect of the present disclosure, a method for balancing a user in a gaiter system is provided.

The method includes holding the user by way of a harness connected to a rope of the gaiter system. The method further includes sensing signals representing one or more parameters associated with the user by way of one or more sensors. The method further includes comparing, by way of a processing unit, the one or more parameters received from the one or more sensors with a desired pattern associated with the user to calculate a required input. The method further includes generating the required input to trigger a pneumatic assembly to match the desired pattern.

20 BRIEF DESCRIPTION OF DRAWINGS

The drawing/s mentioned herein disclose exemplary aspects of the claimed invention. Other objects, features, and advantages of the present invention will be apparent from the following description when read with reference to the accompanying drawing.

25 FIG.1 illustrates an isometric view of a gaiter system, according to an aspect herein; FIG. 2A and 2B illustrates an isometric exploded view of a weight balancing device, according to an aspect herein;

FIG. 2C and 2D illustrate a side view of the weight balancing device illustrating a pneumatic mechanism, according to an aspect herein;

FIG. 3 illustrates a flowchart that depicts working of a processing unit of the weight balancing device of FIG. 2A-2D, according to an aspect herein; and

FIG. 4 illustrates a flowchart that depicts working of the gaiter system, according to an aspect herein.

- 5 To facilitate understanding, like reference numerals have been used, where possible to designate like elements common to the figures.

DETAILED DESCRIPTION OF EMBODIMENT

- This section is intended to provide an explanation and description of various possible embodiments of the present invention. The embodiments used herein, and
- 10 the various features and advantageous details thereof are explained more fully with reference to non-limiting embodiments illustrated in the accompanying drawing/s and detailed in the following description. The examples used herein are intended only to facilitate understanding of ways in which the embodiments may be practiced and to enable the person skilled in the art to practice the embodiments used herein.
- 15 Also, the examples/embodiments described herein should not be construed as limiting the scope of the embodiments herein.

Definitions

- Desired pattern is the pattern generated by a processing unit based on establishing a mathematical relationship between a user's physical parameters and one or more
- 20 health conditions.

Feedback is the information given by one or more sensors about various user's body and health parameters, and position of the pneumatic assembly and the weight balancing system respectively.

- As mentioned, there remains a need for the development of weight balancing
- 25 systems and devices for training and practicing a patient to walk in real-time, therefore: the present disclosure herein provides a gaiter system to balance the body weight of the person in real-time.

FIG. 1 illustrates a gaiter system 100 for assisting a user to walk, according to an aspect herein.

The gaiter system 100 may include a weight balancing device 102, a rope 104, a first set of pulleys 106, a harness 108, and an exercise device 110.

The weight balancing device 102 may be adapted to assist the user in the gaiter system 100.

- 5 The harness 106 may be coupled with the gaiter system 100 by way of the rope 104 and the first set of pulleys 106. The harness 108 may be adapted to hold the user in the gaiter system 100 such that the weight balancing device 102 assists the user in the gaiter system 100 to walk in real-time. In some aspects of the present disclosure, the harness 108 may be coupled with the weight balancing device 102 by way of
10 the rope 104 that may pass through the first set of pulleys 106.

- The exercise device 110 may be operatively coupled with the weight-balancing device 102. In some aspects of the present disclosure, the exercise device 110 may be adapted to allow the user to exhibit walking, or any other movement associated with the body of the user while the weight balancing device 102 assists the user in
15 the harness 108.

The weight balancing device 102 may include one or more sensors 112.

At least one sensor of the one or more sensors 112 may be positioned in the harness 108. The one or more sensors 112 may be adapted to configure one or more parameters associated with the user in the harness 108.

- 20 In some aspects of the present disclosure, the one or more sensors 112 may be one of, a load cell reader, a weighing sensor, a blood pressure sensor, a temperature sensor, a heart rate sensor, a blood oxygen sensor, a pedometer sensor, and the like. In some aspects of the present disclosure, the one or more parameters may include weight, blood pressure, temperature, strides, oxygen level, heart rate, and the like.
25 In an exemplary scenario, the one or more sensors 112 may include the weight sensor, that may be adapted to measure the one or more parameters that include weight of the user in the harness 106.

- In another exemplary scenario, the one or more sensors 112 may include the Blood Pressure sensor, that may be adapted to measure the one or more parameters that
30 include blood pressure associated with the user in the harness 106.

In another exemplary scenario, the one or more sensors 112 may include the temperature sensor, that may be adapted to measure the one or more parameters that include temperature associated with the user in the harness 106.

In another exemplary scenario, the one or more sensors 112 may include a
5 pedometer, that may be adapted to measure the one or more parameters that include one or more strides associated with the user in the harness 106.

In another exemplary scenario, the one or more sensors 112 may include the blood oxygen (SpO₂) sensor, that may be adapted to measure the one or more parameters that include oxygen level associated with the user in the harness 106.

10 In another exemplary scenario, the one or more sensors 112 may include the heart rate sensor, that may be adapted to measure the one or more parameters that include heart rate associated with the user in the harness 106.

At least one sensor of the one or more sensors 112 may be positioned in the weight balancing device 102. The one or more sensors 112 may be adapted to configure
15 one or more parameters associated with the weight balancing device 102. In some aspects of the present disclosure, the one or more sensors 112 may be one of a position sensor, accelerometer, force sensor, and the like.

In an exemplary scenario, one or more sensors 112 may include a position sensor that is adapted to sense signals representing a position of a mounting plate 220
20 (shown and explained in FIG. 2) associated with the weight balancing device 102.

In another exemplary scenario, the one or more sensors 112 may include an accelerometer that is adapted to sense signals representing rotations per minute of one or more actuators 224 (shown and explained in FIG. 2) associated with the weight balancing device 102.

25 In some aspects of the present disclosure, the user may be affected with paralysis, coma, muscle function loss such as quadriplegia and paraplegia, stroke, severe injury, trauma, drug overdose, muscular dystrophy, dermatomyositis, polio, cerebral palsy, Amyotrophic lateral sclerosis (ALS), Botulism, Down syndrome, aging, torn rotator cuff, broken bones, spinal cord or peripheral nerve injuries, long-
30 term corticosteroid therapy, lack of physical activity for an extended period of time,

alcohol associated myopathy, Guillain-Barre syndrome, multiple sclerosis, muscular dystrophy, neuropathy, osteoarthritis, rheumatoid arthritis, spinal muscular atrophy.

In some aspects of the present disclosure, the pulley 106 may be one of a fixed
5 pulley, a movable pulley, a compound pulley, a cone pulley, a block and tackle pulley, and the like.

In some aspects of the present disclosure, the exercise device 110 may be one of a treadmill, a gait trainer, an elliptical trainer, a rowing machine, an indoor cycling, a stair climber, an air dyne, a spin bike, a Jacob's ladder, an ARC trainer or a skiing
10 machine. In some aspects of the present disclosure, the treadmill may be one of, a manual treadmill, a motorized treadmill, a hybrid treadmill, and the like.

FIG. 2A and 2B illustrates an isometric exploded view of the weight balancing device 102, according to an aspect herein.

The weight balancing device 102 may include a front cover 202, a back cover 204,
15 a first side cover 206, a second side cover 208, a third side cover 210, a second set of pulleys 214, and a frame 216.

The front cover 202, the back cover 204, the first side cover 206, the second side cover 208, and the third side cover 210 may be mounted on the frame 216.

The weight balancing device 102 may further include a pneumatic assembly 218,
20 the mounting plate 220, a counter-weight set 222, and the one or more actuators 224 (hereinafter referred to as an actuator for a single component).

The pneumatic assembly 218 may be positioned on the frame 216. In some aspects of the present disclosure, the pneumatic assembly 218 may be positioned on a lower side of the frame 216. In some other aspects of the present disclosure, the pneumatic
25 assembly 218 may be positioned inside the frame 216 as shown in the FIG. 2A. The pneumatic assembly 218 may be adapted to move in a vertical axis from a first position 228 to a second position 230 as shown in FIG. 2C and 2D (explained in later part of the description).

The pneumatic assembly 218 may include at least one sensor of the one or more
30 sensors 112.

The one or more sensors 112 may be positioned on the pneumatic assembly 218. The one or more sensors 112 may be adapted to sense signals representing pressure generated by the pneumatic assembly 218 and a position of a shaft (not shown) of the pneumatic assembly 218. In some aspects of the present disclosure, the one or
5 more sensors 112 may be one of, a pressure sensor or a flow sensor.

In an exemplary scenario, the one or more sensors 112 may include a pressure sensor, that may be adapted to measure pressure of air associated with the pneumatic assembly 218.

In another exemplary scenario, the one or more sensors 112 may include a flow
10 sensor that is adapted to measure flow associated with the pneumatic assembly 218.

The mounting plate 220 may be positioned on the pneumatic assembly 218 such that the pneumatic assembly 218 lifts and lowers down the mounting plate 220 from the first position 228 to the second position 230.

The counter-weight set 222 may be positioned on the mounting plate 220. The
15 counter-weight set 222 may be adapted to lower the mounting plate 220 from the second position 230 to the first position 228, when the pneumatic assembly 218 lifts the mounting plate 220. In some aspects of the present disclosure, the counter weight set 112 may be adapted to balance the weight balancing device 102. In another aspect of the present disclosure, the pneumatic assembly 218 in alone
20 lowers the mounting plate 220 from the second position 230 to the first position 228.

The one or more actuators 224 may be positioned on the mounting plate 220. The one or more actuators 224 may be adapted to extend/slack or retract/pull the rope 104. The one or more actuators 224 may be connected to the harness 108 by way
25 of the rope 104, which passes through the second set of pulleys 214 and the first set of pulleys 106 such that, the harness 108 that is connected on an alternative end of the rope 105 is adapted to move the harness 108 based the extend/slack or retract/pull by the one or more actuators 224.

In some aspects of the present disclosure, the second set of pulleys 214 may be one of a fixed pulley, a movable pulley, a compound pulley, a cone pulley, and a block and tackle pulley.

In some aspects of the present disclosure, the frame 216 may be a moveable frame or a fixed frame. In some other aspects of the present disclosure, the moveable frame may be adjustable in height and size.

The weight balancing device 102 may further include a processing unit 226.

The processing unit 226 may be coupled with the pneumatic assembly 218 and the one or more actuators 224. The processing unit 226 may be configured to communicate with the pneumatic assembly 218 and the one or more actuators 224. The pneumatic assembly 218 may be adapted to lift or lower the mounting plate 220 to match the desired pattern associated with the user. The counter-weight set 222 may be adapted to maintain balanced lifting and lowering of the mounting plate 220.

FIG. 2C and 2D illustrate a side view of the weight balancing device 102 showing raising or lowering of the mounting plate 220. The mounting plate 220 may be in the first position 228 as can be seen through the FIG. 2C and the mounting plate 220 may be in the second position 230 as can be seen through the FIG. 2D.

FIG. 3 illustrates a flowchart that depicts working of the processing unit 226. The processing unit 226 may be configured to receive the feedback associated with the user from one or more sensors (shown as 302 in FIG. 3). Upon receiving the feedback, the processing unit 226 may be adapted to determine the required input and generates the required input to trigger one or more actuators 224 and the pneumatic assembly 218 to match the desired pattern (shown as 304 in FIG. 3). In some aspects of the present disclosure, when the received feedback is less than the desired pattern then the processing unit 226 may be adapted to achieve the desired pattern by adjusting the tensioning of the rope 104 by way of triggering the one or more actuators 224 and the pneumatic assembly 218. In some aspects of the present disclosure, when the received feedback is equal to the desired pattern then the processing unit 226 may not take any action (shown as 308 in FIG. 3).

In operation, the user using the gaiter system 100 may be held by the harness 108 of the gaiter system 100. The processing unit 226 may receive feedback associated with the user by way of the one or more sensors 112. The processing unit 226 may be configured to calculate the required inputs based on the feedback associated with the user. The processing unit 226 may further be configured to trigger the one or more actuators 224 and the pneumatic assembly 218 to match the desired pattern associated with the user. The actuation of the one or more actuators 224 and the pneumatic assembly 218 may be adapted to adjust the tension of the rope 104 that may pass through the first set of pulleys 106. The actuation of the one or more actuators 218 may causes extending/slackening or retracting/pulling of the rope 104 for adjusting the tension and the pneumatic assembly 218 may be adapted to lift or lower the mounting plate 220 from the first position 228 to the second position 230 or *vice versa* carrying the one or more actuators 224 to adjust the tension of the rope 104. This adjustment of the tension of the rope 104 may balance the user held in the harness 108.

In some aspects of the present disclosure, the actuation of the one or more actuators 224 alone may require adjusting the tension of the rope 104.

In some aspects of the present disclosure, the actuation of the pneumatic assembly 218 alone may require adjusting the tension of the rope 104.

In some aspects of the present disclosure, the actuation of the one or more actuators 224 and the pneumatic assembly 218 together may be required to adjust the tension of the rope 104.

In some aspects of the present disclosure, a display unit (not shown) may be coupled to the gaiter system 100 for displaying the gait pattern of the user using the gaiter system 100.

In some aspects of the present disclosure, a monitoring unit (not shown) may be operatively coupled to the gaiter system 100 for monitoring the overall functioning of the gaiter system 100.

In some aspects of the present disclosure, a report generation unit (not shown) may be operatively coupled with the gaiter system 100 for generating a report based on

the historical data associated with the user using the gaiter system 100. In some aspects of the present disclosure, the report generation unit may generate the report based on monitored data that may be received from the monitoring unit. In some aspects of the present disclosure, the report generated by the report generation unit
5 may indicate performance of the user held in the harness 108.

In some aspects of the present disclosure, a storage unit (not shown) may be adapted to store the performances of the user using the gaiter system 100 that may facilitate in determining the gait pattern of the user.

FIG. 4 illustrates a method 400 of balancing/supporting the user using the gaiter system 100 may be disclosed. The method 400 may include the following steps for supporting the user: -
10

- At step 402, the gaiter system 100 may be configured to hold the user by way of the harness 108 that is connected to the rope 104.
- At step 404, the gaiter system 100 may be configured to sense the signals representing feedback associated with the user by way of the one or more sensors 112.
15
- At step 406, the gaiter system 100 may be configured to calculate the required input by comparing the feedback received from the one or more sensors 112 with the desired pattern associated with the user to calculate the required input. In some aspects of the present disclosure, the gaiter system 100 may be configured to calculate the required input by comparing the feedback received from the one or more sensors 112, with the desired pattern associated with the user to calculate the required input.
20
- At step 408, the gaiter system 100 may be configured to generate the required input to trigger one or more actuators 224 and a pneumatic assembly 218 together or alone to match the desired pattern associated with the user.
25
- At step 410, the gaiter system 100 may be configured to monitor the user by way of the monitoring unit (not shown).

- At step 412, the gaiter system 100 may be configured to generate a report based on the monitored data received from the monitoring unit.

While the disclosure has been presented with respect to certain specific embodiments, it will be appreciated that many modifications and changes may be made by those skilled in the art without departing from the spirit and scope of the disclosure. It is intended, therefore, by the appended claims to cover all such modifications and changes as fall within the true spirit and scope of the disclosure.

We Claim:

1. A gaiter system (100) for balancing a user comprising:
 - one or more sensors (112) that are configured to sense signals representing one or more parameters associated with the user; and
 - 5 a weight balancing device (102) that is coupled with the one or more sensors (112) and configured to: (i) receive the one or more parameters and (ii) compare the one or more parameters with a desired pattern associated with the user to determine a required input based on the comparison of the one or more parameters with the desired pattern, the weight balancing device (102)
 - 10 comprising:
 - a pneumatic assembly (218) that is adapted to generate the required input to match the desired pattern.
2. The gaiter system (100) as claimed in claim 1, further comprising a harness
- 15 (108) that is coupled to the weight balancing device (102) and adapted to hold the user in the gaiter system (100).
3. The gaiter system (100) as claimed in claim 1, wherein the weight balancing device (102) further comprising one or more actuators (224) that are coupled
- 20 with the pneumatic assembly (218) such that the pneumatic assembly (218) moves the one or more actuators (224) from a first position (228) to a second position (230) to generate the required input.
4. The gaiter system (100) as claimed in claim 1, wherein the weight balancing device (102) further comprising a processing unit (226) that is configured to: (i)
- 25 determine the required input based on the desired pattern and (ii) trigger the pneumatic assembly (218) to match the desired pattern.
5. The gaiter system (100) as claimed in claim 1, wherein at least one sensor of
- 30 the one or more sensors (112) is positioned in at least one of (i) the harness (108), (ii) the weight balancing device (102), (iii) the pneumatic assembly (218).

6. The gaiter system (100) as claimed in claim 1, further comprising a rope (104) that is coupled to the harness (108) and the one or more actuators (224) through a first set of pulleys (106) and a second set of pulleys (214) such that the one or more actuators (224) adjust tension of the rope (104).
- 5 7. A weight balancing device (102) of a gaiter system (100), the weight balancing device (102) comprising:
- one or more actuators (224) mounted on a mounting plate (220);
- a pneumatic assembly (218) that is coupled with the mounting plate (220)
- 10 configured to lift the mounting plate (220); and
- a processing unit (226) configured to actuate the one or more actuators (224) and the pneumatic assembly (218); wherein actuation of the one or more actuators (224) adjusts a tension of a rope (104) that is connected to a harness (108) of the gaiter system (100) and triggering of the pneumatic assembly (218)
- 15 to match a desired pattern associated with the user.
8. The weight balancing device (102) of the gaiter system (100) as claimed in claim 7, wherein the processing unit (226) is configured to (i) determine a required input based on one or more parameters received from one or more
- 20 sensors (102) and (ii) generates the required input to trigger one or more actuators (224) to adjust the tension of the rope (104) and the pneumatic assembly (218) to match the desired pattern associated with the user.
9. The weight balancing device (102) of the gaiter system (100) as claimed in claim 7, wherein the one or more actuators (224) and the pneumatic assembly (218) together to match the desired pattern associated with the user by adjusting tensioning of the rope (104).
- 25 10. A method (400) for balancing a user in a gaiter system (100), the method (400) comprising:
- 30 holding (402) the user by way of a harness (108) connected to a rope (104) of the gaiter system (100);

sensing (404) signals representing one or more parameters associated with the user by way of one or more sensors (112);

comparing (406), by way of a processing unit (226), the one or more parameters received from the one or more sensors (112) with a desired pattern associated with the user to determine a required input; and

5

generating (408) the required input to trigger a pneumatic assembly (218) to match the desired pattern.