An Intelligent Patient Bed Mover

Field of the invention

The present invention relates to an intelligent patient bed mover to help nurse and/or transporter to move the patient bed easier and safer.

Background of the Invention

The patients in hospital may need to move from the ward to other places, say X-Ray room or Operation Theater. To make patient more comfortable, the patient may need to be moved together with the patient bed by nurses and/or bed transporters.

Because of the total weight of current patient bed with patient may be over 300 kg, so one nurse and/or transporter is difficult to move for a long way. Therefore, a motorized bed mover may need to help nurse/transporter to move the bed.

Normally, the bed mover is clipped on the front side or back side with motorized wheels to drug or push the bed. It causes two major problems at least:

- Most of lifts in the hospital are designed with almost the same length of patient bed, so the bed mover at the front and back sides could not move into the narrow lift. Therefore, the bed could only move at the same floor of building.
- The hospital environment is a public place. The safety is very important. Normal bed mover is difficult to integrate with some intelligent safety functions to protect both person and environment.

Therefore, the innovations and inventions to design an intelligent bed mover to assist nurse/transporter moving the patient bed with higher payload at a limited environment become necessary, especially for patient to be moved for different floors of the hospital.

Summary of the invention

The present invention aims to provide an intelligent patient bed mover to assist people moving the patient bed with/without patient easily and safely. The design and invention for the bed mover are focus on the following criteria:

- Increasing the safety during the movement of the vehicle;
- Being possible of moving into the most lift in the hospitals;
- Being easy operation, especially by single person operation;
- Being suitable for variable application;
- Being lower material cost.

To meet the above criteria, the present invention proposes an intelligent bed mover which comprises six functional modules:

- a microprocessor based robotic control unit to enable programmable control for variable application and to sense the control signal from operation;
- a single driving wheel unit with programmable driving force and speed to match the variable application, which uses double linear guided suspension unit to balance the driving force to variable payload;
- a control panel which could be fixed on the front board or back board of the patient bed to operate the bed mover easily and safely;
- a mobile cart to carry and to integrate the driving wheel to the position near the center of bed;
- an ultrasound sensor unit with a magnetic plate, which could be attached on the front side to detect the environment;
- a robot grasp platform to fix the bed mover on patient bed automatically.

It is a microprocessor based apparatus, so could be programed for variable application and meet variable requirement. The single wheel design provides great flexible for variable application. The human-apparatus active interface system enables an intuitive operation for the intelligent bed mover.

The intelligent bed mover can be also used for assisting people to move a vehicle easily and safely. It is suitable for any vehicle working at normal daily-life and industry environment, such as:

(a) Grapping on the center of a four wheel vehicle, such as a wheeled patient bed in hospital or aged care center, to help nurse to move the patient bed to other place easily and safely;

(b) Grapping on the front of wheeled device to help operator to drug the device to different sites;

(c) Grapping two apparatus invented on two sides of a wheeled food cart in hospital to help the nurse to move the food cart to ward;

(d) Grapping on the front of a wheeled cabinet to help people to collect and delivery materials, such as linen in hospital or hotel, and so on.

Brief Description of the Figures

An embodiment of the invention will now be illustrated for the sake of examples only with reference to the following drawings, in which:

FIG 1 is a perspective view of an apparatus according to an embodiment of the present invention 100. It comprises with a motorized wheel with suspended support frame 101, control panel 102, mobile cart 103, electrical and electronic control unit 104, ultrasound sensor unit 105 and robotic grasp platform 106.

FIG 2 is the three dimension view of the present invention 101 without cover. It comprises with a PU wheel 201, a driving brushless DC motor 202, 1st gear set 203, 2nd gear set 204, two linear guides 205-1 and 205-2, two suspension springs 206-1 and 206-2, wheel lifting unit 207.

FIG 3 is the three dimension view of the present invention 102. It comprises with a stop button 301, a power on button 302, a RFID sensor 303, and a safety button 304, move button 305, forward/backward button 306, and speed control button 307, right control panel 308, left control panel 309.

FIG 4 is a perspective view of the present invention 103. It comprises with three castor wheels 401, power lift 402, driving wheel control mechanism 403, balance wheel 404, mobile handle 405, electrical control box 406, battery and power managing unit 407, power lift control panel 408.

FIG 5 is a three dimension view of the present invention 104 without cover. It comprises with motion control board 501, robotic control board 502, heat dissipation unit 503, control panel management board 504, moving direction selection button 505, and resetting terminal 506.

FIG 6 is a perspective view of the present invention 105. It comprises with two ultrasound sensors and a magnetic plate 602.

FIG 7 is a three dimension view of robotic grasp platform 106. It comprises with two grapplers 701, base plate 702, beam stopper 703, grappler support 704 and 705, grappler move mechanism 706.

FIG 8 is a perspective view of the present invention 103. It shows more details on the driving wheel, especially the wheel lift mechanism, including the lead screw 701 and DC motor 702.

FIG 9 is a perspective view of the present invention 106. It shows more details on the mechanism, especially the grappler move mechanism 706, including lead screw 901 and DC motor 902.

FIG 10 is a side view of the apparatus 100. It shows the handle of the mobile cart can be fold down as arrow shown. The driving wheel 103 can be moved up and down by power lift 402 and turning 360° by the driving wheel control mechanism 403.

FIG 11 is schematic view for an overview of electrical and electronic system of apparatus 100.

FIG 12 is the three dimension view of the apparatus 100, install on the left side of the patient bed 1201. The patient bed comprises with a back board 1202, a front board 1203 and a side frame 1204. The control panel 102 have been installed on the back board of the patient bed and the apparatus 100 has been grasped on the side frame 1204.

FIG 13 is the three dimension view of the apparatus 100, install on the left side of the patient bed 1301.

Detailed Description of the Embodiments

An apparatus 100 which is an embodiment of the invention will now be described with reference to FIGS 1 – 13. The apparatus 100 serves to assist human moving a mobile vehicle easier and safer.

The apparatus 100 is a single wheel driven apparatus, carried by a cart with three castor wheels. It is a one block driven system as shown in FIG 1. The driving wheel 201 in FIG 2 is driven by a brushless DC motor 202 together with encoder 703 in FIG 7 through the two-step gear sets 203 and 204.

The wheel 201 is supported by two suspension springs 206-1 and 206-2, guiding by two linear guides 205-1 and 205-2. It enables the apparatus 100 providing suitable drive force between the vehicle and ground. The drive wheel 201 together with the drive motor 202 will be moved up and down by the wheel lift unit 207, which is driven by a warm geared DC motor 702 through a lead screw 701.

The drive wheel unit 101 is carried by the cart 103. The power lift 402 and the driving wheel control mechanism 403 enable the driving wheel 101 to be moving up/down and turning 360° along the vertical axis.

A grasp platform 106 is fixed on the position as shown in FIG 1. Once the apparatus 100 moving into the position below the patient bed and the stopper 703 touching the support beam of the patient bed, the two grapplers 701 will be moved down by the grappler move mechanism 706 and enable the apparatus 100 fixed on the patient bed. The grappler move mechanism 706 is driving by a warm geared DC motor 902 through a lead screw 901.

To be saved space, the handle 405 can be fold down as shown in FIG 10. The total turning angle is up to 315°.

The driving wheel 102 will be moved down to near the ground automatically by the power lift 402 once the apparatus 100 to be fixed on the patient bed. The distance between the wheel and ground will be controlled at 20mm ±5mm. The bed moving direction could be controlled by manual control and motorized control unit 403 by a warm geared DC motor directly.

A balance wheel 404 will be moved up/down together with the drive wheel to balance the force on the drive wheel during the movement.

Two ultrasound sensors together with the electrical system is built as 105 in FIG 6. A high strength magnetic plate is built on the back side of the unit to enable it stick on the front side of the patient bed easily.

A control panel with left and right unit 102 is shown in FIG 3. A radio-frequency identification (RFID) is integrated into the control panel to enable the operation only by authorized person and to possible to monitor the location of the patient bed. On the control panel, there is a safety button 304 and a move button 305. The bed can be moved by only pressing the two buttons together. It is a safety measurement to make sure that the bed mover is controlled by two hands. The functions of other buttons are as defined.

The control panel can be clipped on the cart, front board and back board of the patient bed.

The apparatus 100 is controlled by a micro-processer based controlling unit 104. The control logical diagram is shown in FIG 11. An Initial Measuring Unit (IMU) is built in the system to monitor the bed turning and moving at a slop road. It will active the intelligent system to maintain the constant speed, slow down the movement or even stop it depending on the situation. A battery pack and battery charger together with a power management system is built in the power boxes 407.

In the control box 104, a direction button 505 enables the user to define the forward or backward direction. The reset terminal enables onsite setting the parameter by an engineer.

FIGS 12 and 13 present two possible positions of the apparatus 100 on the patient bed. For FIG 12, the apparatus 100 is grasped on the side of patient bed and the control panel 102 is clipped at the back board 1202 of the patient bed. It has not enlarge the size of patient bed, so it can be moved into the lift as normally. For FIG 13, the apparatus 100 is grasped on the back of patient bed and the control panel 102 is clipped at the back board 1202 of the patient bed. Once the drive wheel 101 moving down, the balance wheel 404 will be moved down together to balance the drive force during the bed movement.

Basically, the apparatus 100 is an intelligent system, which could be reprogrammable to adjust the speed to sense the interaction between the operator and vehicle. The close loop control by means of robotic controller, sensors and encoder makes the apparatus suitable of wider application to help human moving a vehicle easily and safely.

Claims

1. An apparatus for assisting human to move a vehicle easily and safely, the apparatus comprising:

a single driving wheel unit with programmable driving force to match the variable application;

a double linear guided suspension unit to balance the driving force to variable payload;

a mobile cart to carry the driving wheel unit to the suitable position below the vehicle or patient bed;

A power lift to move the driving wheel unit up/down for grasping the driving at a suitable position;

a turning mechanism to change the direction of the driving at 360°;

a robotic grasp platform comprises with two grapplers to fix the driving wheel on the proper position of the vehicle or patient bed;

a balance on the opposite side of the driving wheel to balance the driving force;

a control panel comprises with control units and RFID unit, providing the programmable control for different operation and safety requirement;

a microprocessor based center control unit to enable programmable control for variable application;

a robotic control unit to sense the control signal from operation;

an ultrasound with magnetic stick to detect the environment;

an IMU unit to detect the turning and slope for intelligent control; and

a battery package together with charging and protecting circuit to manage and provide power for moving the vehicle.

2. An apparatus according to claim 1, wherein the driving mechanisms is depending on a single driving wheel powered by a brushless DC motor with an encoder, in which the driving wheel is carried by a three wheel cart and will be grasping on the suitable position of the vehicle and patient bed.

3. An apparatus according to claims 1 and 2, wherein the driving wheel can be turning along a vertical axis to change the driving direction.

4. An apparatus according to claims 1 to 3, wherein the driving wheel can be moved up/down to adjust the driving force for intelligent control.

5. An apparatus according to claims 1 and 2, wherein a balance wheel to be moved together with the driving wheel to balance the driving force.

6. An apparatus according to claim 1, wherein a robotic grasp platform to be fix on the three wheel cart, which comprises with two grapplers to grasp the cart on the patient bed or a vehicle.

7. An apparatus according to claim 1, wherein the control panels comprises with two control units with a RFID unit which will be clipped on the cart, front side and back side of a patient bed or a vehicle for easy control.

8. An apparatus according to claims 1 to 7, wherein the driving wheel will be grasped on the center or near center of a four wheel vehicle to enable free of turning of the vehicle.

9. An apparatus according to claims 1 to 8, wherein the pressure force to ground of the driving wheel can be adjusted based on the sensor signals from IMU for intelligent control.

10. An apparatus according to claims 1 to 9, wherein the apparatus can be grasped on the center, front side and/or back side of a four wheel vehicle or patient bed.

11. An apparatus according to claims 1 to 10, wherein an ultrasound sensor unit with a magnetic plate to enable the unit attaching on the front side of patient

bed to monitor the environment during movement and to enable the intelligent control for safety.

12. An apparatus according to claims 1 to 12, wherein an RFID unit enabling the apparatus can only be active by authorized person through RFID card.

13. An apparatus according to claims 1 to 11, wherein an IMU unit enabling the detection of the apparatus for the turning and straight movement at a slopping road. It enables the intelligent control on drive force and the speed control.

14. An apparatus according to claims 1 to 12, wherein a moving direct button to enable the identification of the forward movement and backward movement.

15. An apparatus according to any preceding claim, wherein the driving force and speed to the vehicle are automatically controlled, depending on the pushing and dragging forces for different environment.

16. An apparatus according to any preceding claim, wherein the control modes by the combination of two control units are programmable to meet the requirement of different application.