PARALLEL TWO WHEELED PASSENGER CARRIAGE

[DETAILED DESCRIPTION OF THE INVENTION]

[TECHNICAL FIELD]

[0001] The present invention is related to a parallel two wheeled passenger carriage, which is capable of controlling a motor-driven parallel two wheeled vehicle by detecting the balance of a user on the vehicle to enable the vehicle to stand on its own, to move forward and reverse, and to steer the vehicle in any direction by only shifting the user's weight.

[BACKGROUND TECHNOLOGY]

[0002] Conventionally, a parallel two wheeled passenger carriage has been proposed and partially put to practical use, in which each wheel of two parallel wheels provided with a carriage are driven by motors that operate independently of each other, and the operation of each motor is controlled by detecting the gravitational balance applied to the carriage including the user riding on the carriage to enable the carriage to stand on its own. This conventional parallel two wheeled passenger carriage estimates the intention and degree of forward and backward movement of the user by detecting the center of gravity movement in the front-rear direction of the user, and controls the operating direction from a separate operating instruction given by the user.

[0003] Such a parallel two wheeled passenger carriage is, for example, a scooter of parallel two wheeled type as illustrated in FIG. 3 (a). In this parallel two wheeled type scooter, wheels 42, 43 are provided on both sides of a carriage 41, each of which are supported parallel to each other and independently rotatable with respect to the carriage 41, and an aluminum steering rod 44 is fixed to the carriage 41.

[0004] As illustrated in FIG. 3 (b) in an exploded view, the carriage 41 includes a first motor 46 and a second motor 47 on both sides of a casing 45, a battery 48, 48 arranged therebelow, and wheels 42, 43 corresponding to each of the motors are driven via a reduction gear. This motor is a brushless type of about 2 horsepower and is highly efficient, durable, and maintenance-free.

[0005] The battery 48 is a nickel-cadmium (NiCd) battery or a battery using nickel metal hydride, and is operable even when a person weighing about 110 kg rides with a load of 34 kg, can travel a maximum of 28 km on a single charge of the battery, can travel about 17 km in a normal operating state, and is capable of traveling at a speed of 20 km per hour. The part that drives the wheels by these motors is also equipped with a reduction gear, and the wheels are driven by helical gears with a reduction ratio of roughly 24:1.

[0006] The casing is equipped with a balance sensor 50, the actuation of which is detected by at least two rate gyros per degree of freedom, for a total of five rate gyros, in addition to a tilt sensor (accelerometer). Further, a pair of control circuit boards 51 are provided and various signals are input to these control circuit boards 51, such as the signals of the gyro and the tilt sensor described above, to control the rotation of both motors 46, 47 in the forward and reverse directions, allowing this carriage to stand on its own based on the stabilizing control method of the wheel type inverted pendulum. A handle 52 is provided at the upper end of the steering rod 44, and by rotating a grip 53 provided on one side of the handle 52, the rotation speed of the motor on both sides is adjusted to enable steering.

[0007] Above the casing 45 is a chassis 54 which can seal and cover the casing 45, and it is provided with a rubber stepping mat 55 on the top surface thereof on which the user rides. A diaphragm switch is provided in this rubber stepping mat 55, so that when the user gets on, the switch is turned on and this parallel two-wheel type scooter is put into operation, and when the user gets off, the switch is turned off and the operation is stopped. The height of this

stepping mat is about 20 cm off of the ground and the area thereof is about 48 x 64 cm.

[0008] In addition, as illustrated in FIG. 3 (a), the steering rod 44 can be extended and retracted to adjust the height of the handle 52, and the handle 52 is provided with a key 67 and a display part 68. The key 67 has a speed limit setting function as well as a theft prevention function. The display 68 indicates the on/off status of the device, mode status, battery level and other information.

[0009] With regards to the configuration of a control device portion of a parallel two wheeled scooter with this type of configuration, as illustrated in FIG. 4, the left and right motors 46, 47, which drive the left and right wheels 42, 43, are controlled by the respective left and right motor controllers 61, 62 in the control device 60. The signals of the rate gyro 63 and the tilt sensor 64 of the balance sensor 50 described above, and the stepping mat sensor 65 of the stepping mat 55 are input to the control device 60, and the signals of the grip operation amount sensors 66, 66 for steering of the left and right grips 53 provided on the handlebars 52, and the signal of the key switch 67 are input to the control device 60. Overall control is performed for each motor controller 61, 62, and display signals are output to the display part 68.

[0010] In a parallel two wheeled scooter having the configuration described above, when a user operates a key 67 to activate the equipment and rides on the stepping mat 65 of the carriage 41, the balance control and the like of the scooter are activated. In this state, a balance sensor 50 equipped with a rate gyro and a tilt sensor detects the weight balance of the entire carriage including the user riding on the carriage 41, and by detecting the tilt of the carriage, driving control of the left and right motors 46, 47 is performed using the stabilization control method of the wheel type inverted pendulum such that the carriage can remain standing on its own.

[0011] The movement of the center of gravity of the user in the front-rear direction on the carriage 41 is detected, and when movement of the center of gravity is more than a prescribed level, it is assumed that the user wishes to move in that direction, and the rotation speed of the wheels is adjusted according to the degree of movement, so that the user can move forward and backward at a desired speed. Further, by rotating the left and right grips 53 provided at both ends of the handle 52, the user is able to perform steering operations to adjust the number of rotations of the left and right wheels and to adjust the direction of travel.

[0012] In order to make the operation described above take place, a control system as illustrated in FIG. 4 is provided inside this device, and the control device 60 which forms the center of the system is provided with motor controllers 61, 62 which control the driving of the left and right motors 46, 47. The signals of the rate gyro 63 and the tilt sensor 64 of the balance sensor 50 are input to this control device 60 to perform independent control based on the wheel type inverted pendulum stabilizing control method. In addition, the signal of the stepping mat sensor 65 is input to enable detection as to whether or not a user is on the stepping mat 65. In addition, the tilt sensor 64 detects the tilt in the front-rear direction to perform forward and reverse control, and the signal of the grip operation amount sensor 66 of the handle 52 is input to control the rotational speed of the left and right motors or the direction of rotation to perform steering control. Furthermore, the signal of the key switch 67 on the handle 52 is input, and furthermore, necessary indications can be given on the display part 68 provided on the handle 52. The following patent document exists as a technology for orientation control methods in coaxial two wheel vehicles.

Patent Document 1: Japanese Unexamined Patent Application S63-305082

DISCLOSURE OF THE INVENTION

[Problems to be Solved by the Invention]

[0013] In a conventional parallel two wheeled type scooter as a parallel two wheeled passenger carriage, as illustrated in FIG. 3, a steering rod 44 protrudes from a carriage 41, a grip 53 is provided at one end of a handle 52 provided at the upper end thereof, and the rotating speed of the motors for the left and right wheels is adjusted by independently turning and operating the grip 53, which performs steering.

[0014] Therefore, it is necessary to make the steering rod 44 extendable and retractable so that the handle 52 can be extended from a relatively low position to a high position such that a user standing on the carriage 41 can easily perform this steering operation, whether the user is relatively short or tall.

[0015] Therefore, even if an aluminum alloy is used to make the handle as light as possible, the overall weight will be heavy because the steering rod is configured to fit a tall person and the handle is provided as such. In addition, when such a handle is installed on the carriage, the whole carriage becomes bulky, and this, together with the increase in weight as described above, makes it difficult to carry the parallel two wheeled passenger carriage, and it is inconvenient to carry the carriage into a train, to lift it up on the curb of a road, to carry it up and down stairs, and to store it. In particular, it is difficult for weak people, such as women and children, to handle the carriage.

[0016] Furthermore, as the steering for the conventional parallel two wheeled passenger carriage described above is controlled by the grip 53, it is necessary to operate the grip with at least one hand when adjusting the direction of steering, which makes it difficult to operate the grip when, for example, carrying a load with both hands and also to adjust the steering appropriately when carrying a load with one hand.

[0017] Accordingly, a principal object of the present invention is to provide a parallel two wheeled passenger carriage which enables the direction of

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