

An apparatus to assist human moving vehicle easily

Field of the invention

- 5 The present invention relates to an intelligent apparatus to assist people moving a mobile vehicle, such as a patient bed or food cart in a hospital easily and safely.

Background of the Invention

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In both daily life and industry environments, there are a lot of mobile vehicles or tools to help human performing jobs easily. Some of these vehicles are driving by motors or other driving tools and some of these vehicles are directly driving by human. For the vehicles with lighter payload, say less than one hundred
15 kilogram, and with enough spaces to work, there are no problems to move it by one person. In case of a vehicle with a few hundred kilogram payload and with a limited environment to work, the vehicle could be difficult to be moved by one person. Sometimes, it may be dangerous to move it by one person.

- 20 There are a lot of ways to solve the problem mentioned above. One way is to design a fully motorized vehicle for the jobs with higher payload and limited working environment. Technically speaking, there are no problems to design a new vehicle to perform the jobs. The main issue is that not all of the people or institutes could pay the cost to use the fully motorized one and to replace the
25 current one by a new one (currently, millions vehicles with payload over 100 kilograms in use).

Another way is assigning more people to move it. There seems no problem in a developing country with cheaper manpower cost. However, it may course some
30 problems in a much competed business environment to meet the challenged society requirement.

Therefore, the innovations and inventions to design an intelligent apparatus to assist people moving a mobile vehicle with higher payload at a limited environment become necessary, especially for it working at a challenged environment, such as a hospital in a developed country.

Summary of the invention

The present invention aims to provide an intelligent apparatus to assist people moving a mobile vehicle easily and safely. The design and invention for the apparatus are focus on the following criteria:

- Increasing the safety during the movement of the vehicle;
- 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 apparatus which comprises six functional modules:

- a microprocessor based center control unit to enable programmable control for variable application;
- a robotic control unit to sense the control signal from operation;
- a single driving wheel unit with programmable driving force to match the variable application;
- a linear guided suspension unit to balance the driving force to variable payload;
- two control panels providing the programmable control for different safety requirement;
- a battery unit together with charging and protecting circuit to provide power for moving the vehicle.

It is a microprocessor based apparatus, so could be programed for variable application and meet variable requirement. All of components are integrated into one block, so very easy to install on a vehicle. The single wheel design

provides great flexible for variable application. The human-apparatus active interface system enables an intuitive operation for the apparatus.

The apparatus can be 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) Install 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;
- 10 (b) Install on the front of wheeled device to help operator to drug the device to different sites;
- (c) Install 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) Install on the front of a wheeled cabinet to help people to collect and delivery
15 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
20 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, battery with charging and protecting unit 102, electrical and electronic control unit 103, and two movable control panels 104.

25 Fig. 2 is the front view of the present invention 100.

Fig. 3 is the left-side and bottom views of the present invention 100.

Fig. 4 is a perspective view of the motorized wheel with suspended support frame 101. The unit comprises with a linear slide guide 401, a U-shape support frame 402, a wheel 403, a support plate 404, a protect cover 405, and a
30 brushless DC motor 406.

Fig. 5 is also a perspective view of the motorized wheel with suspended support frame 101, together with a cross-section view along AC-AC plane. It shows the T-shape locking nuts 501, suspension spring 502, two bearings 503, gear box 504, magnet encoder 505, and Dc motor 506.

5 Fig. 6 is a perspective view of the battery with charging and protecting unit 102. It comprises the charging and protecting circuit 601 and two batteries 602. Four locking slots 603 show on the top of this unit.

 Fig. 7 is a perspective view of the electrical and electronic control unit 103. The whole control unit shows by 701 and four locking slots 702 show on
10 the top of this unit.

 Fig. 8 is a perspective view of the control panel 104. Two buttons together 801 and 802, with pressure sensors inside each button. The clip spring 803 is fixed on the back side of the panel.

 Fig. 9 is schematic view for an overview of electrical and electronic
15 controlling system of the apparatus 100.

 Fig. 10 is a perspective view of the apparatus 100, installed on the center of a wheeled patient bed 1001. Two control panels 104 have been clipped on the back side of the patient bed, near the handle of the patient bed. A quick fixed on adaptor 1001 on the two sides of the apparatus 100.

20 Fig 11 is the views of front, bottom and side of 1001. It shows the center of the apparatus on the same center of four wheels of patient bed 1101.

 Fig. 12 is perspective view of the apparatus 100, install on the front side of the patient bed 1001. Two control panels 104 have been installed on the back side of the patient bed. A quick fixed on adaptor 1201 on the front side of
25 the patient bed.

 Fig. 13 is the views of front, bottom and side of 1200. The fixed-on adaptor 1201 enables two front wheels higher than the wheel on the apparatus 100 about 2mm to 10mm.

 Fig. 14 is a perspective view of adaptor 1201. The locking bar 1402 can
30 turn 90° to release the apparatus 100.

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Fig. 15 is a perspective view of adaptor 1001. Two holes 1501 are for tighten the apparatus 100 on the patient bed.

Detailed Description of the Embodiments

An apparatus 100 which is an embodiment of the invention will now be described with reference to Figs. 1 – 15. The apparatus 100 serves to assist
5 human moving a mobile vehicle easily and safely.

The apparatus 100 is a single wheel driven apparatus. It is a one block driven system as shown in Fig. 1. The wheel 403 in Fig. 4 is driven by a brushless DC motor 406 together with encoder 505 through a gear box 504.
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The wheel 403 is supported by two ball bearings 503 on a U-shape support frame. The suspension blocks 502 between the U-shape support and the basic plate 404 to enable the apparatus 100 providing suitable drive force between the vehicle and ground. A linear guide block 401 on the side of U-shape support
15 keeps the wheel on the vertical line to ground.

The wheel on the apparatus 100 is controlled by a micro-processor based controlling unit 103. The speed of turning of wheel is programmable to match different application. Four mounting holes 702 is matching with four T-bolt on
20 the support plate 404, making the unit very easy to install and dismantle from the support plate on the top of the apparatus 100. The schematic diagram of Fig. 9 presents the control logic for the unit.

The power of control unit and Dc motor is provided by the battery unit 102. A
25 charging control and protect circuit has been built in the unit. Four holes 603 are also for easy install and dismantle it on and from the T-bolt 501 on the support plate 404.

The control panel 104 could be installed on the front or back sides of vehicle by
30 screws or clipping frame 803. There are two buttons 801 and 802 on the panel to provide speed control. The buttons together with force sensors on them

enable the turning speed of wheel controlled by the force of operator. Once the buttons being release, the vehicle will stop to move.

Two control panels 104 are built on the apparatus 100. The control modes could
5 be programmed for different application. For safety reason, two control panels
will be used together for moving a patient bed 1000 and 1200 in hospitals. In
this case, the patient bed will be moved only two buttons pressed together, such
as pressing two buttons 801 on two control panels 401 to enable the patient
moving on lower speed mode and pressing two buttons 802 on two control
10 panels for higher speed mode, and or 801 on one panel and 802 on another
panel for middle speed mode. The speeds on all of three modes, lower, middle
and higher modes, are still adjustable by the force sensors.

The apparatus 100 composes with a linear guided suspension mechanisms.
15 The suspension force and distance can be adjusted, depending on the
application. For application 1000, the suspension force is adjusted to support
about 70% to 90% payload including the weight of the patient bed. For the
application, the apparatus 100 is installed on the centre of four wheels as
shown in Fig.11. Therefore, the operator on front or back sides can freely turn
20 the bed by only 10% to 30% force in compare of turning the bed without the
apparatus 100. The suspension unit does also provide addition buffer effect to
make the patient feeling more comfortable. A simple adaptor shows in Fig. 15
provide a quick installation mechanisms for easy maintenance.

25 Figs. 12 and 13 present another installation of the apparatus 100 on the patient
bed. The apparatus 100 is installed on the front side and the operator will be at
the back side. The adaptor 1201 enables 100% payload being supported by two
back wheels together with the wheel on the apparatus 100. In this way, the
patient bed will be moved on a three wheel vehicle and two front wheels will
30 play a safety function only.

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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

5 human moving a vehicle easily and safely.

Claims

1. An apparatus for assisting human to move a vehicle easily and safely, the apparatus comprising:
 - 5 a microprocessor based center control unit to enable programmable control for variable application;
 - a robotic control unit to sense the control signal from operation;
 - a single driving wheel unit with programmable driving force to match the variable application;
 - 10 a linear guided suspension unit to balance the driving force to variable payload;
 - two control panels providing the programmable control for different operation and safety requirement;
 - a battery unit together with charging and protecting circuit to provide power for moving the vehicle.
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2. An apparatus according to claim 1, wherein the driving mechanisms is depending on a single wheel powered by a DC motor with a close-loop control system sensing to the pushing or dragging force from operator.
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3. An apparatus according to claims 1 and 2, wherein the spring suspension unit together with a linear guide enables the driving force keeping constant on requirement during the moving of the vehicle.
- 25 4. An apparatus according to claim 1, wherein there are two control panels each with two buttons and sensors on it. The control panel can be installed on any place of vehicle, such as two at front side, two at back side, and one at front side and one at back side, depending on the application.
- 30 5. An apparatus according to claims 1 and 4, wherein two control panels provide three control modes; pressing two buttons 801 on two panels at the

same time for lower speed mode; pressing two buttons 802 on two panels at the same time for higher speed mode; pressing button 801 on one panel and button 802 on another button at the same time for middle speed mode.

5 6. An apparatus according to claim 1, wherein the control unit is integrated onto the apparatus by four T-bolts on the top of the unit.

7. An apparatus according to claim 1, wherein the battery unit is integrated onto the apparatus by four T-bolts on the top of the unit.

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8. An apparatus according to claims 1 to 7, wherein the apparatus can be installed on the center of a four wheel vehicle providing support 60% to 90% payload plus the weight to enable free of turning of the vehicle.

15 9. An apparatus according to claims 1 to 8, wherein the apparatus is installed on the center of a four wheel vehicle by a two screw clamping block.

10. An apparatus according to claims 1 to 7, wherein the apparatus can be installed on the front or back side of a four wheel vehicle. A clamping adaptor
20 enables the single wheel on the apparatus together two back wheels or two front wheels providing support 100% payload plus the weight to enable the vehicle moving as a three wheel vehicle.

11. An apparatus according to any preceding claim, wherein the driving force
25 and speed to the vehicle are depending on the pushing and dragging forces of operator.

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