

## **A WHEELCHAIR**

### **FIELD**

The present disclosure relates to the field of powered wheelchairs.

### **BACKGROUND**

5 Wheelchairs are commonly used in hospitals to temporarily move patients within departments or surgery halls where they are to be operated. Even on completion of a surgery, a patient may require wheelchair during his recovery in case he is advised to rest a certain body part in a fixed position. Since sitting constantly for long hours in the same position results in bed sores, pressure ulcers, sore muscles and fatigue,  
10 conventional wheelchairs are not suitable for patients that may have to spend a lot of time on wheelchairs. In such cases, wheelchairs having special cushions and advanced features, like automated or robotic wheelchair movement, are required for patient's comfort and timely recovery. However, such wheelchairs with advanced features are expensive. Moreover, movement of a patient from a wheelchair to a bed  
15 and vice versa is a challenge.

Therefore, there is a need to limit the abovementioned drawbacks of the conventional wheelchairs, and provide a wheelchair for better suitability to patient needs.

### **OBJECTS**

Some of the objects of the present disclosure, which at least one embodiment herein  
20 satisfies, are as follows:

An object of the present disclosure is to provide a cost effective wheelchair.

Another object of the present disclosure is to provide a wheelchair which has a convertible structure that can be used for resting as well as for movement.

Yet another object of the present disclosure is to provide a wheelchair that can be controlled by a patient or a helper.

Still another object of the present disclosure is to provide a wheelchair that provides a sore-proof technology.

- 5 A further object of the present disclosure is to provide a wheelchair that is easy to control, and provides safety measures.

Other objects and advantages of the present disclosure will be more apparent from the following description, which is not intended to limit the scope of the present disclosure.

## 10 SUMMARY

The present disclosure envisages a wheelchair comprising a power supply module, a driving unit, an obstacle detector, and a recliner unit. The power supply module supplies power. The driving unit receives the power, and facilitates controlled movement of the wheelchair. The obstacle detector detects obstacles present in the  
15 path of the wheelchair, and further provides an alert signal corresponding to the detected obstacles, thereby facilitating the driving unit to alter the movement of the wheelchair to avoid obstacles. The recliner unit receives power from the power supply module, and facilitates reclination of a seat of the wheelchair.

In an embodiment, the driving unit comprises a memory, a processor, a control  
20 module, a motor driver, and at least one DC motor. The memory stores a set of pre-determined rules, and the processor generates processing commands based on the rules. The control module accepts control inputs from a user and further provides control signals, corresponding to the control inputs, to the processor. The motor driver cooperates with the processor and the power supply module, and provides DC  
25 electrical power based on the power from the power supply module, the control

signals, and the processing commands. The at least one DC motor receives and converts the DC electrical power to mechanical power, and further provides the mechanical power to the wheelchair, thereby facilitating controlled movement of the wheelchair based on the processing commands.

- 5 Further, the driving unit cooperates with the obstacle detector to identify if an obstacle is stationary or moving. The driving unit further comprises steering means configured to steer the wheelchair away from a stationary obstacle, and stop movement of the wheelchair till the path is clear, in case of a moving obstacle.

10 In one embodiment, the recliner unit comprises a position module and a locking module. The position module accepts position input related to a reclining position of the seat of the wheelchair from a user. The locking module comprises at least one servo motor, and receives the position input from the position module and power from the power supply module. The locking module facilitates reclination of the seat by the at least one servo motor based on the position input received from the user.

- 15 In another embodiment, the wheelchair comprises an inflatable mat disposed on the seat, a sensor-timer, an inverter, a compressor, and a feedback module. The sensor-timer senses if a user is continuously using the wheelchair for a pre-determined duration, and further generates a trigger signal in response. The inverter receives the trigger signal and the power, and on reception of the trigger signal, provides AC  
20 power corresponding to the power to the compressor. The compressor receives the AC power, and pumps air into the inflatable mat in a wave-like manner thereby providing relief to the user. The feedback module comprises at least one rotary encoder to provide feedback of position of the seat to the reclining unit, thereby facilitating accurate reclination control of the seat, and an accelerometer to  
25 continuously monitor and provide information related to orientation of the wheelchair to the driving unit.

Further, the power supply module includes a battery pack, and the obstacle detector includes at least one ultrasonic sensor to detect obstacles including staircases. In an embodiment, the motor driver is a dual H-bridge motor driver having a plurality of relays for driving the wheelchair. The seat includes a back rest and a leg rest. The control module includes at least two joystick units, wherein a first joystick unit is used by a patient, and a second joystick unit is used by a helper, to provide the control inputs.

### **BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS**

The wheelchair, of the present disclosure will now be described with the help of the accompanying drawings, in which:

**Figure 1** illustrates a schematic block diagram of a wheelchair of the present disclosure, in accordance with an embodiment;

**Figures 2a, 2b and 2c** illustrate schematic views of the wheelchair of **Figure 1** in different positions, in accordance with one embodiment of the present disclosure;

**Figure 3** illustrates another schematic view of the wheelchair of **Figure 1**, in accordance with an embodiment of the present disclosure; and

**Figures 4a and 4b** illustrate different photographic views of the wheelchair of **Figure 1**, in accordance with one embodiment of the present disclosure.

List and details of reference numerals used in the description and drawings:

| <b>Reference Numeral</b> | <b>Reference</b>               |
|--------------------------|--------------------------------|
| 100                      | Wheelchair                     |
| 102                      | Power supply module            |
| 102a                     | Battery pack                   |
| 104                      | Driving unit                   |
| 104a                     | Memory                         |
| 104b                     | Processor                      |
| 104c                     | Control module                 |
| 104d                     | Motor driver                   |
| 104e                     | At least one DC motor          |
| 106                      | Obstacle detector              |
| 106a                     | At least one ultrasonic sensor |
| 108                      | Recliner unit                  |
| 108a                     | Position module                |
| 108b                     | Locking module                 |
| 110                      | Seat                           |
| 110a                     | Inflatable mat                 |
| 112                      | Sensor-timer                   |
| 114                      | Inverter                       |
| 116                      | Compressor                     |
| 118                      | Feedback module                |
| 120                      | Inverter                       |

## DETAILED DESCRIPTION

Wheelchairs are commonly used in hospitals to temporarily move patients within departments or surgery halls where they are to be operated. Even on completion of a surgery, a patient may require wheelchair during his recovery in case he is advised to rest a certain body part in a fixed position. Since sitting constantly for long hours in the same position results in bed sores, pressure ulcers, sore muscles and fatigue, conventional wheelchairs are not suitable for patients that may have to spend a lot of time on wheelchairs. In such cases, wheelchairs having special cushions and advanced features, like automated or robotic wheelchair movement, are required for patient's comfort and timely recovery. However, such wheelchairs with advanced features are expensive. Moreover, movement of a patient from a wheelchair to a bed and vice versa is a challenge. Therefore, there is a need to limit the abovementioned drawbacks of the conventional wheelchairs and provide a wheelchair for better suitability to patient needs.

The present disclosure envisages a wheelchair which limits the aforementioned drawbacks. The envisaged wheelchair is cost effective and equipped with technical and bio-medical features in order to make it suitably comfortable and safe than the conventional wheelchairs. The wheelchair of the present disclosure provides sore-proof technology, wherein it facilitates prevention of bed sores on the patients/subjects that require continuous use of wheelchair for longer durations. The wheelchair has a convertible structure such that it can be used for mobilizing the patient from one place to another, and also can be used by the patient for sleeping. This eliminates the need of shifting the patient from the wheelchair to bed and vice versa.

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The wheelchair of the present disclosure is described with the help of Figures 1 through 4 of the non-limiting accompanying drawings. The wheelchair (100) comprises a power supply module (102), a driving unit (104), an obstacle detector (106), and a recliner unit (108).

- 5 The power supply module (102) is configured to supply power. In an embodiment, the power supply module (102) includes a battery pack (102a). In another embodiment, the power supply module (102) provides 5V DC power and 24V DC power.

The driving unit (104) is adapted to receive power from the power supply module  
10 (102), and is configured to facilitate controlled movement of the wheelchair (100). The driving unit comprises a memory (104a), a processor (104b), a control module (104c), a motor driver (104d), and at least one DC motor (104e).

The memory (104a) is configured to store a set of pre-determined rules. The memory (104a) may include any computer-readable medium known in the art including, for  
15 example, volatile memory, such as static random access memory (SRAM) and dynamic random access memory (DRAM), and/or a non-volatile memory, such as read only memory (ROM), erasable programmable ROM, flash memories, hard disks, optical disks, and magnetic tapes. In an embodiment, the memory (104a) is configured to store predetermined rules related to controlled movement of the  
20 wheelchair (100), rules to convert and lock positions of a seat (110) of the wheelchair (100), rules to provide control based on the user, and the like. In one embodiment, the seat (110) includes a back rest and a leg rest.

The processor (104b) is adapted to cooperate with the memory (104a) to receive the set of pre-determined rules and the power supply module (102) to receive power, and  
25 configured to generate processing commands based on the rules. The processor (104b) may be implemented as one or more microprocessors, microcomputers, microcontrollers, digital signal processors, central processing units, state machines,

logic circuitries, and/or any devices that manipulate signals based on operational instructions. Among other capabilities, the processor (104b) is configured to fetch and execute the predetermined set of rules stored in the memory (104a) to control the wheelchair (100). In an embodiment, the power supply module (102) provides 5V DC  
5 power to the processor (104b).

The control module (104c) is configured to accept control inputs from a user, and further configured to provide control signals, corresponding to the control inputs, to the processor (104b). In an embodiment, the control module (104c) includes at least two joystick units, wherein a first joystick unit (not shown in the figures) is used by a  
10 patient, and a second joystick unit (not shown in the figures) is used by a helper, to provide the control inputs. Only one joystick unit can be used at a time to provide the control inputs. In another embodiment, the first joystick unit is disposed on a hand rest of the wheelchair (100) such that it is accessible to the patient, and the second joystick unit is disposed at the back of the wheelchair (100) such that it can be used  
15 by the helper. The helper in this case can be an assistant, a nurse, a caretaker, or any another person who will control the wheelchair (100) for the patient. In yet another embodiment, the wheelchair (100) includes a switch to toggle navigation control between the patient and the assistant. The switch may be a toggle switch.

The motor driver (104d) is adapted to cooperate with the processor (104b) and the  
20 power supply module (102), and is configured to provide DC electrical power based on the power received from the power supply module (102), the control signals received from the control module (104c), and the processing commands received from the processor (104b). In an embodiment, the motor driver (104d) is a dual H-bridge motor driver having a plurality of relays for driving the wheelchair (100).  
25 Feedback is an important factor to maintain safety. For this, the wheelchair (100) includes a feedback module (118) having at least one rotary encoder (not shown in the figures) and an accelerometer (not shown in the figures). The accelerometer is configured to continuously monitor and provide information related orientation of the

wheelchair (100) to the driving unit (104). In one embodiment, the power supply module (102) provides 24V DC power to the motor driver (104d). The at least one rotary encoder is used to ensure that the seat reclines is desirable angles only. The rotary encoder can be attached to the leg rest and the back rest.

- 5     The at least one DC motor (104e) is configured to receive the DC electrical power from the motor driver (104d) and convert the DC electrical power to mechanical power. This mechanical power is provided by the at least one DC motor (104e) to the wheelchair (100) to facilitate controlled movement of the wheelchair (100) based on the processing commands from the processor (104b).
- 10    The obstacle detector (106) is adapted to cooperate with the driving unit (104) and configured to detect obstacles present in the path of the wheelchair (100), and further configured to provide an alert signal corresponding to the detected obstacles to the driving unit (104). This facilitates the driving unit (104) to alter the movement of the wheelchair (100) to avoid the obstacles. In one embodiment, the obstacle detector
- 15    (106) includes at least one ultrasonic sensor (106a) to detect obstacles. The obstacle detector (106) detects obstacles including staircases. In another embodiment, the driving unit (104) cooperates with the obstacle detector (106) to identify if an obstacle is stationary or moving. The driving unit (104) comprises steering means (not shown in the figures). The steering means steers the wheelchair (100) away from
- 20    a stationary obstacle, and stops movement of the wheelchair (100) till the path is clear, in case of a moving obstacle, thus avoiding moving as well as stationary obstacles.

The recliner unit (108) is adapted to receive power from the power supply module (102) and configured to facilitate reclination of a seat (110) of the wheelchair (100).

- 25    In one embodiment, the at least one rotary encoder provides feedback of position of the seat (110) to the reclining unit (108), thereby facilitating accurate reclination control of the seat (110). The recliner unit (108) comprises a position module (108a)

and a locking module (108b). The position module (108a) accepts position input related to a reclining position of the seat (110) from a user and provides the position input to the locking module (108b). The locking module (108b) includes at least one servo motor adapted to facilitate reclination of the seat (110) based on the position  
5 input and the power from the power supply module (102). In an embodiment, the power supply module (102) provides 24V DC power to the locking module (108b).

The wheelchair (100) also includes an inflatable mat (110a) disposed on the seat (110), a sensor-timer (112), an inverter (114), and a compressor (116). The sensor-timer (112) senses if a user is continuously using the wheelchair (100) for a pre-  
10 determined duration, and further generates a trigger signal in response. For example, if the pre-determined duration is set to thirty minutes and the user is seated or sleeping on the wheelchair (100) for continuous thirty minutes, a trigger signal will be generated by the sensor-timer (112). Once the patient sits on the wheelchair (100) a timer is started and if the patient is still sitting/relaxing/ sleeping after the pre-  
15 determined time, the trigger signal is transmitted by the sensor-timer. This trigger signal is received by the inverter (114), which receives power from the power supply module (102), and on reception of the trigger signal, provides AC power corresponding to the power to the compressor (116). In an embodiment, the power supply module (102) provides 24V DC power to the inverter (114). The compressor  
20 (116) receives the AC power from the inverter (114) and pumps air into the inflatable mat (110a) in a wave-like manner thereby providing relief to the user. This can reduce sores to a great extent, as no part of the patient's body is continuously in rest due to the wave-like motion of the pumped air. In an embodiment, once the air is pumped to a certain capacity, the air is circulated within the inflatable mat (110a) in  
25 the wave-like manner. When desired, the air can be let out of the inflatable mat (110a) through an outlet (not shown in the figures).

In an embodiment, the wheelchair (100) provides three resting positions viz. a sitting position, a relaxing position, and a sleeping position. In the sitting position, the seat

(110) is configured to have 15 degree tilt and 100 degree recline. This is illustrated in Figure 2a. In the relaxing position, the seat (110) is configured to have 15 degree tilt and 120 degree recline, as illustrated in Figure 2b. In the sleeping position, the seat (110) is configured to have 15 degree tilt and 180 degree recline, as illustrated in Figure 2c. Further, in one embodiment, structure of the wheelchair (100) is made of stainless steel which had low displacement distribution and low stress contour. This structure is made with adequate room to accommodate several motors without compromising the patient's safety.

## TECHNICAL ADVANCEMENTS

- 10 The present disclosure described herein above has several technical advantages including, but not limited to, the realization of a wheelchair that:
- is cost effective;
  - has a convertible structure that can be used for resting as well as for movement;
  - 15 • can be controlled by a patient or a helper;
  - provides a sore-proof technology; and
  - is easy to control, and provides safety measures.

The embodiments herein and the various features and advantageous details thereof are explained with reference to the non-limiting embodiments in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein

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Throughout this specification the word “comprise”, or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

- 5 The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and
- 10 range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of
- 15 the embodiments as described herein.

## **CLAIMS**

1. A wheelchair (100) comprising:
  - a power supply module (102) configured to supply;
  - 5 a driving unit (104) adapted to receive power from said power supply module (102), and configured to facilitate controlled movement of said wheelchair (100);
  - an obstacle detector (106) adapted to cooperate with said driving unit (104), and configured to detect obstacles present in the path of said wheelchair (100), and
  - 10 further configured to provide an alert signal corresponding to the detected obstacles, thereby facilitating said driving unit (104) to alter the movement of said wheelchair (100) to avoid the obstacles; and
  - a recliner unit (108) adapted to receive power from said power supply module (102), and configured to facilitate reclination of a seat (110) of said
  - 15 wheelchair (100).
2. The wheelchair (100) as claimed in claim 1, wherein said driving unit (104) comprises:
  - a memory (104a) configured to store a set of pre-determined rules;
  - 20 a processor (104b) adapted to cooperate with said memory (104a) to receive said set of pre-determined rules and said power supply module (102) to receive power, and configured to generate processing commands based on said rules;
  - a control module (104c) configured to accept control inputs from a user, and further configured to provide control signals, corresponding to said control inputs, to
  - 25 said processor (104b);
  - a motor driver (104d) adapted to cooperate with said processor (104b) and said power supply module (102), and configured to provide DC electrical power based on said power, said control signals, and said processing commands; and

at least one DC motor (104e) configured to receive and convert said DC electrical power to mechanical power, and further configured to provide said mechanical power to said wheelchair (100), thereby facilitating controlled movement of said wheelchair (100) based on said processing commands.

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3. The wheelchair (100) as claimed in claim 1, wherein said driving unit (104) cooperates with said obstacle detector (106) to identify if an obstacle is stationary or moving, said driving unit (104) further comprises steering means configured to steer said wheelchair (100) away from a stationary obstacle, and stop movement of said wheelchair (100) till said path is clear, in case of a moving obstacle.

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4. The wheelchair (100) as claimed in claim 1, wherein said recliner unit (108) comprises:

a position module (108a) configured to accept position input related to a reclining position of said seat (110) from a user; and

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a locking module (108b) adapted to receive said position input from said position module (108a) and power from said power supply module (102), said locking module (108b) having at least one servo motor adapted to facilitate reclination of said seat (110) based on said position input.

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5. The wheelchair (100) as claimed in claim 1, which further comprises:

an inflatable mat (110a) disposed on said seat (110);

a sensor-timer (112) configured to sense if a user is continuously using said wheelchair (100) for a pre-determined duration, and further configured to generate a trigger signal in response;

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an inverter (114) adapted to cooperate with said sensor-timer (112) to receive said trigger signal and said power supply module (102) to receive said power

on reception of said trigger signal, and configured to provide AC power corresponding to said power; and

5 a compressor (116) adapted to receive said AC power and configured to pump air into said inflatable mat (110a) in a wave-like manner thereby providing relief to said user.

6. The wheelchair (100) as claimed in claim 1, wherein said power supply module (102) includes a battery pack (102a).

10 7. The wheelchair (100) as claimed in claim 1, wherein said obstacle detector (106) includes at least one ultrasonic sensor (106a), and is configured to detect obstacles including staircases.

15 8. The wheelchair (100) as claimed in claim 1, wherein said motor driver (104d) is a dual H-bridge motor driver having a plurality of relays for driving said wheelchair (100).

9. The wheelchair (100) as claimed in claim 1, which includes a feedback module (118) having:

20 at least one rotary encoder configured to provide feedback of position of said seat to said reclining unit (108), thereby facilitating accurate reclination control of said seat (110); and

an accelerometer configured to continuously monitor and provide information related orientation of said wheelchair (100) to said driving unit (104).

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10. The wheelchair (100) as claimed in claim 2, wherein said control module (104c) includes at least two joystick units, wherein a first joystick unit is used by a patient, and a second joystick unit is used by a helper, to provide said control inputs.