[0013] 所述蓄电池为铅酸电池或镍氢电池或锂电电池。

[0014] 本实用新型的有益效果是：由于在车体重心位置设有电驱动控制装置；电驱动控制装置内设有方向控制器、内部控制传感器、控制电路及驱动电路，这样使车体具有自平衡功能，驾驶者只需稍使车体向前倾斜即可前行，车体没有任何机械结构的刹车，驾驶者只需使车体稍向后倾斜就能实现减速，刹车及后退；双轮平衡车车轮左右分布在车体两侧，且可以通过电控制系统实现正反转，因此转弯半径小几乎为零，驾驶者左右摇摆把手，通过传感器的信号处理，即可实现转弯或原地转弯，能在狭小空间内灵活运行；扶杆下端有一个作为高度调节按钮的松紧螺栓，即可根据驾驶者需要调节至最舒适的高度；扶杆上端与下端有一个角度旋转按钮，驾驶者可以调整上扶杆到合适的倾斜角度；车体的支撑台上还安装有红外光电开光，可辨别驾驶者是否处于车体上。

附图说明

[0015] 图 1 为本实用新型的爆炸图；

[0016] 图 2 是图 1 中 A 处局部放大图；

[0017] 图 3 为本实用新型系统供电回路原理框图；

[0018] 图 4 为系统组成总体框图；

具体实施方式

[0019] 请参考图 1 至图 4，一种智能平衡车包括一个支撑其它部件的车体 30、一个转向调节机构、一个电驱动控制装置。

[0020] 车体 30 包括一个扶杆、一个起支撑人体作用的支撑台、包括二个车轮 6 的行走装置。

[0021] 扶杆整体为“T”形杆；包括把手 1、上扶杆 2、下扶杆 8，两者之间安装有一个角度调节机构，该机构包括连接在一起的角度旋转按钮 26、弹簧 7、六角螺栓；上扶杆 2 与下扶杆 8 相互卡接，上扶杆 2 与下扶杆 8 通过六角螺栓与弹簧 7 以及角度旋转按钮 26 相连接，转动角度旋转按钮 26 就可以调整上扶杆 2 的倾斜角度，该机构主要是使上扶杆可在下扶杆上旋转，其结构为常见的结构。下扶杆 8 为高度可调节的下扶杆，其包括外杆及内杆，内杆套在外杆内部，外杆与内杆之间连接有高度调节按钮 9。松紧高度调整按钮 9 就可以调整把手 1 至合适的高度。为了节省运输空间，松紧高度调节按钮 9 可以将上扶杆 2 拆下。

[0022] 支撑台上设有踏板，在该踏板内部设有检测是否有人在踏板上的脚踏传感器。脚踏传感器可以是金属抗冲击开关、红外光电开关 29 以及其它可以用来检测人上下车的装置。作为优选，本实施例采用红外光电开关 29。作为脚踏传感器，当人上车时，红外光检测到红外光电开关 29 导通，微处理器工作在自动平衡状态。该支撑台内部设有蓄电池，具体可根据需要选择铅酸电池或镍氢电池或锂电电池，对应的，在车体 30 后部的车体后灯 15 的中间位置加工有用于为蓄电池 33 充电的充电接口 16。

[0023] 转向调节机构包括一个转向轴 18、一个转向轴平衡机构；转向轴 18 一端固定在扶杆底端并与之固定连接，另一端则与方向控制器固定在一起；转向轴平衡机构固定在转向轴 24 上并同时又固定在支撑台内部。转向轴平衡机构包括轴承座、保护转向装置内部器件的转向外壳 10、矩形弹簧 22、与矩形弹簧 22 相连的弹簧挡片 20 及六角法兰螺栓 19、横穿过

轴承座的转向轴 18、六角法兰螺母 21、平键 17、电位器连接头 23。

[0024] 电驱动控制装置包括均设置在车体 30 中心位置的方向控制器如电位器 24、内部控制传感器、控制电路及驱动电路；内部控制传感器包括角速度传感器如陀螺仪传感器、加速度传感器；上述两个传感器连同方向控制器均分别通过驱动电路与控制电路连接在一起。上述车轮 6 也可根据需要设定单个轮体或多个轮体，分布方式可以为平行或相对设置等。控制电路包括陀螺仪电路板 31、自动控制及驱动电路板 32、控制红外光电开关的红外光电开关电路 13 以及指示灯电路板 11。

[0025] 下扶杆 8 的下端设有转向联轴器并通过平键 17 连接转向装置内的转向轴 18，转向轴 18 通过轴承与轴承座固定在转向外壳 10 的前后两端，转向轴 18 后端通过一电位器连接头 23 连接电位器 24 的旋转轴，从而改变其输出电阻。左右摇摆把手 1，带动转向轴 18 旋转，通过左右两边矩形弹簧 22 以及弹簧挡片 20 限制了把手 1 左右摇摆的角度，并使其回复到中间位置，通过调整电位器 24 电阻值，改变行走装置的转速与方向，从而实现转弯或原地转弯。

[0026] 行走装置还包括有防护支撑管 3、挡泥板 4、泥板装饰盖 5、泥板固定座 28 以及电机固定座 14。车轮 6 内安装有电机，通过电机固定座 14 连接在车体 30 两侧，挡泥板 4 与防护支撑管 3 固定于泥板固定座 28 后一起连接在车体 30 上，加强驾驶者的安全。电机在本实施例中采用轮毂电机，该轮毂电机的转轴固定在所述车体 30 内。为了方便晚上出行，还可以在车体 30 的前端安装车体前大灯 27、车体前灯 12 以及在车体 30 后端安装车体后灯 15。当然为了方便携带物品还可以在上扶杆 2 上设置安装挂包 25 的装置。挂包 25 的大小及形状可以根据具体情况而定。电机由驱动电路即驱动控制器驱动运转。

[0027] 上述一种自动平衡车的具体工作原理为：

[0028] 由把手 1、上扶杆 2、下扶杆 8 组成的扶杆为 T 型杆，下端与转向轴 18 相连，可以作偏离中心法线左右三十二度摆动，同时带动电位器连接头 23 转动。当扶杆左右摆动时，电位器 24 内的旋转轴也会跟着转动，此时电位器 24 内的输出电压大小就会发生变化，从而检测到扶杆的运动位置，内部微处理器就会相应控制左右转弯操作。

[0029] 系统供电回路原理框图如图 3 所示，电源选用安全耐用、适合于大电流放电的铅酸蓄电池，供电电压为 48V，电池正极通过电源开关给系统供电，由于无刷电机为感性负载，工作时电机线圈自感和互感引起的感应电压可引起系统干扰，为避免电机驱动控制器的供电部分通过电源回路干扰到自动控制系统，自动控制系统即控制电路的供电回路宜采用独立电源，通过多级线性稳压装置，把 48V 直流电压稳定到 5V，给自动控制微处理器、加速度传感器、角速度传感器和电位器 24 供电。电机驱动控制器电源通过线性稳压器，从 48V 稳压到 5V，给前端驱动器供电。左右分布的两轮电动车有两个电机驱动控制器，分别采用独立的两路稳压电源供电；单轮车只有一个电机驱动控制器，相应地内部电路也仅有一路电机驱动控制器电源为其供电。

[0030] 电机驱动控制器采用六个大功率开关型 CMOS 管作为后级驱动，所连接的电机为三相星形六状态驱动方式，每两个大功率 CMOS 管桥联作为电机的一相输出，连接直流母线正极的 CMOS 管为上桥臂管，连接电流采样电阻到直流母线负极的 CMOS 管为下桥臂管。驱动控制器的三个 PWM 输出通过缓冲驱动电路后，分别驱动三个上桥 CMOS 管，三个选通信号通过缓冲驱动电路后，分别驱动三个下桥 CMOS 管。驱动控制微处理器通过并口通信接口与

自动控制微处理芯片相连，受自动控制微处理器的灵活控制，而驱动微处理器可以对电机转速即时测量，通过上行数据把转速信号传递给自动控制微处理器，微处理器对比左右两边电机驱动控制器上传的测量数据，经过补偿算法后，使得两边车轮 6 的转速不至于受到参数不一致的影响而偏离行走方向。电机驱动电路下桥 CMOS 管连接有康铜电阻，可对流过电机的电流进行采样测量，一旦遇到电机过流的情况，微处理器及时地关断 PWM 输出和选通信号，防止电机过流或意外短路引发的电路故障，确保电机运行安全。

[0031] 如图 4 所示本实用新型通过加速度传感器和角速度传感器，可以即时测量车体 30 的平衡状况及运行状况、包括车体 30 的倾角和车轮 6 的转角信息，反馈给自动控制微处理器，计算出两个车轮 6 和车体 30 的角速度及角加速度，从而计算出车轮 6 所需的电机转矩，实现对车体 30 的平衡控制。采集电机的转速可以使用磁编码传感器，也可以用光编码或者线霍尔传感器取代。

[0032] 当车体 30 不运动也不倾斜时，加速度传感器得到车体 30 倾角信号，此时为中心电压 2.5V，并送入控制微处理器，微处理器根据此信号并综合左、右车轮 6 的转速信号，此时转速几乎为零，算出两轮所需的电机力矩控制量，将该控制量送入驱动控制器即驱动微处理器，从而驱动电机相应输出动力，保持车体 30 原地平衡。当需要车体 30 前进时，骑行者控制重心向前偏移，使车体 30 稍微向前倾斜，加速度传感器得到倾角信号，此时电压增大，并送入控制微处理器，控制微处理器根据此信号并综合左、右车轮 6 转速信号，算出两轮所需的电机力矩控制量，将该控制量送入驱动控制器，电机驱动电路就驱动电机向前转动并始终保持车体平衡。倾角越大，传感器输出的电压信号偏离中心电压值越大，加速就越快。当需要减速、刹车或后退时，骑行者控制重心向后移动，使车体 30 稍微向后倾斜，控制微处理器同样可以根据传感器信号，算出所需反向力矩，从而控制电机向后转动，并始终保持车体平衡。向后倾角越大，反向加速越快。需要转弯时，骑行者通过摆动扶手，使安装在扶手下面的电位器得到不同电压值，控制微处理器通过计算得出左、右轮的不同力矩大小，从而控制两边车轮 6 分别以不同的速度或方向转动并始终保持车体 30 平衡，由此可以控制车体 30 转动到所需方向。

[0033] 实际应用中，该自动平衡车并不限制于两轮，当为单轮电动车时，只有一个轮毂电机，安装于两个踏板之间，骑行者两脚放与两个踏板上。单轮车或两轮车的轮毂电机轮轴均固定在车体 30 上，内部控制传感器是角速度传感器和加速度传感器，均安装于车体 30 的重心位置，控制电路固化有智能控制的程序软件。

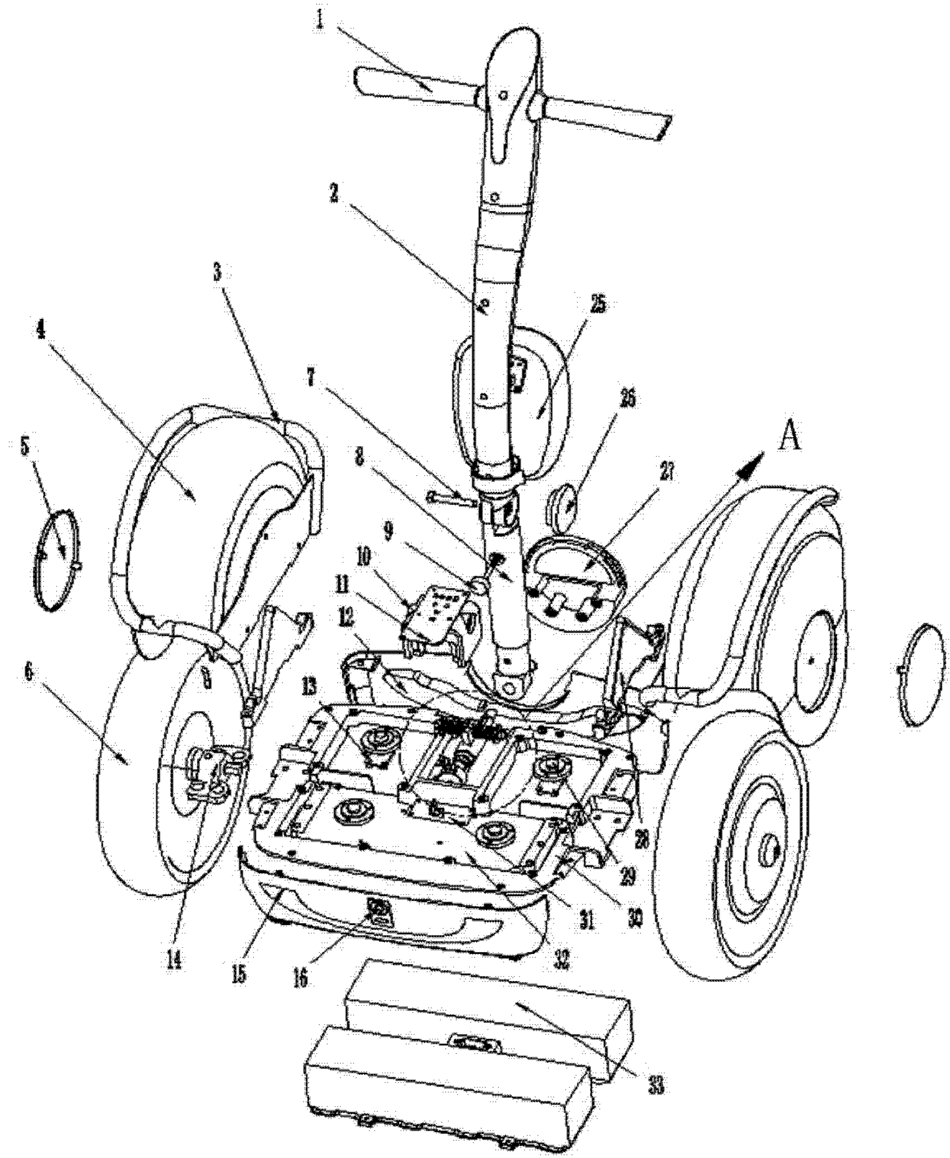

图 1

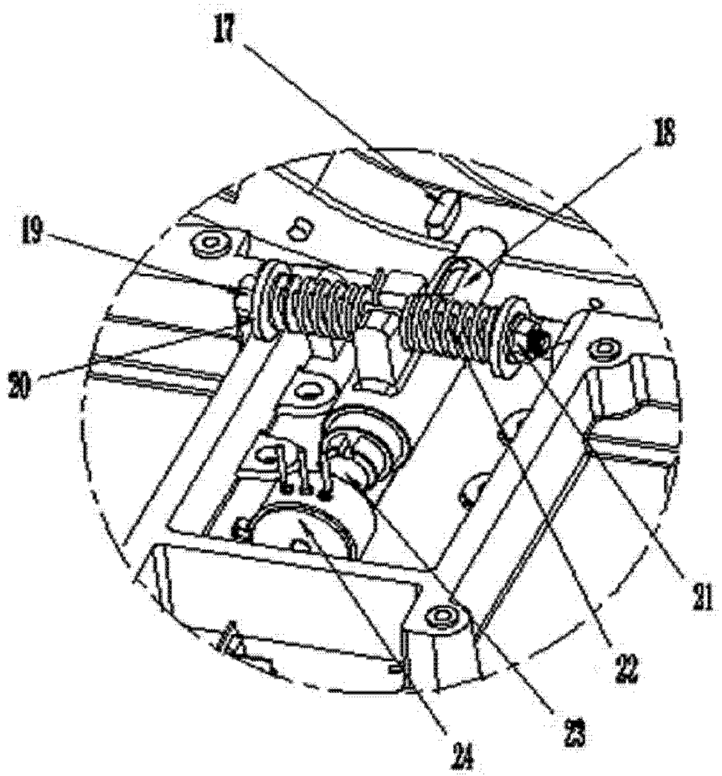

图 2

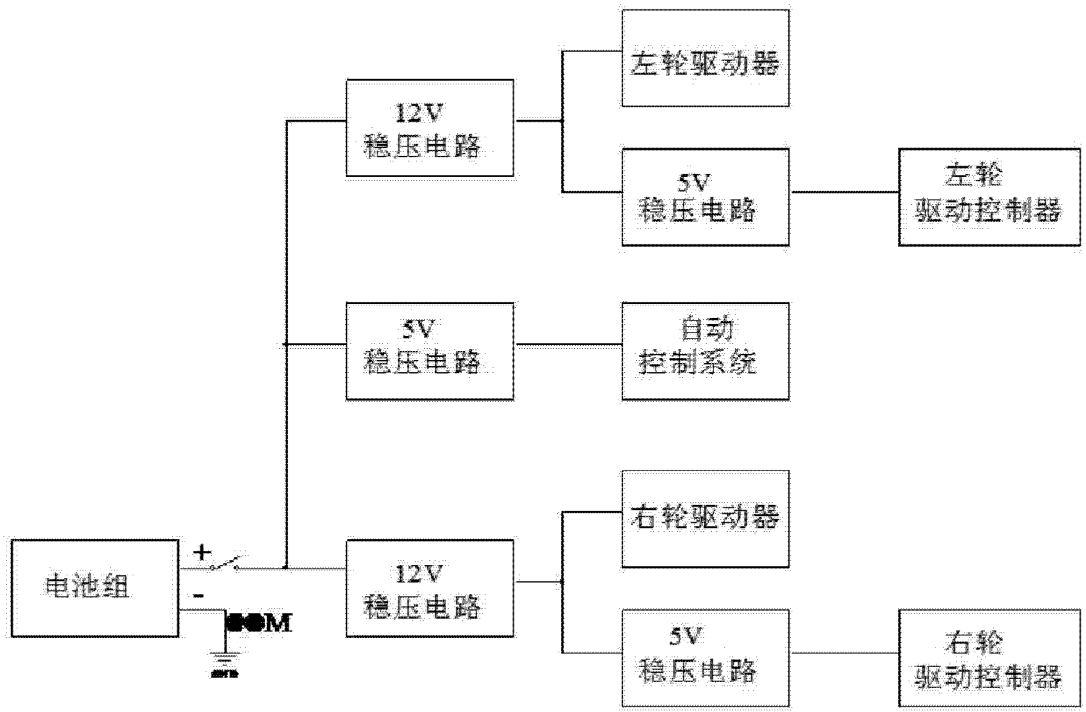
左轮驱动器
12V
稳压电路
5V
稳压电路
左轮
驱动控制器
5V
稳压电路
自动
控制系统
右轮驱动器
电池组
+
-
12V
稳压电路
5V
稳压电路
右轮
驱动控制器

图 3

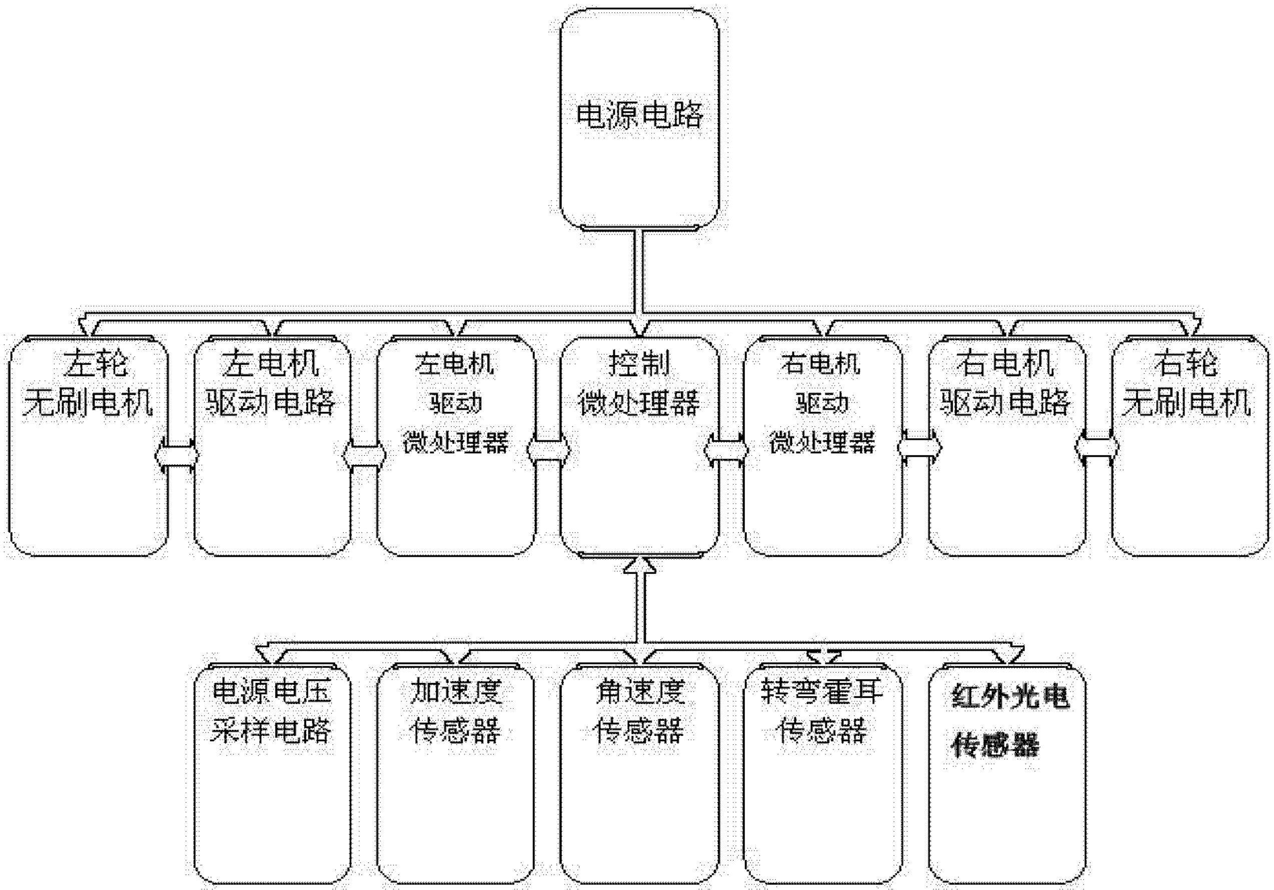
电源电路
左轮
无刷电机
左电机
驱动电路
左电机
驱动
微处理器
控制
微处理器
右电机
驱动
微处理器
右电机
驱动电路
右轮
无刷电机
电源电压
采样电路
加速度
传感器
角速度
传感器
转弯霍耳
传感器
红外光电
传感器

图 4

Espacenet

Bibliographic data: CN203381739 (U) — 2014-01-08

Self-balance two-wheel electric vehicle

Inventor(s):	SHEN HAITAO; MENG DEMING; MENG YUQUN; SU SHAOLING; GUAN ZENGHUI + (SHEN HAITAO, ; MENG DEMING, ; MENG YUQUN, ; SU SHAOLING, ; GUAN ZENGHUI)	
Applicant(s):	INST METAL RES CHINESE ACAD SC + (INSTITUTE OF METAL RESEARCH, CHINESE ACADEMY OF SCIENCES)	
Classification:	**- international:**	*B62K11/00; B62K3/00*
	- cooperative:	B62K11/007 (EP)
Application number:	CN201320300947U 20130528	
Priority number (s):	CN201320300947U 20130528	

Abstract of CN203381739 (U)

The utility model aims to provide a self-balance two-wheel electric vehicle. The self-balance two-wheel electric vehicle comprises a vehicle body chassis, motors, speed reducers, a battery, wheels, pedals, a display panel, a logic control system and a steering rocker; the vehicle body chassis is mounted on a middle shaft for connecting the left and right wheels; the battery and the two motors are mounted in the vehicle body chassis; two wheels on the left and right are respectively connected with one motor by one speed reducer; the pedals are arranged on the vehicle body chassis; the display panel is arranged in the middle of the pedals; the logic control system is mounted in the display panel and is formed by a power supply voltage reducing module, a motor driving circuit module, a microprocessor circuit module, a gyroscope, an acceleration sensor circuit module and a steering mechanism.

Notice

CLAIMS CN208381739

1.

A two-wheel self-balancing electric vehicle includes a vehicle body chassis, a motor, a reducer, a battery, a wheel, a foot pedal, a display panel, a logic control system, and a steering rocker;

Wherein, the chassis of the vehicle body is mounted on a shaft connecting the left and right wheels, and a battery and two motors are arranged inside the chassis of the vehicle body, wherein the left and right wheels are respectively connected to one motor through a reducer; the chassis of the vehicle body The above is a foot pedal; a display panel is arranged in the middle of the foot pedal, and a logic control system is installed inside;

The logic control system is composed of a power supply buck module, a motor drive circuit module, a microprocessor circuit module, a gyroscope, an acceleration sensor circuit module and a steering mechanism, wherein the battery inside the chassis of the vehicle body respectively supplies a power supply buck module and The motor drive circuit module supplies power; the power supply buck module supplies the microprocessor circuit module, the gyroscope, the acceleration sensor circuit module and the display panel after the voltage is dropped; the microprocessor circuit module collects the data of the gyroscope, the acceleration sensor circuit module and the steering mechanism And performing analysis and calculation, and then issuing a command to the motor drive circuit module, the motor drive circuit module respectively controls the rotation direction, the motor output power and the rotation speed of the two motors according to the instruction of the microprocessor circuit module; the steering mechanism is set on the foot pedal The front end is connected to the steering rocker, and a potentiometer is arranged inside the steering mechanism. When the driver rotates the rocker left and right, the potentiometer installed inside the steering mechanism sends a voltage signal to the microprocessor circuit module.

2

A two-wheeled self-balancing electric vehicle according to claim 1, wherein a power switch is provided on the display panel.

3

A two-wheeled self-balancing electric vehicle according to claim 1, wherein an LCD liquid crystal display and an LED indicator are provided on the display panel.

4

A two-wheeled self-balancing electric vehicle according to claim 1, wherein said steering rocker is a retractable rocker, and is composed of a telescopic rod, a locking device, a rocker and a handle, wherein one end of the rocker passes The locking device is connected with the telescopic rod, and the other end of the telescopic rod is provided with a handle, and one end of the rocking rod is connected with the steering mechanism.

5

A two-wheeled self-balancing electric vehicle according to claim 4, wherein said handle is provided with a handle.

6

A two-wheeled self-balancing electric vehicle according to claim 1, wherein a fender is provided on the wheel.

7.

The two-wheel self-balancing electric vehicle according to claim 1, wherein the logic control system of the two-wheel self-balancing electric vehicle further comprises a wireless remote control module, and is equipped with a corresponding remote controller to control the two-wheel self-balancing electric vehicle. The power-on and step-down modules respectively reduce the voltage to 12v, and after 5v, supply the wireless remote control module, and the wireless remote control module transmits the collected data to the microprocessor circuit module.

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A two-wheeled self-balancing electric vehicle according to claim 1, wherein said steering mechanism is a cylindrical full-sealing structure.

Notice

DESCRIPTION CN203381739

The object of the present invention is to provide a two-wheel self-balancing electric vehicle including a vehicle body chassis, a motor, a reducer, a battery, a wheel, a foot pedal, a display panel, a logic control system, and a steering a rocker; wherein the chassis of the vehicle body is mounted on a shaft connecting the left and right wheels, and a battery and two motors are arranged inside the chassis of the vehicle body, wherein the left and right wheels are respectively connected to a motor through a reducer; The car body chassis is provided with a foot pedal; a display panel is arranged in the middle of the foot pedal, and a logic control system is installed therein; the logic control system is composed of a power supply buck module, a motor drive circuit module, a microprocessor circuit module, a gyro The instrument, the accelerometer circuit module and the steering mechanism are composed.

Two-wheel self-balancing electric vehicle

Technical field

The utility model belongs to the field of automatic robot and automatic traveling vehicle design, and particularly provides a two-wheel self-balancing electric vehicle.

Background technique

For some roads that are relatively narrow or densely crowded and require flexible movement in a small space, because the size and structure of vehicles such as cars and electric vehicles are relatively large, they cannot move flexibly in tight spaces, and walking is tiring. The disadvantages are obvious, so there is a need for an electric mobility tool that can be flexibly driven in various situations without being restricted by the environment, and has a small size and a simple driving style.

Utility model content

The purpose of the utility model is to provide a two-wheel self-balancing electric vehicle, which has certain intelligence, can be self-balanced without interference from external factors, and has strong passability and flexibility.

The utility model particularly provides a two-wheel self-balancing electric vehicle, which comprises a vehicle body chassis, a motor, a reducer, a battery, a wheel, a pedal, a display panel, a logic control system and a steering shake. Rod

Wherein, the chassis of the vehicle body is mounted on a shaft connecting the left and right wheels, and a battery and two motors are arranged inside the chassis of the vehicle body, wherein the left and right wheels are respectively connected to one motor through a reducer; the chassis of the vehicle body The above is a foot pedal; a display panel is arranged in the middle of the foot pedal, and a logic control system is installed inside;

The logic control system is composed of a power supply buck module, a motor drive circuit module, a microprocessor circuit module, a gyroscope, an acceleration sensor circuit module and a steering mechanism, wherein the battery inside the chassis of the vehicle body respectively supplies a power supply buck module and The motor drive circuit module supplies power; the power supply buck module supplies the microprocessor circuit module, the gyroscope, the acceleration sensor circuit module and the display panel after the voltage is dropped; the microprocessor circuit module collects the data of the gyroscope, the acceleration sensor circuit module and the steering mechanism And performing analysis and calculation, and then issuing a command to the motor drive circuit module, the motor drive circuit module respectively controls the rotation direction, the motor output power and the rotation speed of the two motors according to the instruction of the microprocessor circuit module; the steering mechanism is set on the foot pedal The front end is connected to the steering rocker, and a potentiometer is arranged inside the steering mechanism. When the driver rotates the rocker left and right, the potentiometer installed inside the steering mechanism sends a voltage signal to the microprocessor circuit module.

The two-wheel self-balancing electric vehicle of the present invention is characterized in that a power switch is arranged on the display panel.

The two-wheel self-balancing electric vehicle of the utility model is characterized in that: an LCD liquid crystal display and an LED indicator light are arranged on the display panel.

The two-wheel self-balancing electric vehicle of the present invention is characterized in that: the steering rocker is a retractable rocker, which is composed of a telescopic rod, a locking device, a rocker and a handle, wherein one end of the rocker passes the lock The tensioning device is coupled to the telescopic rod, and the other end of the telescopic rod is provided with a handle, and one end of the rocker is connected to the steering mechanism.

The two-wheel self-balancing electric vehicle of the present invention is characterized in that: the handle is provided with a handle sleeve.

The two-wheel self-balancing electric vehicle of the present invention is characterized in that a fender is arranged on the wheel.

The two-wheel self-balancing electric vehicle of the utility model is characterized in that: the logic control system of the two-wheel self-balancing electric vehicle is further provided with a wireless remote control module, and is equipped with a corresponding remote controller to control the two-wheel self-balancing electric vehicle. Turning on and off; wherein the power step-down module drops the voltage to 12v, 5v, and then supplies the wireless remote control module, and the wireless remote control module transmits the collected data to the microprocessor circuit module.

The two-wheel self-balancing electric vehicle of the present invention is characterized in that the steering mechanism is a cylindrical full-sealing structure.

The advantages of the utility model are:

1、

The vehicle body has a simple structure, reasonable internal space, stable and reliable chip control, low manufacturing cost, light weight and small volume.

2、

It has a logic control system: it can self-control and limit the speed during the riding process. If it is overspeed, the system can issue an alarm and automatically drop to the set safe speed, and the attitude transition is stable, during the riding process. The start is smooth, the acceleration is strong and smooth.

In normal mode, the maximum riding speed is 18km/h. Through stable performance, it can not only ride on ordinary roads, but also travel on grass, dirt roads, sand and other roads. The maximum climbing angle is 30 degrees and the continuous driving distance is 15km.

There are two sets of motor drive systems, each driving two motors independently.

The motor drive circuit can adopt stable and high-power MOS tube, withstand voltage of 75v, can withstand 209A current, can effectively avoid the large current impact caused by motor stall, resulting in burning the device on the motor drive board, causing the two-wheel balance car to suddenly lose. Power can't work.

3、

The height of the steering rocker can be adjusted to the appropriate position according to the driver's height. The steering rocker has a folding and quick disassembly function, which is convenient for storage in a relatively small space. The soft rubber material on the handle is not only beautiful, but also non-slip and increases the comfort of the driver.

4、

User-friendly display panel: It is divided into two parts. The LCD panel displays the current working status of the balance car (driving mode), showing the remaining battery capacity, the mileage that can be driven, the speed of driving, etc.; there are also 7 LED indicators on the display panel. The lamp, in which the blue 5 LEDs are responsible for displaying the real-time car body posture, the red LED is a hazard warning light, and when the red light is on, the speaker also emits an alarm sound, and the green LED is the work indicator light.

5、

Wireless control: The switch can be turned on and off with a wireless remote control handle, and has an anti-theft alarm function.

Turning the lights on and off with a wireless remote control handle increases safety during night driving. The wireless remote control handle can change different driving modes in real time according to different drivers. The novice mode is the learning mode, which allows the driver who has just contacted the two-wheeled balance car to understand the functions of the two-wheeled balance car more quickly. Drive at a lower speed. The normal mode is all-terrain mode, and the vehicle speed is high, which is suitable for driving on various roads.

6、

The steering mechanism can be designed as a cylindrical full-sealed structure, which not only has beautiful appearance, but also reduces the occupied space. The steering mechanism is mainly responsible for the direction control, and can rotate left and right along the axis, and the steering rocker can smoothly move in the left and right direction of the axis. With high elasticity. A potentiometer is installed inside the steering mechanism. When the driver rotates the rocker to the left and right of the axis, the potentiometer installed inside the steering mechanism collects a linear voltage, and the logic control system collects the data and makes a calculation, and transmits the result to the The drive circuit of the two motors controls the direction and speed of the motor rotation.

7、

The battery adopts lithium iron phosphate power battery, with high efficiency output, standard discharge is 30-60C, continuous high current discharge can reach 60C, and instantaneous pulse discharge (10s) can reach 130A. It has an excellent cycle life, and its discharge capacity is still greater than 95% after 1500cycles. The power is fast, the cost is low, and there is no pollution to the environment.

DRAWINGS

Figure 1 Two-wheel self-balancing electric vehicle structure diagram (1 of which Handle, 1.1 handle handle, 2 Retractable pole, 3 Locking device, 4 Turn the rocker, 5 Steering mechanism, 6 Fender, 7. Wheel, 8 Reducer, 9 Display panel, 10 Power switch, 11. Foot pedal, 12 Battery, 13 Logic control circuit, 14 Motor, 15 Car body chassis);

Figure 2is a block diagram of the working principle of two-wheel self-balancing electric vehicle.

detailed description

Example 1

The two-wheel self-balancing electric vehicle of the utility model comprises a vehicle body chassis 15, a motor 14, a speed reducer 8, a battery 12, a wheel 7, a fender 6, a foot pedal 11, a display panel 9, a logic control system, and a power switch. 10. Steering the joystick and the remote control;

The self-balancing electric vehicle is provided with two left and right wheels 7 with a fender 6 mounted on a shaft connecting the left and right wheels 7 and a driving battery inside the chassis 15 of the vehicle body. 12. Two motors 14, wherein the left and right wheels 7 are respectively connected to a motor 14 through a reducer 8; the car body chassis is a foot pedal 11 for supporting the human body; and the foot pedal 11 In the middle is a display panel 9, which is respectively provided with an LCD liquid crystal display, an LED indicator and a power switch 10, and the display panel 9 is internally provided with a logic control system.

The logic control system is composed of a power supply buck module, a motor drive circuit module, a microprocessor circuit module, a gyroscope, an acceleration sensor circuit module, a wireless remote control module and a steering mechanism 5, wherein the battery 12 inside the chassis of the vehicle body respectively Power supply buck module and motor drive circuit module; power buck module reduces voltage to 12v, 5v to supply microprocessor circuit module, gyroscope, acceleration sensor circuit module, wireless remote control module; wireless remote control module receives remote control to send The signal, the microprocessor circuit module acquires the data of the gyroscope, the acceleration sensor circuit module, the wireless remote control module, the steering mechanism 5, and analyzes and calculates, and outputs a command to the motor drive circuit module after calculation; the motor drive circuit module is based on the microprocessor circuit module The command is issued to respectively control the rotation direction of the two motors, the motor output power and the rotation speed; the steering mechanism 5 is disposed at the front end of the foot pedal and connected to the steering rocker, and a potentiometer is installed inside the steering mechanism 5, and the driver is along the axis When the rocker is rotated, it is installed in the steering mechanism 5 The potentiometer collects a linear voltage and sends the collected data to the microprocessor circuit module. The microprocessor circuit module makes a calculation and transmits the result to the two motor drive circuit modules respectively to drive the direction of motor rotation. And speed.

The steering rocker is a retractable rocker, which is composed of a telescopic rod 2, a locking device 3, a rocker 4 and a handle 1. The rocker 4 is connected with the telescopic rod 2 through a locking device 3, and the telescopic rod 2 is A handle 1 with a handle sleeve 1.1 is provided at one end, and the other end of the rocker 4 is connected to the steering mechanism 5.

The above embodiments are only intended to illustrate the technical concept and the features of the present invention, and the purpose of the present invention is to enable those skilled in the art to understand the contents of the present invention and to implement the present invention, and the scope of the present invention is not limited thereto. Equivalent changes or modifications made in accordance with the spirit of the invention are intended to be included within the scope of the invention.

(19) 中华人民共和国国家知识产权局

(12) 实用新型专利

(10) 授权公告号 CN 203381739 U
(45) 授权公告日 2014.01.08

(21) 申请号 201320300947.5

(22) 申请日 2013.05.28

(73) 专利权人 中国科学院金属研究所
地址 110015 辽宁省沈阳市沈河区文化路 72 号

(72) 发明人 沈海涛 孟德铭 孟宇群 宿少玲 关增辉

(74) 专利代理机构 沈阳晨创科技专利代理有限责任公司 21001
代理人 张晨

(51) Int.Cl.
B62K 3/00(2006.01)
B62K 11/00(2013.01)

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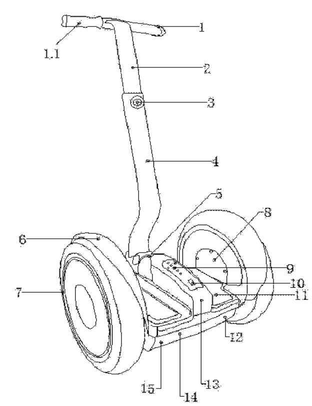
(54) 实用新型名称

一种两轮自平衡电动车

(57) 摘要

本实用新型的目的在于提供一种两轮自平衡电动车，所述两轮自平衡电动车包括车体底盘、电机、减速机、电池、车轮、脚踏板、显示面板、逻辑控制系统以及转向摇杆；其中，车体底盘安装在连接左右两个车轮中间的轴上，在车体底盘内部安有电池和两台电机，其中左右两个车轮分别通过一台减速机与一台电机相连；车体底盘上面为脚踏板；在脚踏板中间设有显示面板，其内部装有逻辑控制系统；所述逻辑控制系统由电源降压模块，电机驱动电路模块，微处理器电路模块，陀螺仪，加速度传感器电路模块以及转向机构组成。



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1. 一种两轮自平衡电动车，所述两轮自平衡电动车包括车体底盘、电机、减速机、电池、车轮、脚踏板、显示面板、逻辑控制系统以及转向摇杆；

其中，车体底盘安装在连接左右两个车轮中间的轴上，在车体底盘内部安有电池和两台电机，其中左右两个车轮分别通过一台减速机与一台电机相连；车体底盘上面为脚踏板；在脚踏板中间设有显示面板，其内部装有逻辑控制系统；

所述逻辑控制系统由电源降压模块，电机驱动电路模块，微处理器电路模块，陀螺仪，加速度传感器电路模块以及转向机构组成，其中，在车体底盘内部的电池分别给电源降压模块和电机驱动电路模块供电；电源降压模块将电压下降后供给微处理器电路模块、陀螺仪、加速度传感器电路模块以及显示面板；微处理器电路模块采集陀螺仪、加速度传感器电路模块和转向机构的数据，并进行分析计算，计算后发出指令到电机驱动电路模块，电机驱动电路模块根据微处理器电路模块发出指令分别控制两台电机的旋转方向、电机输出功率和转速；转向机构设置在脚踏板前端，并与转向摇杆相连，在转向机构内部安有一个电位器，驾驶者左右旋转摇杆时，安装在转向机构内部的电位器将电压信号发送给微处理器电路模块。

2. 按照权利要求 1 所述两轮自平衡电动车，其特征在于：在显示面板上设有电源开关。

3. 按照权利要求 1 所述两轮自平衡电动车，其特征在于：在显示面板上设有 LCD 液晶显示屏和 LED 指示灯。

4. 按照权利要求 1 所述两轮自平衡电动车，其特征在于：所述转向摇杆为可以伸缩的摇杆，由可伸缩杆、锁紧装置、摇杆以及手柄组成，其中摇杆的一端通过锁紧装置与可伸缩杆连接，可伸缩杆的另一端设有手柄，摇杆的一端与转向机构相连。

5. 按照权利要求 4 所述两轮自平衡电动车，其特征在于：所述手柄上设有把套。

6. 按照权利要求 1 所述两轮自平衡电动车，其特征在于：在车轮上设有挡泥板。

7. 按照权利要求 1 所述两轮自平衡电动车，其特征在于：所述两轮自平衡电动车的逻辑控制系统还设有无线遥控模块，并配有相应遥控器来控制两轮自平衡电动车的开启与关闭；其中电源降压模块分别将电压下降到 12v，5v 后供给无线遥控模块，无线遥控模块将所采集到的数据传递给微处理器电路模块。

8. 按照权利要求 1 所述两轮自平衡电动车，其特征在于：所述转向机构为筒型全密封结构。

一种两轮自平衡电动车

技术领域

[0001] 本实用新型属于自动化机器人、自动化代步交通工具设计领域，特别提供一种两轮自平衡电动车。

背景技术

[0002] 对于一些道路比较狭窄或人员比较密集，要求在小空间范围内灵活运动的场合，由于汽车、电动车等车辆的体积和架构比较庞大，不能在狭小的空间灵活运动，且步行又令人感觉疲惫，缺点比较明显，因此需要有一种可以不受环境限制，能够在各种场合灵活行驶，且体积小、驾驶方式简单的电动代步工具。

实用新型内容

[0003] 本实用新型的目的在于提供一种两轮自平衡电动车，该车具有一定的智能，不受外部因素干扰能够自我平衡，并且有较强的通过性和灵活性。

[0004] 本实用新型具体提供了一种两轮自平衡电动车，所述两轮自平衡电动车包括车体底盘、电机、减速机、电池、车轮、脚踏板、显示面板、逻辑控制系统以及转向摇杆；

[0005] 其中，车体底盘安装在连接左右两个车轮中间的轴上，在车体底盘内部安有电池和两台电机，其中左右两个车轮分别通过一台减速机与一台电机相连；车体底盘上面为脚踏板；在脚踏板中间设有显示面板，其内部装有逻辑控制系统；

[0006] 所述逻辑控制系统由电源降压模块，电机驱动电路模块，微处理器电路模块，陀螺仪，加速度传感器电路模块以及转向机构组成，其中，在车体底盘内部的电池分别给电源降压模块和电机驱动电路模块供电；电源降压模块将电压下降后供给微处理器电路模块、陀螺仪、加速度传感器电路模块以及显示面板；微处理器电路模块采集陀螺仪、加速度传感器电路模块和转向机构的数据，并进行分析计算，计算后发出指令到电机驱动电路模块，电机驱动电路模块根据微处理器电路模块发出指令分别控制两台电机的旋转方向、电机输出功率和转速；转向机构设置在脚踏板前端，并与转向摇杆相连，在转向机构内部安有一个电位器，驾驶者左右旋转摇杆时，安装在转向机构内部的电位器将电压信号发送给微处理器电路模块。

[0007] 本实用新型所述两轮自平衡电动车，其特征在于：在显示面板上设有电源开关。

[0008] 本实用新型所述两轮自平衡电动车，其特征在于：在显示面板上设有 LCD 液晶显示屏和 LED 指示灯。

[0009] 本实用新型所述两轮自平衡电动车，其特征在于：所述转向摇杆为可以伸缩的摇杆，由可伸缩杆、锁紧装置、摇杆以及手柄组成，其中摇杆的一端通过锁紧装置与可伸缩杆连接，可伸缩杆的另一端设有手柄，摇杆的一端与转向机构相连。

[0010] 本实用新型所述两轮自平衡电动车，其特征在于：所述手柄上设有把套。

[0011] 本实用新型所述两轮自平衡电动车，其特征在于：在车轮上设有挡泥板。

[0012] 本实用新型所述两轮自平衡电动车，其特征在于：所述两轮自平衡电动车的逻辑

控制系统还设有无线遥控模块，并配有相应遥控器来控制两轮自平衡电动车的开启与关闭；其中电源降压模块分别将电压下降到 12v，5v 后供给无线遥控模块，无线遥控模块将所采集到的数据传递给微处理器电路模块。

[0013] 本实用新型所述两轮自平衡电动车，其特征在于：所述转向机构为筒型全密封结构。

[0014] 本实用新型的优点在于：

[0015] 1、车体结构简单，内部空间合理，采用稳定可靠且比较低廉的芯片控制，制造成本低，重量轻，体积小。

[0016] 2、设有逻辑控制系统：在骑行过程中能够自我控制和限定速度，如果一旦超速，系统能够发出报警，并自动降到所设定的安全速度内，且姿态转换平稳，在骑行过程中能够达到启动平稳、加速有力且顺滑。正常模式最大骑行时速为 18km/h。通过性能稳定，不但能够在普通路面骑行，而且能够在草地、土路、沙石等路面上行驶。最大爬坡角度为 30 度，连续行驶里程 15km。

[0017] 设有两套电机驱动系统，分别独立驱动两台电机工作。

[0018] 电机驱动电路可以采用稳定大功率的 MOS 管，耐压 75v，能承受 209A 电流，能够有效避免电机堵转带来的大电流冲击，导致烧毁电机驱动板上的器件，造成两轮平衡车突然失去动力无法工作。

[0019] 3、转向摇杆的高度可以根据驾驶者的身高调节到合适的位置，转向摇杆带有折叠和速拆卸功能，便于存放在比较小的空间内。手柄上外敷软胶皮材料，不仅美观，还可以防滑并增加了驾驶者的舒适性。

[0020] 4、人性化显示面板：其中分为两部分，LCD 液晶面板显示平衡车当前的工作状态（驾驶模式），显示剩余电量、可行驶的里程、行驶的速度等；显示面板上还设有 7 个 LED 指示灯，其中蓝色的 5 个 LED 负责显示实时的车体姿态，红色 LED 为危险报警灯，在红灯亮起时同时喇叭也随之发出报警声，绿色 LED 为工作指示灯。

[0021] 5、无线控制：可以通过无线遥控手柄实现开关机，并带有防盗报警功能。通过无线遥控手柄实现灯光开启和关闭，这样可以增加在夜间驾驶的安全性。通过无线遥控手柄可以根据不同的驾驶者，实时的改变不同的驾驶模式，新手模式为学习模式，可以让刚刚接触两轮平衡车的驾驶者更快的了解两轮平衡车的各项功能，以较低的速度行驶。正常模式即为全地形模式，车速较高，适合在各种不同的路面上行驶。

[0022] 6、转向机构可以设计为筒型全密封结构，不但美观，而且降低了所占用的空间，转向机构主要负责方向的控制，能够左、右沿轴线转动，转向摇杆能够以轴为中心左右方向平滑运动，具有高弹性。在转向机构内部安有一个电位器，驾驶者沿轴线左右旋转摇杆时，安装在转向机构内部的电位器采集到一个线性电压，逻辑控制系统采集到数据并做出计算，将结果分别传输到两台电机的驱动电路上，控制电机旋转的方向和速度。

[0023] 7、电池采用磷酸铁锂动力电池，以高效率输出，标准放电为 30-60C，连续高电流放电可达 60C，瞬间脉冲放电（10s）可达 130A。具有极好的循环寿命，经 1500 次循环，其放电容量仍大于 95%。冲电速度快，成本低，对环境无污染。

附图说明

[0024]　图 1 两轮自平衡电动车结构图(其中 1. 手柄、1.1 手柄把套、2. 可伸缩杆、3. 锁紧装置、4. 转向摇杆、5. 转向机构、6. 挡泥板、7. 车轮、8. 减速机、9. 显示面板、10. 电源开关、11. 脚踏板、12. 电池、13. 逻辑控制电路、14. 电机、15. 车体底盘)；

[0025]　图 2 两轮自平衡电动车工作原理结构框图。

具体实施方式

[0026]　实施例 1

[0027]　本实用新型所述两轮自平衡电动车包括车体底盘 15、电机 14、减速机 8、电池 12、车轮 7、挡泥板 6、脚踏板 11、显示面板 9、逻辑控制系统、电源开关 10、转向摇杆以及遥控器；

[0028]　其中，所述自平衡电动车设有左右两个带有挡泥板 6 的车轮 7，车体底盘 15 安装在连接左右两个车轮 7 中间的轴上，在车体底盘 15 内部安有驱动电池 12、两台电机 14，其中左右两个车轮 7 分别通过一台减速机 8 与一台电机 14 相连；所述车体底盘上面为脚踏板 11，为支撑人体的板；在脚踏板 11 中间为显示面板 9，其面板上分别设有 LCD 液晶显示屏、LED 指示灯和电源开关 10，显示面板 9 内部装有逻辑控制系统。

[0029]　所述逻辑控制系统由电源降压模块，电机驱动电路模块，微处理器电路模块，陀螺仪，加速度传感器电路模块，无线遥控模块以及转向机构 5 构成，其中，在车体底盘内部的电池 12 分别给电源降压模块和电机驱动电路模块供电；电源降压模块将电压下降到 12v，5v 后供给微处理器电路模块，陀螺仪，加速度传感器电路模块，无线遥控模块；无线遥控模块接收遥控器发送的信号，微处理器电路模块采集陀螺仪，加速度传感器电路模块，无线遥控模块，转向机构 5 的数据并分析计算，计算后发出指令到电机驱动电路模块；电机驱动电路模块根据微处理器电路模块发出指令分别控制两台电机的旋转方向、电机输出功率和转速；转向机构 5 设置在脚踏板前端，并与转向摇杆相连，在转向机构 5 内部安有一个电位器，驾驶者沿轴线左右旋转摇杆时，安装在转向机构 5 内部的电位器采集到一个线性电压，并将采集到的数据发送给微处理器电路模块，微处理器电路模块做出计算，将结果分别传输到两台电机驱动电路模块上，驱动电机旋转的方向和速度。

[0030]　转向摇杆为可以伸缩的摇杆，由可伸缩杆 2、锁紧装置 3、摇杆 4 以及手柄 1 组成，其中摇杆 4 通过锁紧装置 3 与可伸缩杆 2 连接，可伸缩杆 2 的一端设有带有手柄把套 1.1 的手柄 1，摇杆 4 的另一端与转向机构 5 相连。

[0031]　上述实施例只为说明本实用新型的技术构思及特点，其目的在于让熟悉此项技术的人士能够了解本实用新型的内容并据以实施，并不能以此限制本实用新型的保护范围。凡根据本实用新型精神实质所作的等效变化或修饰，都应涵盖在本实用新型的保护范围之内。

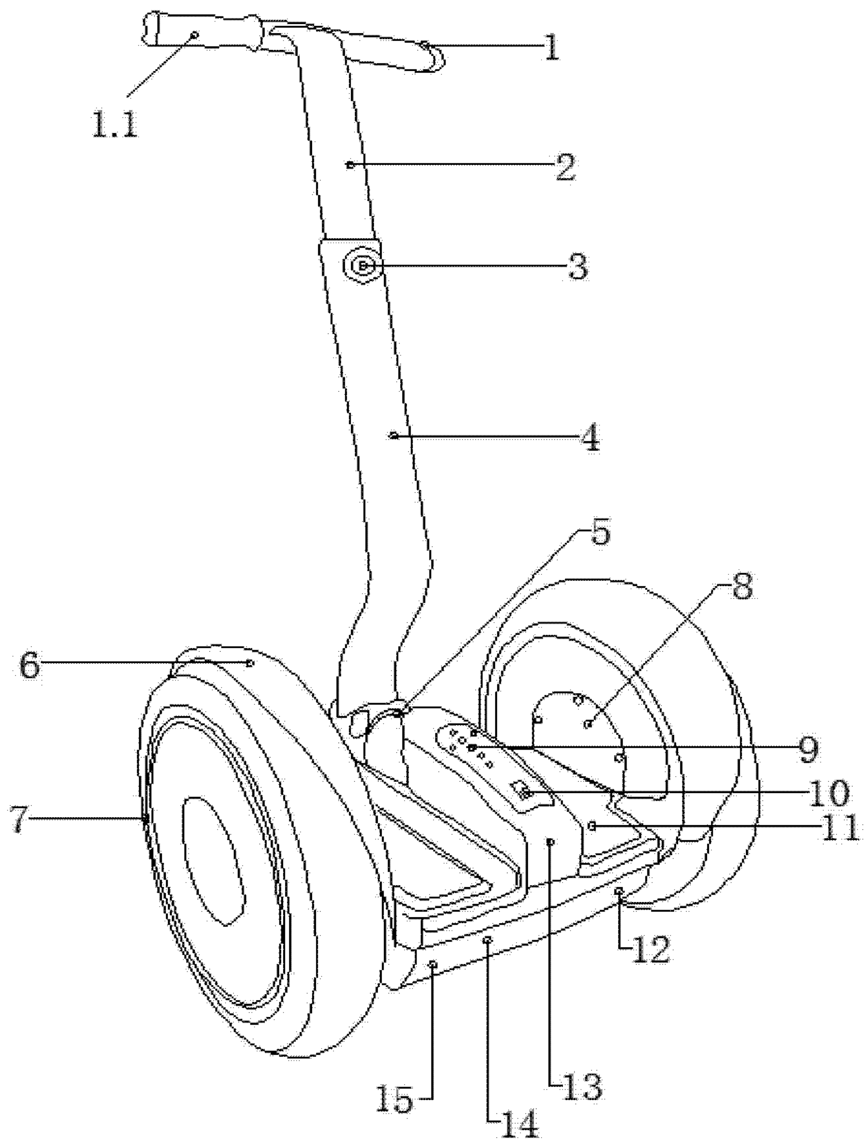

图 1

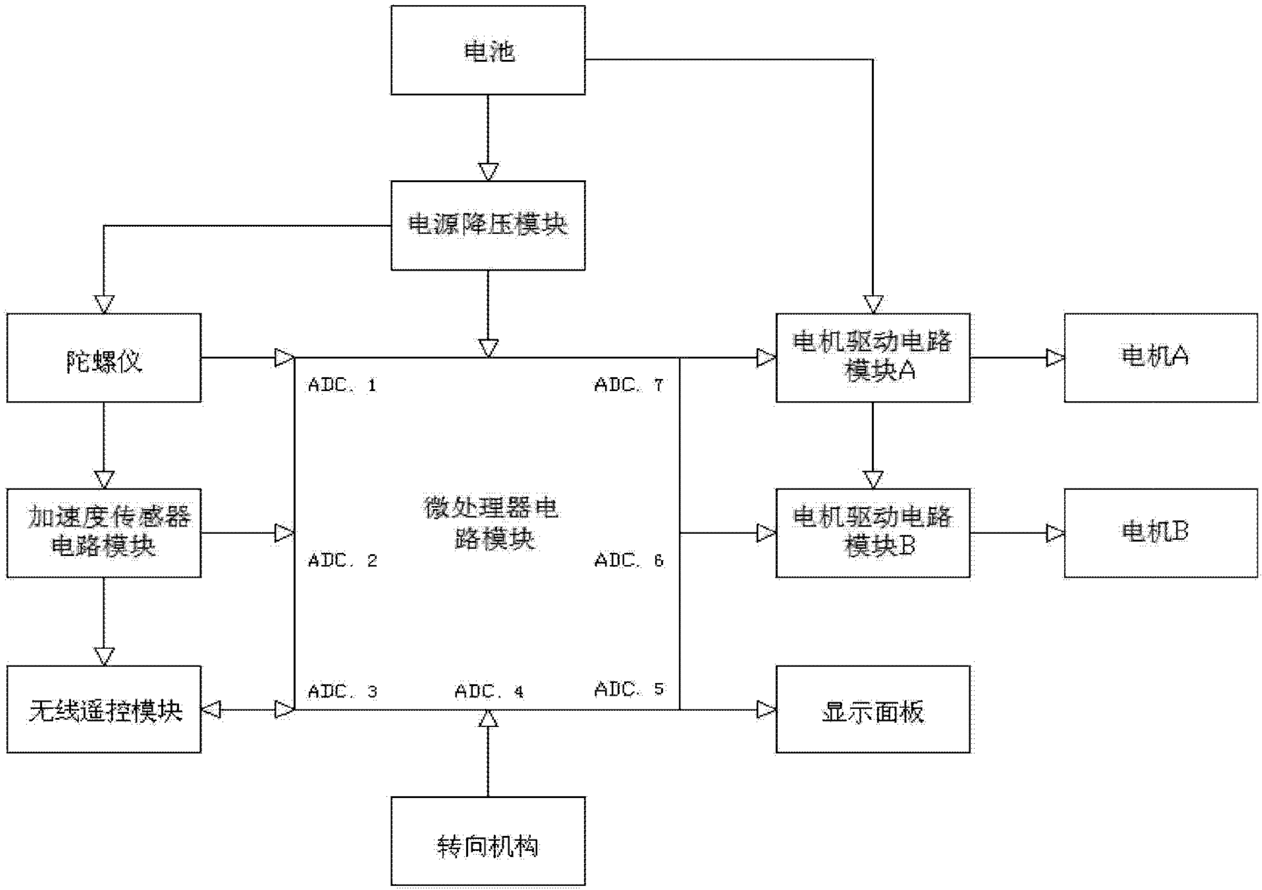
电池
电源降压模块
陀螺仪
加速度传感器电路模块
无线遥控模块
微处理器电路模块
ADC. 1
ADC. 2
ADC. 3
ADC. 4
ADC. 5
ADC. 6
ADC. 7
电机驱动电路模块A
电机驱动电路模块B
电机A
电机B
显示面板
转向机构

图 2

Espacenet

Bibliographic data: CN203698535 (U) — 2014-07-09

Two-wheeled balance car with dual-adjustment rotating shaft

Inventor(s):	YING YIFAN; WEI QINGQIAN + (YING YIFAN, ; WEI QINGQIAN)	
Applicant(s):	SHANGHAI CHUANGHUI ROBOT TECHNOLOGY CO LTD + (SHANGHAI CHUANGHUI ROBOT TECHNOLOGY CO., LTD)	
Classification:	**- international:**	***B62K11/00***
	- cooperative:	
Application number:	CN20142066028U 20140214	
Priority number (s):	CN20142066028U 20140214	

Abstract of CN203698535 (U)

The utility model discloses a two-wheeled balance car with a dual-adjustment rotating shaft. A car body is formed by combining a left car body and a right car body. A load-bearing platform is also divided into a left platform and a right platform. The left car body and the right car body are connected in a rotating mode through the rotating shaft to form the flexibly-connected combined type car body. The left car body and the right car body rotate round the rotating shaft. The left car body and the left platform rotate synchronously, and the right car body and the right platform rotate synchronously. Sensors used for real-time detection of the difference between the posture of the left platform and the posture of the right platform are arranged inside the left car body and the right car body respectively. Control panels conduct independent control over a left half car balance system and a right half car balance system respectively according to signals of the sensors, so that the self-balancing state of the two-wheeled balance car is realized. According to the two-wheeled balance car with the dual-adjustment rotating shaft, the left car body and the right car body are connected through the rotating shaft, the left car body and the right car body can rotate around the rotating shaft, distributed control cover software and hardware is realized, the manual-control burden is reduced, an operator can control the direction through the body posture, and the two-wheeled balance car is simpler in structure, more flexible to operate and control, and lighter in overall weight.

DGL Exhibit 1002

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Notice

CLAIMS CN208698535

1.

A two-wheel balance car capable of double-tuning a shaft, comprising a vehicle body, a load platform, a battery, a control board (5), two wheel hub motors (7) and two wheels, and the two hub motors (7) are respectively fixedly mounted on a battery and a control board (5) are mounted on the left and right sides of the vehicle body, and the carrying platform is fixedly mounted on the vehicle body between the two wheels, wherein the vehicle body is left by the vehicle. The body (1) and the right body (2) are combined, and the bearing platform is also divided into two parts, a left platform (4) and a right platform (6), in the left body (1) and Between the right body (2), the left body (1) and the right body (2) are rotationally coupled by a rotating shaft (3) to form a flexible coupled combined body, the left The vehicle body (1) and the right vehicle body (2) rotate about the rotating shaft (3), and the left vehicle body (1) and the left platform (4) rotate synchronously, and the right vehicle body (2) Rotating synchronously with the right platform (6), the left platform (4), the left body (1), and a hub coupled to the left outer side The machine (7) forms a left half-vehicle balance system, the right platform (6), the right body (2) and another hub motor (7) coupled on the right outer side form a right half-car balance system, A set of sensors for detecting the posture of the left platform (4) in real time is disposed in the left body (1), and another set of sensors for detecting the posture of the right platform (6) in real time is disposed in the right body (2). The control board (5) independently controls the left half-vehicle balance system and the right half-vehicle balance system according to the signals of the sensors to realize the self-balancing state of the two-wheel balance vehicle.

2.

The two-wheel balancer according to claim 1, wherein the control board (5) is provided with a signal fusion unit, and the left half-vehicle balance system and the right half-vehicle balance system are provided. The attitude signal processing data is subjected to fusion calculation, and then the control board (5) issues an executable command signal to each of the hub motors (7).

Notice

DESCRIPTION CN208698535

The utility model discloses a two-wheel balance car capable of double-tuning a rotating shaft, wherein the vehicle body is composed of a combination of a left body and a right body, and the bearing platform is also divided into two parts: a left platform and a right platform. The left car body and the right car body are rotationally coupled by a rotating shaft to form a flexible coupled composite car body. The left and right car bodies rotate around the rotating shaft, and the left car body and the left platform rotate synchronously, and the right car body and the right platform are rotated. Synchronous rotation, different sensors for real-time detection of the left and right platform attitudes are respectively arranged in the left vehicle body, and the control panel independently controls the left half-vehicle balance system and the right half-vehicle balance system according to the signals of the respective sensors to realize the two-wheel balance vehicle. Self-balancing state. The utility model adopts a rotating shaft to link the left and right vehicle bodies, and the left and right vehicle bodies can rotate around the rotating shaft, realize distributed control of software and hardware, reduce the burden of manual control, and the controller can control the direction by the posture of the body, and the structure is simpler. The control is more flexible and the whole vehicle is lighter.

Two-wheel balance car with dual adjustment shaft

Technical field

The utility model relates to a self-balancing transportation vehicle, in particular to a two-wheel balancing vehicle, which is applied in the technical field of self-balancing control.

Background technique

The two-wheeled balance car in the existing market usually adopts a special balancing strategy to drive two wheels to perform positive and negative reversal to achieve vehicle body balance. The turning control generally needs to be manually controlled, and the driver's hands and feet are required to be used. The structure is complicated. Poor handling, mainly due to the unreasonable structure of the two-wheeled vehicle.

Utility model content

The utility model aims to overcome the deficiencies of the prior art, and provides a two-wheel balance vehicle capable of double-adjusting a rotating shaft, which adopts a rotating shaft to couple the left body and the right body, and the left body and the right body can rotate around the rotating shaft. The battery and the control board are placed inside to realize distributed control of software and hardware, reducing the burden of hand control. The controller can control the direction by the posture of the body, has a simpler structure and more flexible handling, and the whole vehicle is light and portable. .

In order to achieve the above invention and creation purpose, the utility model adopts the following technical solutions:

A two-wheel balance vehicle capable of double-tuning a shaft, comprising a vehicle body, a load platform, a battery, a control board, two wheel hub motors and two wheels, a battery and a control panel are installed in the vehicle body, and two wheel hub motors are respectively fixedly mounted on the vehicle The left and right sides of the body are fixedly mounted on the vehicle body between the two wheels. The car body is composed of a left car body and a right car body, and the load platform is also divided into a left platform and a right platform. In part, between the left body and the right body, the left body and the right body are coupled by a rotating shaft to form a flexible coupled vehicle body, and the left body and the right body rotate around the rotating shaft, and the left car The body and the left platform rotate synchronously, the right body and the right platform rotate synchronously, and the left platform, the left body and the one hub motor connected on the left outer side form a left half balance system, the right platform, the right body and the right outer joint The other wheel motor forms the right half-car balance system. The left car body is provided with a set of sensors for real-time detection of the left platform attitude. The right car body is provided with another set of sensors for real-time detection of the right platform attitude. Signals from the sensors, independently controlled left and right vehicle drive system balance balance system, to achieve equilibrium state from two balanced car.

As a preferred technical solution of the present invention, a signal fusion unit is provided in the control panel, and the attitude signal processing data of the left half-vehicle balance system and the right half-vehicle balance system are combined and calculated, and then the control board separately sends out to each hub motor.

Executable instruction signals.

Compared with the prior art, the utility model has the following substantive features and advantages:

Compared with the current two-wheeled balance car on the market, when driving the utility model, the two-wheel balance car with dual-rotation shaft can control the direction by the posture of the body, reduce the manual operation, and have a simpler structure and more. Flexible handling, light weight, more energy saving and high intelligence.

DRAWINGS

1is a schematic view showing the structure of a two-wheel balance vehicle capable of double-adjusting a rotating shaft according to a preferred embodiment of the present invention.

detailed description

The preferred embodiment of the present invention is described below with reference to the accompanying drawings:

In this embodiment, referring to FIG. 1, a two-wheel balance vehicle capable of double-tuning a shaft includes a vehicle body, a load platform, a battery, a control panel 5 two hub motors 7and two wheels, and two hub motors 7They are fixedly mounted on the left and right sides of the vehicle body, and the battery and control board 5are installed in the vehicle body. The load platform is fixedly mounted on the vehicle body between the two wheels, and the vehicle body is composed of the left body 1and the right body 2The carrier platform is also divided into two parts, a left platform 4and a right platform 6 and between the left body 1and the right body 2, the left body 1and the right body 2are rotatably coupled via a rotating shaft 3 Forming a flexible coupled vehicle body, the left body 1and the right body 2rotate about the rotating shaft 3 the left body 1and the left platform 4 rotate synchronously, and the right body 2and the right platform 6rotate synchronously, and the left platform 4 The left body 1and a hub motor 7coupled to the left outer side form a left half balance system, and the right platform 6 the right body 2and the other hub motor 7coupled to the right outer side form a right half balance system. A set of sensors for detecting the attitude of the left platform 4in real time is provided in the left body 1, and the right body 2is provided Another real time detection sensor group of a right attitude platform 6 the control board 5in accordance with signals from the sensors, independently controlled left and right vehicle drive system balance balance system, to achieve equilibrium state from two balanced car. In this embodiment, the structure of the two-wheel balance car with dual-tuning shaft is reasonable and simple, the controller can control the direction by the posture of the body, and does not need to set a special hand-controlled direction controller, and the maneuverability is greatly improved, and the steering control of both hands is liberated. To make the occupants more focused on the control of the two-wheeled balance car.

In this embodiment, referring to FIG. 1, a signal fusion unit is disposed in the control board 5 and the attitude signal processing data of the left half-vehicle balance system and the right half-vehicle balance system are fused and calculated, and then respectively controlled by the control board 5The hub motor 7issues an executable command signal, and through the fusion calculation, realizes the signal processing analysis of the mutual influence of the left half-vehicle balance system and the right half-vehicle balance system, the signal processing is more precise, the positioning of the balance control is improved, and the posture control is improved. Sensitivity and achieve more efficient energy savings.

The embodiments of the present invention have been described above with reference to the accompanying drawings, but the present invention is not limited to the above embodiments, and various changes can be made according to the purpose of the utility model creation of the present invention, and the spirit of the technical solution according to the present invention is The changes, modifications, substitutions, combinations, and simplifications made under the essence and principle should be equivalent replacement methods. As long as they conform to the structure and construction principle of the two-wheel balance car used for the double-tuning shaft of the present invention, The scope of protection of utility models.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 203698535 U
(45)授权公告日 2014.07.09

(21)申请号 201420066028.0

(22)申请日 2014.02.14

(73)专利权人 上海创绘机器人科技有限公司
地址 201800 上海市嘉定区城中路20号数码B楼204室

(72)发明人 应亦凡 魏庆前

(51)Int.Cl.
B62K 11/00(2013.01)

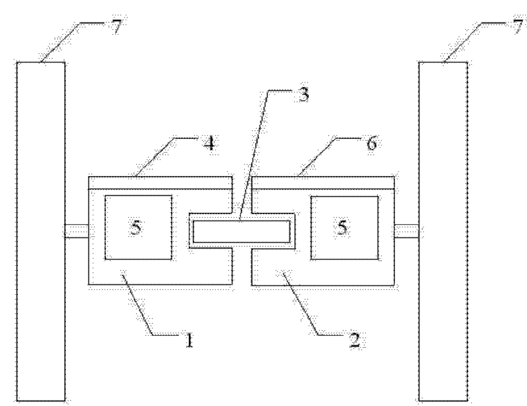
权利要求书1页 说明书2页 附图1页

(54)实用新型名称

可双调转轴的两轮平衡车

(57)摘要

本实用新型公开了一种可双调转轴的两轮平衡车，其车体由左车体和右车体两部分组合而成，同时也将承载平台分割成左平台和右平台两部分，在左车体和右车体之间通过一个转轴转动联接，形成柔性联接的组合式的车体，左、右车体围绕转轴进行转动，左车体和左平台同步转动，右车体和右平台同步转动，左车体内分别设有实时检测左、右平台姿态的不同的传感器，控制板根据各传感器的信号，分别独立控制左半车平衡系统和右半车平衡系统，实现两轮平衡车的自平衡状态。本实用新型采用转轴联结左、右车体，并且左、右车体可绕转轴转动，实现软件和硬件的分布式控制，减少手控负担，操控者可以依靠身体的姿态控制方向，结构更简单，操控更灵活，整车更轻便。



CN 203698535 U

1. 一种可双调转轴的两轮平衡车，包括车体、承载平台、电池、控制板（5）、两台轮毂电机（7）和两个车轮，两个轮毂电机（7）分别固定安装在所述车体的左右两侧，所述车体内安装电池和控制板（5），所述承载平台固定安装在两个车轮之间的车体上，其特征在于：所述车体由左车体（1）和右车体（2）两部分组合而成，同时也将所述承载平台分割成左平台（4）和右平台（6）两部分，在所述左车体（1）和所述右车体（2）之间，通过一个转轴（3）转动联接所述左车体（1）和所述右车体（2），形成柔性联接的组合式的车体，所述左车体（1）和所述右车体（2）围绕所述转轴（3）进行转动，所述左车体（1）和所述左平台（4）同步转动，所述右车体（2）和所述右平台（6）同步转动，所述左平台（4）、所述左车体（1）和位于左外侧联接的一台轮毂电机（7）形成左半车平衡系统，所述右平台（6）、所述右车体（2）和位于右外侧联接的另一台轮毂电机（7）形成右半车平衡系统，所述左车体（1）内设有实时检测所述左平台（4）姿态的一组传感器，所述右车体（2）内设有实时检测所述右平台（6）姿态的另一组传感器，所述控制板（5）根据各传感器的信号，分别独立控制所述左半车平衡系统和所述右半车平衡系统，实现两轮平衡车的自平衡状态。

2. 根据权利要求 1 所述可双调转轴的两轮平衡车，其特征在于：所述控制板（5）内设有信号融合单元，将所述左半车平衡系统和所述右半车平衡系统的姿态信号处理数据进行融合计算，然后再由所述控制板（5）分别向各所述轮毂电机（7）发出可执行指令信号。

可双调转轴的两轮平衡车

技术领域

[0001] 本实用新型涉及一种自平衡代步交通工具，特别是一种两轮平衡车，应用自平衡控制技术领域。

背景技术

[0002] 现有市场上的两轮平衡车通常采用专门的平衡策略分别驱动两个车轮进行正反转来实现车体平衡，其转弯控制一般需要通过人为手控，需要驾驶者手脚并用，结构复杂，可操控性不佳，主要由于两轮车的主体结构不合理造成。

实用新型内容

[0003] 本实用新型的目的在于克服现有技术的不足，提供一种可双调转轴的两轮平衡车，采用转轴联结左车体与右车体，并且左车体与右车体可绕转轴转动，在其内部分别放置电池及控制板，实现软件和硬件的分布式控制，减少手部操控负担，操控者可以依靠身体的姿态控制方向，具有更简单的结构以及更灵活的操控性，整车轻便。

[0004] 为达到上述发明创造目的，本实用新型采用下述技术方案：

[0005] 一种可双调转轴的两轮平衡车，包括车体、承载平台、电池、控制板、两台轮毂电机和两个车轮，车体内安装电池和控制板，两个轮毂电机分别固定安装在车体的左右两侧，承载平台固定安装在两个车轮之间的车体上，车体由左车体和右车体两部分组合而成，同时也将承载平台分割成左平台和右平台两部分，在左车体和右车体之间，通过一个转轴转动联接左车体和右车体，形成柔性联接的组合式的车体，左车体和右车体围绕转轴进行转动，左车体和左平台同步转动，右车体和右平台同步转动，左平台、左车体和位于左外侧联接的一台轮毂电机形成左半车平衡系统，右平台、右车体和位于右外侧联接的另一台轮毂电机形成右半车平衡系统，左车体内设有实时检测左平台姿态的一组传感器，右车体内设有实时检测右平台姿态的另一组传感器，控制板根据各传感器的信号，分别独立控制左半车平衡系统和右半车平衡系统，实现两轮平衡车的自平衡状态。

[0006] 作为本实用新型优选的技术方案，控制板内设有信号融合单元，将左半车平衡系统和右半车平衡系统的姿态信号处理数据进行融合计算，然后再由控制板分别向各轮毂电机发出可执行指令信号。

[0007] 本实用新型与现有技术相比较，具有如下实质性特点和优点：

[0008] 与当前的市场上的两轮平衡车相比，驾驶本实用新型可双调转轴的两轮平衡车时，操控者可以依靠身体的姿态控制方向，减轻手控操作，具有更简单的结构以及更灵活的操控性，整车轻便，更加节能，智能化程度高。

附图说明

[0009] 图 1 是本实用新型优选实施例可双调转轴的两轮平衡车结构示意图。

具体实施方式

[0010] 本实用新型的优选实施例结合附图说明如下：

[0011] 在本实施例中，参见图 1，一种可双调转轴的两轮平衡车，包括车体、承载平台、电池、控制板 5、两台轮毂电机 7 和两个车轮，两个轮毂电机 7 分别固定安装在车体的左右两侧，车体内安装电池和控制板 5，承载平台固定安装在两个车轮之间的车体上，车体由左车体 1 和右车体 2 两部分组合而成，同时也将承载平台分割成左平台 4 和右平台 6 两部分，，在左车体 1 和右车体 2 之间，通过一个转轴 3 转动联接左车体 1 和右车体 2，形成柔性联接的组合式的车体，左车体 1 和右车体 2 围绕转轴 3 进行转动，左车体 1 和左平台 4 同步转动，右车体 2 和右平台 6 同步转动，左平台 4、左车体 1 和位于左外侧联接的一台轮毂电机 7 形成左半车平衡系统，右平台 6、右车体 2 和位于右外侧联接的另一台轮毂电机 7 形成右半车平衡系统，左车体 1 内设有实时检测左平台 4 姿态的一组传感器，右车体 2 内设有实时检测右平台 6 姿态的另一组传感器，控制板 5 根据各传感器的信号，分别独立控制左半车平衡系统和右半车平衡系统，实现两轮平衡车的自平衡状态。本实施例可双调转轴的两轮平衡车结构合理简单，操控者可以依靠身体的姿态控制方向，不需要设置专门的手控方向控制器，可操控性也大大提高，解放了双手对转向控制，使驾乘者更加专注于身体姿态对两轮平衡车的控制。

[0012] 在本实施例中，参见图 1，控制板 5 内设有信号融合单元，将左半车平衡系统和右半车平衡系统的姿态信号处理数据进行融合计算，然后再由控制板 5 分别向各轮毂电机 7 发出可执行指令信号，通过融合计算，实现对左半车平衡系统和右半车平衡系统的相互影响的信号处理分析，信号处理更加精确，提高平衡控制的针对性，提高身体姿态操控的灵敏度，并实现更有效的节能效果。

[0013] 上面结合附图对本实用新型实施例进行了说明，但本实用新型不限于上述实施例，还可以根据本实用新型的实用新型创造的目的做出多种变化，凡依据本实用新型技术方案的精神实质和原理下做的改变、修饰、替代、组合、简化，均应为等效的置换方式，只要符合用于本实用新型可双调转轴的两轮平衡车的结构和构造原理，都属于本实用新型的保护范围。

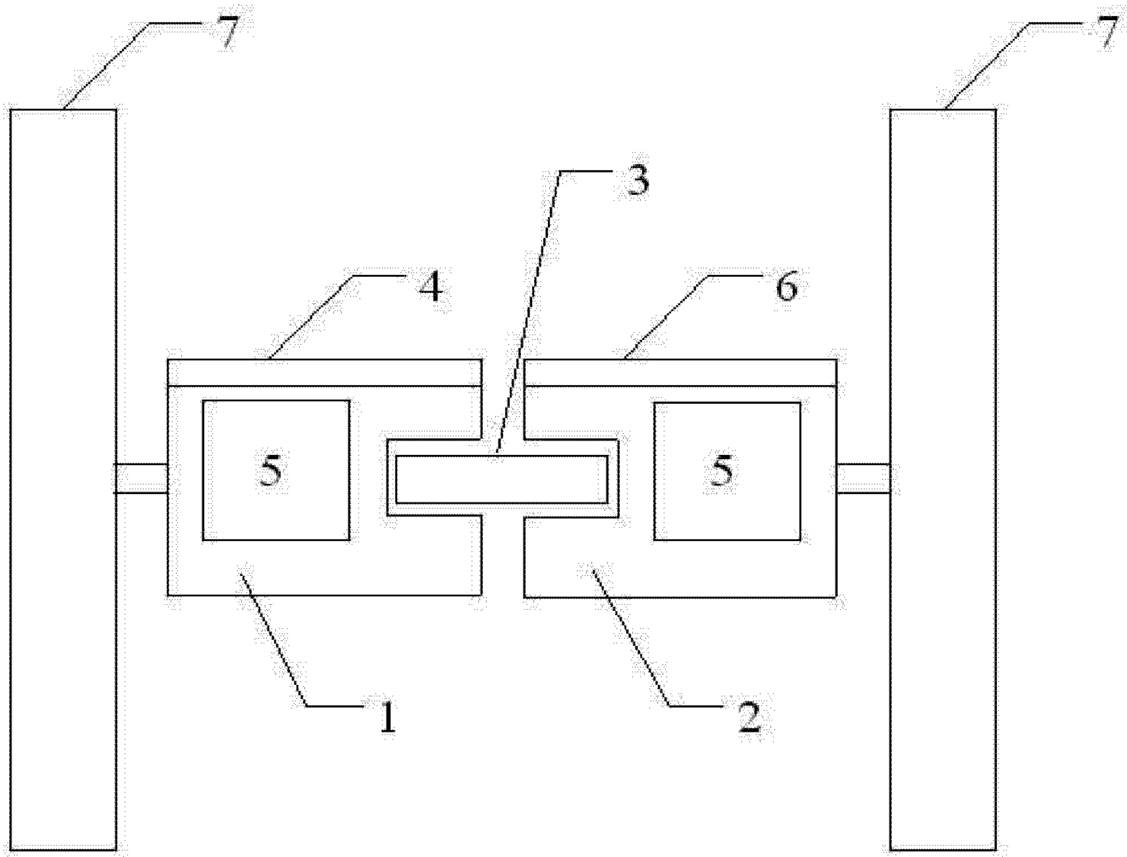


图 1

Espacenet

Bibliographic data: CN203996649 (U) — 2014-12-10

Electrically-balanced swing car

Inventor(s): YING JIAWEI; CAO SHAOJUN ± (YING JIAWEI, ; CAO SHAOJUN)

Applicant(s): HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO LTD ± (HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO., LTD)

Classification: **- international:** ***B62K11/00***
- cooperative:

Application number: CN201420314351U 20140613

Priority number (s): CN201420314351U 20140613

Abstract of CN203996649 (U)

The utility model discloses an electrically-balanced swing car. The electrically-balanced swing car comprises a top cover, an inner cover, a bottom cover, wheel hub motors, a rotating mechanism and a balance mechanism, wherein each of the top cover, the inner cover and the bottom cover comprises two components which are symmetrically arranged pairwise and can rotate relative to each other; the inner cover is positioned between the top cover and the bottom cover, and is matched with the top cover and the bottom cover; the rotating mechanism is fixed at a transverse position in the middle of the inner cover; the longitudinally-arranged wheel hub motors are fixed on the left edge and the right edge of the inner cover; the balance mechanism is fixed on the bottom cover, and is connected with the motors; the rotating mechanism comprises two bearings, one shaft sleeve and two clamp springs; the two bearings are fixed at the inner ends of two identical components of the inner cover respectively; the shaft sleeve is fixed in the two bearings, and is fixed on the inner cover through the clamp springs. By adopting the electrically-balanced swing car, a user can control the running state of the balance car only by using feet.

DGL Exhibit 1002
Page 0438

Notice

CLAIMS CN208996649

1.

The electric balance twisting vehicle is characterized in that it comprises a top cover, an inner cover, a bottom cover, a hub motor, a rotating mechanism and a balance mechanism; the top cover, the inner cover and the bottom cover respectively comprise two components which are symmetrically arranged and mutually rotatable The inner cover is disposed between the top cover and the bottom cover and is matched with the two; the middle cover of the inner cover is fixed with a rotating mechanism; the left and right edges of the inner cover are fixed with a longitudinally disposed hub motor; the balance mechanism is fixed On the bottom cover and connected to the motor; the rotating mechanism comprises two bearings, one sleeve and two circlips; the two bearings are respectively fixed at the inner ends of two identical parts of the inner cover, and the sleeve is fixed at two The inside of the bearing is fixed to the inner cover by a snap spring.

2.

The electric balance twisting vehicle according to claim 1, wherein said top cover comprises a left top cover and a right top cover; said left top cover and right top cover are symmetrically arranged, left top cover and right top cover The inwardly facing portions are joined to form an "X" shape, and the outwardly facing portions of the left and right top caps each have an arcuate projection that is above the hub motor.

3.

The electric balance twisting vehicle according to claim 2, wherein the left top cover and the right top cover are adjacent to each other with two prompting plates, and the prompting plate is connected with the balance mechanism, and one of them is a display power source. The reminder board of the capacity, and the other one is a reminder board for displaying whether it works, and each of the above prompt boards has a transparent cover.

4

The electric balance twisting vehicle according to claim 2, wherein the left top cover and the right top cover have a first empty slot at an intermediate position; the inner cover includes a left inner cover and a right inner cover; left and right inner The cover has a second recess at a position corresponding to the first recess, and the first recess and the second recess combine to form a pedal cavity in which the pedal is placed.

5

An electric balance twisting vehicle according to claim 1, wherein said electric balance twisting vehicle includes a pedal placed in a pedal cavity, the upper surface of the pedal having frictional forces spaced apart from each other Friction strip.

6

The electric balance twisting vehicle according to claim 4, wherein the inward end of the left inner cover and the right inner cover has a cylindrical cylinder, and the bearing and the sleeve pass through the circlip from the outside to the inside. Installed in the barrel.

7.

The electric balance twisting vehicle according to claim 6, wherein a limiting shaft is disposed between the inner end of the left inner cover and the inner inner cover, and the limiting shaft is located in the right inner cover. The length is longer than the length inside the left inner cover.

8

The electric balance twisting vehicle according to claim 1or 7, wherein the balancing mechanism comprises a power supply, a controller, a hub motor driving circuit, an acceleration sensor, a gyroscope, an infrared photoelectric sensor; a power supply and a control The controller is connected to the hub motor drive circuit, the acceleration sensor, the gyroscope, and the infrared photoelectric sensor.

9

The electric balance twisting vehicle according to claim 8, wherein the outer side of the bottom cover further has a transparent decorative lamp.

10

The electric balance twisting vehicle according to claim 8, wherein a "U" shaped gyroscope foot pedal is disposed under the gyroscope, and the gyroscope foot pedal is mounted on the base.

Notice

DESCRIPTION CN203996649

The utility model discloses an electric balance twisting vehicle, which comprises a top cover, an inner cover, a bottom cover, a hub motor, a rotating mechanism and a balance mechanism; the top cover, the inner cover and the bottom cover respectively comprise two symmetrically arranged and mutually mutually a rotating component, the inner cover is between the top cover and the bottom cover and is matched with the two; the middle cover of the inner cover is fixed with a rotating mechanism; the left and right edges of the inner cover are fixed with a longitudinally disposed hub motor; The balance mechanism is fixed on the bottom cover and connected to the motor; the rotating mechanism comprises two bearings, a bushing and two circlips; the two bearings are respectively fixed at the inner ends of the two identical parts of the inner cover, and the sleeve is fixed The inner cover is fixed in the two bearings and by a snap spring. The utility model can solve the technical problem of how to allow the user to control the running state of the balance car only by using the foot.

Electric balance twist car

Technical field

The utility model relates to an electric balance two-wheeled vehicle, wherein two platforms of a loader can be twisted with each other to drive walking.

Background technique

Electric balance car, also known as body car, thinking car, its operation principle is mainly based on a basic principle called "dynamic stability", using the gyroscope and acceleration sensor inside the car body to detect the posture of the car body. Change and use the servo control system to accurately drive the motor to adjust accordingly to maintain the balance of the system.

Current electric balance vehicles generally have an operating lever; the user stands on the pedal platform of the balancing vehicle to operate the operating lever to advance, retreat, and stop. Such control is also referred to as "hand control." At present, the pedal platform of the balance car is generally a plate-shaped flat plate, which is always in a horizontal state during use and cannot be relatively rotated, so that the user cannot control the balance car only by using the foot.

Utility model content

The purpose of the utility model is to provide an electric balance twisting vehicle, which solves the technical problem of how to allow the user to control the running state of the balance vehicle only by using the foot.

The electric balance twisting vehicle comprises a top cover, an inner cover, a bottom cover, a hub motor, a rotating mechanism and a balance mechanism; the top cover, the inner cover and the bottom cover respectively comprise two components which are symmetrically arranged and mutually rotatable, and the inner cover is at The top cover and the bottom cover are matched with the two; the middle cover of the inner cover is fixed with a rotating mechanism; the left and right edges of the inner cover are fixed with a longitudinally disposed hub motor; the balance mechanism is fixed on the bottom cover And the motor is connected; the rotating mechanism comprises two bearings, a sleeve and two circlips; the two bearings are respectively fixed at the inner ends of the two identical parts of the inner cover, and the sleeve is fixed in the two bearings and passes through The retaining spring is fixed to the inner cover.

The top cover comprises a left top cover and a right top cover; the left top cover and the right top cover are symmetrically arranged, and the inwardly facing portions of the left top cover and the right top cover are connected to form an "X" shape, a left top cover and a right top cover The outwardly facing portions each have an arcuate projection that is above the hub motor.

The left top cover and the right top cover are adjacent to each other at two positions, and the prompting board is connected with the balance mechanism, one of which is a prompt board for displaying the power capacity, and the other is a reminder board for displaying whether the work is performed, Each of the cue boards has a transparent cover.

The left top cover and the right top cover have a first empty slot at an intermediate position; the inner cover includes a left inner cover and a right inner cover; and the left and right inner covers have a second empty slot at a position corresponding to the first empty slot, first The empty slot and the second recess combine to form a pedal cavity in which the pedal is placed.

The electric balance twisting vehicle includes a pedal placed in a pedal cavity having an upper surface having friction-increasing friction strips spaced apart from each other.

The inward end of the left inner cover and the right inner cover has a cylindrical barrel in which the bearing and the sleeve are mounted from the outside to the inside by a snap spring.

A limiting shaft is disposed between the inner end of the left inner cover and the inner inner cover, and the length of the limiting shaft in the right inner cover is longer than the length in the left inner cover.

The balance mechanism comprises a power supply, a controller, a hub motor drive circuit, an acceleration sensor, a gyroscope, an infrared photoelectric sensor; a power supply and a controller are connected, and the controller and the hub motor drive circuit, the acceleration sensor, the gyroscope, the infrared photoelectric Sensor connection.

The outer side of the bottom cover also has a transparent decorative light.

A "U" shaped gyroscope foot pedal is disposed under the gyroscope, and the gyroscope foot pedal is mounted on the base.

The beneficial effects of the utility model are:

1、
Since the rotating mechanism, the balance mechanism, and the top cover, the inner cover and the bottom cover are all composed of two components which are symmetrically arranged and mutually rotatable, such that the force of the foot drives the top cover or the inner side of one or both sides. The cover and the bottom cover are twisted together, so that the sensor sends a signal to the balance mechanism, and the balance mechanism drives the hub motor according to the internal control program, thereby allowing the user to move forward or backward, thus achieving "foot control", which is There is a clear difference between manual control and a special

driving method.

2、
An arc-shaped protrusion is arranged on the outwardly facing portion of the left top cover and the right top cover, the curved protrusion is just above the hub motor, and the hub motor is located at the left and right edge edges of the inner cover, so that the The large-sized hub motor has an obvious advantage in terms of the movement stroke and speed of the balance car that is mounted on the bottom of the bottom cover.

3、
The pedal is placed in combination with the first recess and the second recess, thus reducing the overall volume of the entire device as a whole.

4、
One end of the limiting shaft is movable at one end, and the movement of the rotating mechanism provides support.

DRAWINGS

Figure 1 is a cross-sectional view of a balance twisting vehicle;

Figure 2is a schematic exploded view of a balanced twisting vehicle;

In the figure

Top cover, 11.

Left top cover, 12

Right top cover, 13

Tip board, 14. Transparent cover, 15. Curved bulge, 16. The first empty slot, 2. Inner cover, 21. Left inner cover, 22. Right inner cover, 23. The second empty slot, 24. Cylinder, 3. Bottom cover, 31. Left bottom cover, 32. Right bottom cover, 33. Decorative lights, 4. Motor, 5. Pedal, 51. Friction strip, 61. Bearing, 62. Bushing, 63. Circlip, 7. Limit axis, 81. Power supply, 82. Controller, 83. Gyro, 9. Gyro pedals.

detailed description

Referring to FIG. 1 to FIG. 2, the electric balance twisting vehicle includes a top cover 1, an inner cover 2, a bottom cover 3, two hub motors 4, a rotating mechanism, and a balance mechanism. 1. The inner cover 2and the bottom cover 3cooperate with each other to form a main structure of the balance vehicle. The hub motor 4is longitudinally mounted on both sides of the main structure and drives the main structure forward and backward under the action of the rotating mechanism and the balance mechanism. Turning.

The top cover 1 is at the topmost portion, and includes a left top cover 11 and a right top cover 12; the left top cover 11 and the right top cover 12are substantially identical in shape and arranged symmetrically to the left and right, and the two top covers are in a rotating mechanism. The relative rotation of the left top cover 11 and the right top cover 12is connected to form an "X" shape, and has two cue sheets 13at the innermost end position, and the cue plate 13is connected with the balance mechanism. One of them is a reminder board 13for displaying the power source capacity, and the other is a reminder board 13for displaying whether or not it is operated, and each of the above-mentioned reminder boards 13has a transparent cover 14. The function of the installation reminder board 13is mainly to let the user know the specific situation of the balance vehicle in real time. The remaining portions of the left top cover 11 and the right top cover 12, i.e., the outwardly facing portions, each have an arcuate projection 15, which is just above the hub motor 4, which corresponds to a motor cover.

The inner cover 2is in an intermediate position, which mainly supports the components of the balance car and the hub motor 4, and also includes a left inner cover 21 and a right inner cover 22; the shape of the left inner cover 21 and the right inner cover 22The left inner cover 21 and the right inner cover 22can be rotated relative to each other under the action of the rotating mechanism; the middle position of the inner cover 2can be mounted with a rotating mechanism, and the left and right side edges are fixedly mounted longitudinally. Hub motor 4.

In order to prevent the pedal 5and reduce the overall volume of the balance vehicle, a first recess 16is specially designed at a position intermediate between the left top cover 11 and the right top cover 12, the left and right inner covers are designed at positions corresponding to the first recess 16The two empty slots 23, the first recess 16and the second recess 23are combined to form a pedal cavity for placing the pedal 5, and the pedal 5is placed in the pedal cavity. In order to enhance the friction of the pedal 5, the pedal 5can be The upper surface is designed to increase the frictional friction strip 51 spaced apart from each other.

The bottom cover 3 is at the bottommost portion, and includes a left bottom cover 31 and a right bottom cover 32. The left bottom cover 31 and the right bottom cover 32 have substantially the same shape and are arranged symmetrically to the left and right. The two bottom covers are in the rotating mechanism. The relative rotation can occur under the action; the inwardly facing portions of the left bottom cover 31 and the right bottom cover 32 are connected to form an "X" shape and have two transparent decorative lamps 33 on the outermost side of the innermost end.

The rotating mechanism comprises two oil bearing 61, a bushing 62 and two retaining springs 63, two bearings 61 are respectively fixed to the inner ends of the left and right inner covers of the inner cover 2, and the bushing 62 is fixed in the two bearings 61 and passes through The retaining spring 63 is fixed to the inner cover 2 such that the left and right inner covers of the inner cover 2 are rotatable by the cooperation of the rotating mechanism. In order to mount the above-described rotating mechanism, a cylindrical cylinder 24 is designed at the inward end of the left inner cover 21 and the right inner cover 22, and the bearing 61 and the sleeve 62 are mounted to the cylindrical body 24 from the outside to the inside by the snap spring 63. Inside. In order to prevent the deflection of the rotating mechanism, a limiting shaft 7 is also arranged between the inwardly facing ends of the left inner cover 21 and the right inner cover 22, the length of the limiting shaft 7 in the right inner cover 22 being longer than The length inside the left inner cover 21 is such that one end acts as a limit and the other end acts as a movable.

The balancing mechanism is a common component used in the current balancing vehicle, and the internal program is also a prior art. For details, reference may be made to the currently disclosed balancing vehicle control method and the balance adopted by various balancing vehicle manufacturers. Institutions, such as China Patent No. 201320050547.3, the patent name is a smart balance car balance control device and a smart balance car. This control device is the balance mechanism in this embodiment, or such as Chinese Patent No. 201220367045.9, the patent name is the use of CPLD control balance car It is described in the circuit control device of the motor; of course, in practical applications, other control devices and control methods may also be selected, such as Chinese Patent No. 201310516158. X, the patent name is the control method described in the two-wheel self-balancing vehicle control method. This embodiment simply mounts it to the base 3 and controls the motor 4. The balancing mechanism mainly comprises a power supply 81, a controller 82, an in-wheel motor driving circuit, an acceleration sensor, a gyroscope 83, and an infrared photoelectric sensor; the power supply 81 and the controller 82 are connected to the controller to supply power, and the controller 82 and the hub motor are driven. The circuit connection is to drive the corresponding components to work, and the acceleration sensor, the gyroscope 83, and the infrared photoelectric sensor sequentially detect the acceleration change of the vehicle body, the angle change, and whether there is a user on the vehicle body, which are all those skilled in the art. Very clear understanding of the technology, so no longer describe this too much. Accordingly, in order to mount the gyroscope 83, a "U"-shaped gyroscope footrest 9 is provided below the gyroscope 83, and the gyroscope footrest

9 is mounted on the base 3

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 203996649 U
(45)授权公告日 2014.12.10

(21)申请号 201420314351.5
(22)申请日 2014.06.13
(73)专利权人 杭州骑客智能科技有限公司
地址 310000 浙江省杭州市余杭区良渚街道七贤桥村4幢
(72)发明人 应佳伟 曹少军
(74)专利代理机构 杭州裕阳专利事务所(普通合伙) 33221
代理人 应圣义
(51)Int.Cl.
B62K 11/00(2013.01)

(ESM)同样的发明创造已同日申请发明专利

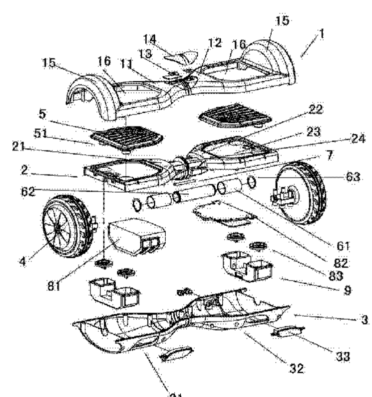
权利要求书1页 说明书3页 附图1页

(54)实用新型名称

电动平衡扭扭车

(57)摘要

本实用新型公开了一种电动平衡扭扭车,包括顶盖、内盖、底盖、轮毂电机、转动机构、平衡机构;顶盖、内盖、底盖均包括两个成对称布置且可相互转动的部件,内盖处于顶盖及底盖之间并与这两者配合在一起;内盖的中间横向位置固定有转动机构;内盖的左右两侧边缘位置固定有纵向设置的轮毂电机;平衡机构固定在底盖上并与电机连接;所述转动机构包括两个轴承、一个轴套、两个卡簧;两个轴承分别固定在内盖的两个相同部件的内端,轴套固定在两个轴承内并通过卡簧固定在内盖上。本实用新型可解决如何让使用者仅仅通过利用脚部即可对平衡车的运行状态进行控制的技术问题。



1. 电动平衡扭扭车，其特征在于：包括顶盖、内盖、底盖、轮毂电机、转动机构、平衡机构；顶盖、内盖、底盖均包括两个成对称布置且可相互转动的部件，内盖处于顶盖及底盖之间并与这两者配合在一起；内盖的中间横向位置固定有转动机构；内盖的左右两侧边缘位置固定有纵向设置的轮毂电机；平衡机构固定在底盖上并与电机连接；所述转动机构包括两个轴承、一个轴套、两个卡簧；两个轴承分别固定在内盖的两个相同部件的内端，轴套固定在两个轴承内并通过卡簧固定在内盖上。

2. 根据权利要求 1 中所述的电动平衡扭扭车，其特征在于：所述顶盖包括左顶盖和右顶盖；该左顶盖和右顶盖成对称布置，左顶盖和右顶盖朝内的部分相连形成“X”形，左顶盖和右顶盖朝外的部分均具有一个弧形凸起、该弧形凸起处于轮毂电机上方。

3. 根据权利要求 2 中所述的电动平衡扭扭车，其特征在于：所述左顶盖和右顶盖相互靠近的位置具有二个提示板，上述提示板与平衡机构连接，其中一个为显示电源容量的提示板，另一个为显示是否工作的提示板，在上述每个提示板上均具有一个透明外罩。

4. 根据权利要求 2 中所述的电动平衡扭扭车，其特征在于：所述左顶盖和右顶盖中间位置具有第一空槽；内盖包括左内盖和右内盖；左、右内盖在与第一空槽相对应位置具有第二空槽，第一空槽和第二空槽结合形成放置踏板的踏板空腔。

5. 根据权利要求 1 中所述的电动平衡扭扭车，其特征在于：所述电动平衡扭扭车包括踏板，该踏板放置在踏板空腔内，该踏板的上表面具有彼此间隔的增加摩擦力的摩擦条。

6. 根据权利要求 4 中所述的电动平衡扭扭车，其特征在于：所述左内盖和右内盖朝内的端头具有圆柱形的筒体，轴承和轴套从外至内通过卡簧安装在该筒体内。

7. 根据权利要求 6 中所述的电动平衡扭扭车，其特征在于：所述左内盖和右内盖朝内的端头之间设置有一个限位轴，该限位轴处于右内盖内的长度要长于处于左内盖内的长度。

8. 根据权利要求 1 或者 7 中所述的电动平衡扭扭车，其特征在于：所述平衡机构包括供电电源、控制器、轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器；供电电源与控制器连接，控制器分别与轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器连接。

9. 根据权利要求 8 中所述的电动平衡扭扭车，其特征在于：所述底盖外侧面还具有透明的装饰灯。

10. 根据权利要求 8 中所述的电动平衡扭扭车，其特征在于：所述陀螺仪下方设有一个“U”形的陀螺仪脚踏板，该陀螺仪脚踏板安装在底座上。

电动平衡扭扭车

技术领域

[0001] 本实用新型涉及一种电动平衡两轮车，其承载人的两个平台可以相互扭动进而驱动行走。

背景技术

[0002] 电动平衡车，又叫体感车、思维车，其运作原理主要是建立在一种被称为“动态稳定”的基本原理上，利用车体内部的陀螺仪和加速度传感器，来检测车体姿态的变化，并利用伺服控制系统，精确地驱动电机进行相应的调整，以保持系统的平衡。

[0003] 目前的电动平衡车一般都具有一个操作杆；使用者站在平衡车的脚踏平台上对操作杆进行操作，从而前进、后退及停止，这样的控制也称“手控”。目前平衡车的脚踏平台一般是一块板状的平板，其在使用过程中始终是保持水平状态，无法相对转动，所以无法让使用者仅仅通过利用脚部即可对平衡车进行控制。

实用新型内容

[0004] 本实用新型的目的是提供一种电动平衡扭扭车，解决如何让使用者仅仅通过利用脚部即可对平衡车的运行状态进行控制的技术问题。

[0005] 电动平衡扭扭车，包括顶盖、内盖、底盖、轮毂电机、转动机构、平衡机构；顶盖、内盖、底盖均包括两个成对称布置且可相互转动的部件，内盖处于顶盖及底盖之间并与这两者配合在一起；内盖的中间横向位置固定有转动机构；内盖的左右两侧边缘位置固定有纵向设置的轮毂电机；平衡机构固定在底盖上并与电机连接；所述转动机构包括两个轴承、一个轴套、两个卡簧；两个轴承分别固定在内盖的两个相同部件的内端，轴套固定在两个轴承内并通过卡簧固定在内盖上。

[0006] 所述顶盖包括左顶盖和右顶盖；该左顶盖和右顶盖成对称布置，左顶盖和右顶盖朝内的部分相连形成“X”形，左顶盖和右顶盖朝外的部分均具有一个弧形凸起、该弧形凸起处于轮毂电机上方。

[0007] 所述左顶盖和右顶盖相互靠近的位置具有二个提示板，上述提示板与平衡机构连接，其中一个为显示电源容量的提示板，另一个为显示是否工作的提示板，在上述每个提示板上均具有一个透明外罩。

[0008] 所述左顶盖和右顶盖中间位置具有第一空槽；内盖包括左内盖和右内盖；左、右内盖在与第一空槽相对应位置具有第二空槽，第一空槽和第二空槽结合形成放置踏板的踏板空腔。

[0009] 所述电动平衡扭扭车包括踏板，该踏板放置在踏板空腔内，该踏板的上表面具有彼此间隔的增加摩擦力的摩擦条。

[0010] 所述左内盖和右内盖朝内的端头具有圆柱形的筒体，轴承和轴套从外至内通过卡簧安装在该筒体内。

[0011] 所述左内盖和右内盖朝内的端头之间设置有一个限位轴，该限位轴处于右内盖内

的长度要长于处于左内盖内的长度。

[0012] 所述平衡机构包括供电电源、控制器、轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器；供电电源与控制器连接，控制器分别与轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器连接。

[0013] 所述底盖外侧面还具有透明的装饰灯。

[0014] 所述陀螺仪下方设有一个“U”形的陀螺仪脚踏板，该陀螺仪脚踏板安装在底座上。

[0015] 本实用新型的有益效果是：

[0016] 1、由于采用转动机构、平衡机构及顶盖、内盖、底盖均是由两个成对称布置且可相互转动的部件构成，这样其利用脚部的力驱动一侧或者两侧的顶盖、内盖、底盖一起扭转，这样进而使传感器发出信号给平衡机构，平衡机构依据内部的控制程序驱动轮毂电机运转，进而让使用者朝前或者朝后运动，这样实现“脚控”，其与“手控”存在明显区别，是一种特别的驱动方式。

[0017] 2、在左顶盖和右顶盖朝外的部分均具设置一个弧形凸起，弧形凸起正好处于轮毂电机的正上方，并且轮毂电机处于内盖的左右两侧边缘位置，这样可使用较大尺寸的轮毂电机，相对电机安装在底盖底部的那种平衡车，其运动行程及速度优势明显。

[0018] 3、通过第一空槽和第二空槽结合放置踏板，这样整体减少整个设备的自身体积。

[0019] 4、限位轴一端限位一端活动，该转动机构的运动提供支撑。

附图说明

[0020] 图 1 是平衡扭扭车的剖视图；

[0021] 图 2 是平衡扭扭车的爆炸示意图；

[0022] 图中 1. 顶盖、11. 左顶盖、12. 右顶盖、13. 提示板、14. 透明外罩、15. 弧形凸起、16. 第一空槽、2. 内盖、21. 左内盖、22. 右内盖、23. 第二空槽、24. 筒体、3. 底盖、31. 左底盖、32。右底盖、33. 装饰灯、4. 电机、5. 踏板、51. 摩擦条、61. 轴承、62. 轴套、63. 卡簧、7. 限位轴、81. 电源、82. 控制器、83. 陀螺仪、9. 陀螺仪脚踏板。

具体实施方式

[0023] 请参考图 1 至图 2，图中的电动平衡扭扭车，包括一个顶盖 1、一个内盖 2、一个底盖 3、两个轮毂电机 4、一个转动机构、一个平衡机构，上述顶盖 1、内盖 2、底盖 3 共同相互配合构成平衡车的主体结构，轮毂电机 4 纵向的安装在该主体结构的两侧并在转动机构和平衡机构的作用下驱动该主体结构前进、后退或者转弯。

[0024] 顶盖 1 处于最顶部，其包括一个左顶盖 11 和一个右顶盖 12；上述左顶盖 11 和右顶盖 12 的形状基本相同且成对称的左右布置，这两个顶盖在转动机构的作用下能发生相对转动；左顶盖 11 和右顶盖 12 朝内的部分相连形成“X”形，且在最内端的位置具有二个提示板 13，上述提示板 13 与平衡机构连接，其中一个为显示电源容量的提示板 13，另一个为显示是否工作的提示板 13，在上述每个提示板 13 上均具有一个透明外罩 14。安装提示板 13 的作用主要是让使用者实时了解平衡车的具体情况。左顶盖 11 和右顶盖 12 剩余的部分即朝外的部分均具有一个弧形凸起 15、该弧形凸起 15 正好处于轮毂电机 4 上方，其相当于一个电机罩。

[0025] 内盖 2 处于中间位置，其主要是给平衡车的部件及轮毂电机 4 提供支撑，其同样包括一个左内盖 21 和一个右内盖 22 ；上述左内盖 21 和一个右内盖 22 的形状基本相同且成对称的左右布置，左内盖 21、右内盖 22 在转动机构的作用下能发生相对转动 ；该内盖 2 的中间位置可安装转动机构，左右两侧边缘位置则固定纵向安装的轮毂电机 4。

[0026] 为了防止踏板 5 及减少平衡车整体的体积，特别在左顶盖 11 和右顶盖 12 中间位置设计出第一空槽 16 ；左、右内盖在与第一空槽 16 相对应位置设计第二空槽 23，第一空槽 16 和第二空槽 23 相互结合形成放置踏板 5 的踏板空腔，踏板 5 就放置在踏板空腔内，为了增强踏板 5 的摩擦力，可在踏板 5 的上表面设计彼此间隔的增加摩擦力的摩擦条 51。

[0027] 底盖 3 处于最底部，其包括一个左底盖 31 和一个右底盖 32 ；上述左底盖 31 和右底盖 32 的形状基本相同且成对称的左右布置，这两个底盖在转动机构的作用下能发生相对转动 ；左底盖 31 和右底盖 32 朝内的部分相连形成“X”形且在最内端的外侧面具有二个透明的装饰灯 33。

[0028] 转动机构包括两个含油轴承 61、一个轴套 62、两个卡簧 63 ；两个轴承 61 分别固定在内盖 2 的左右内盖的内端，轴套 62 固定在两个轴承 61 内并通过卡簧 63 固定在内盖 2 上，这样内盖 2 的左右两个内盖就可在转动机构的配合下转动。为了安装上述转动机构，就在左内盖 21 和右内盖 22 朝内的端头设计圆柱形的筒体 24，轴承 61 和轴套 62 从外至内通过卡簧 63 安装在该筒体 24 内。为了防止转动机构的偏移，在左内盖 21 和右内盖 22 朝内的端头之间还设计有一个限位轴 7，该限位轴 7 处于右内盖 22 内的长度要长于处于左内盖 21 内的长度，这样一端起到限位的作用，另一端起到活动的作用。

[0029] 平衡机构为目前常见的使用到平衡车上的部件即属于现有技术，其内部程序也为现有技术，具体可参考目前已经公开的平衡车控制方法及各家平衡车生产企业采用到的平衡机构，如中国专利号 201320050547.3，专利名称为智能平衡车平衡控制装置及智能平衡车，这个控制装置即为本实施例中的平衡机构，或者如中国专利号 201220367045.9，专利名称为使用 CPLD 控制平衡车电机的电路控制装置中描述的 ；当然，在实际应用中，还可选用其它控制装置及控制方法，如中国专利号 201310516158.X，专利名称为两轮自平衡车控制方法中描述的控制方法。本实施例只是将其安装到底座 3 上并对电机 4 进行控制。该平衡机构主要包括供电电源 81、控制器 82、轮毂电机驱动电路、加速度传感器、陀螺仪 83、红外光电传感器 ；供电电源 81 与控制器 82 连接给控制器提供电源，控制器 82 与轮毂电机驱动电路连接是让其驱动对应的部件进行工作，加速度传感器、陀螺仪 83、红外光电传感器依次是检测车体的加速度变化、角度变化及车体上是否有使用者，这些都是本领域的技术人员非常清楚了解的技术，所以不再此过多描述。对了，为了安装陀螺仪 83，特别在陀螺仪 83 下方设有一个“U”形的陀螺仪脚踏板 9 且该陀螺仪脚踏板 9 安装在底座 3 上。

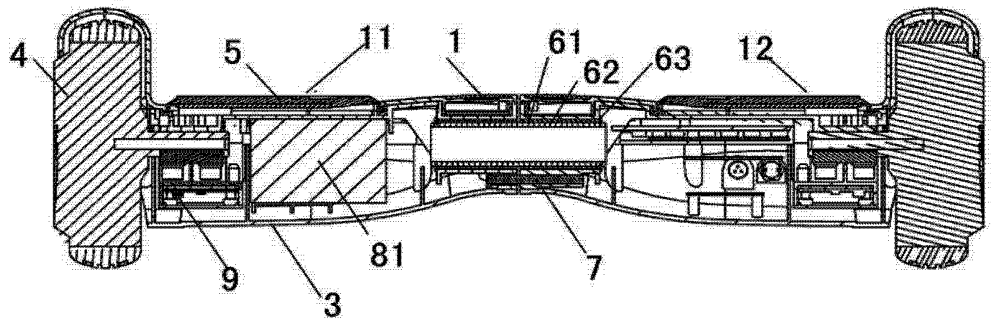

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图 1

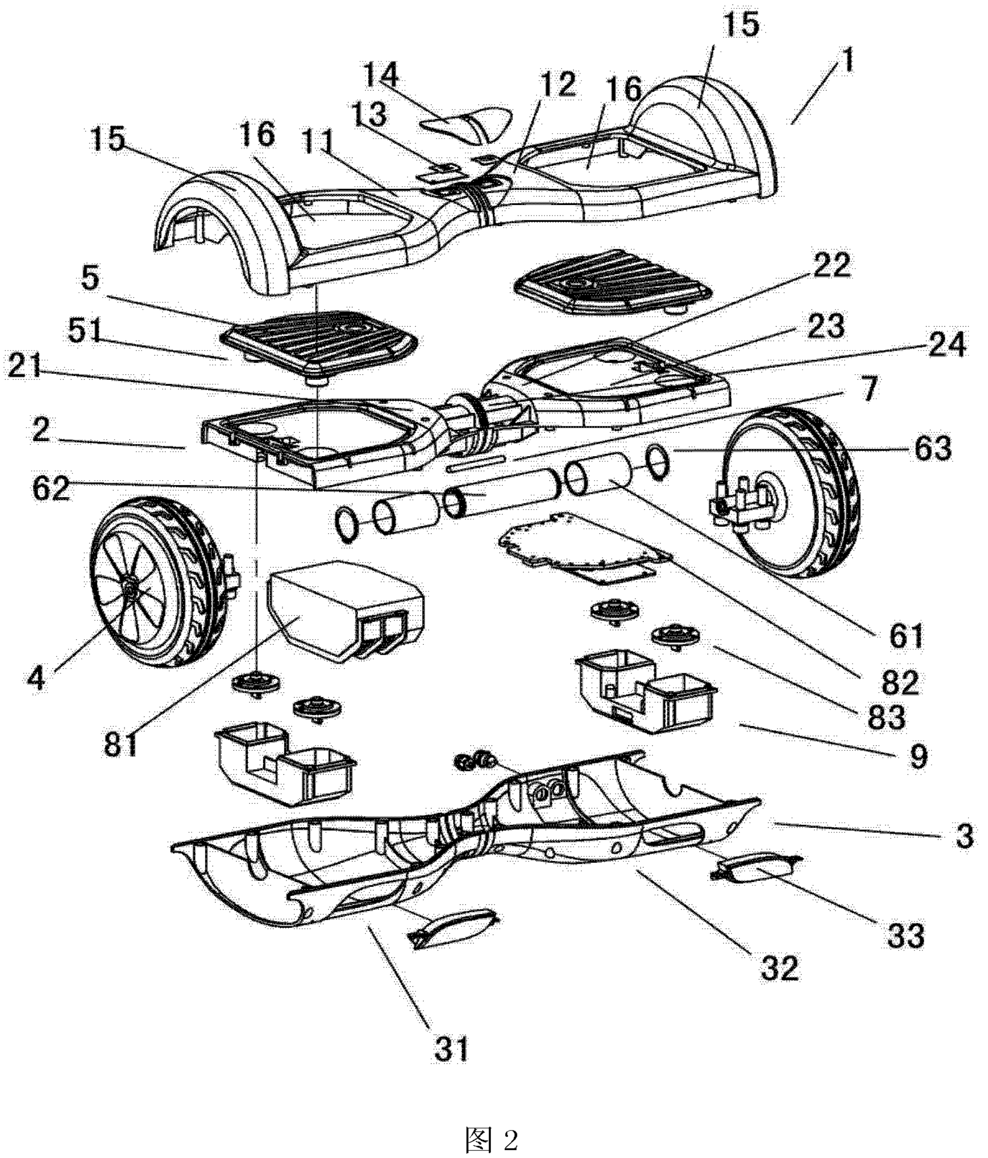
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图 2

Espacenet

Bibliographic data: CN204050913 (U) — 2014-12-31

Vehicle with double wheels in longitudinal direction

Inventor(s): YING JIAWEI; CAO SHAOJUN ± (YING JIAWEI, ; CAO SHAOJUN)

Applicant(s): HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO LTD ± (HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO., LTD)

Classification: **- international:** ***A63C17/00; A63C17/04; A63C17/12; A63C17/26***
- cooperative:

Application number: CN201420315165U 20140613

Priority number (s): CN201420315165U 20140613

Abstract of CN204050913 (U)

The utility model discloses a vehicle with double wheels in the longitudinal direction. The vehicle comprises a top cover, an inner cover, a bottom cover, hub motors and a rotary mechanism, wherein the top cover, the inner cover and the bottom cover comprise two components which are symmetrically distributed and can rotate relative to each other, the inner cover is positioned between the top cover and the bottom cover, and is matched with the top cover and the bottom cover, the rotary mechanism is fixed in the middle transverse position of the inner cover, the hub motors longitudinally distributed are fixed on the edge positions of the left and right sides of the inner cover, the top cover, the inner cover and the bottom cover surround jointly to form a cavity for mounting an electric drive system, the electric drive system is connected with the hub motors, the rotary mechanism comprises two bearings, one shaft sleeve and two clamping springs, the two bearings are fixed at the inner ends of two same components of the inner cover, the shaft sleeve is fixed in the two bearings and fixed on the inner cover through the clamping springs. With the adoption of the vehicle, the technical purpose of changing the structure of the vehicle to enable the vehicle to be well matched with the electric drive system is achieved.

DGL Exhibit 1002
Page 0455

Vehicle with double wheels in longitudinal direction

Abstract

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CN204050913U

China

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Other languages: Chinese

Inventor: [illegible]

Worldwide applications

2014 CN

Application CN 201420315165 events

2014-06-13	Application filed by 杭州骑客智能科技有限公司
2014-06-13	Priority to CN 201420315165
2014-12-31	Application granted
2014-12-31	Publication of CN204050913U
2015-09-24	First worldwide family litigation filed

Info: Cited by (5), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, Discuss

Description

translated from Chinese

Wheeled vehicle longitudinal

FIELD

[0001] The present invention relates to a riding equipment, specifically a wheel having two longitudinally mounted, vehicle wheel vehicle body longitudinal torsional do the operation.

Background technique

[0002] Scooter An Outdoor Gear, which has a caster platform and a platform for people to stand installed underneath the scooter under the influence of people can be forward movement, in order to enhance the entertainment, some scooters the platform can be rotated to each other. Currently scooters mainly rely on human-driven, when the stroke than transport, its use is not well adapted to, if you need to install the electric drive system, the original scooter due to the restriction that is flat plate-like structure of its structure can not a good match with the electric drive system and the use of the electric drive system.

SUMMARY

[0003] The object of the present invention is to provide a two-wheeled vehicle longitudinal address how to change body structure so that it can fit well with the electric drive system technical problems.

[0004] The longitudinal wheeled vehicle, comprising a top cover, inner cover, bottom cover, in-wheel motor, the rotation mechanism; the top cover, inner cover, the bottom cover includes two symmetrically arranged and mutually rotatable member in the inner cap and fitting between the top cover and bottom cover together with the two; the lateral position of the cover is fixed to the intermediate rotating mechanism; edges on both sides of the inner cover fixed positions longitudinally disposed wheel motor; the top cover, inner cover, bottom together with the cover to enclose the cavity mounted electric drive system, the drive system is connected to the power-wheel motor; the rotation mechanism comprises two bearings, a hub, two circlip; twenty-two bearings are fixed to the inner cover the inner end of the same member, and the sleeve is fixed by a circlip fixed to the inner lid in two bearings.

[0005] The cap includes a left cover and a right cover; the left and right cover cap is arranged symmetrically, toward the left portion of the inner cover and a right cover connected to form an "X", and the left cover portion of the right cap each have an arcuate outwardly convex, arcuate projection which is located above the wheel motor.

[0006] The left and right cover cap has two positions close to each other prompts plate, said presentation plate is connected to the electric drive system, in which a display panel prompt power capacity, another prompt is displayed if the working plate in each of said tips has a transparent cover plate.

[0007] The left and right cover cap having a first recess intermediate position; inner cover comprising a lid and an inner lid left and right; left, the right cover at a position corresponding to the first recess having a second recess , a first recess and a second recess to form a cavity disposed pedal pedal.

[0008] The longitudinal-wheeled vehicle includes a pedal, the pedal is placed in the cavity of the pedal, said pedal having an upper surface to increase the friction of the friction strips spaced apart from one another.

[0009] The inner lid left and right inner lid inward tip has a cylindrical barrel, and the bearing sleeve from the outside to the inside through the circlip mounted on the barrel.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 204050913 U

(45)授权公告日 2014.12.31

(21)申请号 201420315165.3

(22)申请日 2014.06.13

(ESM)同样的发明创造已同日申请发明专利

(73)专利权人 杭州骑客智能科技有限公司

地址 310000 浙江省杭州市余杭区良渚街道七贤桥村4幢

(72)发明人 应佳伟 曹少军

(74)专利代理机构 杭州裕阳专利事务所(普通合伙) 33221

代理人 应圣义

(51)Int.Cl.

A63C 17/00(2006.01)

A63C 17/04(2006.01)

A63C 17/12(2006.01)

A63C 17/26(2006.01)

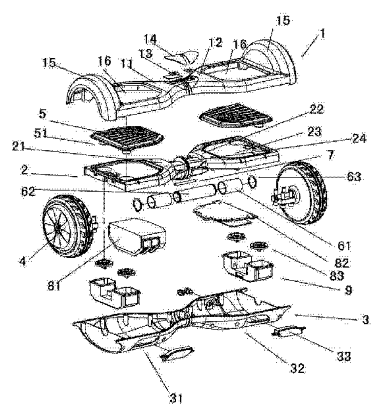
权利要求书1页 说明书3页 附图1页

(54)实用新型名称

纵向双轮车体

(57)摘要

本实用新型公开了一种纵向双轮车体,包括顶盖、内盖、底盖、轮毂电机、转动机构;顶盖、内盖、底盖均包括两个成对称布置且可相互转动的部件,内盖处于顶盖及底盖之间并与这两者配合在一起;内盖的中间横向位置固定有转动机构;内盖的左右两侧边缘位置固定有纵向设置的轮毂电机;顶盖、内盖、底盖共同配合围成安装电力驱动系统的空腔,上述电力驱动系统与轮毂电机相连;所述转动机构包括两个轴承、一个轴套、两个卡簧;两个轴承分别固定在内盖的两个相同部件的内端,轴套固定在两个轴承内并通过卡簧固定在内盖上。本实用新型可解决如何改变车体结构从而使得其能与电力驱动系统很好的配合的技术问题。



CN 204050913 U

1. 纵向双轮车体，其特征在于：包括顶盖、内盖、底盖、轮毂电机、转动机构；顶盖、内盖、底盖均包括两个成对称布置且可相互转动的部件，内盖处于顶盖及底盖之间并与这两者配合在一起；内盖的中间横向位置固定有转动机构；内盖的左右两侧边缘位置固定有纵向设置的轮毂电机；顶盖、内盖、底盖共同配合围成安装电力驱动系统的空腔，上述电力驱动系统与轮毂电机相连；所述转动机构包括两个轴承、一个轴套、两个卡簧；两个轴承分别固定在内盖的两个相同部件的内端，轴套固定在两个轴承内并通过卡簧固定在内盖上。

2. 根据权利要求 1 中所述的纵向双轮车体，其特征在于：所述顶盖包括左顶盖和右顶盖；该左顶盖和右顶盖成对称布置，左顶盖和右顶盖朝内的部分相连形成“X”形，左顶盖和右顶盖朝外的部分均具有一个弧形凸起、该弧形凸起处于轮毂电机上方。

3. 根据权利要求 2 中所述的纵向双轮车体，其特征在于：所述左顶盖和右顶盖相互靠近的位置具有二个提示板，上述提示板与电力驱动系统连接，其中一个为显示电源容量的提示板，另一个为显示是否工作的提示板，在上述每个提示板上均具有一个透明外罩。

4. 根据权利要求 2 中所述的纵向双轮车体，其特征在于：所述左顶盖和右顶盖中间位置具有第一空槽；内盖包括左内盖和右内盖；左、右内盖在与第一空槽相对应位置具有第二空槽，第一空槽和第二空槽结合形成放置踏板的踏板空腔。

5. 根据权利要求 1 中所述的纵向双轮车体，其特征在于：所述纵向双轮车包括踏板，该踏板放置在踏板空腔内，该踏板的上表面具有彼此间隔的增加摩擦力的摩擦条。

6. 根据权利要求 4 中所述的纵向双轮车体，其特征在于：所述左内盖和右内盖朝内的端头具有圆柱形的筒体，轴承和轴套从外至内通过卡簧安装在该筒体内。

7. 根据权利要求 6 中所述的纵向双轮车体，其特征在于：所述左内盖和右内盖朝内的端头之间设置有一个限位轴，该限位轴处于右内盖内的长度要长于处于左内盖内的长度。

8. 根据权利要求 1 或者 7 中所述的纵向双轮车体，其特征在于：所述电力驱动系统包括供电电源、控制器、轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器；供电电源与控制器连接，控制器分别与轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器连接。

9. 根据权利要求 8 中所述的纵向双轮车体，其特征在于：所述底盖外侧面还具有透明的装饰灯。

10. 根据权利要求 8 中所述的纵向双轮车体，其特征在于：所述陀螺仪下方设有一个“U”形的陀螺仪脚踏板，该陀螺仪脚踏板安装在底座上。

纵向双轮车体

技术领域

[0001]　本实用新型涉及一种骑行装备，具体的说是一种具有两个纵向安装的轮子、整车可做扭转动作的纵向双轮车体。

背景技术

[0002]　滑板车，一种户外活动用品，其具有一个供人站立的平台及平台下方安装的万向轮，该滑板车在人的作用下可朝前运动，为了增强娱乐性，有些滑板车上的平台还可相互转动。目前滑板车主要还是依靠人力驱动，当行程较运时，其使用起来就不是很适应，如果需要安装电力驱动系统，原有的滑板车由于自身的结构即板状的平板状结构的限制就无法与电力驱动系统很好的配合及使用该电力驱动系统。

实用新型内容

[0003]　本实用新型的目的是提供一种纵向双轮车体，解决如何改变车体结构从而使得其能与电力驱动系统很好的配合的技术问题。

[0004]　纵向双轮车体，包括顶盖、内盖、底盖、轮毂电机、转动机构；顶盖、内盖、底盖均包括两个成对称布置且可相互转动的部件，内盖处于顶盖及底盖之间并与这两者配合在一起；内盖的中间横向位置固定有转动机构；内盖的左右两侧边缘位置固定有纵向设置的轮毂电机；顶盖、内盖、底盖共同配合围成安装电力驱动系统的空腔，上述电力驱动系统与轮毂电机相连；所述转动机构包括两个轴承、一个轴套、两个卡簧；两个轴承分别固定在内盖的两个相同部件的内端，轴套固定在两个轴承内并通过卡簧固定在内盖上。

[0005]　所述顶盖包括左顶盖和右顶盖；该左顶盖和右顶盖成对称布置，左顶盖和右顶盖朝内的部分相连形成“X”形，左顶盖和右顶盖朝外的部分均具有一个弧形凸起、该弧形凸起处于轮毂电机上方。

[0006]　所述左顶盖和右顶盖相互靠近的位置具有二个提示板，上述提示板与电力驱动系统连接，其中一个为显示电源容量的提示板，另一个为显示是否工作的提示板，在上述每个提示板上均具有一个透明外罩。

[0007]　所述左顶盖和右顶盖中间位置具有第一空槽；内盖包括左内盖和右内盖；左、右内盖在与第一空槽相对应位置具有第二空槽，第一空槽和第二空槽结合形成放置踏板的踏板空腔。

[0008]　所述纵向双轮车体包括踏板，该踏板放置在踏板空腔内，该踏板的上表面具有彼此间隔的增加摩擦力的摩擦条。

[0009]　所述左内盖和右内盖朝内的端头具有圆柱形的筒体，轴承和轴套从外至内通过卡簧安装在该筒体内。

[0010]　所述左内盖和右内盖朝内的端头之间设置有一个限位轴，该限位轴处于右内盖内的长度要长于处于左内盖内的长度。

[0011]　所述电力驱动系统包括供电电源、控制器、轮毂电机驱动电路、加速度传感器、陀

螺仪、红外光电传感器；供电电源与控制器连接，控制器分别与轮毂电机驱动电路、加速度传感器、陀螺仪、红外光电传感器连接。

[0012] 所述底盖外侧面还具有透明的装饰灯。

[0013] 所述陀螺仪下方设有一个“U”形的陀螺仪脚踏板，该陀螺仪脚踏板安装在底座上。

[0014] 本实用新型的有益效果是：

[0015] 1、由于采用了顶盖、内盖、底盖、轮毂电机、转动机构；其中顶盖、内盖、底盖共同配合围成安装电力驱动系统的空腔；这样就可很好的安装电力驱动系统了，由于同时配备了轮毂电机及转动机构，这样当安装好电力驱动系统后就能与该电力驱动系统配合一起工作，从而驱动使用者前行，从而可以依靠电力取代人力行驶较远的距离。

[0016] 2、在左顶盖和右顶盖朝外的部分均具设置一个弧形凸起，弧形凸起正好处于轮毂电机的正上方，并且轮毂电机处于内盖的左右两侧边缘位置，这样可使用较大尺寸的轮毂电机，相对电机安装在底盖底部的那种平衡车，其运动行程及速度优势明显。

[0017] 3、通过第一空槽和第二空槽结合放置踏板，这样整体减少整个设备的自身体积。

[0018] 4、限位轴一端限位一端活动，该转动机构的运动提供支撑。

附图说明

[0019] 图 1 是平衡扭扭车体与电力驱动系统配合的剖视图；

[0020] 图 2 是平衡扭扭车体与电力驱动系统配合后的爆炸示意图；

[0021] 图中 1. 顶盖、11. 左顶盖、12. 右顶盖、13. 提示板、14. 透明外罩、15. 弧形凸起、16. 第一空槽、2. 内盖、21. 左内盖、22. 右内盖、23. 第二空槽、24. 筒体、3. 底盖、31. 左底盖、32。右底盖、33. 装饰灯、4. 电机、5. 踏板、51. 摩擦条、61. 轴承、62. 轴套、63. 卡簧、7. 限位轴、81. 电源、82. 控制器、83. 陀螺仪、9. 陀螺仪脚踏板。

具体实施方式

[0022] 请参考图 1 至图 2，图中的纵向双轮车体，包括一个顶盖 1、一个内盖 2、一个底盖 3、两个轮毂电机 4、一个转动机构；轮毂电机 4 纵向的安装在该主体结构的两侧并在转动机构和电力驱动系统的作用下驱动该主体结构前进、后退或者转弯。

[0023] 顶盖 1 处于最顶部，其包括一个左顶盖 11 和一个右顶盖 12；上述左顶盖 11 和右顶盖 12 的形状基本相同且成对称的左右布置，这两个顶盖在转动机构的作用下能发生相对转动；左顶盖 11 和右顶盖 12 朝内的部分相连形成“X”形，且在最内端的位置具有二个提示板 13，上述提示板 13 与电力驱动系统连接，其中一个为显示电源容量的提示板 13，另一个为显示是否工作的提示板 13，在上述每个提示板 13 上均具有一个透明外罩 14。安装提示板 13 的作用主要是让使用者实时了解整车的具体情况。左顶盖 11 和右顶盖 12 剩余的部分即朝外的部分均具有一个弧形凸起 15、该弧形凸起 15 正好处于轮毂电机 4 上方，其相当于一个电机罩。

[0024] 内盖 2 处于中间位置，其主要是给整车的各个部件及轮毂电机 4 提供支撑，其同样包括一个左内盖 21 和一个右内盖 22；上述左内盖 21 和一个右内盖 22 的形状基本相同且成对称的左右布置，左内盖 21、右内盖 22 在转动机构的作用下能发生相对转动；该内盖 2 的中间位置可安装转动机构，左右两侧边缘位置则固定纵向安装的轮毂电机 4。

[0025] 为了防止踏板 5 及减少整车的体积，特别在左顶盖 11 和右顶盖 12 中间位置设计出第一空槽 16；左、右内盖在与第一空槽 16 相对应位置设计第二空槽 23，第一空槽 16 和第二空槽 23 相互结合形成放置踏板 5 的踏板空腔，踏板 5 就放置在踏板空腔内，为了增强踏板 5 的摩擦力，可在踏板 5 的上表面设计彼此间隔的增加摩擦力的摩擦条 51。

[0026] 底盖 3 处于最底部，其包括一个左底盖 31 和一个右底盖 32；上述左底盖 31 和右底盖 32 的形状基本相同且成对称的左右布置，这两个底盖在转动机构的作用下能发生相对转动；左底盖 31 和右底盖 32 朝内的部分相连形成“X”形且在最内端的外侧面具有二个透明的装饰灯 33。

[0027] 转动机构包括两个含油轴承 61、一个轴套 62、两个卡簧 63；两个轴承 61 分别固定在内盖 2 的左右内盖的内端，轴套 62 固定在两个轴承 61 内并通过卡簧 63 固定在内盖 2 上，这样内盖 2 的左右两个内盖就可在转动机构的配合下转动。为了安装上述转动机构，就在左内盖 21 和右内盖 22 朝内的端头设计圆柱形的筒体 24，轴承 61 和轴套 62 从外至内通过卡簧 63 安装在该筒体 24 内。为了防止转动机构的偏移，在左内盖 21 和右内盖 22 朝内的端头之间还设计有一个限位轴 7，该限位轴 7 处于右内盖 22 内的长度要长于处于左内盖 21 内的长度，这样一端起到限位的作用，另一端起到活动的作用。

[0028] 电力驱动系统为目前常见的使用在平衡车上的部件即属于现有技术，其内部程序也为现有技术，具体可参考目前已经公开的平衡车控制方法及各家平衡车生产企业采用到的电力驱动系统，如中国专利号 201320050547.3，专利名称为智能平衡车平衡控制装置及智能平衡车，这个控制装置即为本实施例中的电力驱动系统，或者如中国专利号 201220367045.9，专利名称为使用 CPLD 控制平衡车电机的电路控制装置中描述的；当然，在实际应用中，还可选用其它控制装置及控制方法，如中国专利号 201310516158.X，专利名称为两轮自平衡车控制方法中描述的控制方法。本实施例只是将其安装到底座 3 上并对电机 4 进行控制。具体的，该电力驱动系统主要包括供电电源 81、控制器 82、轮毂电机驱动电路、加速度传感器、陀螺仪 83、红外光电传感器；供电电源 81 与控制器 82 连接给控制器提供电源，控制器 82 与轮毂电机驱动电路连接是让其驱动对应的部件进行工作，加速度传感器、陀螺仪 83、红外光电传感器依次是检测车体的加速度变化、角度变化及车体上是否有使用者，这些都是本领域的技术人员非常清楚了解的技术，所以不再此过多描述。为了安装陀螺仪 83，特别在陀螺仪 83 下方设有一个“U”形的陀螺仪脚踏板 9 且该陀螺仪脚踏板 9 安装在底座 3 上。

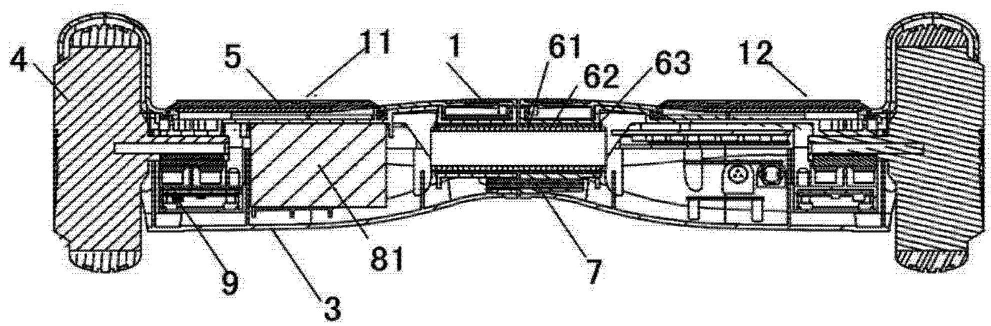

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图 1

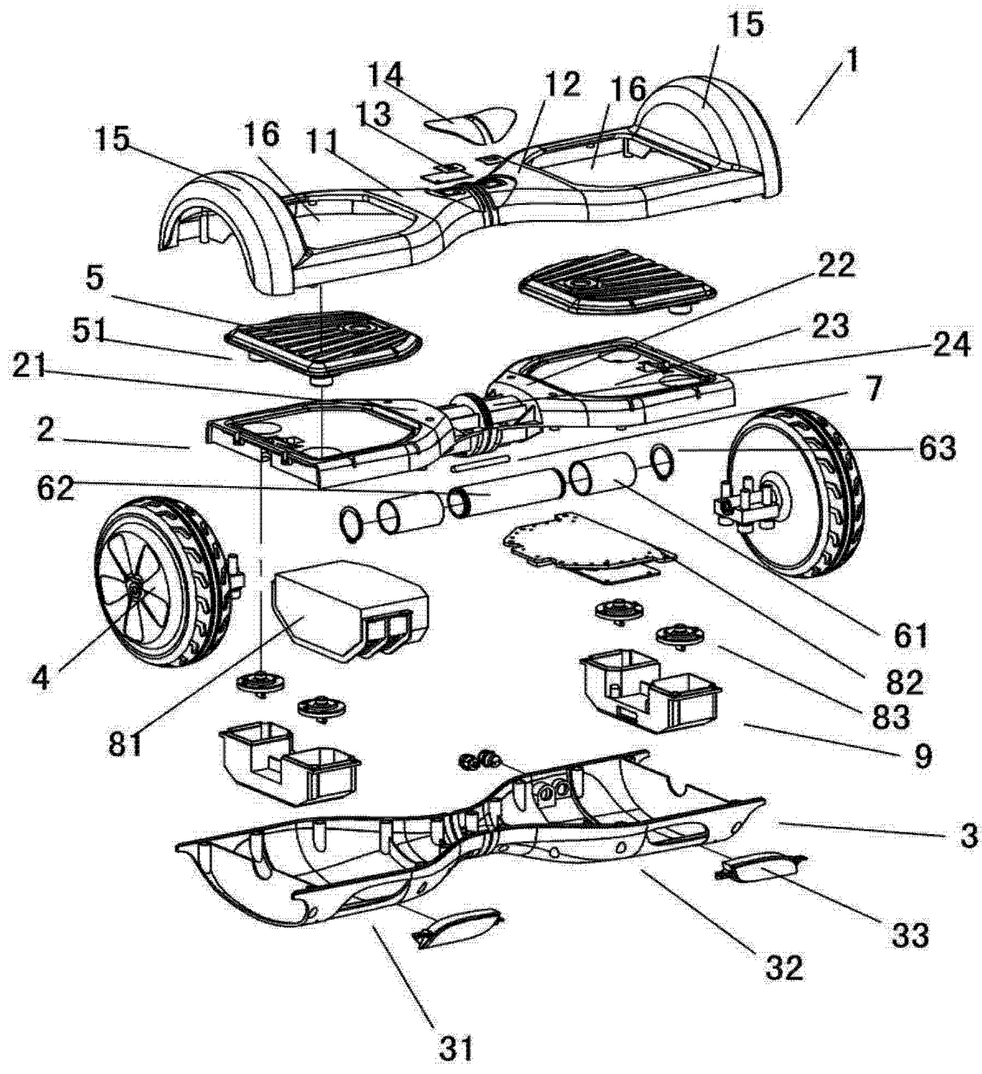
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图 2

CN302534790

Electric two-wheelers

Abstract

translated from Chinese by Google Patents

1. The application called electric two-wheelers, the operator's feet standing between two wheels on the pedal, the operator can manipulate the advancing and steering the motorcycle. 2. The application proposes Design 1 and 2 two kinds of similar design, similar to the design, the design of the wheel 1 is partially covered the wheels, 2 wheel cover is designed to cover most of the wheels. 3. Design a basic design, specify design a three-dimensional figure bulletin view. 4. Design 1 and Design 2 a perspective view, a front view, rear view, a plan view and a bottom view of the graphic center of the solid line represents the design of the two-wheeled electric vehicle is composed of left and right halves, the two halves can relative to one another twist.

电动两轮车

申请号：201330069450.2
申请日：2013-03-18

申请(专利权)人	陈和
地址	400700 重庆市北碚区朝阳路58号4-3-4室
发明(设计)人	陈和
主分类号	12-11
分类号	12-11
公开(公告)号	302534790S
公开(公告)日	2013-08-14
专利代理机构	
代理人	

(19) 中华人民共和国国家知识产权局

(12) 外观设计专利

(10) 授权公告号 CN 302534790 S
(45) 授权公告日 2013.08.14

(21) 申请号 201330069450.2

(22) 申请日 2013.03.18

(73) 专利权人 陈和
地址 400700 重庆市北碚区朝阳路 58 号
4-3-4 室

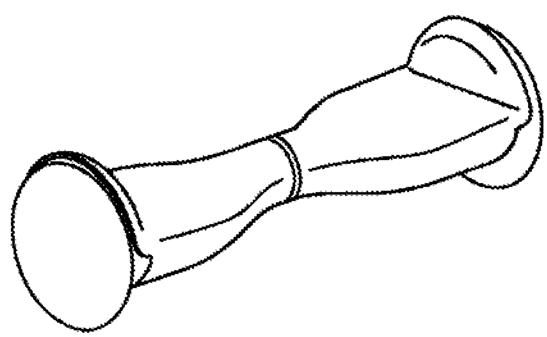
(72) 设计人 陈和

(51) LOC(9)Cl.
12-11

图片或照片 14 幅　简要说明 1 页

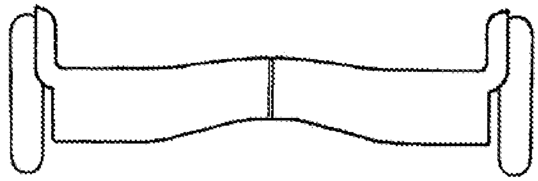
(54) 使用外观设计的产品名称

电动两轮车



设计 1 立体图

CN 302534790 S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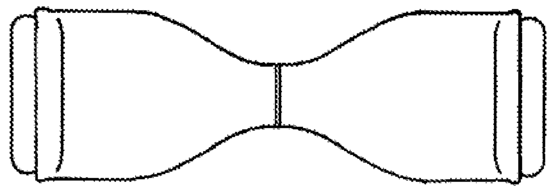
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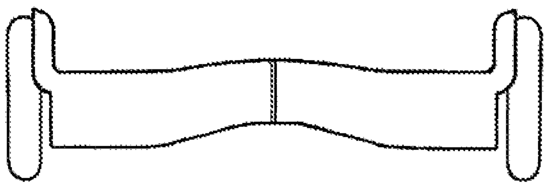
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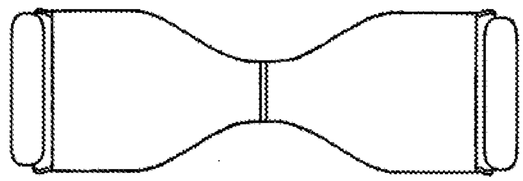
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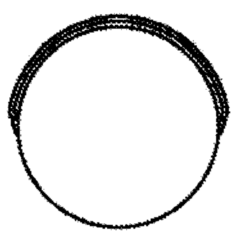
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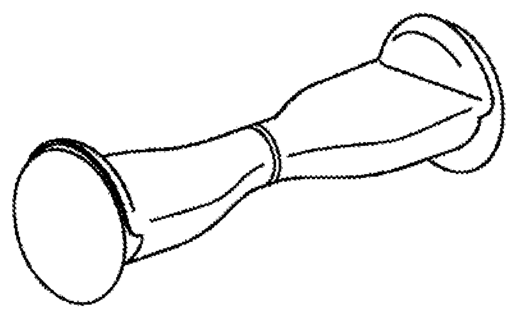
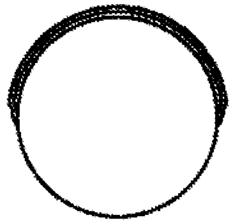
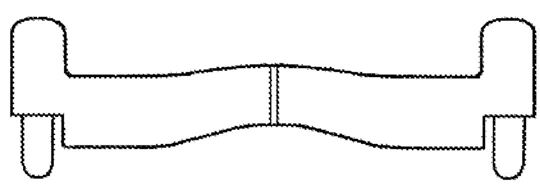
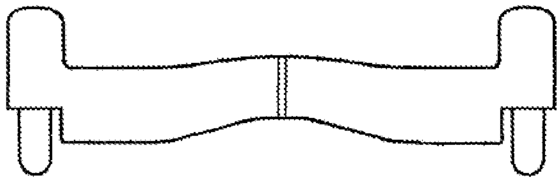
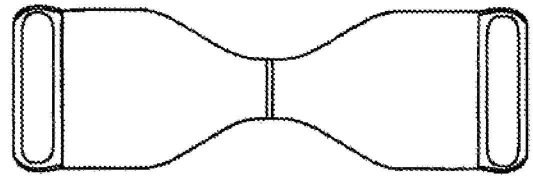

设计 1 立体图


设计 1 右视图

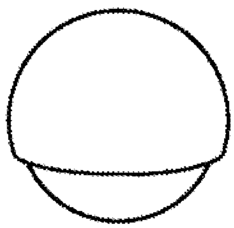

设计 2 主视图



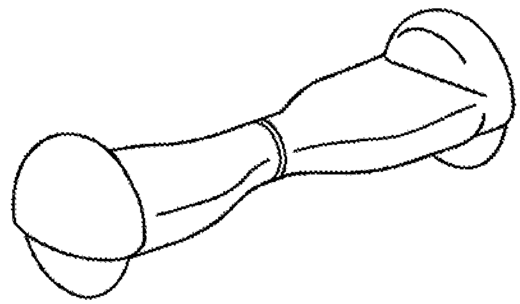
设计 2 后视图



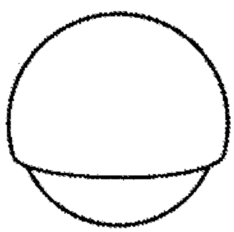
设计 2 仰视图



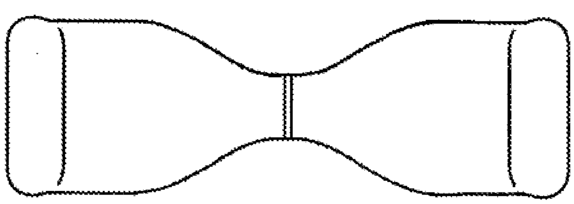
设计 2 左视图



设计 2 立体图



设计 2 右视图



设计 2 俯视图

1. 本申请名为电动两轮车，操作者的两脚站立在两个轮子之间的踏板上，操作者即可操纵两轮车的前进与转向。

2. 本申请提出了设计 1 与设计 2 两种同类的、相近的设计，设计 1 的轮罩是部分地盖住了轮子，设计 2 的轮罩是大部分地盖住了轮子。

3. 设计 1 为基本设计，指定设计 1 立体图为公告视图。

4. 设计1与设计2的立体图、主视图、后视图、俯视图与仰视图上，图形中央的实线表示本设计的两轮电动车是由左右两半部分所组成的，这两半部分能够彼此相对地扭转。

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 630 086 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 158(3) EPC

(43) Date of publication:
01.03.2006 Bulletin 2006/09

(21) Application number: **04745626.4**

(22) Date of filing: **01.06.2004**

(51) Int Cl.:
B62K 17/00 (1968.09) ***B62K 3/00*** (1968.09)
B62J 39/00 (1968.09) ***A63C 17/02*** (1968.09)

(86) International application number:
PCT/JP2004/007908

(87) International publication number:
WO 2004/108513 (16.12.2004 Gazette 2004/51)

(84) Designated Contracting States:
DE FR GB

(30) Priority: **04.06.2003 JP 2003159546**

(71) Applicant: **SONY CORPORATION**
Tokyo 141-0001 (JP)

(72) Inventor: **NISHIKAWA, Gousuke,**
c/o Sony Corporation
Tokyo 141-0001 (JP)

(74) Representative: **Körber, Martin Hans**
Mitscherlich & Partner,
Patent- und Rechtsanwälte,
Sonnenstrasse 33
80331 München (DE)

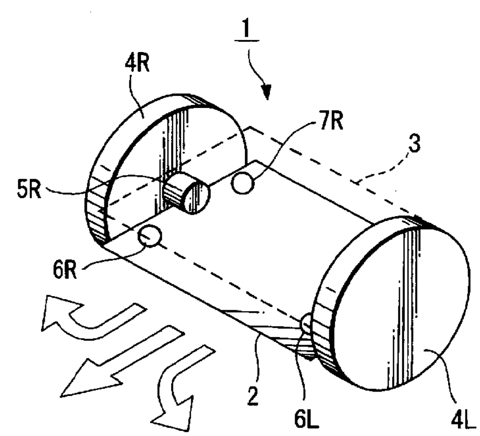
(54) VEHICLE STEERABLE BY MOVEMENT OF CENTER OF GRAVITY

(57) The present invention relates to a vehicle which can travel in the front and back direction and which can turn by right and left wheels rotated when a rider riding on a step-board moves the position of rider's balance from the center of a vehicle base.

A vehicle which can be steered based on movement of balance according to the present invention includes left and right wheels 4L and 4R located at least on the same axis, first and second drive motors 5L and 5R for rotating the left and right wheels 4L, 4R, a vehicle base 2 having the left and right wheels located at its left and right sides and which has the first and second drive motors mounted thereon, a step-board 3 located above the vehicle base 2 and on which a rider rides, pressure sensors 6L, 6R, 7L, 7R interposed between the vehicle base and the step-board to detect movement of rider's balance and a drive control means 10 for controlling driving of the first and second drive motors based on detected signals from the pressure sensors to enable the vehicle to travel straight and/or turn.

According to the present invention, it is possible for the rider to run the vehicle in the front and back direction and to turn the vehicle in the left and right direction by only moving rider's weight.

FIG. 1



Printed by Jouve, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The present invention relates to a vehicle which can be steered based on movement of balance in which a rider is able to run the vehicle in the forward and backward direction and to turn the vehicle by driving left and right wheels when the balance position of a rider riding on a step-board is moved from the center of a vehicle base after the rider's balance position has been detected.

BACKGROUND ART

[0002] In general, a skateboard is known as a vehicle by which a rider riding on a vehicle base or a step-board can skate on the skating surface of the land. This skateboard is composed of a board long in the front and back direction and which has suitable resiliency and front and back wheels rotatably supported on the lower surface of the front and back of this board. Each of the front and back wheels is formed of a combination of left and right wheels located symmetrically in the left and right direction. Accordingly, the board is supported on the skating surface of land by the four wheels on the whole.

[0003] Although the skateboarder is able to steer the skateboard having the above arrangement by moving skate-boarder's weight, it is difficult for the skateboarder to continuously move the skateboarder's own weight and hence it is required that the skateboarder should become skillful to slalom. For this reason, as is disclosed in Cited Patent Reference 1, there is proposed a skating roller board by which the skateboarder becomes able to slalom easily.

[0004] Cited Patent Reference 1 has described the skating roller board for training by which skateboarders can skate or snowboarder can skate. The skating roller board described in the Cited Patent Reference 1 is characterized in that the front wheel is composed of one wheel.

[0005] Also, in the ordinary skateboard, the skateboarder is a power source for generating power and hence the skateboarder has to generate propulsive force to go ahead by kicking the ground with the foot. Accordingly, since almost all skateboarders suffer from hard labor to continuously generate propulsive force, there is provided a power-driven skateboard. An example of such power-driven skateboard is shown as Cited Patent Reference 2.

[0006] Cited Patent Reference 2 has described a power-driven skateboard with a safety device. In a skateboard including a propulsive force generating means and a controller for controlling the propulsive force generating means, this power-driven skateboard is comprised of a weighting detecting means for detecting whether or not vertical weighting is applied to the skateboard and a control means for allowing the propulsive force generating means to generate propulsive force when weighting is detected.

Cited Patent Reference 1:

[0007] Official Gazette of Japanese laid-open patent application No. 2003-126325 (page 2, FIG. 4)

Cited Patent Reference 2:

[0008] Official Gazette of Japanese laid-open patent application No. 2000-140190 (page 2, FIG. 1)

[0009] However, in the above-mentioned skateboard, the skateboarder is able to steer the skateboard by moving skateboarder's weight. When the skateboarder moves the skateboarder's weight, the shakeboard is bent to set an inclination angle between an axle of a front wheel and an axle of a back wheel, whereby the skateboarder can turn the skateboard in the inclination direction. Therefore, the skateboarder has to move the shakeboarder's weight after the skateboarder has determined the movement amount of the weight, the movement speed and the like in consideration of various factors such as a running speed and a radius of turning. Accordingly, it is difficult for the skateboarder to balance on the skateboard and hence it is requested that the skateboarder should become skillful to skate.

[0010] In view of the aforesaid aspects, the present invention intends to provide a vehicle which can be steered based on movement of weight, the rider being able to run this vehicle in the front and back direction and who is also able to turn this vehicle in the left and right direction by only moving the rider's weight.

DISCLOSURE OF THE INVENTION

[0011] In order to solve the above-described problems and in order to attain the above-described object, a vehicle which can be steered based on movement of balance according to claim 1 of the present application is composed of first and second wheels located at least on the same axis, a first rotary drive means for rotating the first wheel and a second rotary drive means for rotating the second wheel, a vehicle base having the first and second wheels located at its right and left sides and which has the first and second rotary drive means mounted thereon, a step-board located above the vehicle base and on which someone rides, a balance movement detecting means interposed between the vehicle base and the step-board to detect movement of rider's balance and a drive control means for controlling driving of the first and second rotary drive means based on a detected signal from the balance movement detecting means to enable the vehicle to travel straight and/or turn.

[0012] In a vehicle which can be steered based on movement of balance according to claim 2 of the present application, the balance movement detecting means is composed of a front-side detecting means located ahead of the position at which a rider rides on the vehicle base and a back-side detecting means located behind the position at which the rider rides on the vehicle.

[0013] In a vehicle which can be steered based on movement of balance according to claim 3 of the present application, the balance movement detecting means is composed of two front-side detecting means located at right and left sides ahead of the position at which a rider rides on the vehicle base and two back-side detecting means located at right and left sides behind the position at which the rider rides on the vehicle base.

[0014] In a vehicle which can be steered based on movement of balance according to claim 4 of the present application, the front-side detecting means and the back-side detecting means are both pressure sensors.

[0015] In a vehicle which can be steered based on movement of balance according to claim 5 of the present application, a third wheel is provided in addition to the first and second wheels and the third wheel is located with a displacement ahead of or behind an axial line connecting the first and second wheels.

[0016] In a vehicle which can be steered based on movement of balance according to claim 6 of the present application, third and fourth wheels located on the same axis are provided in addition to the first and second wheels and the third and fourth wheels are located with a displacement ahead of or behind the axial line connecting the first and second wheels.

[0017] In a vehicle which can be steered based on movement of balance according to claim 7 of the present application, the vehicle base includes a support shaft to rotatably support the step-board at one place in substantially a point-contact fashion.

[0018] In a vehicle which can be steered based on movement of balance according to claim 8 of the present application, the support shaft is provided on the vehicle base so as to rise at the position of balance of the vehicle base.

[0019] According to the aforementioned arrangement, in the vehicle which can be steered based on movement of balance according to the claim 1 of the present application, when the rider riding on the step-board moves rider's weight, movement of rider's weight is detected by the balance movement detecting means interposed between the vehicle base and the step-board and a detected signal is transmitted to the drive control means. Having received the detected signal, the drive control means supplies a control signal corresponding to the detected signal to the first and second rotary drive means to rotate the first and second wheels in response to the position of rider's weight. Consequently, the vehicle can travel straight and/or turn in response to the movement of rider's weight, and hence it is possible to provide an interesting vehicle which can be moved and steered by only moving rider's balance.

[0020] In a vehicle which can be steered based on movement of balance according to the claim 2 of the present application, since the front-side detecting means is located ahead of the vehicle base, the back-side detecting means is located behind the vehicle base and the step-board is supported by the front and back two detecting means, it is possible to accurately and reliably detect by the front and back two detecting means the direction and degree in which the position of rider's balance is moved when the rider on the step-board moves one's weight.

[0021] In a vehicle which can be steered based on movement of balance according to the claim 3 of the present application, since the right and left two front-side detecting means are located ahead of the vehicle base, the right and left two back-side detecting means are located behind the vehicle base and the step-board is supported by the four detecting means in total, it is possible to accurately and reliably detect by the front and back four detecting means the direction and degree in which the position of rider's balance is moved when the rider on the step-board moves rider's weight.

[0022] In a vehicle which can be steered based on movement of balance according to the claim 4 of the present application, since the pressure sensors are used as the detecting means, it is possible to easily and accurately detect movement of rider's balance by a simple mechanism.

[0023] In a vehicle which can be steered based on movement of balance according to the claim 5 of the present application, since the vehicle includes the third wheel in addition to the first and second wheels and the axle of the third wheel is located ahead of or behind the axle which connects the first and second wheels, it is possible to realize the vehicle of the present invention as a tricycle to improve stability of the vehicle.

[0024] In a vehicle which can be steered based on movement of balance according to the claim 6 of the present application, since the vehicle includes the third and fourth wheels located on the same axis in addition to the first and second wheels and the axle which connects the third and fourth wheels is located ahead of or behind the axle which connects the first and second wheels, it is possible to realize the vehicle of the present invention as a four-wheeled vehicle to improve stability of the vehicle.

[0025] In a vehicle which can be steered based on movement of balance according to the claim 7 of the present application, since the step-board is supported to the vehicle base at one portion by the supporting shaft, it is possible to simplify processing executed by the drive control means which executes calculation based on the detected signal outputted from the balance movement detecting means.

[0026] Also, in a vehicle which can be steered based on movement of balance according to the claim 8 of the present application, since the support shaft is provided at the position of balance of the vehicle base, it is possible to simplify processing executed by the drive control means more.

BRIEF DESCRIPTION OF DRAWINGS

[0027]

FIG. 1 is a perspective view schematically showing an arrangement of a bicycle according to a first embodiment of a vehicle which can be steered based on balance movement according to the present invention;
FIG. 2 is a plan view of the bicycle shown in FIG. 1;
FIG. 3 is a front view of the bicycle shown in FIG. 1;
FIG. 4 is a front view of a modified embodiment of the bicycle shown in FIG. 1;
FIG. 5 is an explanatory diagram useful for explaining a pressure distribution of pressure sensors which show a balance movement detecting means according to a first embodiment of the present invention;
FIG. 6 is a circuit diagram showing an arrangement of a drive control means according to a first embodiment of the present invention;
FIG. 7A is an explanatory diagram used to explain balance movement detected by the balance movement detecting means according to the present invention and to which reference will be made in explaining the state in which balance W and a vehicle center O become coincident with each other;
FIG. 7B is a diagram used to explain balance movement detected by the balance movement detecting means according to the present invention and to which reference will be made in explaining the state in which the balance W is moved from the vehicle center O to the front side;
FIG. 7C is a diagram used to explain balance movement detected by the balance movement detecting means according to the present invention and to which reference will be made in explaining the state in which the balance W is moved from the vehicle center O to the front left side;
FIG. 8 is an explanatory diagram showing the state in which someone rides on the bicycle according to the first embodiment of the present invention;
FIG. 9 is an explanatory diagram showing the bicycle according to the second embodiment of the present invention;
FIG. 10 is an explanatory diagram showing a bicycle according to a third embodiment of the present invention;
FIG. 11 is an explanatory diagram showing a tricycle according to a first embodiment of the present invention;
FIG. 12 is an explanatory diagram showing a tricycle according to a second embodiment of the present invention; and
FIG. 13 is an explanatory diagram showing a four-wheeled vehicle according to a first embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0028] Embodiments of the present invention will be described below with reference to the attached drawings.

[0029] As shown in FIGS. 1 to 3, a bicycle 1 of a vehicle which can be steered based on balance movement according to a first embodiment of the present invention is composed of a vehicle base 2, a step-board 3, two wheels 4L, 4R, two drive motors 5L, 5R, four pressure sensors S_{FL}, S_{FR}, S_{BL} and S_{BR} and so forth.

[0030] The vehicle base 2 is formed of a square board-like member and it has a left-hand side drive motor 5L, which shows a specific example of a first rotary drive means, mounted on the left-hand side of its intermediate portion of the front and back direction. Also, it has a right-hand side drive motor 5R, which shows a specific example of a second rotary drive means, mounted on the right-hand side of its intermediate portion of the front and back direction. A DC motor, a synchronous motor, an induction motor and a stepper motor, for example, may be suitable for the application to these drive motors 5L, 5R but motors of other types also can be applied to these drive motors.

[0031] The respective drive motors 5L, 5R are fixed to the vehicle base 2 by a fixing means such as screws such that their rotary shafts 8 are projected in the lateral directions. A left-hand side wheel 4L is fixed to a rotary shaft 8L of the left-hand side drive motor 5L and a right-hand side wheel 4R is fixed to a rotary shaft 8R of the right-hand side drive motor 5R. Thus, when the left and right drive motors 5L, 5R are rotated in the directions opposite to each other, the left and right wheels 4L, 4R are rotated in the front direction or in the back direction at the same time in response to their rotation directions. On the other hand, when the left and right drive motors 5L, 5R are rotated in the same direction, the left and right wheels are rotated in the directions opposite to each other in response to their rotation directions.

[0032] Four pressure sensors, in total, which show a specific example of a balance movement detecting means, are mounted on the four corners of the vehicle base 2. Specifically, a front left-hand side sensor (S_{FL}) 6L is disposed at the front left corner of the vehicle base 2 and a front right-hand side sensor (S_{FR}) 6R is disposed at the front right corner of the vehicle base. Then, a back left-hand side sensor (S_{BL}) 7L is disposed at the back left corner of the vehicle base 2 and a back right-hand side sensor (S_{BR}) 7R is disposed at the back right corner of the vehicle base. The same pressure sensors are used as the four pressure sensors 6L, 6R, 7L, 7R and they are fixed to the vehicle base 2 in such a manner that their input portions are faced upward.

[0033] A step-board 3 formed of a square board member, which has substantially similar planar shape as that of the vehicle base 2, is mounted on the four pressure sensors 6L, 6R, 7L, 7R. As shown in FIG. 3, this step-board 3 may be only mounted on the four pressure sensors 6L, 6R, 7L, 7R without setting the reference position along the height direction. However, as shown in FIG. 4, it is desirable that the step-board 3 should rotatably be supported at one place by a support shaft 9 erected on the vehicle base 2 in substantially a point-contact fashion.

[0034] In this case, when the step-board 3 is supported, the support shaft 9, for example, has a spherical surface portion formed at its tip end and a spherical surface bearing which can rotatably hold the above spherical surface portion is formed on the lower surface of the step-board 3, whereby the step-board can be supported by a combination of the spherical surface portion and the spherical surface bearing. This spherical surface portion and the spherical surface bearing may be disposed in the manner opposite to the above manner so that the spherical surface bearing may be formed on the tip end of the support shaft 9 and that the spherical surface portion may be formed on the step-board 3.

[0035] As described above, the step-board 3 is supported by the support shaft 9 from the lower direction and the four pressure sensors 6L, 6R, 7L, 7R are disposed with the equal distance from the support shaft 9, whereby values (reference values) of all pressure sensors 6L, 6R, 7L, 7R can be set to be equal when the step-board 3 is placed in the horizontal state. In such a case, detected values among the four pressure sensors 6L, 6R, 7L, 7R need not be adjusted each other and their detected values are supplied to a drive control means, which will be described later on, as they are. Accordingly, it is possible to simplify calculation processing of inclination direction, inclination angle and the like by using their detected values.

[0036] On the other hand, in the case of the embodiment shown in FIG. 3 in which the support shaft 9 is not provided, since the reference position of the step-board 3 is not set, the height of the step-board 3 in the horizontal state is changed with the rider's weight. Consequently, as the rider's balance is moved, the inclination of the step-board 3 is changed while the whole of the step-board is being moved in the upper and lower direction. Accordingly, the reference position of the step-board 3 is changed every time and it is necessary to calculate the reference position of the step-board 3 each time. Then, since it becomes possible to calculate the displacement amounts among the pressure sensors 6L, 6R, 7L, 7R by comparing the thus calculated reference positions with respective detected values and also it becomes possible to calculate the inclination direction, the inclination angle and so on of the step-board 3 by using the calculated values, the calculation processing becomes a little cumbersome.

[0037] In order to execute such calculation processing, the detected signals are supplied from the four pressure sensors 6L, 6R, 7L, 7R to the vehicle base 2 and this vehicle is provided with a drive control means 10 which outputs control signals to control driving of the two drive motors 5L, 5R based on these detected signals. This drive control means 10 may have an arrangement shown in FIG. 6, for example.

[0038] The drive control means 10 is composed of four adders 11, 12, 13, 14, a summing subtracter 15, three amplifiers 16, 17, 18 and two summing accumulators 20, 21. A detected signal from the front right sensor (S_{FR}) 6R is inputted to the first and second adders 11 and 12. A detected signal from the back right sensor (S_{BR}) 7R is inputted to the second and third adders 12 and 13. Also, a detected signal from the front left sensor (S_{FL}) 6L is inputted to the first and fourth adders 11 and 14 and a detected signal from the back left sensor (S_{BL}) 7L is inputted to the third and fourth adders 13 and 14.

[0039] A signal outputted from the first adder 11 is inputted to the summing subtracter 15 and a signal outputted from the third adder 13 also is inputted to the summing subtracter 15. A signal outputted from the summing subtracter 15 is inputted to the first amplifier 16. Also, a signal outputted from the second adder 12 is inputted to the second amplifier 17 and a signal outputted from the fourth adder 14 is inputted to the third amplifier 18. Then, signals outputted from the first amplifier 16, the second amplifier 17 and the third amplifier 18 are respectively inputted to the first and second summing accumulators 20 and 21.

[0040] The first summing accumulator 20 is connected to the right-hand side drive motor 5R for rotating the right-hand side wheel 4R and the second summing accumulator 21 is connected to the left-hand side drive motor 5L for rotating the left-hand side wheel 4L. As a result, the first summing accumulator 20 outputs a control signal to control driving of the right-hand side drive motor 5R and the second summing accumulator 21 outputs a control signal to control driving of the left-hand side drive motor 5L. Driving forces for driving the respective drive motors in response to the thus outputted control signals are calculated by the following equations, for example.

[0041] Let it be now assumed that pressures of the four pressure sensors 6L, 6R, 7L, 7R are S_{FL}, S_{FR}, S_{BL}, S_{BR} and that coefficients of the three amplifiers 16, 17, 18 are K, K_L, K_R. Then, driving force M_R of the right-hand side drive motor 5R is expressed by the following equation:

$$M_R = K_R (S_{FR} + S_{BR}) - K_L (S_{FL} + S_{BL}) + K (S_{FR} + S_{FL} - S_{BR} + S_{BL}) \quad \ldots (1)$$

[0042] Driving force M_L of the left-hand side drive motor 5L is given by the following equation:

$$M_L = K_L (S_{FL} + S_{BL}) - K_R (S_{FR} + S_{BR}) + K (S_{FR} + S_{FL} - S_{BR} + S_{BL}) \quad \ldots (2)$$

[0043] Also, as shown in FIG. 5, let it be assumed that a total weight applied to the four pressure sensors 6L, 6R, 7L, 7R is W, weight components shared by the respective pressure sensors 6L, 6R, 7L, 7R are W1, W2, W3, W4, a center of balance of the vehicle base 2 is O and that distances from the x axis and the y axis of orthogonal coordinate axes set around the balance O to the weight W are X and Y. Further, let it be assumed that the distances from the x axis and the y axis to the respective pressure sensors 6L, 6R, 7L, 7R are equally Lx and Ly.
[0044] Then, the total weight W obtained at that time is expressed by the following equation:

$$\text{Total weight } W = S_{FL} + S_{FR} + S_{BL} + S_{BR} \quad \ldots (3)$$

[0045] Also, weight components W1, W2, W3, W4 are respectively expressed by the following equations:

$$\text{Weight component } W1 = (S_{FL} + S_{FR})/2 \quad \ldots (4)$$

$$\text{Weight component } W2 = (S_{BL} + S_{BR})/2 \quad \ldots (5)$$

$$\text{Weight component } W3 = (S_{FL} + S_{BL})/2 \quad \ldots (6)$$

$$\text{Weight component } W4 = (S_{BR} + S_{FR})/2 \quad \ldots (7)$$

[0046] Further, coordinate positions X, Y of the balance O are expressed by the following equations:

$$X = Lx \times (W1 - W2)/(W1 + W2) \quad \ldots (8)$$

$$Y = Ly \times (W3 - W4)/(W3 + W4) \quad \ldots (9)$$

[0047] Because the rider stands on the central portion of the step-board 3, the balance W is coincident with the center O of the vehicle base 2 (shown by solid arrows in FIGS. 3 and 4) with the result that the vehicle base 2 and the step-board 3 are both placed horizontally in the equilibrium state as shown in FIG. 7A.
[0048] Let it now be assumed that the rider moves the weight in this balanced state so that the above state is changed to the state shown in FIG. 7B. At that time, since the balance W exists on the y axis, although the values of the pressure

sensors 6L and 6R and the pressure sensors 7L and 7R located on the left and right direction are equal to each other ($S_{FL} = S_{FR}$), ($S_{BL} = S_{BR}$), the values of the pressure sensors 6L and 7L and the pressure sensors 6R and 7R located in the front and back direction become positive and negative ($S_{FL} = -S_{BL}$), ($S_{FR} = -S_{BR}$) , respectively.

[0049] For example, assuming that the values of $S_{FL} = S_{FR}$ are equal to each other and that they are 10 kg, then $S_{BL} + S_{BR} = -10$ kg is established.

[0050] Also, if the values of K, K_L, K_R are respectively selected to be 1 in order to simplify computation, the following equation is obtained from the equation (1) :

$$M_R = 1\ (10 - 10) - 1\ (10 - 10) + 1\ (10 + 10 + 10 - 10) = 20$$

[0051] Similarly, the following equation is obtained from the equation (2):

$$M_L = 1\ (10 - 10) - 1\ (10 - 10) + 1\ (10 + 10 + 10 - 10) = 20$$

[0052] As described above, driving forces for rotating the left and right wheels 4L, 4R become the same values with the same sign and become 20 kg. As a result, the left and right wheels 4L and 4R are both rotated in the front direction by the equal driving force. As a consequence, this vehicle travels straight in the upper direction along the y axis direction in FIG. 7B.

[0053] On the other hand, let it be assumed that the well-balanced state shown in FIG. 7A is changed to the state shown in FIG. 7C by movement of the balance W. At that time, for example, let it be assumed that the value of S_{FL} is 10 kg, the values of S_{FR} and S_{BL} are both 5 kg and that the value of S_{BR} is -10 kg. Then, M_R obtained at that time is expressed by the equation (1) as:

$$M_R = 1\ (5 - 10) - 1\ (10 + 5) + 1\ (5 + 10 + 10 + 5) = -5 - 15 + 30 = 10$$

[0054] Also, M_L is given by the equation (2) as:

$$M_L = 1\ (10 + 5) - 1\ (5 - 10) + 1\ (5 + 10 + 10 + 5) = 15 + 5 + 30 = 50$$

[0055] In this case, the driving force for rotating the left wheel 4L becomes 50kg and the driving force for rotating the right wheel 4R becomes 10 kg. Accordingly, control signals corresponding to these driving forces are outputted from the drive control means 10 to the left-hand side drive motor 5L and the right-hand side drive motor 5R. Thus, in response to the values of the inputted control signals, the left wheel 4L is rotated by the driving force of 50 kg and the right wheel 4R is rotated by the driving force of 10 kg. As a result, this vehicle turns in the clockwise direction in FIG. 7C.

[0056] Therefore, according to this embodiment, as shown in FIG. 7A, when the balance W is moved in the front side from the vehicle center O by movement of rider's weight, the weight balance of the vehicle is moved toward the front side and movement of the balance W is detected by the four pressure sensors 6L, 6R, 7L, 7R. As a result, the detected signals corresponding to the detected values are outputted from the respective pressure sensors 6L, 6R, 7L, 7R and these detected signals are inputted to the drive control means 10, whereby the drive control means 10 outputs the control signals corresponding to the movement amount of the balance W to the left and right drive motors 5L, 5R.

[0057] Thus, the left and right wheels 4L, 4R are similarly rotated in the front side. As a result, the vehicle travels in the front side and the vehicle can continuously travel straight in the forward direction by maintaining the state in which the balance W is moved from the vehicle center O to the front side.

[0058] When this vehicle is stopped from traveling in the forward direction, the balance W that has been placed at the displaced position should be returned to the vehicle center O. At that time, when the balance W is returned to the vehicle center O, the detected values outputted from the four pressure sensors 6L, 6R, 7L, 7R become equal to each other so that the control signals outputted to the left and right drive motors 5L, 5R are both decreased to zero. As a result, rotations of the left and right drive motors 5L, 5R are stopped and the vehicle is stopped running.

[0059] Controlling of traveling of the vehicle will apply for the case in which the balance W is moved from the vehicle center O to the rearward as well. Specifically, when it is detected by the four pressure sensors 6L, 6R, 7L, 7R that the balance W is moved from the vehicle center O to the rearward, the drive control means 10 outputs the control signals to enable the left and right wheels 4L, 4R to be rotated in the backward direction. Thus, the vehicle can travel in the backward direction. Also, the vehicle can be stopped from being moved in the backward direction by a method similar to the aforementioned method required when the vehicle is stopped from being moved in the forward direction.

[0060] Also, when the balance W is moved from the vehicle center O to the front direction or the oblique backward direction or the lateral direction by movement of rider's weight, the weight balance of the vehicle is changed in the moving direction of the balance W and the changes of balance are detected as the changes of pressure by the four pressure sensors 6L, 6R, 7L, 7R and the detected signals are supplied to the drive control means 10. Consequently, the drive control means 10 outputs the control signals corresponding to the movement amount of the balance W to the left and right drive motors 5L, 5R.

[0061] Accordingly, the left and right wheels 4L, 4R are rotated in the forward direction or the backward direction in response to the respective control signals. As a result, the wheel of the direction in which the balance W is moved is rotated more strong that the other wheel and the driving force corresponding to the weight component is generated, whereby the vehicle can turn in the right direction or the left direction.

[0062] The vehicle which can be moved and steered as described above may be realized as vehicles having arrangements shown in FIGS. 8 to 13, for example. FIGS. 8 to 10 show the vehicles constructed as bicycle type vehicles; FIGS. 11 and 12 show the vehicles constructed as tricycle type vehicles and FIG. 13 shows the vehicle constructed as a four-wheeled type vehicle. In FIGS. 8 to 13, elements and parts identical to those of FIGS. 1 to 4 are denoted by identical reference numerals and therefore need not be described.

[0063] A first embodiment of the bicycle type vehicle shown in FIG. 8 shows the vehicle by which the rider can ride on the vehicle with legs wide open in the lateral direction as if the rider was riding on the log. In the case of this bicycle 1, the rider can ride on this bicycle relatively easily with high stability as if the rider was riding on the log, and hence the rider is able to run and steer this bicycle by only moving the balance.

[0064] A second embodiment of the bicycle type vehicle shown in FIG. 9 shows the vehicle by which the rider can ride on this bicycle with legs wide open in the front and back direction as if the rider was riding on the surfboard. In the case of this bicycle 30, the rider can ride on this bicycle as if the rider was surfing. In addition, the rider can ride on this bicycle with high stability and the rider is able to run and steer the bicycle by only moving the balance.

[0065] A third embodiment of the bicycle type vehicle shown in FIG. 10 shows the vehicle in which the rider can ride on this bicycle with left and right legs attached to bicycles as roller skates. In the case of this bicycle 31, the rider can ride on this bicycle as if the rider was roller skating. Thus, in a similar manner, the rider is able to run and steer this bicycle by only moving the balance.

[0066] A first embodiment (tricycle 32) of the tricycle type vehicle shown in FIG. 11 shows the tricycle in which one auxiliary wheel 22 is provided at the front central portion of the left and right wheels 4L, 4R. Also, a second embodiment (tricycle 33) of the tricycle type vehicle shown in FIG. 12 shows the tricycle in which one auxiliary wheel 23 is provided at the rear central portion of the left and right wheel 4L, 4R. Since the auxiliary wheel 22 of the tricycle 32 and the auxiliary wheel 23 of the tricycle 33 are mainly used to maintain stability of the vehicle base 2, although it is sufficient that they may be rotatably supported to the vehicle base 2 or the step-board 3, they may include power such a driving motor similarly to the left and right wheels 4L, 4R.

[0067] A first embodiment (four-wheeled vehicle 34) of a four-wheeled type vehicle shown in FIG. 13 shows a four-wheeled vehicle in which a pair of auxiliary wheels 24L, 24R is provided at the back side (front side is also possible) of the left and right wheels 4L, 4R. Since the auxiliary wheels 24L, 24R of the four-wheeled vehicle 34 are mainly used to maintain stability of the vehicle base 2, although it is sufficient that they may be rotatably supported to the vehicle base 2 or the step-board 3, they may have power such as driving motors similarly to the left and right wheels 4L, 4R. Also, although not shown, one auxiliary wheel may be disposed at the front and back central portions of the left and right wheels 4L, 4R, whereby four wheels may be located in a diamond fashion on the whole.

[0068] According to the vehicles 30, 31, 32, 33 and 34 having the arrangements shown in FIGS. 9 to 13, similarly to the vehicle 1 of the aforementioned first embodiment, the rider can run and steer the vehicles by moving the balance.

[0069] As the aforementioned wheels, there can be used wheels made of various kinds of materials such as tubular tires into which air is filled, solid rubber tires the whole of which are made of rubber, wooden wheels, metal wheels and plastic wheels. Also, while the examples in which the pressure sensors are used as the balance movement detecting means have been described so far, the pressure sensor may be replaced with a strain gauge in which a physical amount such as pressure, load, displacement and torque may be converted into an electric signal to thereby detect a weight.

[0070] Further, while the cases in which the vehicle includes the four pressure sensors S_{FL}, S_{FR}, S_{BL} and S_{BR} have been described so far in the above-described embodiments, the present invention is not limited thereto and one pressure sensor may be disposed ahead of or behind the balance position of the vehicle. In this case, the front and back pressure sensors may be located in the front and back diagonal lines or they may be located in the front and back direction along the central line.

[0071] For example, only the front left-hand side sensor (S_{FL}) 6L may be located at the left corner of the front side of the vehicle base 2 and only the back right-hand side sensor (S_{BR}) 7R may be located at the right corner of the back side of the vehicle base 2. Conversely, only the front right-hand side sensor (S_{FR}) 6R may be located at the right corner of the front side of the vehicle base 2 and only the back left-hand side sensor (S_{BL}) 7L may be located at the left corner of the back side of the vehicle base 2. In the case of such arrangement, if the outputs of the front side pressure sensor (S_{FR}) or (S_{FL}) and the back side pressure sensor (S_{BL}) or (S_{BR}) that should be deleted are decreased to zero, explanations concerning the above-mentioned calculation equations will apply for operations other than turning operation and hence the rider can run the vehicle straight.

[0072] Further, if the vehicle has the arrangement in which it includes any one of the front left-hand side sensor (S_{FL}) 6L or the front right-hand side sensor (S_{FR}) 6R and the back right-hand side sensor (S_{BR}) 7R or the back left-hand side sensor (S_{BL}) 7L, then the rider can turn the vehicle. In this case, if the outputs of the front side pressure sensor (S_{FR}) or (S_{FL}) and the back side pressure sensor (S_{BL}) or (S_{BR}) that should be deleted are decreased to zero, then explanations concerning the above-mentioned calculation equations will apply for operations other than traveling straight as well and hence the rider can turn the vehicle. Furthermore, the vehicle may have a modified arrangement in which three pressure sensors are located in a triangular fashion.

[0073] Also, while the examples in which the pressure sensors are used as specific examples of the balance movement detecting means have been described so far in the above-described embodiments, sensors of other types, such as an elastomer sensor and an electrostatic capacity pressure transducer, can be applied to specific examples of the balance movement detecting means. The elastomer sensor is made of a material in which slight conductivity is given to rubber and soft synthetic resin and molded as a necessary shape. This elastomer sensor generates a resistance change proportional to a deformed amount and a resistance change proportional to its speed in addition to the function of the resistance change sensor. Further, this elastomer sensor has characteristics such that it can be made flexible and which can be processed by molding. By using this elastomer sensor, it is possible to obtain a signal which is coincident with the operation direction and also it is possible to obtain a signal proportional to a degree of rider's weight movement and fluctuations of a movement speed of rider's weight.

[0074] Also, the electrostatic capacity pressure transducer is adapted to measure pressure by using electric characteristics of electrostatic capacity (capacitance). When this electrostatic capacity pressure transducer is in use, a gap between the electrodes is decreased under a certain pressurized circumstance. Hence, it is possible to achieve effects similar to those of the above-described embodiments by measuring the change of resulting electrostatic capacity with a driving circuit. As described above, the present invention is not limited to the aforementioned embodiments shown in the sheets of drawings and can be variously modified and carried out without departing from the gist thereof.

Claims

1. A vehicle which can be steered based on movement of balance comprising:

first and second wheels located at least on the same axis;
first rotary drive means for rotating said first wheel and second rotary drive means for rotating said second wheel;
a vehicle base having said first and second wheels located at its right and left sides and which has said first and second rotary drive means mounted thereon;
a step-board located above said vehicle base and on which a rider rides;
balance movement detecting means interposed between said vehicle base and said step-board to detect movement of rider's balance; and
drive control means for controlling driving of said first and second rotary drive means based on a detected signal from said balance movement detecting means to enable said vehicle to travel straight and/or turn.

2. In a vehicle which can be steered based on movement of balance according to claim 1, a vehicle which can be steered based on movement of balance is **characterized in that** said balance movement detecting means is composed of a front-side detecting means located ahead of the position at which someone rides on said vehicle base and a back-side detecting means located behind the position at which a rider rides on said vehicle base.

3. In a vehicle which can be steered based on movement of balance according to claim 1, a vehicle which can be steered based on movement of balance is **characterized in that** said balance movement detecting means is composed of two front-side detecting means located at right and left sides ahead of the position at which a rider rides on said vehicle base and two back-side detecting means located at right and left sides behind the position at which the rider rides on said vehicle base.

4. In a vehicle which can be steered based on movement of balance according to claim 2, a vehicle which can be steered based on movement of balance is **characterized in that** said front-side detecting means and said back-side detecting means are both pressure sensors.

5. In a vehicle which can be steered based on movement of balance according to claim 1, a vehicle which can be steered based on movement of balance is **characterized in that** a third wheel is provided in addition to said first and second wheels and said third wheel is located with a displacement ahead of or behind an axial line connecting said first and second wheels.

6. In a vehicle which can be steered based on movement of balance according to claim 1, a vehicle which can be steered based on movement of balance is **characterized in that** third and fourth wheels located on the same axis are provided in addition to said first and second wheels and said third and fourth wheels are located with a displacement ahead of or behind the axial line connecting said first and second wheels.

7. In a vehicle which can be steered based on movement of balance according to claim 1, a vehicle which can be steered based on movement of balance is **characterized in that** said vehicle base includes a support shaft to rotatably support said step-board at one place in substantially a point-contact fashion.

8. In a vehicle which can be steered based on movement of balance according to claim 7, a vehicle which can be steered based on movement of balance is **characterized in that** said support shaft is provided on said vehicle base so as to rise at the position of balance of said vehicle base.

FIG. 1

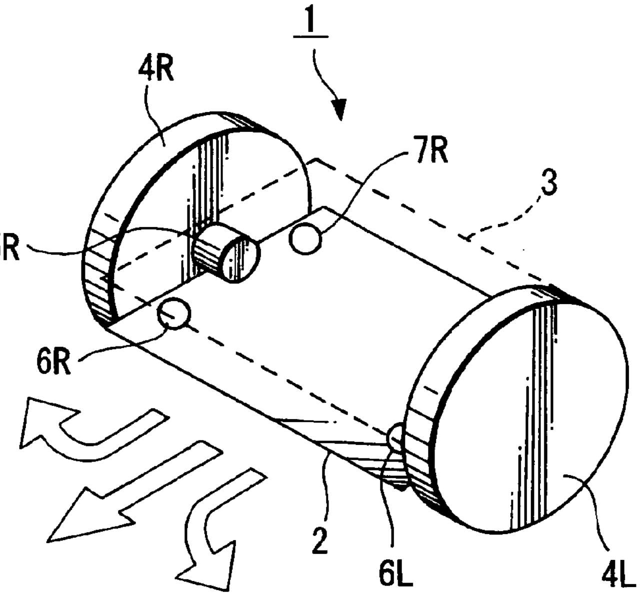

1
4R
7R
3
5R
6R
2
6L
4L

FIG. 2

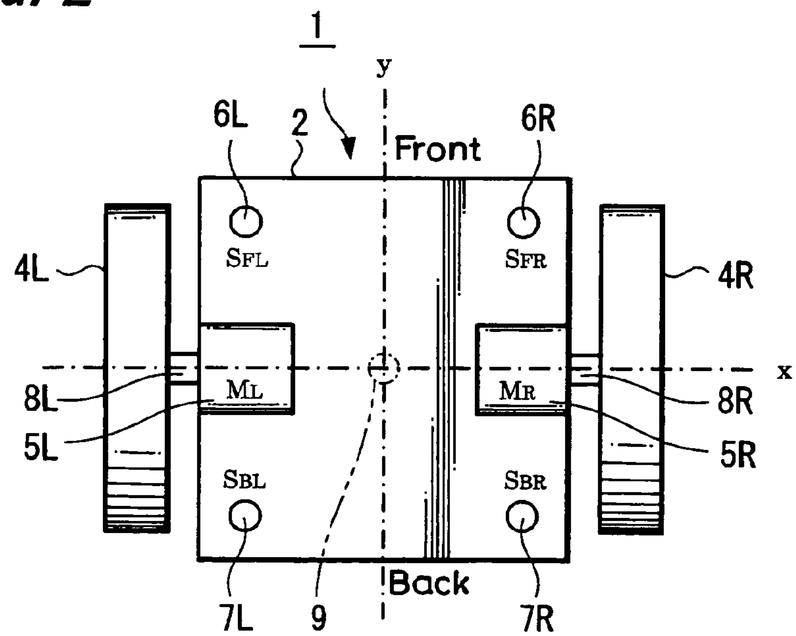

1
y
6L
2
Front
6R
SFL
SFR
4L
4R
x
8L
ML
MR
8R
5L
5R
SBL
SBR
Back
7L
9
7R

FIG. 3

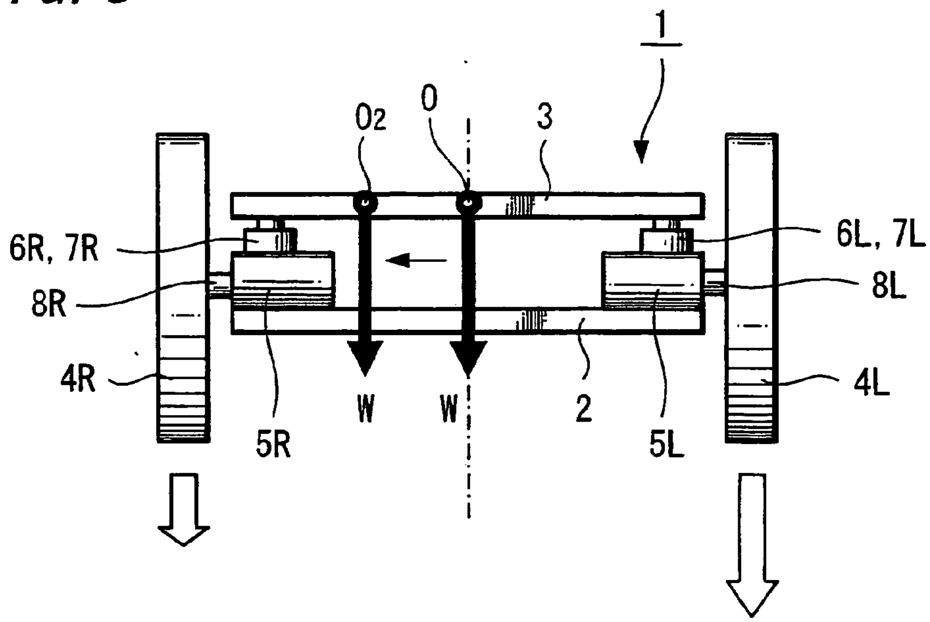

1
O2
O
3
6R, 7R
6L, 7L
8R
8L
4R
4L
W
W
2
5R
5L

FIG. 4

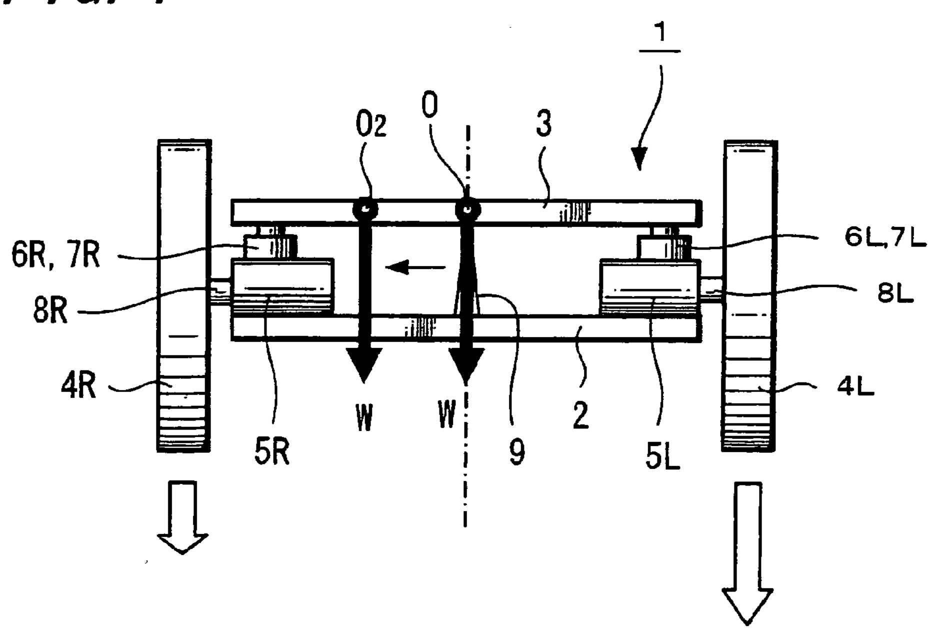
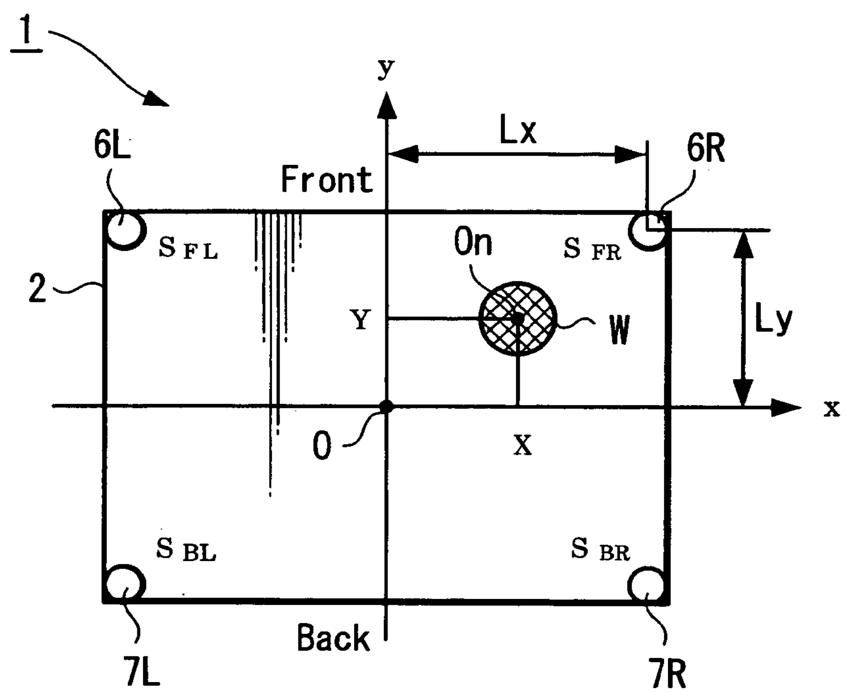

1
O2
O
3
6R, 7R
6L,7L
8R
8L
4R
4L
W
W
9
2
5R
5L

FIG. 5



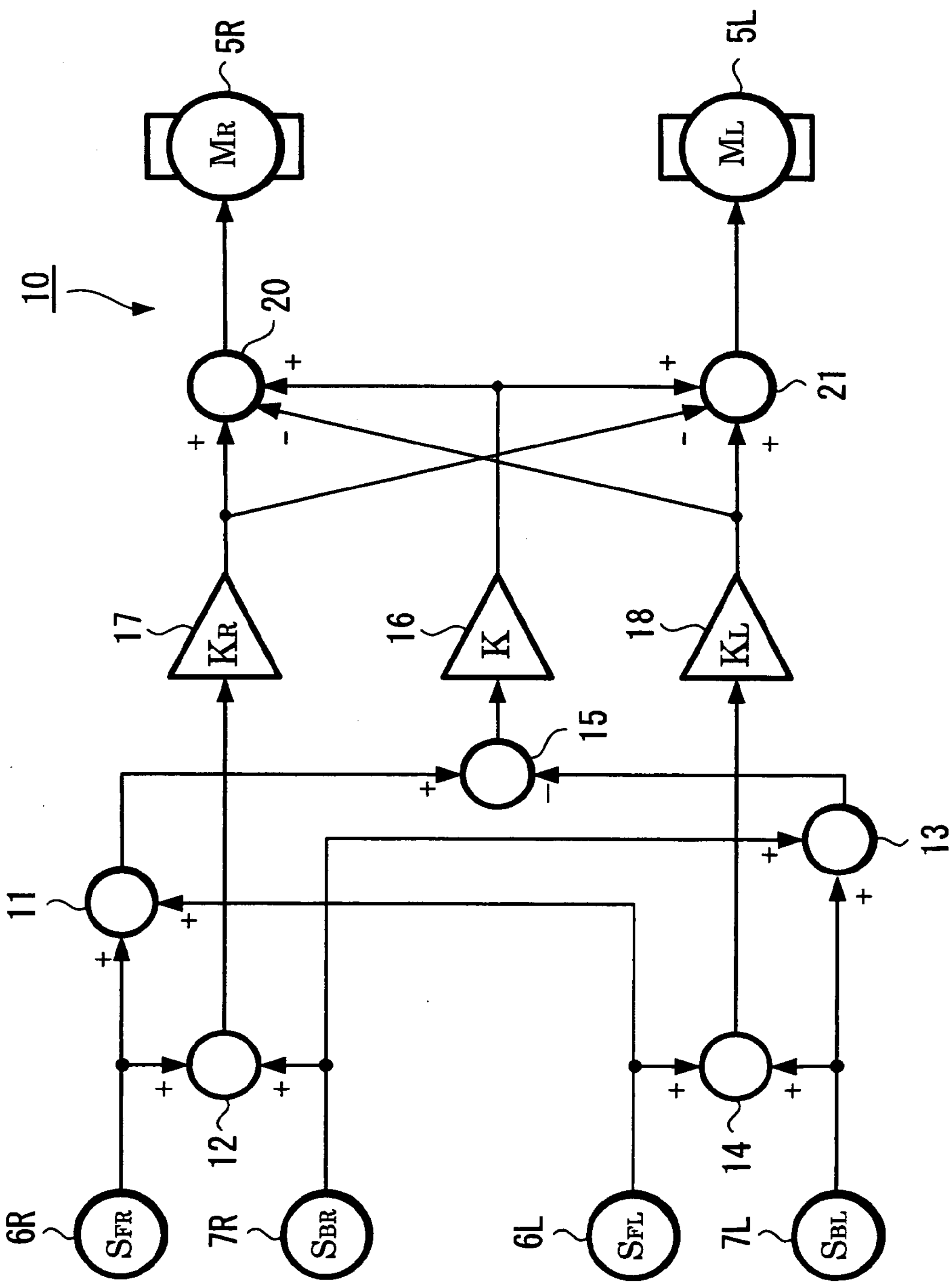

10
MR
5R
ML
5L
20
21
KR
17
K
16
KL
18
15
11
13
12
14
SFR
6R
SBR
7R
SFL
6L
SBL
7L

FIG. 6

FIG. 7A

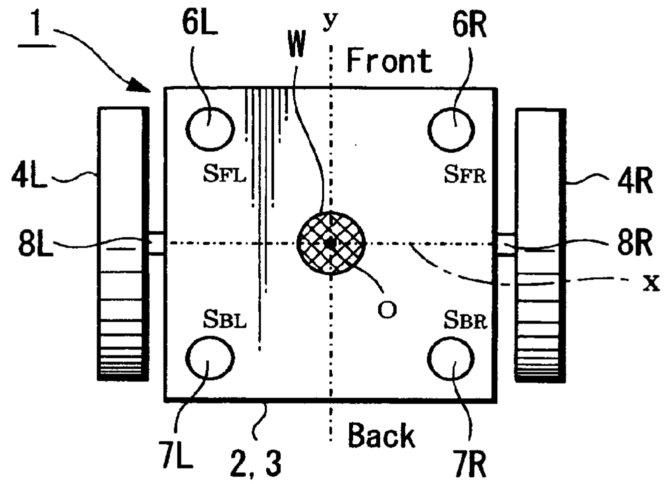


FIG. 7B

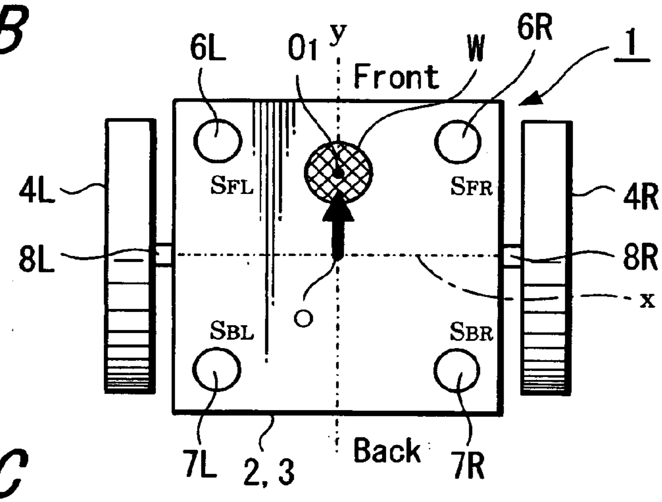


FIG. 7C

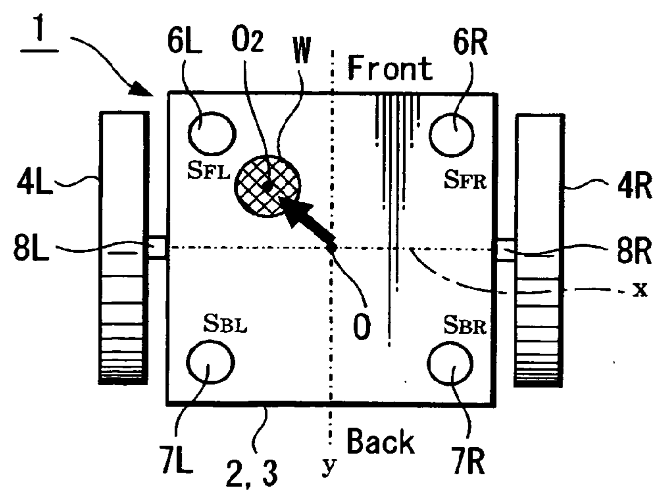


FIG. 8

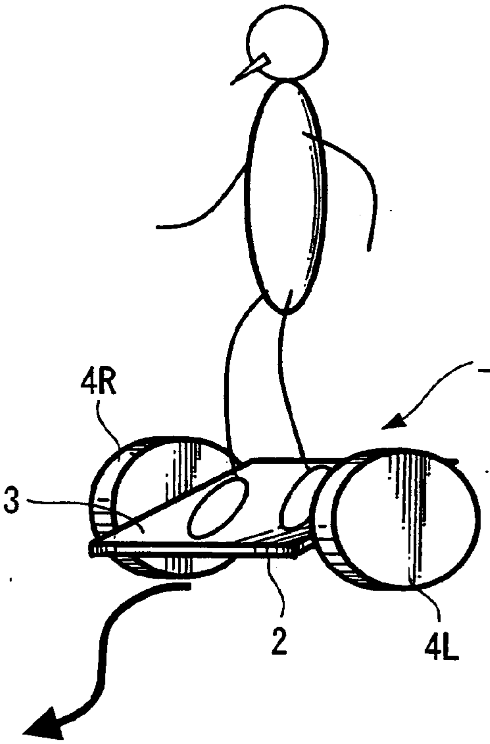


FIG. 9

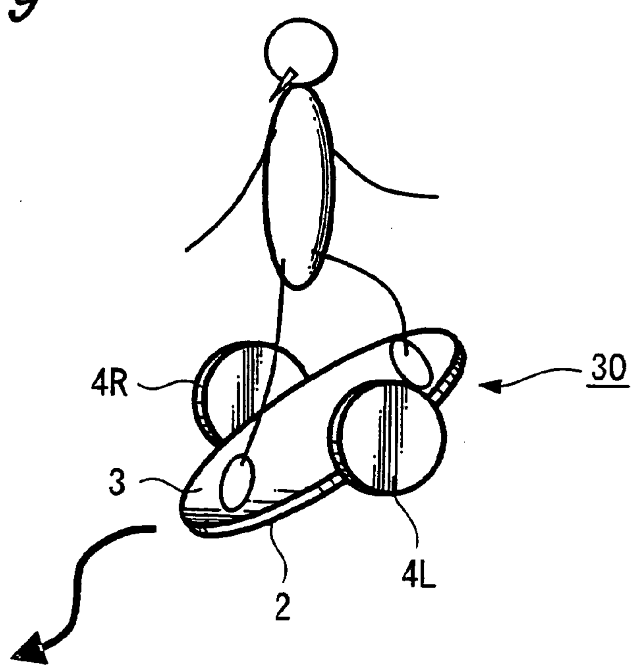


FIG. 10

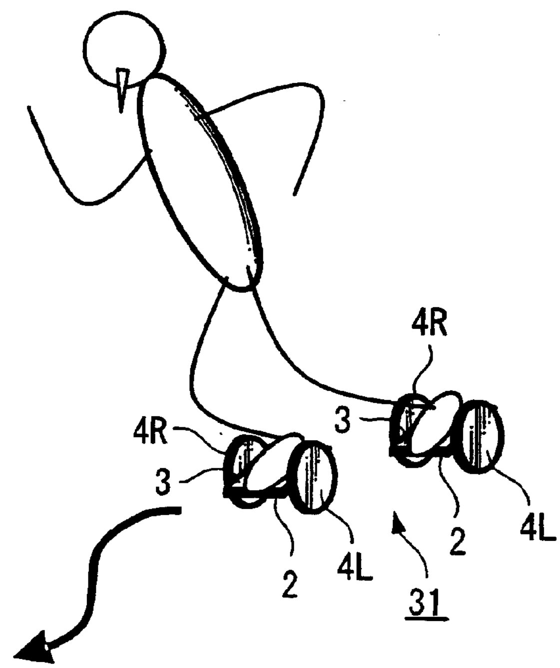


FIG. 11

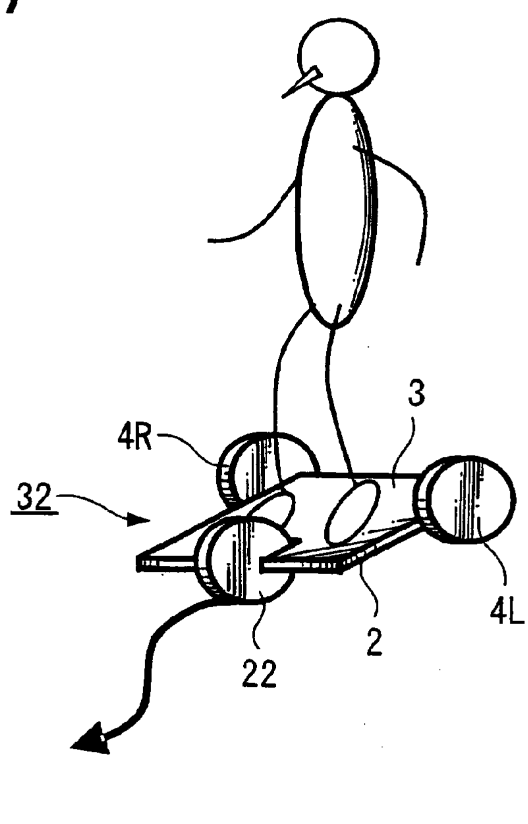


FIG. 12

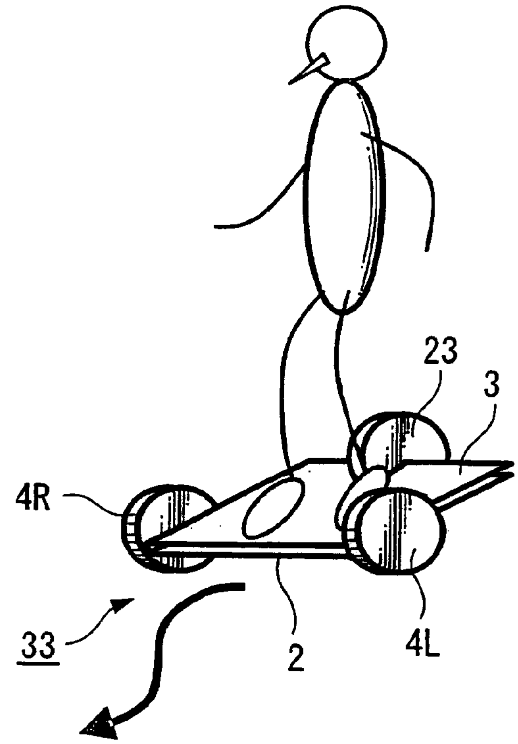
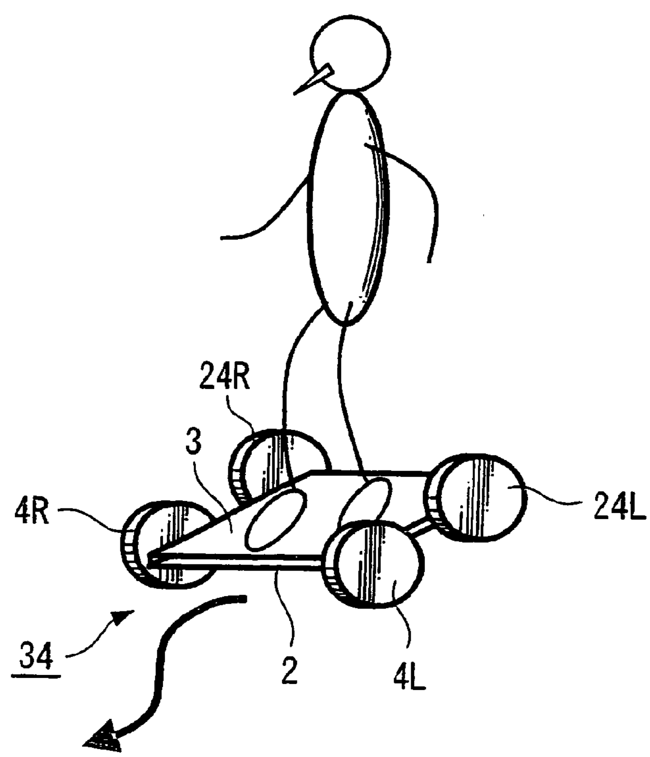


FIG. 13



DESCRIPTION OF REFERENCE NUMERALS

1, 30, 31 ... bicycle (vehicle)

2 ... vehicle base

3 ... step-board

4L, 4R ... wheel

5L, 5R ... drive motor (rotary drive means)

6L, 6R, 7L, 7R ... pressure sensor (balance movement detecting means)

9 ... support shaft

10 ... drive control means

11, 12, 13, 14 ... adder

15 ... adding subtracter

16, 17, 18 ... amplifier

20 ... summing accumulator

22, 23, 24L, 24R ... auxiliary wheel

32, 33 ... tricycle (vehicle)

34 ... four-wheeled vehicle

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/007908

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B62K17/00, B62K3/00, B62J39/00, A63C17/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B62K17/00, B62K3/00, B62J39/00, A63C17/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-2004
Kokai Jitsuyo Shinan Koho	1971-2004	Jitsuyo Shinan Toroku Koho	1996-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 6408240 B1 (DEKA Products Ltd. Partnership), 18 June, 2002 (18.06.02), Column 8 to 9; Figs. 1 to 6 & US 6288505 B1 & WO 02/30730 A2 & EP 1324911 B1	1-4 5-8
Y	US 6435535 B1 (DEKA Products Ltd. Partnership), 20 August, 2002 (20.08.02), Fig. 6 & WO 01/64502 A2 & US 2002/149172 A1 & EP 1259415 A	5,6
Y	JP 2001-249060 A (Mitsubishi Paper Mills Ltd.), 14 September, 2001 (14.09.01), Figs. 1 to 6 (Family: none)	7,8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 June, 2004 (30.06.04)	20 July, 2004 (20.07.04)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Veröffentlichungsnummer:
(11) Publication number:
(11) Numéro de publication:

EP 1 791 609 A0

Internationale Anmeldung veröffentlicht durch die Weltorganisation für geistiges Eigentum unter der Nummer:

WO 2006/031917 (art. 158 des EPÜ).

International application published by the World Intellectual Property Organisation under number:

WO 2006/031917 (art. 158 of the EPC).

Demande internationale publiée par l'Organisation Mondiale de la Propriété sous le numéro:

WO 2006/031917 (art. 158 de la CBE).

Espacenet

Bibliographic data: JP2005094898 (A) — 2005-04-07

PARALLEL TWO-WHEEL RIDING TRUCK

Inventor(s): MATSUMOTO OSAMU; KOMORIYA KIYOSHI + (MATSUMOTO OSAMU, ; KOMORIYA KIYOSHI)

Applicant(s): NAT INST OF ADV IND & TECHNOL + (NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL & TECHNOLOGY)

Classification: **- international:** ***A63C17/12; A63G25/00; B60L15/20; B62K3/00;*** (IPC1-7): A63C17/12; A63G25/00; B60L15/20; B62K3/00
- cooperative: **B62K11/007 (EP)**; Y02T10/7258 (EP)

Application number: JP20030323980 20030917 Global Dossier

Priority number (s): JP20030323980 20030917

Also published as: JP3981733 (B2)

Abstract of JP2005094898 (A)

PROBLEM TO BE SOLVED: To solve the problem that, since the steering direction control of a conventional parallel two-wheel riding truck is performed by the rotation of a grip of a handle that is projected from the truck, the truck is bulky as a whole, heavy in weight, inconvenient in carrying, and not allowed in riding with baggages held by both hands. ;SOLUTION: A tilting support part 10, which supports a boarding platform 5 at an upper place so as to be tiltable back and forth and right and left, is formed at the center of the upper place base 8 wherein motors 15, 16 for driving both-side wheels 3, 4 are arranged. The boarding platform 5 is supported on the base 8 with a spring 11 at its back and forth and right and left, boarding-platform tilt sensors 13 are arranged on the boarding platform 5 at its back and forth and right and left, base tilt sensors 14 are similarly arranged on the base 8 at its right and left. A control unit of a circuit board 18 controls the balance of the two-wheel riding truck by the principle of a wheel-type rising pendulum by signals of a rate gyro 20, a base tilt sensor 21 or the like so as to make the truck self-sustained. The control unit performs back-and-forth control by detecting the movement of the weight of a user riding on a footstool 9, and also performs the control of a traveling direction by detecting the movement of the weight of the user to the right and left.

Notice

CLAIMS JP2005094898

1.

A base having wheels parallel to the left and right; a boarding base provided on the base so as to be swingable in the left and right direction; a motor for independently driving the left and right wheels; and a rotation angle for detecting a motor rotation angle. A sensor, a tilt angle sensor for detecting a balance in the front-rear direction of the base, a tilt angular velocity sensor, a boarding tilt detection means for detecting a relative angle in the left-right direction with respect to the base of the board, and at least according to a signal of the sensor A control device for controlling the rotation of the motor, the control device performs balance control of the passenger carriage by the signal, and moves forward and backward by the tilt angle of the base in the front-rear direction, and in the left-right direction with respect to the base of the board A parallel two-wheeled carriage, wherein each of the steering directions is controlled by a relative angle.

2.

The boarding board inclination detecting means detects a boarding board inclination sensor provided on the boarding board and a signal from a base board inclination sensor provided on the base corresponding to the boarding board inclination sensor. Item 2. A parallel two-wheeled carriage according to item 1.

3.

2. The parallel two-wheel riding according to claim 1, wherein the boarding tilt detection means detects a rotation angle of a tilting support portion that tilts the boarding base in a left-right direction with respect to a base. Trolley.

Notice

DESCRIPTION JP2005094898

PROBLEM TO BE SOLVED: To control the operation direction of a conventional parallel two-wheeled carriage by rotating a handle grip protruding from the carriage, the whole is bulky, heavy, inconvenient to carry, and has luggage in both hands. I couldn't take it with me. SOLUTION: A tilting support portion 10 that supports an upper boarding platform 5 so as to be tiltable in the front-rear and left-right directions is provided at a central position of an upper portion of a base 8 provided with motors 15 and 16 for driving wheels 3 and 4 on both sides. Provided. The boarding platform 5 is supported on the base 8 by springs 11 in the front, rear, left and right. The boarding platform 5 is provided with boarding tilt sensors 13 on the front, rear, left and right, and the base 8 is similarly provided with base tilt sensors 14 on the left and right. Yes. In the control device for the circuit board 18, balance control is performed based on the principle of the wheel-type inverted pendulum based on signals from the rate gyro 20, the base tilt sensor 21, and the like, so that the circuit board 18 is self-supporting. A forward / backward movement control is performed by detecting the forward / backward movement of the user on the platform 9, and a traveling direction is controlled by detecting a lateral weight shift. [Selection] Figure 1

Parallel two-wheel passenger cart

[0001]
The present invention detects the balance of a user riding on a carriage, thereby controlling and driving the parallel two-wheeled vehicle driven by a motor so that it can move forward and backward, and can be freely moved only by shifting the weight of the user. The present invention relates to a parallel two-wheeled carriage that can be operated in any direction.

[0002]

Conventionally, each wheel of a parallel two-wheeled vehicle provided with a carriage is driven by a motor that operates independently of each other, and a gravity balance applied to the carriage including a user riding on the carriage is detected to detect each of the motors. By controlling the operation and making the cart independent, it is possible to estimate the will and degree of forward and backward movement by detecting the center of gravity movement of the user in the longitudinal direction, and to perform the forward and backward control of the entire cart, and further by the user Separately, a parallel two-wheeled carriage that controls the direction of operation by operating instructions has been proposed and partially put into practical use.

[0003]

As such a parallel two-wheeled carriage, for example, there is a parallel two-wheel type scooter as shown in FIG.

This parallel two-wheeled scooter includes wheels 42 and 43 supported on both sides of a carriage 41 so as to be parallel to each other and independently rotatable with respect to the carriage 41, and the carriage 41 has an aluminum steering rod 44. Is fixed.

[0004]

As shown in FIG. 3B, the main components are disassembled, and the carriage 41 includes a first motor 46 and a second motor 47 on both sides of the casing 45, and batteries 48, 48 disposed below the first motor 46 and the second motor 47. Is used as the driving power source, and the wheels 42 and 43 corresponding to the respective motors are driven via a reduction gear.

This motor is a brushless type of about 2 horsepower, and has high efficiency, high durability, and maintenance-free.

[0005]

In addition, the battery 48 uses a NiCd battery or a battery using nickel metal hydride. The battery 48 can operate even when a person of about 110kg rides with 34 kg of luggage, and can be up to 28 km by charging the battery once. The vehicle is capable of traveling, and can travel about 17 km in a normal operation state, and can travel at a speed of 20 km / h. Moreover, the part which drives the wheel by these motors is equipped with a reduction gear, and the wheel is driven using a helical gear with a reduction ratio of about 24: 1.

[0006]

A balance sensor 50 is provided in the casing, and its operation is detected by at least two rate gyros per one degree of freedom. A total of five rate gyros are provided, and an inclination sensor (acceleration sensor) is provided. Furthermore, the control circuit board 51 includes a pair of control circuit boards 51. The control circuit board 51 inputs various signals such as the signals of the gyroscope and the tilt sensor to control the rotation of the motors 46 and 47 in the forward and reverse directions. This cart can be made independent by the stabilization control method of the wheel type inverted pendulum. Further, a steering wheel 52 is provided at the upper end of the steering rod 44, and by rotating a grip 53 provided on one side of the steering wheel 52, the rotational speed of the motors on both sides is adjusted to enable steering.

[0007]

Above the casing 45, a chassis 54 capable of sealing and covering the casing 45 is provided, and a rubber platform 55 on which a user rides is provided on the upper surface. This rubber step 55 is provided with a diaphragm switch, which is turned on when the user gets on it, and the parallel two-wheeled scooter is activated, and is turned off when the user gets off. I have to. The height of this step is about 20 cm, and the width is about 48 × 64 cm.

[0008]

Further, as shown in FIG. 3A, the steering rod 44 can be expanded and contracted to adjust the height of the handle 52, and a key 67 and a display unit 68 are provided on the handle 52. A set function is also provided, and the display unit 68 displays the on / off state of the device, the mode state, the remaining battery level, and the like.

[0009]

As shown in FIG. 4, the left and right motors 46 and 47 for driving the left and right wheels 42 and 43 are connected to the left and right motors 46 and 47 in the control device 60 as shown in FIG. The driving of each motor control unit 61, 62 is controlled.

The control device 60 receives signals from the rate gyro 63 and the tilt sensor 64 in the balance sensor 50, and further the signal from the step sensor 65 of the step platform 55, and the grip operation amount sensor for operating the left and right grips 53 provided on the handle 52. The signals 66 and 66 and the signal of the key switch 67 are input to perform overall control on the motor control units 61 and 62 and to output a display signal to the display unit 68.

[0010]

In the parallel two-wheel type scooter configured as described above, when the user operates the key 67 to activate the device and rides on the platform 65 in the carriage 41, the balance control of the scooter is activated. It becomes. In this state, the balance sensor 50 including the rate gyro and the inclination sensor detects the overall weight balance including the user on the carriage 41, and detects the inclination of the carriage, thereby stabilizing the wheel-type inverted pendulum. Therefore, the left and right motors 46 and 47 are driven and maintained in an independent state.

[0011]

Further, the movement of the center of gravity of the user in the front-rear direction on the carriage 41 is detected, and when the movement of the center of gravity is greater than or equal to a predetermined value, the user desires to move in that direction, and the degree of movement is adjusted. The wheel speed is adjusted to move forward and backward at the desired speed. Further, the user can adjust the rotational speed of the left and right wheels by rotating the left and right grips 53 provided at both ends of the handle 52 so as to perform a steering operation for adjusting the traveling direction. .

[0012]

In order to perform the operation as described above, this apparatus is provided with a control system as shown in FIG. 4, and a central control device 60 includes a motor control unit 61 that controls driving of the left and right motors 46 and 47, 62. Signals from the rate gyro 63 and the tilt sensor 64 of the balance sensor 50 are input to the control device 60, and self-supporting control is performed by a stabilization control method for the wheel-type inverted pendulum. In addition, a signal from the step sensor 65 is input to detect whether or not a user has got on the step 65. Further, the tilt sensor 64 detects the tilt in the front-rear direction and performs the forward-reverse control, and inputs the signal of the grip operation amount sensor 66 of the handle 52 to control the rotation speed or the rotation direction of the left and right motors to control the operation. I do. Further, a signal of a key switch 67 on the handle 52 is inputted, and a necessary display can be performed on a display unit 68 provided on the handle 52. The following patent document exists as a technique related to the attitude control method in the coaxial two-wheeled vehicle. JP 63-305082 A

[0013]
As shown in FIG. 3, in a conventional parallel two-wheeled scooter as a parallel two-wheeled carriage, a steering rod 44 is projected from the carriage 41, and a grip 53 is provided at one end of a handle 52 provided at the upper end thereof. The grip 53 is rotated independently to adjust the rotational speed of the left and right wheel motors for steering.

[0014]
Therefore, the handle 52 can be extended from a relatively low position to a high position so that a user standing on the carriage 41 can easily perform this steering operation, regardless of whether the person is relatively short or tall. It is necessary to make the steering rod 44 extendable so as to be able to do so.

[0015]

Therefore, even if an aluminum alloy is used to reduce the weight of the handle portion as much as possible, the steering rod is configured for a tall person and the handle is further provided, so the overall weight must be increased.

In addition, when such a handle is provided on the carriage, the whole must be bulky, and coupled with the increase in weight as described above, it becomes difficult to carry this parallel two-wheeled carriage, for example, bringing it into a train, It is inconvenient to lift even at the stepped portion on the road, carry around when going up and down the stairs, store, etc., and handling is especially difficult for weak people such as women and children.

[0016]

Further, in the above conventional parallel two-wheeled carriage, since the operation is controlled by the grip 53, it is necessary to operate the grip with at least one hand when adjusting the operation direction. In addition, there is a problem that it is difficult to properly adjust the operation even when carrying a baggage in one hand.

[0017]

Therefore, a main object of the present invention is to provide a parallel two-wheeled carriage that can freely control the operation direction in accordance with the user's intention without providing a handle.

[0018]

In order to solve the above problems, the invention according to claim 1 includes a base having wheels parallel to the left and right, a boarding base provided on the base so as to be swingable in the left and right directions, and the left and right Rotation angle sensor for detecting the motor and the rotation angle of the motor independently, the inclination angle sensor for detecting the balance of the base, the inclination angular velocity sensor, and the relative angle in the horizontal direction with respect to the base of the boarding base And a control device for controlling the rotation of the motor based on at least a signal from the sensor, the control device performing balance control of the passenger car based on the signal, and an inclination angle of the base in the front-rear direction. The parallel two-wheeled carriage is characterized in that the forward and backward travel is controlled by the above and the steering direction is controlled by the relative angle in the horizontal direction with respect to the base of the boarding base.

[0019]

According to a second aspect of the present invention, the boarding tilt detecting means is detected by a boarding tilt sensor provided on the boarding board and a signal from a base tilt sensor provided on the base corresponding to the boarding tilt sensor. The parallel two-wheeled carriage according to claim 1, wherein:

[0020]

Further, the invention according to claim 3 is characterized in that the boarding board inclination detecting means detects a rotation angle of a tilting support part that supports the boarding board so as to be tiltable in the left-right direction with respect to the base. The parallel two-wheeled carriage according to claim 1 is provided.

[0021]

Since the present invention is configured as described above, it is not necessary to provide a handle that protrudes from a boarding carriage like the conventional one, and it can be reduced in size and weight, and this can be achieved on a road step or staircase, and further on a train. It is easy to carry and can be used as a parallel two-wheel passenger cart that is easy to use.

In addition, it is no longer necessary to adjust the operation by rotating the left and right grips like the conventional one, and the operation direction can be controlled by the user's weight movement, so it is also possible to move with both hands on the luggage. In particular, it can be easily used even by a handicapped person.

—

[0022]
The present invention provides a parallel two-wheel passenger carriage that can freely control the direction of operation according to the user's will without providing a handle. Aboarding base provided on the base so as to be swingable in the left-right direction, a motor for independently driving the left and right wheels, a rotation angle sensor for detecting a motor rotation angle, and an inclination for detecting a balance of the base An angle sensor, an inclination angular velocity sensor, a boarding board inclination detecting means for detecting a relative angle in the left-right direction with respect to the base of the boarding board, and a control device for controlling the rotation of the motor based on at least a signal of the sensor; The device controls the balance of the passenger car based on the signals, controls the forward / backward movement based on the inclination angle of the base in the front-rear direction, and controls the steering direction based on the relative angle in the left-right direction with respect to the base of the boarding base. .

[0023]

Embodiments of the present invention will be described with reference to the drawings.

FIG. 1 shows a parallel two-wheeled carriage 1 according to the present invention. As shown in

FIG. 1A, the outline thereof is changed from the conventional parallel two-wheeled carriage shown in FIG. 3 to a steering rod 44 and a handle 52. In addition, the grip 53 provided at one end thereof is removed.

That is, the parallel two-wheel passenger carriage 1 shown in FIG. 1 (a) has wheels 3 and 4 parallel to each other on both the left and right sides of the carriage 2 in the same manner as the conventional example, and motors corresponding to each other as will be described later. Can be rotated independently of each other.

An upper portion of the carriage 1 is provided with a boarding platform 5 on which a user stands and rides. In the illustrated example, a key switch 6 and a display unit 7 are provided as in the conventional example shown in FIG.

[0024]
As shown in the cross-sectional view of the schematic configuration of FIG. 1B, the parallel two-wheeled carriage 1 includes a base 8 provided with main constituent members and a boarding base 5 placed thereon. Thus, in the illustrated embodiment, the boarding base 5 is supported by the tilting support portion 10 of the base 8 so as to be freely tiltable in the left-right direction with respect to the base 8.

[0025]
In addition, springs 11 are provided between the boarding base 5 and the base 8 at the front, rear, left and right portions with the tilting support portion 10 as the center, so that the weight of the user riding on the boarding base 5 can be reduced. When moving in the left-right direction, the boarding platform 5 can be tilted to the left and right correspondingly.

[0026]

Further, on the lower surface of the board 5, similarly to the spring 11, a boarding table tilt sensor 13 is provided at the left and right positions around the tilting support portion 10, and the upper surface of the base 8 corresponds to the boarding table tilt sensor 13. A base tilt sensor 14 is provided at the position.

The relative inclination angle of the boarding base 5 with respect to the base 8 can be detected in correspondence with the left and right directions by the signals of both the inclination sensors.

[0027]

The base 8 is provided with motors 15 and 16 on both left and right sides thereof, and the left and right wheels 3 and 4 can be rotated independently of each other by each motor.

In the illustrated embodiment, each of the motors 15 and 16 is provided with a rotation angle sensor 22 and 23 to detect the rotation angle of the motor, that is, the rotation angle of the wheel 3 and the wheel 4 driven by the motor via a speed reducer (not shown). It is possible.

In the illustrated embodiment, a battery 17 is mounted below the base 8 and a circuit board 18 is provided above.

Further, in the illustrated embodiment, a rate gyro 20 and a base tilt sensor 21 are provided in the space of the base 8, and signals from the rate gyro 20, the base tilt sensor 21, and the motor rotation angle sensors 22 and 23 are sent to the circuit board 18. The parallel two-wheeled carriage 1 can be made self-supporting by the same operation as the above-mentioned conventional one by the stabilization control method of the wheel type inverted pendulum.

[0028]

In the parallel two-wheeled carriage 1 of the illustrated embodiment having the above-described configuration, the signals of the various sensors as described above are input and a predetermined operation is performed. It can be activated by a control system as shown. That is, the control device 25 includes a system control unit 26 that is operated by software for performing integrated control of the entire control device, and each sensor of the boarding tilt sensor 13 provided at the left and right positions as described above with respect to the boarding table 5. A signal is input, and each sensor signal of the base tilt sensor 14 provided at the front, rear, left, and right positions is similarly input to the base 8. Further, the signal of the rate gyro 20 and the base tilt sensor 21 provided in the base 8, the signal of the key switch 6, the motor rotation angle sensor 22 that detects the rotation of the motor 15, and the motor rotation that detects the rotation of the motor 16. A signal from the angle sensor 23 is input.

[0029]

The control device 25 includes a rate control gyro 20 and a balance control unit 28 for performing independent control of the passenger car based on signals from the base tilt sensor 21, and particularly a forward /backward control for controlling forward /backward movement of the vehicle based on signals from the base tilt sensor 21. 27, in particular, an operation control unit 29 for controlling the traveling direction of the vehicle, and the number of rotations and the direction of rotation of the motor 15 are controlled by the lateral signal of the boarding tilt sensor 13 and the lateral signal of the base tilt sensor 14. The motor control unit 30 is similarly provided with a motor control unit 31 that controls the rotation speed and rotation direction of the motor 16. Further, a signal of the key switch 6 is input to the control device 25 and a necessary display signal is output to the display unit 7.

[0030]
The parallel two-wheeled carriage according to the present invention adopts the above-described configuration and control system, so that when the user who has stepped on the platform 9 of the boarding platform 5 moves the center of gravity more than a predetermined direction in the longitudinal direction, the longitudinal direction , The signal of the base tilt sensor 21 and the state of movement of the center of gravity in the front-rear direction estimated by the system control unit 26 are detected, and the forward-reverse control unit 27 switches the left and right motors 15, 16 in proportion to the degree of the tilt. Rotate in the same direction and perform forward /reverse control.

[0031]

Further, when the user who has stepped on the platform 9 of the boarding platform 5 moves the center of gravity more than a predetermined amount in the left-right direction, the user uses the signal from the boarding tilt sensor 13 and the signal from the base tilt sensor 14 arranged in the left-right direction. The operation control unit 29 controls the traveling direction by rotating the left and right motors 15 and 16 at different directions or at different speeds in proportion to the degree of the inclination.

In addition, you may use a diaphragm switch etc. for the said step board like the said conventional thing.

[0032]
In addition to the above-described embodiments, the present invention may use, for example, a sensor that detects a tilt angle of the tilt support portion 10 by providing a tilt sensor on the tilt support portion 10. The present invention can be implemented in various modes such as directly detecting the relative angle of the table 5.

[0033]
The parallel two-wheeled carriage according to the present invention is particularly suitable as a portable carriage, but can also be applied to a larger carriage, and the same technology can be applied to a robot such as a two-legged two-wheel robot capable of running on wheels. Can also be applied.

[0034]

The Example of this invention is shown, (a) is the perspective view, (b) is sectional drawing which shows the outline | summary structure.

It is a control system block diagram of the Example.

A conventional example is shown, (a) is a perspective view thereof, and (b) is an exploded perspective view of a carriage part. It is a control system block diagram of a prior art example.

Explanation of symbols

[0035]
DESCRIPTION OF SYMBOLS 1 Parallel two-wheel passenger cart 2 Bogie 3, 4 Wheel 5 Boarding board 6 Key switch 7 Display part 8 Base 9 Step stand 10 Tilt support part 11 Spring 13 Boarding board inclination sensor (left-right direction) 14 Base inclination sensor (left-right direction) 15, 16 Motor 17 Battery 18 Circuit board 20 Rate gyro (front-rear direction) 21 Base tilt sensor (front-rear direction) 22, 23 Motor rotation angle sensor

(19) 日本国特許庁(JP)　　(12) 公開特許公報(A)　　(11) 特許出願公開番号

特開2005-94898

(P2005-94898A)

(43) 公開日　平成17年4月7日(2005.4.7)

(51) Int.Cl.[7]	F I		テーマコード（参考）
B60L 15/20	B６０L 15/20	J	５H１１５
A63C 17/12	A６３C 17/12		
A63G 25/00	A６３G 25/00		
B62K 3/00	B６２K 3/00		

審査請求 未請求　請求項の数 3　OL　（全 8 頁）

(21) 出願番号　特願2003-323980 (P2003-323980)

(22) 出願日　平成15年9月17日 (2003.9.17)

(71) 出願人　301021533
独立行政法人産業技術総合研究所
東京都千代田区霞が関１－３－１

(72) 発明者　松本　治
茨城県つくば市東１－１－１　独立行政法人産業技術総合研究所つくばセンター内

(72) 発明者　小森谷　清
茨城県つくば市東１－１－１　独立行政法人産業技術総合研究所つくばセンター内

Fターム(参考)　5H115 PA01 PG04 PG10 PU01 QE20
QN02 RB14 SE03 T030 U103

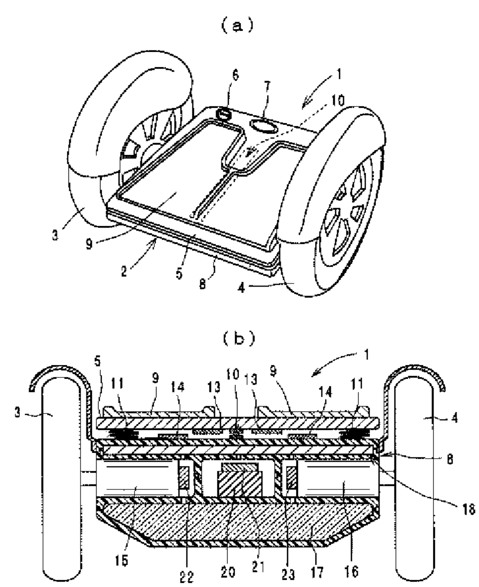
(54)【発明の名称】平行２輪乗用台車

(57)【要約】

【課題】　従来の平行２輪乗用台車の操行方向制御は、台車から突出したハンドルのグリップの回転により行っていたため、全体が嵩張り、重量も重く、持ち運びに不便であり、且つ両手に荷物を持って乗ることができなかった。

【解決手段】　両側の車輪３、４を駆動するモータ１５、１６を設けた基台８の上部の中心位置には、上方の搭乗台５を前後左右に傾動可能に支持する傾動支持部１０を設けている。搭乗台５は前後左右をスプリング１１で基台８に支持され、搭乗台５には前後左右に搭乗台傾斜センサ１３を設け、基台８には同様に左右に基台傾斜センサ１４を設けている。回路基板１８の制御装置においては、レートジャイロ２０、基台傾斜センサ２１等の信号により車輪型倒立振り子の原理によりバランス制御を行い自立させる。踏み台９に乗った利用者の前後の体重移動を検出して前後進制御を行い、左右の体重移動を検出して走行方向の制御を行う。

【選択図】図１



【特許請求の範囲】
【請求項1】
　左右に平行な車輪を備えた基台と、
　前記基台上に左右方向に揺動自在に設けた搭乗台と、
　前記左右の車輪を独立して駆動するモータ及びモータ回転角度を検出する回転角度センサと、
　基台の前後方向のバランスを検出する傾斜角センサ、傾斜角速度センサと、
　搭乗台の基台に対する左右方向の相対角度を検出する搭乗台傾斜検出手段と、
　少なくとも前記センサの信号により前記モータの回転を制御する制御装置とを備え、
　前記制御装置は前記信号により乗用台車のバランス制御を行い、基台の前後方向の傾斜角度により前後進を、また搭乗台の基台に対する左右方向の相対角度により操行方向を各々制御することを特徴とする平行２輪乗用台車。
【請求項2】
　前記搭乗台傾斜検出手段は、搭乗台に設けた搭乗台傾斜センサと当該搭乗台傾斜センサに対応して基台に設けた基台傾斜センサの信号により検出するものであることを特徴とする請求項１記載の平行２輪乗用台車。
【請求項3】
　前記搭乗台傾斜検出手段は、基台に対して搭乗台を左右方向に傾斜自在に支持する傾動支持部の回転角度を検出するものであることを特徴とする請求項１記載の平行２輪乗用台車。

【発明の詳細な説明】
【技術分野】
【0001】
　本発明は、台車上に乗った利用者のバランスを検出することにより、モータで駆動する平行２輪車の駆動制御を行って自立させるとともに前後進を行い、また利用者の体重移動のみによって自由な方向に操行することができるようにした平行２輪乗用台車に関する。
【背景技術】
【0002】
　従来より、台車を備えた平行２輪車の各々の車輪を、互いに独立して作動するモータにより駆動するとともに、台車に乗った利用者を含めた台車にかかる重力バランスを検出して各モータの作動を制御し、台車を自立可能とするとともに、利用者の前後方向の重心移動を検出することにより前後進の意志及びその程度を推定して台車全体の前後進制御を行い、更に利用者による別途操作指示により操行方向の制御を行うようにした平行２輪乗用台車が提案され一部実用化がなされている。
【0003】
　このような平行２輪乗用台車としては例えば図３（ａ）に示すような平行２輪形式のスクータが存在する。この平行２輪形式のスクータにおいては、台車４１の両側に各々が互いに平行に、かつ台車４１に対して独立して回転可能に支持した車輪４２、４３を備え、台車４１にアルミニウム製ステアリングロッド４４を固定している。
【0004】
　この台車４１は図3（ｂ）にその主要構成部品を分解状態で示しているように、ケーシング４５の両側に第１モータ４６及び第２モータ４７を備え、その下方に配置するバッテリ４８、４８をその駆動電源とし、各モータに対応する車輪４２、４３を減速機を介して駆動している。このモータは２馬力程度のブラシレス形式で、高効率で耐久性が高く、メンテナンスフリーのものが用いられる。
【0005】
　また、バッテリ４８はニッカド（ＮｉＣｄ）電池、或いはニッケルメタルハイドライドを用いた電池が採用され、１１０ｋｇ程度の人が３４ｋｇの荷物を持って乗っても作動可能とし、バッテリの１回の充電で最大２８ｋｍ走行可能であり、通常の作動状態では１７

ｋｍ程度走行可能とし、時速２０ｋｍの速度で走行することができるようにしている。また、これらのモータによる車輪を駆動する部分には減速機を備え、２４：１程度の減速比のヘリカルギアを用いて車輪を駆動している。

【0006】

ケーシング内にはバランスセンサ５０を備え、１自由度につき少なくとも２つのレートジャイロによりその作動を検出し、合計５個のレートジャイロを備えており、また傾斜センサ（加速度センサ）を備えている。更に、一対の制御回路基板５１を備えており、この制御回路基板５１は上記ジャイロと傾斜センサの信号等の種々の信号を入力して両モータ４６、４７の正逆方向の回転制御を行い、車輪型倒立振り子の安定化制御法によってこの台車を自立可能としている。また、ステアリングロッド４４の上端にはハンドル５２を備え、このハンドル５２の片側に設けたグリップ５３を回転操作することにより両側のモータの回転速度を調節し、ステアリングを可能としている。

【0007】

ケーシング４５の上方には、このケーシング４５を密封して覆うことができるシャーシ５４を備え、その上面に利用者が乗るゴム製の踏み台５５を備えている。このゴム製の踏み台５５内にはダイヤフラムスイッチを備え、利用者がこの上に乗るとスイッチがオンしてこの平行２輪形式のスクータが作動状態となり、降りるとオフして作動停止状態となるようにしている。この踏み台の高さは２０ｃｍ程度であり、広さは４８×６４ｃｍ程度である。

【0008】

また、図３（ａ）に示すようにステアリングロッド４４はハンドル５２の高さ調節のため伸縮自在とし、そのハンドル５２にキー６７及び表示部６８を設け、キー６７により盗難防止機能の他速度制限セット機能も備え、表示部６８においては装置のオンオフ状態、モード状態、バッテリ残量等を表示している。

【0009】

このような構成をなす平行２輪形式のスクータの制御装置部分の構成については、図４に示すように左右の車輪４２、４３を駆動する左右のモータ４６、４７は制御装置６０内の左右の各モータ制御部６１、６２によってその駆動が制御される。制御装置６０には前記バランスセンサ５０におけるレートジャイロ６３及び傾斜センサ６４、更には踏み台５５の踏み台センサ６５の信号が入力し、またハンドル５２に設けた左右のグリップ５３における操行用のグリップ操作量センサ６６、６６の信号、及びキースイッチ６７の信号が入力し、各モータ制御部６１、６２に対する総合制御を行うとともに、表示部６８に対して表示信号を出力する。

【0010】

上記のような構成をなす平行２輪形式のスクータにおいては、利用者がキー６７を操作して機器を作動状態にし、この台車４１における踏み台６５上に乗るとこのスクータのバランス制御等が作動状態となる。この状態ではレートジャイロと傾斜センサを備えたバランスセンサ５０により台車４１上の利用者を含んだ全体の重量バランスを検出し、また台車の傾斜を検出することにより車輪型倒立振り子の安定化制御法によって左右のモータ４６、４７の駆動制御を行い、自立状態を維持している。

【0011】

また、台車４１上における利用者の前後方向の重心移動を検出し、その重心移動が所定以上の時には利用者がその方向に移動することを希望しているものとして、その移動の程度に合わせた車輪の回転数調節を行い、希望する速度での前後進を行うようにしている。更に、利用者はハンドル５２の両端に設けた左右のグリップ５３の回動を行うことにより、左右の車輪の回転数調節を行い、進行方向を調節するステアリング操作を行うことができるようにしている。

【0012】

上記のような作動を行わせるため、この装置においては図４に示すような制御システムを備え、その中心をなす制御装置６０には左右のモータ４６、４７の駆動を制御するモー

タ制御部６１、６２を備えている。この制御装置６０に対してバランスセンサ５０のレートジャイロ６３と傾斜センサ６４の信号を入力して車輪型倒立振り子の安定化制御法により自立制御を行う。また、踏み台センサ６５の信号を入力し、踏み台６５に利用者が乗ったか否かを検出する。また、前記傾斜センサ６４により前後方向の傾斜を検出して前後進制御を行い、ハンドル５２のグリップ操作量センサ６６の信号を入力して左右のモータの回転数、或いは回転方向を制御し操行制御を行う。更にハンドル５２上のキースイッチ６７の信号を入力し、更にハンドル５２に設けた表示部６８に必要な表示を行うことができるようにしている。なお、同軸二輪車における姿勢制御方法に関する技術として下記の特許文献が存在する。

【特許文献1】特開昭６３−３０５０８２号公報

【発明の開示】

【発明が解決しようとする課題】

【0013】

従来の平行２輪乗用台車としての平行２輪形式のスクータにおいては図３に示すように、台車４１からステアリングロッド４４を突出させ、その上端部に設けたハンドル５２の片端部にグリップ５３を設け、このグリップ５３を独立して回動操作することにより左右の車輪用モータの回転速度を調節してステアリングを行っている。

【0014】

そのため、比較的身長が低い人でもまた高い人でも、台車４１上に立った利用者が容易にこのステアリング操作を行うことができるように、ハンドル５２を比較的低い位置から高位置迄延ばすことができるように、ステアリングロッド４４を伸縮自在にしておく必要がある。

【0015】

したがってハンドル部分をできる限り軽量化するためにアルミニウム合金を用いたとしても、身長の高い人に合わせてステアリングロッドを構成し、更にハンドルを備えるため、全体の重量は重くならざるを得ない。また、このようなハンドルを台車上に設けると、全体が嵩張らざるを得ず、前記のような重量の増大と相まって、この平行２輪乗用台車の持ち運びが困難となり、例えば電車等への持ち込み、走行路上の段差部分でのも持ち上げ、階段の上り下りに際しての持ち運び、収納等が不便であり、特に女性や子供等の力の弱い人にはその取り扱いは困難とならざるを得ない。

【0016】

更に、上記従来の平行２輪乗用台車においては、グリップ５３によって操行制御を行っているため、操行方向の調節時には少なくとも片手でグリップを操作する必要があり、例えば両手に荷物を持っている時には操作できず、また片手に荷物を持っているときも適切な操行調節をすることが困難になるという問題もある。

【0017】

したがって本発明は、ハンドルを設けることなく、利用者の意志に沿って操行方向を自由に制御することができるようにした平行２輪乗用台車を提供することを主たる目的とする。

【課題を解決するための手段】

【0018】

本発明は上記課題を解決するため、請求項１に係る発明は、左右に平行な車輪を備えた基台と、前記基台上に左右方向に揺動自在に設けた搭乗台と、前記左右の車輪を独立して駆動するモータ及びモータ回転角度を検出する回転角度センサと、基台のバランスを検出する傾斜角度センサ、傾斜角速度センサと、搭乗台の基台に対する左右方向の相対角度を検出する搭乗台傾斜検出手段と、少なくとも前記センサの信号により前記モータの回転を制御する制御装置とを備え、前記制御装置は前記信号により乗用台車のバランス制御を行い、基台の前後方向の傾斜角度により前後進を、また搭乗台の基台に対する左右方向の相対角度により操行方向を各々制御することを特徴とする平行２輪乗用台車としたものである。

【0019】
　また、請求項２に係る発明は、前記搭乗台傾斜検出手段は、搭乗台に設けた搭乗台傾斜センサと当該搭乗台傾斜センサに対応して基台に設けた基台傾斜センサの信号により検出するものであることを特徴とする請求項１記載の平行２輪乗用台車としたものである。
【0020】
　また、請求項３に係る発明は、前記搭乗台傾斜検出手段は、基台に対して搭乗台を左右方向に傾斜自在に支持する傾動支持部の回転角度を検出するものであることを特徴とする請求項１記載の平行２輪乗用台車としたものである。
【発明の効果】
【0021】
　本発明は上記のように構成したので、従来のもののような搭乗台車から突出するハンドルを設ける必要がなく、小型軽量化することができ、路面の段差、或いは階段において、更には電車においてこれを持ち運ぶことが容易となり、使用しやすい平行２輪乗用台車とすることができる。また従来のもののような左右のグリップの回転操作により操行調整を行う必要がなくなり、操行方向を利用者の体重移動によって制御することができるので、両手に荷物を持って移動することも可能となり、特に手の不自由な人でも容易に利用可能となる。
【発明を実施するための最良の形態】
【0022】
　本発明は、ハンドルを設けることなく、利用者の意志に沿って操行方向を自由に制御することができるようにした平行２輪乗用台車とするため、左右に平行な車輪を備えた基台と、前記基台上に左右方向に揺動自在に設けた搭乗台と、前記左右の車輪を独立して駆動するモータ及びモータ回転角度を検出する回転角度センサと、基台のバランスを検出する傾斜角度センサ、傾斜角速度センサと、搭乗台の基台に対する左右方向の相対角度を検出する搭乗台傾斜検出手段と、少なくとも前記センサの信号により前記モータの回転を制御する制御装置とを備え、前記制御装置は前記信号により乗用台車のバランス制御を行い、基台の前後方向の傾斜角度により前後進を、また搭乗台の基台に対する左右方向の相対角度により操行方向を各々制御する。
【実施例】
【0023】
　本発明の実施例を図面に沿って説明する。図１には本発明による平行２輪乗用台車１を示しており、その概要は同図（ａ）に示すように前記図３に示す従来の平行２輪乗用台車からステアリングロッド４４、及びハンドル５２並びにその片端に設けたグリップ５３を取り除いた構成をなしている。即ち、図１（ａ）に示す平行２輪乗用台車１は前記従来例と同様に台車２の左右両側に互いに平行な車輪３、４を回転自在に配置し、後述するように各々対応するモータによって互いに独立して回転可能としている。台車１上部には利用者がその上に立って乗る搭乗台５を備え、また図示の例においては前記図３に示す従来のものと同様にキースイッチ６、表示部７を備えている。
【0024】
　この平行２輪乗用台車１は図１（ｂ）の概略構成を示す断面図に示すように、台車２については主要構成部材を備える基台８と、その上に載置する搭乗台５とからなり、搭乗台５は図示実施例においては基台８の傾動支持部１０により、基台８に対して左右方向に自由に傾動可能に支持されている。
【0025】
　また、この搭乗台５と基台８との間には、前記傾動支持部１０を中心としてその前後左右部分にスプリング１１を設けており、それにより搭乗台５上に乗った利用者の体重が左右方向に移動するとき、搭乗台５がそれに対応して左右に傾斜可能としている。
【0026】
　更にこの搭乗台５の下面には、前記スプリング１１と同様に、傾動支持部１０を中心として左右位置に搭乗台傾斜センサ１３を設け、基台８の上面にはその搭乗台傾斜センサ１

３に対応した位置に基台傾斜センサ１４を設けている。この両傾斜センサの信号によって、搭乗台５の基台８に対する相対的な傾斜角度を左右方向に対応して検出することができるようにしている。

【0027】

基台８にはその左右両側にモータ１５、１６を備え、各モータによって左右の車輪３、４を互いに独立して回転可能としている。図示実施例においては各モータ１５、１６に各々回転角度センサ２２、２３を設け、モータの回転角度、即ちこのモータにより図示されない減速機を介して駆動される車輪３及び車輪４の回転角度を検出可能としている。また、図示実施例においては基台８の下方にバッテリ１７を搭載しており、また上方には回路基板１８を備えている。更に図示実施例においては基台８の空所にレートジャイロ２０、基台傾斜センサ２１を設け、このレートジャイロ２０、基台傾斜センサ２１、モータ回転角度センサ２２、２３からの信号を回路基板１８の制御回路で処理し、車輪型倒立振り子の安定化制御法による前記従来のものと同様の作動により、この平行２輪乗用台車１を自立可能としている。

【0028】

上記のような構成からなる図示実施例の平行２輪乗用台車１においては、前記のような種々のセンサの信号を入力し所定の作動を行うものであるが、その際には例えば図２に示すような制御システムによって作動させることができる。即ち、制御装置２５には制御装置全体の統合制御を行うソフトウエアで作動するシステム制御部２６を備え、搭乗台５に対して前記のように左右位置に設けた搭乗台傾斜センサ１３の各センサ信号を入力し、基台８に対して同様に前後左右位置に設けた基台傾斜センサ１４の各センサ信号を入力している。更に基台８内に設けたレートジャイロ２０、及び基台傾斜センサ２１の信号、キースイッチ６の信号、モータ１５の回転を検出するモータ回転角度センサ２２、及びモータ１６の回転を検出するモータ回転角度センサ２３の信号を入力している。

【0029】

制御装置２５には、特にレートジャイロ２０、基台傾斜センサ２１の信号により乗用台車の自立制御を行うバランス制御部２８、特に基台傾斜センサ２１の信号により車両の前後進を制御する前後進制御部２７、特に搭乗台傾斜センサ１３の左右方向の信号と基台傾斜センサ１４の左右方向の信号とにより車両の進行方向制御する操行制御部２９、及びモータ１５の回転数、回転方向を制御するモータ制御部３０、同様にモータ１６の回転数、回転方向を制御するモータ制御部３１を備えている。また、制御装置２５にはキースイッチ６の信号を入力し、表示部７に対して必要な表示信号を出力している。

【0030】

本発明による平行２輪乗用台車は上記のような構成、及び制御システムを採用することにより、搭乗台５の踏み台９に乗った利用者が前後方向に所定以上の重心移動を行うときには、前後方向に関しては、基台傾斜センサ２１の信号とシステム制御部２６により推定される前後方向の重心移動状態を検出し、前後進制御部２７がその傾斜の程度に比例して左右のモータ１５、１６を同方向に回転させ、前後進の制御を行う。

【0031】

また、搭乗台５の踏み台９に乗った利用者が左右方向に所定以上の重心移動を行うときには、左右方向に配置した搭乗台傾斜センサ１３の信号と基台傾斜センサ１４の信号により、利用者の上記の体重移動状態を検出し、操行制御部２９がその傾斜の程度に比例して左右のモータ１５、１６を異なる方向、或いは異なる速度で回転させ、進行方向の制御を行う。なお、上記踏み台には、前記従来のものと同様にダイアフラムスイッチ等を用いてもよい。

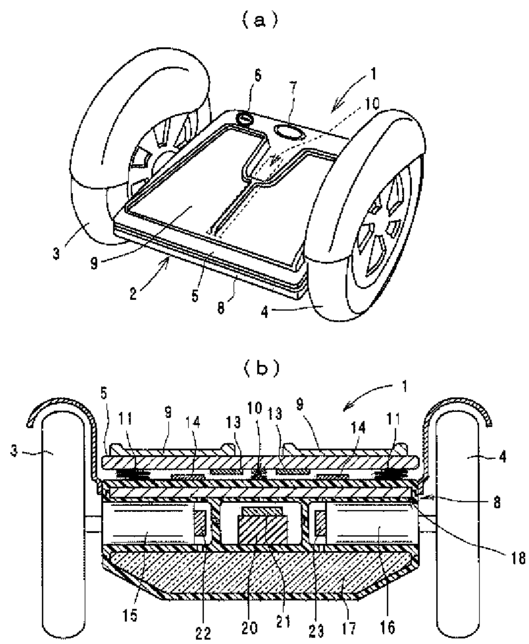
【0032】

本発明は上記のような実施例の他、例えば傾斜センサを傾動支持部１０に設け、この傾動支持部１０の傾斜角度を検出するセンサを用いてもよく、その際には基台８に対する搭乗台５の相対角度を直接検出する等、種々の態様で実施することができる。

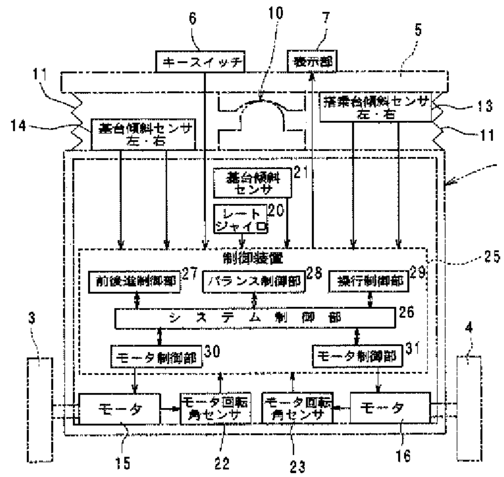
【産業上の利用可能性】

【0033】
　本発明による平行２輪乗用台車は、特に携帯用台車として適するものであるが、より大型の台車にも適用でき、更に同様の技術を車輪走行可能な２足２輪ロボット等のロボットに対しても適用することができる。
【図面の簡単な説明】
【0034】
【図1】本発明の実施例を示し、（ａ）はその斜視図であり、（ｂ）はその概要構成を示す断面図である。
【図2】同実施例の制御システム構成図である。
【図3】従来例を示し、（ａ）はその斜視図であり、（ｂ）は台車部分の分解斜視図である。
【図4】従来例の制御システム構成図である。
【符号の説明】
【0035】
　１　平行２輪乗用台車
　２　台車
　３、４　車輪
　５　搭乗台
　６　キースイッチ
　７　表示部
　８　基台
　９　踏み台
　１０　傾動支持部
　１１　スプリング
　１３　搭乗台傾斜センサ（左右方向）
　１４　基台傾斜センサ（左右方向）
　１５、１６　モータ
　１７　バッテリ
　１８　回路基板
　２０　レートジャイロ（前後方向）
　２１　基台傾斜センサ（前後方向）
　２２、２３　モータ回転角度センサ

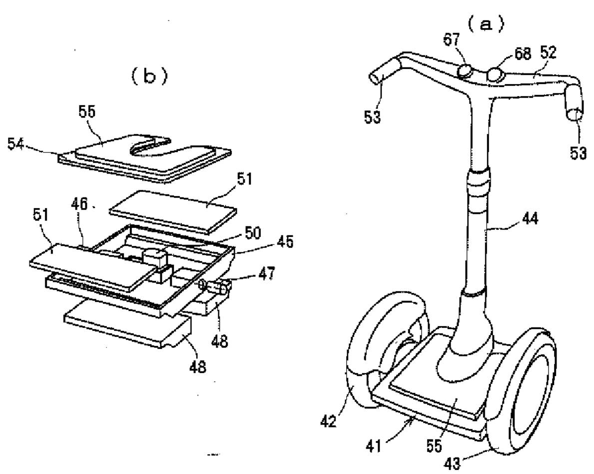
【図1】


(a)
(b)

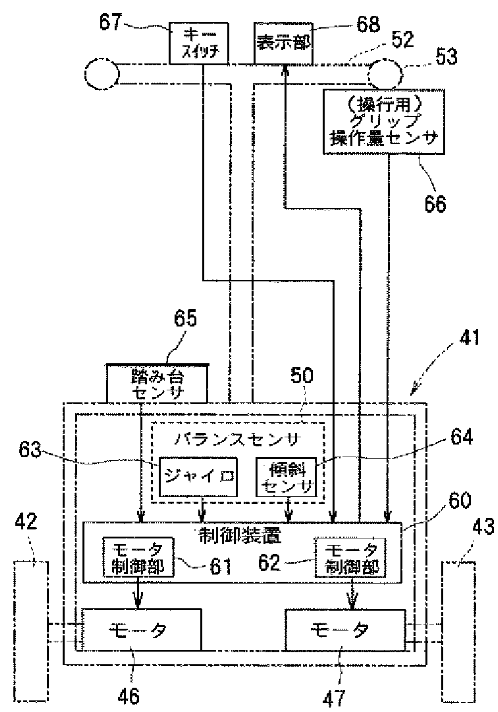
【図2】


キースイッチ
表示部
基台傾斜センサ
左・右
搭乗台傾斜センサ
左・右
基台傾斜
センサ
レート
ジャイロ
制御装置
前後進制御部
バランス制御部
操行制御部
システム制御部
モータ制御部
モータ制御部
モータ
モータ回転
角センサ
モータ回転
角センサ
モータ

【図3】


(a)
(b)

【図4】


キー
スイッチ
表示部
(操行用)
グリップ
操作量センサ
踏み台
センサ
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Bibliographic data: JP2005335471 (A) — 2005-12-08

TRAVELING DEVICE

Inventor(s): KAKINUMA BUICHI ± (KAKINUMA BUICHI)

Applicant(s): SONY CORP ± (SONY CORP)

Classification: - **international:** ***B60L11/18; B62J99/00; B62K17/00; B62K3/00;*** (IPC1-7): B60L11/18; B62J39/00; B62K17/00; B62K3/00
- **cooperative:** Y02T10/7005 (EP)

Application number: JP20040154806 20040525 Global Dossier

Priority number (s): JP20040154806 20040525

Also published as: JP4442319 (B2)

Abstract of JP2005335471 (A)

PROBLEM TO BE SOLVED: To provide a traveling device capable of calculating the correct speed and the correct traveling distance of the traveling device and displaying them on a speedometer and a traveling distance meter without being affected by the rocking of a step stand. ;SOLUTION: The traveling device comprises a pair of wheels 101 arranged parallel to each other, a driving means, a step stand 103 of an occupant, a steering wheel held by the occupant, and a posture detection sensor to control the angular velocity and the traveling acceleration of the step stand 103, and the signal to maintain the predetermined traveling state is output to a driving circuit to drive the wheels. A rotary plate 110 and a detection unit 111 are mounted on the wheels 101 side via a rotor 109 of the driving means and on the step stand 103 side via a stator 113 of the driving means, respectively. The rotational speed of the wheels is detected from the rotation of the rotary plate 110 by the detection unit 111. An indicator to indicate the traveling speed and the traveling distance from compound rotation information of the wheels and the step stand is provided.

Notice

CLAIMS JP2005335471

1.

A pair of wheels arranged in parallel; drive means for independently rotating and driving the wheels; a casing that rotatably supports the wheels and constituting a passenger's step base; a stay and a passenger in the casing; A handle that is held by the sensor, and a gyro sensor that detects angular velocities of the pitch axis, yaw axis, and roll axis, and an acceleration sensor that detects acceleration of the Xaxis, Yaxis, and Zaxis. Posture detecting means for detecting the angular velocity and acceleration of the body when traveling and controlling the angular velocity and traveling acceleration of the housing, and maintaining a predetermined running state from the signal from the posture detecting means via an arithmetic unit A driving device that outputs a signal to the driving circuit and drives the wheel by the driving means, the rotating plate being a position detecting disk on the wheel side via the rotor of the driving means, Enclosure Detection means are respectively attached to the drive means via the stator, and the detection means detects the rotational speed of the wheel from the rotation of the rotating plate. The wheel and the housing are combined. A travel device comprising a speed display meter and a travel distance meter for displaying a travel speed and a travel distance of the travel device from rotation information.

2.

The travel speed is calculated by adding and subtracting rotation information of the casing, which is a pitch axis angular speed by a gyro sensor from the posture detection means, and displaying the speed on a speed indicator. Item 2. The traveling device according to item 1.

3.

The travel device according to claim 1, wherein the travel speed is a travel speed based on a rotation average value of the pair of wheels.

4.

The travel device according to claim 1, wherein the travel distance is calculated by calculating an integral value of a travel speed and displayed on a travel odometer.

5.

The travel device according to claim 1, wherein the speed indicator and the odometer are attached to an upper end portion of the stay and the handle portion.

Notice

DESCRIPTION JP2005335471

PROBLEM TO BE SOLVED: To provide a traveling device capable of calculating an accurate speed and traveling distance of a traveling device without being affected by a swing of a step base in the pitch direction, and displaying the calculated speed and traveling distance on a speedometer or odometer. SOLUTION: A pair of wheels 101 arranged in parallel, a driving means, a passenger's step base 103, a handle held by the passenger, an attitude detection sensor for controlling an angular velocity and a traveling acceleration of the step base 103, A driving device for driving a wheel by outputting a signal for maintaining a predetermined traveling state to a driving circuit, and a rotating plate 110 and a step base 103 via a rotor 109 of driving means on the wheel 101 side. The detection unit 111 is attached to each side via the stator 113 of the driving means, and the rotation speed of the wheel is detected from the rotation of the rotating plate 110 by the detection unit 111, and the combined rotation of the wheel and the step base An indicator that displays the travel speed and travel distance from the information was provided. [Selection] Figure 4

Traveling device

[0001]
The present invention relates to a traveling device suitable for use in a vehicle traveling on two wheels with a human being on board, for example, and more specifically, this type of traveling device is equipped with a speedometer and a odometer to ensure safety of travel and traffic regulations. It is possible to realize the correspondence to.

[0002]
For example, a vehicle that travels on two wheels with a human being on board has been

proposed (see, for example, Patent Document 1).

[0003]
US Pat. No. 6,288,505

[0004]
For example, the applicant of the present application has previously proposed a traveling apparatus as described below (Japanese Patent Application No. 2003-168224) as a vehicle that travels on two wheels with a human being on board.

[0005]

First, an external perspective view of an embodiment of a coaxial two-wheeled vehicle proposed by the present applicant is shown in FIG.

In the coaxial two-wheel vehicle 1 shown in FIG. 9, a pair of wheels 3 (a right wheel 3 </ b> R and a left wheel 3 </ b> L) are fixed to both ends of the wheel shaft 2.

The wheel 3 is formed of a rubber material having flexible characteristics, and the inside thereof is filled with air, nitrogen gas, or the like.

By adjusting the gas pressure to adjust the flexibility of the wheel 3, vibrations of the airframe can be absorbed, and vibrations caused by road surface unevenness and impacts caused by steps can be reduced.

[0006]

Further, the wheel shaft 2 includes a base 4 in which a substantially rectangular parallelepiped housing in which a control device or the like to be described later is housed is joined below a plate-like body on which a person rides in a standing posture. It is supported so that it can tilt around.

In the following description, it is assumed that the intermediate point of the wheel shaft 2 connecting the two wheels is the origin O of the XYZ coordinate system, passes through this origin O, is parallel to the main surface of the base 4 and is connected to the wheel shaft 2. The vertical direction is defined as the X axis or roll axis, the wheel axis direction passing through the origin O is defined as the Y axis or pitch axis, and the direction passing through the origin O and perpendicular to the main surface of the base 4 is defined as the Z axis or yaw axis. Further, the front of the coaxial two-wheel vehicle 1 is defined as the positive direction of the X axis, the left is defined as the positive direction of the Y axis, and the upper direction is defined as the positive direction of the Z axis.

[0007]

As shown in FIG. 10, a motor 10 (10 </ b> R and 10 </ b> L) that can rotate forward and backward is mounted on the base 4, and a rotary encoder 11 that detects the rotational position of the motor 10 adjacent to the motor 10. (11R and 11L) are provided. Further, a speed reducer 12 (12R and 12L) using a gear or a timing belt is interposed between the motor 10 and the wheel 3, and the rotation of the motor 10 is performed via the speed reducer 12 and a joint (not shown). And transmitted to the wheel 3.

[0008]
Further, the base 4 includes the gyro sensor 13 for detecting the angular velocity ωp and ωyaw around the pitch axis of the base 4 and the yaw axis, and linear accelerations Ax, Ay, Az and pitch axes in the X, Y, and Z axis directions. Various sensors such as an acceleration sensor 14 for detecting angular accelerations αp, αr, αyaw around the roll axis and the yaw axis and a pressure sensor 15 for detecting a load weight on the base 4 are incorporated.

[0009]
Among them, the pressure sensors 15 are provided at four corners between the support base 4a and the movable base 4b constituting the plate-like body of the base 4 as shown in the plan view of FIG. 11A and the side view of FIG. 11B. From the sensor signals of the four pressure sensors 151, 152, 153, 154, the barycentric coordinates (Xg, Yg) of the load on the base 4 and the load weight Wg can be detected.

[0010]
That is, when the sensor signals of the pressure sensors 151 to 154 are PS1, PS2, PS3, and PS4,

respectively, and the own weight applied to the pressure sensors 151 to 154 in the no-load state is W0, the load weight Wg is expressed by the following formula (1).

[0011]

[0012]
Further, when the coordinates of the pressure sensors 151, 152, 153, 154 are (Xps, Yps), (-Xps, Yps), (-Xps, -Yps), (Xps, -Yps), respectively, the center-of-gravity coordinates (Xg, Yg) is obtained as in the following formula (2).

[0013]

[0014]
In this equation (2), W14 represents the weight applied to the pressure sensors 151 and 154 in the unloaded state, W23 represents the weight applied to the pressure sensors 152 and 153 in the unloaded state, and W12 represents the pressure sensor 151 in the unloaded state. , 152, and W34 represents the weight applied to the pressure sensors 153 and 154 in a no-load state.

[0015]
In this way, since the load load torque T1 due to the load on the base 4 can be calculated by the pressure sensor 15, the balance is maintained on the base 4 and the posture is stabilized by giving the reaction moment to the motor 10. Is possible.

[0016]

Furthermore, a control device 16 composed of a microcomputer is mounted on the lower housing of the base 4, and various sensor signals and detection signals are input to the control device 16.

Based on these input signals, the control device 16 generates motor torque for moving the aircraft forward, backward, and swivel while maintaining the pitch axis angle and yaw axis angle of the base 4 at appropriate values as will be described later. Control.

[0017]

As shown in FIG. 12, the coaxial two-wheel vehicle 1 is configured such that the weight center M of the base 4 that can be tilted around the wheel shaft 2 is positioned below the wheel shaft 2.

As a result, the position of the center of gravity of the aircraft is kept at the most stable position even when stopped, and it is difficult for the aircraft to fall.

In FIG. 12, the height of the upper surface of the base 4 is higher than that of the wheel shaft 2, but the upper surface of the base 4 may be lower than that of the wheel shaft 2.

[0018]

Here, a control concept for maintaining the posture on the base 4 will be described.

As shown in FIG. 13, when the motor torque Tm is controlled so as to generate the same moment with respect to the load on the base 4, for example, the load torque T1 due to human weight, the base 4 is centered on a fulcrum like a seesaw. Keep balance.

The point corresponding to this balance maintaining point, that is, the point at which the rotational moment about the wheel shaft 2 becomes zero is called ZMP (Zero Moment Point).

When this ZMP coincides with the contact point with the road surface of the wheel 3 or when it is within the contact surface with the road surface, the balance is maintained and the posture on the base 4 can be maintained.

[0019]

When a person with a weight Wh gets on the coaxial two-wheel vehicle 1, the weight center M of the base 4 is tilted about the wheel shaft 2 according to the inclination angle θ of the person as shown in FIG.

At this time, the wheel shaft torque T0 for balancing the wheel shaft 2 is expressed by the following equation (3), and the motor torque Tm for maintaining the posture is T0 / N, where the reduction ratio of the speed reducer 12 is N: 1. It is represented by

[0020]

[0021]
Thus, in the above-described coaxial two-wheeled vehicle 1, the weight center M of the base 4 is configured to be positioned below the wheel shaft 2 as described above. It is only necessary to add the difference between the moment due to Wh and the moment due to the weight Wm of the base 4 as the wheel shaft torque T0, and the balance can be maintained with a relatively small motor torque.

[0022]

Further, a dynamic model for maintaining the posture on the base 4 will be described in detail using an XZ coordinate system shown in FIG.

Here, for the sake of simplicity in FIG.

Further, the wheel 3, the base 4, and the person on the base 4 are regarded as links, and the center-of-gravity position coordinates are (x0, z0), (x1, z1), and (x2, z2), respectively.

Further, the mass of each link is m0, m1, and m2, respectively, and the moment of inertia is I0, I1, and I2.

[0023]

Each momentum of the i-th link (i = 0, 1, 2) around the defined point Ω (σ, φ) is expressed by the following formula (4), where the center-of-gravity position coordinates are (xi, zi). . Here, one point given above x and z in Equation (4) indicates that it is the first derivative of x and z.

[0024]

[0025]

Accordingly, the moment due to the inertial force of all links is expressed by the following equation (5).

Here, the two points on x and z in the equation (5) indicate the second-order differentiation of x and z. The moment due to gravity of all links is expressed by the following equation (6), where g is the acceleration of gravity.

[0026]

[0027]
The sum of the moment due to the inertial force and the moment due to gravity gives a moment MΩ around the point Ω (σ, ϕ) as shown in Equation (7).

[0028]

[0029]

Except for the moment due to the gravity of the wheel 3 having the mass m0, the moment MΩ described above becomes the moment Ma around the wheel axis 2 by taking the point Ω (σ, ϕ) as the origin.

The moment Ma about the wheel shaft 2 is expressed by the following equation (8).

[0030]

[0031]
If the moment $M\Omega$ is expressed using this moment Ma, when $x0 = 0$, that is, when the center of gravity of the wheel 3 is on the wheel shaft 2, the following equation (9) is given.

[0032]

[0033]

Here, ZMP is defined as a point on the floor where the moment $M\Omega$ is zero.

Therefore, when the height of the wheel shaft 2 is set to h and the coordinates of the ZMP are set to (σzmp, $-$h) into the formula (7), the following formula (10) is obtained.

By solving Equation (10) for σzmp, ZMP can be expressed by link position, acceleration, and mass.

[0034]

[0035]

Further, when the ZMP coordinates (σzmp, $-$h) are substituted into the above equation (9), the following equation (11) is obtained.

In addition, this Formula (11) shows the formula of the balance of the moments around the wheel shaft 2.

[0036]

[0037]

Here, the force acting on the ZMP is illustrated in FIG.

In FIG. 16, FN represents a floor reaction force, FT represents a rolling friction force, and F represents a combined vector of FN and FT.

Note that the floor reaction force FN is actually distributed over the entire ground contact surface of the wheel 3, but is shown in FIG.

From this figure, the formula of the balance of moments about the wheel shaft 2 is expressed as the following formula (12).

[0038]

[0039]
If the following formulas (13) to (15) are substituted into the formula (12), the formula (11) is the same as the above-described formula (11).

[0040]

[0041]

In order to stabilize the posture on the base 4, it is only necessary to satisfy σ zmp = 0 in the equation (12).

That is, if the wheel shaft torque T0 = −FT * h is established, the posture can be maintained.

Therefore, the posture can be stabilized by controlling the state variable represented by the following equation (16) that satisfies T0 = FT = 0.

[0042]

[0043]

At this time, x0 and x1 are uniquely determined by the mechanism structure, but m2, I2, x2, and z2 are undefined values because they are human.

The moment Mt on the base 4 due to m2, I2, x2, and z2 is given by the following equation (17).

However, the base 4 is assumed to be kept horizontal as shown in FIG.

[0044]

[0045]

Here, when the load is a human, the angular velocity $\omega 2$ is sufficiently small. Therefore, when $\omega 2$ 0 is approximated, the moment Mt becomes zero when x2 and its second-order differential value are made zero in equation (18).

Setting x2 and its second-order differential value to zero may be considered equivalent to controlling x0 and x1 so that the load torque T1 on the base 4 becomes zero.

The moment Mt due to the load torque T1 is equivalent to acting on the action point (xf, L) on the base 4 with the force F2. Therefore, if x0 and x1 that make xf zero can be given, T1 = 0, and the condition for maintaining a stable posture can be satisfied.

[0046]
As shown in FIG. 17, when feedback control is performed on the gyro sensor signal on the base 4

and the motor torque Tm is applied to maintain x0 = x1, the motor torque Tm is set so that xf = x0. By controlling, the posture can be kept stable.

[0047]

Specifically, when the error Ef = xf−x0, if Ef> 0, the motor is moved forward with the motor torque Tm negative in order to displace x0 in the positive direction, and if Ef <0, x0 is set. The error Ef can be converged to zero by reversing the airframe with the motor torque Tm being positive in order to displace in the negative direction.

That is, when A0 is a positive constant and motor torque Tm satisfying Tm = −A0 * Ef is given, Ef is converged to zero, and the posture can be kept stable.

[0048]
Actually, for example, as shown in FIG. 18, when the base 4 is tilted about the pitch axis by an angle θ 0, a load weight torque of T1 (= M τ × L) is generated by a person having a weight M, and therefore the load load torque T1. By controlling the motor torque Tm so as to give the wheel shaft torque T0 in the opposite direction, the ZMP can be made to coincide with the ground contact point of the wheel 3 and the posture can be kept stable.

[0049]

Here, when a person rides on the base 4, although there is an individual difference, the force applied to the sole is usually changed in order to maintain the posture in a cycle of 1 to 2 seconds. The torque T1 changes indefinitely.

Therefore, it is necessary to add torque that can be balanced in real time to the motor 10 to keep the angle of the base 4 constant with respect to load fluctuations.

[0050]

Therefore, the above-described coaxial two-wheeled vehicle 1 has a control mechanism as shown in FIG. 19 in the control device 16 in order to cancel such load fluctuations in real time. In FIG. 19, the subtracter 20 takes a deviation between the base angle command θref, which is an attitude command, and the current base angle θ0 detected by the gyro sensor 13 and the acceleration sensor 14, and this deviation is supplied to the attitude controller 21. The The attitude controller 21 calculates a motor torque current value Tgyr [A] from the base angle command θref and the current base angle θ0.

[0051]

Further, the regulator 22 estimates the load load torque T1 using the sensor signals PS1, PS2, PS3, PS4 of the pressure sensor 15, and estimates load load torque current value T1′ / Km [A] for canceling the load load torque T1. Calculate Here, Km is a motor constant [Nm / A]. When the barycentric coordinates of the load are (Xg, Yg) and the load weight is Wg, the estimated load load torque T1′ is given by the following equation (18).

[0052]

[0053]

The subtracter 23 takes a deviation between the motor torque current value Tgyr and the estimated load load torque current value T1′ / Km, and this deviation is given to the motor 24 as the motor current I [A].

The motor 24 is rotated by the motor current I to generate a motor torque Tm. In the adder 25, the motor torque Tm and the load load torque T1 are added and transmitted to the base 26.

[0054]
Thus, by adding the motor torque Tm for canceling the load load torque T1 to the motor 24, the base angle can be kept constant with respect to the load fluctuation at the time of stop.

[0055]

Although the posture stability control can be performed by the above control mechanism, in order to travel in this state, a control mechanism for travel control is further required.

Therefore, the above-described coaxial two-wheel vehicle 1 actually has a two-wheel structure control mechanism that independently obtains motor torque for posture stability control and motor torque for travel control.

[0056]

A physical model of such a two-wheel structure control mechanism is shown in FIG. In FIG. 20, for the sake of simplicity, description will be made assuming that there is one wheel 3. As shown in FIG. 20, the base 4 incorporates various sensors such as a gyro sensor 13, an acceleration sensor 14, and a pressure sensor 15, and there are a motor stator 30, a rotary encoder 31, and a motor rotor 32 below. The rotation of the motor rotor 32 is transmitted to the wheel 3 via the speed reducer 33 and the joint 34.

[0057]

The attitude controller / adjuster 40 is based on the base angle command θ ref, which is an attitude command, the current base angle θ 0 detected by the gyro sensor 13 and the acceleration sensor 14, and the sensor signals PS1, PS2, PS3, and PS4 of the pressure sensor 15. The calculated motor torque Tgyr and estimated load load torque T1 'are calculated. Further, the motor controller 41 calculates a motor torque for traveling from the rotational position command Pref of the motor rotor 32 that is a traveling command and the current rotational position θ r of the motor rotor 32 detected by the rotary encoder 31.

[0058]
The adder 42 adds the motor torque Tgyr and the estimated load load torque T1 ′ and the motor torque for traveling, and supplies the added value to the motor rotor 32.

[0059]

Here, the base angle command θ ref described above is a target value of the base angle that is set according to the acceleration Ax in the X-axis direction so that the passenger can ride stably.

Specifically, the base 4 is horizontal when the X-axis acceleration Ax is zero, and the base 4 is tilted forward when the X-axis acceleration Ax is negative. Each is set to tilt backward.

[0060]

Therefore, for example, when the X-axis acceleration Ax is positive, as shown in FIG. 21, when the base 4 is tilted so that the ZMP is positioned in the direction of the combined vector of the inertial force and gravity, the occupant maintains a stable posture. be able to. The base angle command θ ref changes in proportion to the X-axis acceleration Ax.

[0061]

A block diagram of the control mechanism is shown in FIG. The subtracter 50 takes a deviation between the base angle command θ ref, which is an attitude command, and the current base angle θ 0 detected by the gyro sensor 13 (and the acceleration sensor 14), and supplies this deviation to the attitude controller 51. The attitude controller 51 calculates the motor torque Tgyr from the base angle command θ ref and the current base angle θ 0, and supplies the motor torque Tgyr to the adder 54.

[0062]

On the other hand, the subtracter 52 takes a deviation between the rotational position command Pref of the motor rotor 57 that is a running command and the current rotational position θ r of the motor rotor 57 detected by the rotary encoder 58, and this deviation is supplied to the motor controller 53. The The motor controller 53 calculates a motor torque for traveling from the rotational position command Pref and the current rotational position θ r, and supplies the motor torque to the adder 54.

[0063]
When the load torque T1 is applied to the base 4, the sensor signals PS1, PS2, PS3, and PS4 of the pressure sensor 15 are supplied to the adjuster 55, and the adjuster 55 uses the sensor

signal to estimate the estimated load described above. A load torque T1 'is calculated.

[0064]

The adder 54 adds the motor torque Tgyr from the attitude controller 51 and the motor torque from the motor controller 53, and the subtracter 56 subtracts the estimated load load torque T1 'from this added value.

This becomes the final motor torque Tm and is given to the motor rotor 57. In the adder 59, the reaction force of the motor torque Tm and the load load torque T1 are added, and this added value is given to the motor stator / base 60.

[0065]

The rotation of the motor rotor 57 is controlled according to the motor torque Tm. The rotational position θr of the motor rotor 57 is converted to 1 / N by the reducer 61 having a reduction ratio N: 1 and transmitted to the wheels 3. That is, the rotational position θw of the wheel 3 is 1 / N of the rotational position θr of the motor rotor 57. The rotary encoder 58 detects the rotational position θr of the motor rotor 57 and supplies a detection signal to the subtractor 52.

[0066]
On the other hand, as described above, an added value of the reaction force of the motor torque Tm and the load load torque T1 is applied to the motor stator / base 60. However, since they cancel each other, the tilt of the motor stator / base 60 is It can be suppressed.

[0067]

FIG. 23 represents the process in the block diagram shown in FIG. 22 as a mathematical model using a Laplace operator.

As described above, the attitude controller 51 is given a deviation between the base angle command θref and the current base angle θ0, and the motor controller 53 receives the rotation position command Pref of the motor rotor 57 and the current rotation position θr. Deviation is given. In the attitude controller 51 and the motor controller 53, each motor torque is calculated by feedback control that performs, for example, PID (proportional / integral / derivative) calculation.

[0068]

That is, Kp0 and Kp1 are proportional gains, Ki0 and Ki1 are integral gains, and Kd0 and Kd1 are differential gains. With these control gains, the followability of the motor responding to the attitude command θref and the travel command Pref changes. For example, when the proportional gains Kp0 and Kp1 are reduced, the motor rotor 57 moves with a slow follow-up delay, and when the proportional gains Kp0 and Kp1 are increased, the motor rotor 57 follows at high speed. In this way, by changing the control gain, it is possible to adjust the attitude command θref, the travel command Pref, the magnitude of the actual motion error, and the response time.

[0069]

The motor rotor 57 is given a motor torque Tm obtained by subtracting the estimated load load torque T1′ from the sum of the motor torque from the attitude controller 51 and the motor torque from the motor controller 53, and only the rotation angle θr. Rotate. Here, Jr is an inertia of the motor rotor 57, and Dr is a viscous resistance (damper coefficient) of the motor rotor 57.

[0070]

On the other hand, the motor stator / base 60 is added with the added value of the reaction force of the motor torque Tm and the load load torque T1 as described above. However, since they cancel each other, tilting is suppressed. Here, J is the inertia of the motor stator / base 60, and D is the viscous resistance (damper coefficient) of the motor stator / base 60.

[0071]

More specifically, the mathematical model shown in FIG. 23 is as shown in FIG. As shown in FIG.

24, the attitude controller 70 generates motor torque Tgyr for attitude control by performing PID control on the deviation between the base angle command θref and the current base angle θ0, and the motor controller 71 generates motor torque for travel control by performing PID control on the deviation between the rotational position command Pref of the motor 10 and the current rotational position θr.

[0072]

Further, the adjuster 72 generates an estimated load load torque T1′ from the sensor signal of the pressure sensor 15. The adder 73 adds these torques and gives the obtained motor torque Tm to the motor 10. The motor 10 is rotationally driven by the motor torque Tm, and the rotation is converted to 1/16 by the reducer 74 having a reduction ratio of 16: 1 and transmitted to the wheels 3.

[0073]
As described above, in FIG. 20 to FIG. 24, it is assumed that there is one wheel 3 for simplicity. However, in the actual coaxial two-wheeled vehicle 1 having the left and right wheels 3R and 3L, for example, the attitude controller 51 in FIG. While used in common by the left and right wheels 3R, 3L, a motor controller 53 is provided independently on the left and right.

[0074]

A block diagram of the control mechanism in this case is shown in FIG.

The sensor value ωp from the gyro sensor 13 is sent to the angle calculator 82 via a bandpass filter (BPF) 80 having a pass band of 0.1 to 50 Hz, for example, and the sensor value αp from the acceleration sensor 14 is, for example, a cutoff frequency Is sent to the angle calculator 82 via a low-pass filter (LPF) 81 of 0.1 Hz. The angle calculator 82 calculates the current base angle θ0 based on these sensor values.

[0075]

Further, the subtractor 83 takes a deviation between the base angle command θref, which is a posture command, and the current base angle $\theta 0$, and this deviation is supplied to the posture controller 84. The attitude controller 84 calculates the motor torque Tgyr described above from the base angle command θ ref and the current base angle $\theta 0$.

[0076]

On the other hand, the subtractor 85R takes a deviation between the rotational position command Prefr of the motor rotor 92R, which is a traveling command for the right wheel 3R, and the current rotational position θ r of the motor rotor 92R detected by the rotary encoder 93R, and this deviation is proportional to the position. It is supplied to the controller 86R. The position proportional controller 86R performs position proportional (P) control on this deviation and supplies the proportional control result to the subtractor 87R.

[0077]

The differentiator 88R differentiates the rotational position θ r of the motor rotor 92R supplied from the rotary encoder 93R, and supplies the differentiation result to the subtractor 87R. In the subtractor 87R, the deviation between the proportional control result from the position proportional controller 86R and the differential result from the differentiator 88R is taken, and this deviation is supplied to the speed proportional controller 89R. The speed proportional controller 89R performs speed proportional (P) control on this deviation, and supplies the proportional control result to the adder 90R.

[0078]

In the adder 90R, the proportional control result, the motor torque Tgyr, and the estimated load load torque T1 ′ obtained from the sensor signals PS1, PS2, PS3, and PS4 of the pressure sensor 15 in the adjuster 94 are added, and the added value is current controlled. This is supplied to the amplifier 91R. The current control amplifier 91R generates a motor current based on the added value and drives the motor rotor 92R. The rotational position of the motor rotor 92R is supplied to the differentiator 88R together with the subtractor 85R. Since the same applies to the left wheel 3L, the description thereof is omitted.

[0079]

Thus, the above-described coaxial two-wheel vehicle 1 has a control mechanism for posture stability control common to the left and right wheels 3R and 3L and a control mechanism for independent left and right travel control, and these perform independent control. Therefore, it is possible to achieve both stable posture control and traveling control in a stable manner.

[0080]
Next, speed control in the above-described coaxial two-wheel vehicle 1 will be described.

[0081]

As described above, in the coaxial two-wheel vehicle 1 described above, the barycentric coordinates (Xg, Yg) of the load on the base 4 from the sensor signals PS1, PS2, PS3, PS4 of the four pressure sensors 151 to 154 provided at the four corners of the base 4 are described.) And its load weight Wg, and the load load torque T1 is obtained. Further, the center of gravity coordinates (Xg, Yg) are used as a direction and speed control command.

Specifically, when the load weight Wg is equal to or greater than a predetermined value, the speed command Vx is changed based on the X coordinate Xg of the center of gravity position.

[0082]

This is shown in FIG.

Here, in FIG. 26, the range from X3 to X1 is a stop region, and the command travel speed is set to zero within this range. This stop area is preferably the X coordinate range of the contact surface with the road surface of the wheel 3. In this case, for example, when the load weight Wg is large or when the gas pressure of the wheel 3 is low, the contact area with the road surface of the wheel 3 increases, so the range of the stop region also increases. By providing the stop region (dead zone) in this way, the aircraft can be prevented from moving forward and backward due to a slight center of gravity movement unintended by the passenger.

[0083]

When the X coordinate becomes equal to or greater than X1, the command speed increases according to the size of the X coordinate until the maximum forward speed SfMAX is reached. When the X coordinate becomes X2 or more, the vehicle is forcibly decelerated and stopped until the posture is stabilized again within the stop region. Thus, by providing the area where the vehicle is forcibly decelerated and stopped, the safety of the passenger when traveling at the maximum speed can be ensured.

[0084]

Similarly, when the X coordinate becomes X3 or less, the command speed increases in accordance with the size of the X coordinate until the maximum reverse speed SbMAX is reached. The maximum reverse speed SbMAX is preferably smaller than the maximum forward speed SfMAX. When the X coordinate becomes X4 or less, the vehicle is forcibly decelerated and stopped until the posture is stabilized again within the stop region.

[0085]

When the X coordinate is between X1 and X2 or between X3 and X4, the rotational position command Prefr of the motor 10R and the rotational position command Prefl of the motor 10L are determined according to the X coordinate Xg, for example, by the following equation (19): Is generated. Here, in Expression (19), G0 is a positive constant gain, and can be made variable according to, for example, the load weight Wg.

[0086]

[0087]

When the speed command at the time t = 0 is Vx0 and the speed command at the time t = t1 is Vx1, the acceleration is continuously changed and the vehicle travels so as not to cause mechanical resonance vibration. Is preferred.

In this case, assuming that the time to reach Vx1 is Δt, the traveling speed command Vref (t) at time t ($0 \leqq t \leqq t1$) can be calculated by the following equation (20), for example.

[0088]

[0089]

At this time, the rotational position command Pref (t) of the motor 10 is a value obtained by integrating the traveling speed command Vref (t) of the equation (20), and is given by a quintic function as shown in the following equation (21).

Here, in Expression (21), Pref0 is a rotational position command at time t = 0.

[0090]

[0091]

In addition to forward / backward movement, when the load weight Wg is equal to or greater than a predetermined value, the turning speed command Vr can be changed based on the Y coordinate Yg of the center of gravity position as shown in FIG. 27, for example.

Here, in FIG. 27, the range from -Y1 to Y1 is a stop region, and the command turning speed is set to zero within this range.

[0092]

This stop area can be arbitrarily set in the vicinity of the origin O. By providing the stop region (dead zone) in this way, it is possible to prevent the aircraft from turning due to a slight center of gravity movement that is not intended by the passenger. When the Y coordinate becomes Y1 or more, the command turning speed increases according to the size of the Y coordinate until the clockwise maximum speed CWMAX is reached. Similarly, when the Y coordinate becomes —Y1 or less, the command turning speed increases according to the magnitude of the Y coordinate until the counterclockwise maximum speed CCWMAX is reached.

[0093]

When the Y coordinate is Y1 or more or −Y1 or less, the rotational position command Rrefr of the motor 10R and the rotational position command Rrefl of the motor 10L are generated according to the Y coordinate Yg. When the traveling speed is zero, the rotational position command Rrefr of the motor 10R and the rotational position command Rrefl of the motor 10L are antiphase commands as shown in the following formula (22), for example. Here, in Expression (22), G1 is a positive constant gain, and can be made variable according to, for example, the load weight Wg.

[0094]

[0095]

On the other hand, when the traveling speed is not zero, the rotational position command Rrefr of the motor 10R and the rotational position command Rrefl of the motor 10L are in-phase commands as shown in the following equations (23) and (24), for example.

Here, in the equations (23) and (24), G2 is a positive constant gain, and can be varied according to the load weight Wg, for example.

[0096]

[0097]

Here, when traveling on uneven road surfaces such as uneven road surfaces and inclined road surfaces, it becomes difficult to travel in the target direction given by the rotational position commands of the left and right motors 10R, 10L. There is a risk of deviation in the traveling direction.

Further, even when the effective diameter of the wheel 3 is different due to the difference in gas pressure between the left and right wheels 3R, 3L, there is a possibility that the target direction and the actual traveling direction are similarly shifted.

[0098]
Therefore, in the above-described coaxial two-wheeled vehicle 1, the actual traveling direction is detected by the gyro sensor 13 that detects the angular velocity ωyaw around the yaw axis, and the rotational speeds of the left and right motors 10R and 10L are independently controlled, thereby obtaining the target direction. Eliminate deviations from the actual direction of travel.

[0099]

As an example, as shown in FIG. 28A, the effective diameter of the left wheel 3L is shorter than that of the right wheel 3R, and as shown in FIG. 28B, ωyaw1 [A case where [rad / sec] is detected will be described.

In such a case, assuming that the average of the rotational speed commands Vrefr and Vrefl is Vref0, the rotational speed commands Vrefr and Vrefl to be given to the left and right motors 10R and 10L are expressed as shown in the following equations (25) and (26). By correcting, the aircraft can go straight. Here, in the expressions (25) and (26), K0 is a positive constant.

[0100]

[0101]
Further, when Dref [rad / sec] is given as the target direction as shown in FIG. 28C, the rotational speed command Vrefr is applied to the left and right wheels as shown in the following equations (27) and (28). , Vrefl is given.

[0102]

[0103]

The rotational speed commands Vrefr and Vrefl thus obtained are converted into wheel rotational position commands Prefr and Prefl by the following equations (29) and (30), respectively.

Here, in Expressions (29) and (30), k is an integer representing the number of times of sampling, and Pref (k) indicates a rotational position command in k sampling.

[0104]

[0105]

Similarly, when turning, there is a possibility that the turning speed may be shifted due to a difference in gas pressure between the left and right wheels 3R and 3L, a difference in road surface conditions, and the like.

Also in this case, the actual turning speed is detected by the gyro sensor 13 that detects the angular velocity ωyaw around the yaw axis, and the rotational speeds of the left and right motors 10R and 10L are independently controlled, so that the target turning speed and the actual turning speed can be determined. The deviation from the turning speed of can be eliminated.

[0106]

As an example, the case where the effective diameter of the left wheel 3L is shorter than the right wheel 3R and ωyaw2 [rad / sec] is detected as a gyro sensor signal around the yaw axis when turning will be described.

If the signals obtained by differentiating the rotational position command Rrefr of the right wheel 3R and the rotational position command Rrefl of the left wheel 3L are respectively Vrefr and Vrefl, the turning speed error ωerr is expressed by the following equation (31).

[0107]

[0108]

In this case, as shown in the following equations (32) and (33), the airframe can be turned as intended by correcting the rotational position commands Rrefr and Rrefl given to the left and right motors 10R and 10L.

Here, in Expressions (32) and (33), G3 is a positive constant gain, and can be varied according to, for example, the load weight Wg.

[0109]

[0110]
Thus, in the above-described coaxial two-wheeled vehicle 1, the actual traveling direction and turning speed are detected by the gyro sensor 13 that detects the angular velocity ωyaw around the yaw axis, and the rotational speeds of the left and right motors 10R and 10L are independently controlled. Thus, the deviation between the target direction (turning speed) and the traveling direction (turning speed) can be eliminated.

[0111]

Furthermore, the software configuration of the coaxial two-wheel vehicle 1 will be described with reference to FIG.

As shown in FIG. 29, the hardware layer 150 in the lowest layer is arranged in a hierarchical structure including a kernel layer 151, an on-body layer 152, a network layer 153, and an application layer 154 in the highest layer. The

[0112]

The hardware layer 150 is a circuit hierarchy, and includes, for example, a motor control circuit, a central control circuit, a sensor circuit control circuit, and the like.

The kernel layer 151 is a layer that performs various calculations such as motor servo calculation, attitude control calculation, traveling control calculation, or real-time traveling target value calculation.

In the hardware layer 150 and the kernel layer 151, basic attitude stabilization control and traveling control are realized. The on-body layer 152 is a layer that performs a travel target value calculation, an obstacle avoidance trajectory generation, and the like.

[0113]

Each of these hierarchies is executed with a different sampling control cycle, and the cycle becomes longer as the upper hierarchies. For example, in the hardware layer 150 of the lowest layer, the control cycle is as short as 0.1 msec, whereas in the kernel layer 151, the control cycle is as long as 1 msec and on-body layer 152 is 10 msec. .

[0114]

Next, the overall circuit configuration of the coaxial two-wheel vehicle 1 will be described. As shown in FIG. 30, sensor signals PS1, PS2, PS3, and PS4 from the pressure sensors 151 to 154 are supplied to the sensor circuit 200. In addition to this sensor signal, the sensor circuit 200 detects sensor signals ωp, ωyaw from the gyro sensor 13 that detects angular velocities around the pitch axis and the yaw axis, linear acceleration in the X, Y, and Z axis directions, pitch axis, roll The sensor signals Ax, Ay, Az, αp, αr, αyaw from the acceleration sensor 14 that detects the angular acceleration around the axes and the yaw axes are combined and supplied to the control device 16.

[0115]

Based on these sensor signals, the control device 16 generates the motor torque Tgyr and the rotational position command Pref of the motor rotor, which is a travel command, as described above, and supplies these to the left and right motor drivers 203R and 203L. The motor drivers 203R and 203L calculate the optimum motor current for driving the motors 10R and 10L of 200 W, for example, based on the motor torque Tgyr, the rotational position command Pref of the motor rotor, and the like, and supply them to the motors 10R and 10L. . The rotational positions of the motors 10R and 10L are obtained by the rotor encoders 11R and 11L and fed back to the motor drivers 203R and 203L.

[0116]

The servo-on / power switch 204 is connected to the control device 16 and the power switch 205, and a signal from the power switch 205 is supplied to the power management circuit 206. The power management circuit 206 is connected to the battery 207 and supplies control power of 24V to the control device 16, the audio processing circuit 201, and the image processing circuit 202, and also supplies motor power to the motor drivers 203R and 203L. . The power management circuit 206 is supplied with regenerative power of the motors 10R and 10L via the motor drivers 203R and 203L, and the power management circuit 206 charges the battery 207 using this regenerative power.

[0117]

A detailed internal configuration of the overall configuration shown in FIG. 30 will be described with reference to FIG. As shown in FIG. 31, the sensor circuit 200 includes sensor signals PS1, PS2, PS3 and PS4 from the pressure sensors 151 to 154, sensor signals ωp and ωyaw from the gyro sensors 131 and 132, and a sensor signal from the acceleration sensor 14. Ax, Ay, Az, αp, αr, αyaw are supplied. The sensor circuit 200 adjusts the gain of the sensor signals PS1, PS2, PS3, and PS4 from the pressure sensor 15 with a pressure gain of, for example, 10 mv / N, and further converts them into digital signals via an analog-digital converter (not shown). This is supplied to the center-of-gravity calculation unit 210 of the control device 16.

[0118]

The sensor circuit 200 adjusts the gain of the sensor signals ωp and ωyaw from the gyro sensors 131 and 132 with a posture gain of 1.6 V / (rad / sec), for example, and also detects the sensor signals Ax, Ay, Az, αp, αr, and αyaw are adjusted with a posture gain of, for example, 1.6 V / (rad / sec <2>), converted into a digital signal via an analog-digital converter (not shown), and then subjected to signal preprocessing. To the unit 211. The signal preprocessing unit 211 performs preprocessing such as applying a digital filter to the input signal, or calculating an offset adjustment or a posture position, that is, a base angle $\theta 0$.

[0119]
The center-of-gravity calculation unit 210 obtains the center-of-gravity position coordinates (Xg, Yg) of the load on the base 4 and its load weight Wg as described above based on the sensor signals PS1, PS2, PS3, PS4 from the pressure sensors 151-154. The center of gravity position coordinates (Xg, Yg) and the information on the load weight Wg are supplied to the travel command calculator 212, and the information on the Y coordinate Yg of the center of gravity position and the load weight Wg is supplied to the turning command generator 215. .

[0120]

The travel command calculator 212 generates a speed command Vx based on, for example, the center-of-gravity position X coordinate-travel speed characteristic as shown in FIG. 26, and the rotational speed command generator 213 is based on the speed command Vx. A rotation speed command Vref (t) is generated by performing a next function calculation.

The rotational speed command generator 213 supplies the rotational position command Pref (t) to the rotational position command generator 214, the turning command generator 215, and the attitude command generator 216.

[0121]
The turning command generator 215 includes the Y coordinate Yg and the load weight Wg of the center of gravity supplied from the center of gravity calculating unit 210, the rotational angular velocity ωyaw about the yaw axis supplied from the signal preprocessing unit 211, and the rotational speed command generator 213. A phase command for turning, for example, Yg * G1, is generated based on the rotational speed command Vref (t) supplied from, and this phase command is supplied to the rotational position command generator 214.

[0122]

The rotational position command generator 214 integrates the rotational speed command Vref

(t) supplied from the rotational speed command generator 213 to generate a rotational position command Pref (t), and sends the rotational position command Prefr (t), Prefl (t) is supplied.

At this time, the rotational position command generator 214 generates rotational position commands Prefr (t) and Prefl (t) in consideration of the phase command from the turning command generator 215.

[0123]

The attitude command generator 216 calculates a base angle command θ ref which is an attitude command based on the rotation speed command Vref (t) supplied from the rotation speed command generator 213 as described with reference to FIG. The angle command θ ref is supplied to the subtracter 217. The subtractor 217 subtracts the current base angle θ 0 obtained by the signal preprocessing unit 211 from the base angle command θ ref, and supplies the deviation to the attitude controller 218. The attitude controller 218 performs PID control based on this deviation to obtain the motor torque Tgyr.

[0124]

When performing PID control, the PI gain may be changed according to the load weight Wg on the base 4. Specifically, it is preferable to increase the proportional gain and decrease the integral gain when the load weight Wg increases. The attitude control unit 218 supplies the motor torque Tgyr to the left and right motor drivers 203R and 203L.

[0125]

In the motor driver 203R for the right wheel 3R, the subtractor 230R takes a deviation between the rotational position command Prefr, which is a traveling command for the motor 10R, and the current rotational position θ r of the motor 10R detected by the rotary encoder 11R. The deviation is supplied to the position proportional controller 231R. The position proportional controller 231R performs position proportional (P) control on this deviation, and supplies the proportional control result to the subtractor 232R. The differentiator 233R differentiates the rotational position θ r of the motor 10R supplied from the rotary encoder 11R, and supplies the differentiation result to the subtractor 232R.

[0126]

The subtractor 232R takes a deviation between the proportional control result from the position proportional controller 231R and the differential result from the differentiator 233R, and this deviation is supplied to the speed proportional / integral controller 234R. The speed proportional / integral controller 234R performs speed proportional / integral (PI) control on this deviation, and supplies the proportional / integral control result to the adder 235R. The adder 235R adds the proportional / integral control result and the motor torque Tgyr, and supplies the added value to the current control amplifier 236R.

[0127]

The current control amplifier 236R generates a motor current based on the added value, and drives the 200W motor 10R, for example. The rotational position of the motor 10R is supplied to the differentiator 233R together with the subtractor 230R. Since the same applies to the left wheel 3L, the description thereof is omitted.

[0128]

The power management circuit 206 is connected to, for example, a 24V battery 207, supplies 24V and 1A control power to the control device 16, and supplies 24V and 30A motor power to the motor drivers 203R and 203L, respectively. The power management circuit 206 is supplied with regenerative power of the motors 10R and 10L via the motor drivers 203R and 203L, and the power management circuit 206 charges the battery 207 using this regenerative power.

[0129]
As described above, in the coaxial two-wheeled vehicle 1 previously proposed by the present inventor, the motor torque Tgyr for controlling the angle of the base 4 using the gyro sensor 13 and the acceleration sensor 14 and the load load torque using the pressure sensor 15. A posture controller common to the left and right wheels 3R and 3L, and a left and right independent motor controller that generates motor torque for running control using the pressure sensor 15. Since they are provided and perform independent control, it is possible to achieve both stable posture control and stable travel control.

[0130]
Moreover, in the coaxial two-wheeled vehicle 1 previously proposed by the inventor of the present application, traveling control is performed according to the center of gravity coordinates of the load on the base 4, but stops in the X coordinate range and the Y coordinate range of the ground contact surface with the road surface of the wheel 3. Since the area (dead zone) is provided, the aircraft can be prevented from moving forward, backward, and turning due to a slight movement of the center of gravity that is not intended by the passenger.

[0131]

Further, in the coaxial two-wheeled vehicle 1 previously proposed by the present inventor, the actual traveling direction and turning speed are detected by the gyro sensor 13 that detects the angular velocity ωyaw around the yaw axis, and the rotational speeds of the left and right motors 10R and 10L are independent. By controlling to, the deviation between the target direction (turning speed) and the traveling direction (turning speed) can be eliminated.

The applicant of the present application has previously proposed a traveling device using such a coaxial two-wheeled vehicle.

Further, as a traveling device using a coaxial two-wheeled vehicle as described above and including a handle that a passenger grips and a seat that is seated, a traveling device has been proposed, for example, by the technique described in Japanese Patent Laid-Open No. 4-201793.

[0132]

By the way, in the traveling apparatus as described above, there is no speed indicator and mileage indicator, and therefore, it is very inconvenient when taking into consideration safety of traveling and maintenance of the traveling apparatus, and it is not possible to respond to traffic regulations. . Also, assuming that a speed indicator and a mileage indicator are attached, simply calculating the speed and mileage of the traveling device from the rotational speed of the wheel is a human being because the traveling device itself is a two-wheel structure arranged in parallel. There is a problem that an accurate speed and travel distance cannot be calculated due to the influence of the pitch axis angular velocity of the step board on which the board is boarded, that is, the fluctuation of the step board in the pitch direction.

[0133]
The present invention has been made in view of the above-described points, and does not require the installation of a new sensor, and is not affected by the swing of the step base in the pitch direction. An object of the present invention is to obtain a traveling device that calculates a speed and a travel distance and can display the speed and the travel distance on a speedometer and a travel distance meter.

[0134]
In order to achieve the object of the present invention, the traveling device of claim 1 includes a speed indicator and a odometer for displaying a traveling speed and a traveling distance of the traveling device from rotation information obtained by combining the wheel and the casing. It is characterized by that.

[0135]
According to the second aspect of the present invention, the traveling speed is calculated by adding or subtracting the pitch axis angular speed by the gyro sensor from the attitude detecting means, that is, the rotation information of the casing, and the speed indicator It is characterized by displaying.

[0136]
Further, according to the travel device of claim 3, the travel speed is defined as a travel speed by a rotation average value of the pair of wheels.

[0137]
According to the travel device of claim 4, the travel distance is calculated by calculating an integral value of the travel speed and displayed on the travel distance meter.

[0138]
According to the traveling device of the fifth aspect, the speed indicator and the odometer are attached to an upper end portion of the stay and the handle portion.

[0139]

According to the first aspect of the present invention, the accurate speed and travel distance of the travel device can be calculated and displayed on the speedometer and travel distance meter without being affected by the swing of the step base in the pitch direction.

As a result, it is possible to meet the safety of travel of the travel device, compliance with traffic regulations, and grasp the travel state, and it is possible to estimate the maintenance time of the travel device, which is suitable for maintenance and inspection.

[0140]
According to the second aspect of the present invention, an accurate speed and travel distance can be calculated and displayed on the speedometer and travel distance meter even if the step base swings in the pitch axis direction.

[0141]
According to the invention of claim 3, the traveling speed can be easily calculated from the rotation average value of the inner wheel and the outer wheel even when the traveling device is turning.

[0142]
According to the invention of claim 4, the travel distance can be easily calculated with the integral value of the travel speed.

[0143]
According to the fifth aspect of the present invention, the speed indicator and the odometer can be easily visually recognized during traveling of the traveling device, and traveling safety can be ensured.

[0144]

Embodiments of a traveling device according to the present invention will be described below with reference to the drawings.

FIG. 1 is an overall perspective view showing the configuration of an embodiment of a coaxial two-wheeled vehicle to which a traveling device according to the present invention is applied, FIG. 2 is a rear view of the whole, and FIG. 3 is a right side view of the whole.

[0145]

1 to 3, a pair of left and right wheels 101 and 102 are provided.

These left and right wheels 101 and 102 are arranged so that the center of each wheel is in a straight line, and supported by a step base (housing) 103 on which a passenger rides.

The step base 103 is at a position where the center of gravity is lower than the center of the wheels 101 and 102.

The configuration of the wheels 101 and 102 and the step base 103 and their relationship will be described later.

[0146]

At the end of the step base 103 (the right end side in FIG. 3 which is the traveling direction of the traveling device), a stay 104 is suspended upward, and a handle 105 is provided at the upper end of the stay 104.

A display meter 106 in which a speedometer and an odometer are integrated is attached to the handle post at the upper end of the stay 104.

[0147]

Here, the configuration of the wheels 101 and 102 and the step base 103 will be described.

Since the wheels 101 and 102 have the same configuration, one wheel 101 and the step base 103 will be described with reference to FIGS.

[0148]

The wheel 101 is coupled to a motor shaft and a motor rotor 109 constituting a wheel drive motor 100L via an output shaft 108 of a speed reducer 107 fixed to a step base 103. A disk for detecting a rotor angle is provided at the other end of the motor rotor 109. A rotating plate 110 is attached.

The rotation speed of the rotating plate 110 is detected by the detection unit 111.

[0149]

The detection unit 111 is mounted on a circuit board 112, and the circuit board 112 is fixed to a motor case 114 to which a motor stator 113 constituting the wheel drive motor 100L is fixed.

The motor case 114 is fixed to the step base 103 via the housing of the speed reducer 107.

[0150]

With this configuration, the wheel 101 and the step base 103 described above are rotated integrally with the motor rotor 109 on the wheel 101 side, and the step base 103 side is integrated with the motor stator 113, so that the step base 103 travels. As shown by the arrow in FIG. 5, the apparatus is configured to be rotated (oscillated) by a pitch about the wheel shaft center O as indicated by an arrow in FIG. 5.

Therefore, the rotating plate 110 and the detection unit 111 are relatively affected.

[0151]

FIG. 6 shows a block diagram of the system configuration of the traveling apparatus described above. The wheel drive motor 100L having the rotor angle detector 115L and the wheel drive motor 100R having the rotor angle detector 115R are respectively connected to the drive circuits 116 and 117. Connected to a calculation device 120 having a calculation circuit (CPU) 118 and a storage device (memory) 119, the calculation device 120 has a posture detection sensor 121 for detecting the posture of a passenger who has boarded the step base 103 of the traveling device. It is connected.

[0152]

The posture detection sensor 121 detects the pitch axis angular velocity, yaw axis angular velocity, roll axis angular velocity by the gyro sensor 122 and X axis acceleration, Y axis acceleration, and Z axis acceleration by the acceleration sensor 123 in order to detect the posture of the step base 103. To do.

Thereby, the traveling device outputs a signal for maintaining a predetermined traveling state to the drive circuits 116 and 117 from the signal from the posture detection sensor 121 described above, and drives the wheels 101 and 102.

[0153]
Note that a power source 124 formed of a secondary battery and a switch 125 for emergency stop of the traveling device are connected between the drive circuits 116 and 117 and the arithmetic device 120.

[0154]
Next, a method for calculating the traveling speed and the traveling distance in the traveling device configured as described above will be described.

[0155]
According to the traveling device of the present invention, the rotational speeds of the wheels 101 and 102 can be detected by detecting the rotational speed of the rotating plate 110 that rotates together with the motor rotor 109 by the detection unit 111. The fact that the accurate speed and travel distance cannot be calculated due to the influence of the pitch axis angular speed 103 has been described in the problem to be solved by the previous invention.

[0156]
Therefore, the present invention adds the pitch axis angular velocity of the step base 103 by the gyro sensor 122 from the attitude detection sensor 121, that is, the rotation information of the step base 103, from the combined rotation information of the wheels 101 and 102 and the step base 103, By subtracting, the traveling device inherently accurate traveling can be performed without being affected by the step base 103.

[0157]

For example, when the input / output rotation of the speed reducer 107 is in the same direction, the wheel base 101 rotates counterclockwise at a predetermined speed, and the step base 103 is in the state where the traveling device is traveling in the direction of the arrow. The detection unit 111 that detects the rotational speed of the wheel is considered to have increased the rotational speed of the wheel at the moment when it is tilted backward as opposed to the traveling direction as indicated by the one-dot chain line by the weight shift.

In this case, the pitch axis angular velocity for which the step base 103 is tilted backward is subtracted.

[0158]

On the other hand, at the moment when the step base 103 is tilted forward in the traveling direction as indicated by the two-dot chain line due to the weight shift of the passenger, the detection unit 111 that detects the wheel rotation speed is the wheel rotation speed. Is considered to have slowed down.

In this case, the step base 103 adds the pitch axis angular velocity that is tilted forward.

[0159]
Here, when a mathematical expression is applied, the rotational speed of the left wheel drive motor is rmL, the pitch axis angular speed of the gyro sensor is rjP, the reduction gear ratio of the reduction gear is n, and the wheel diameter is d, the traveling speed S is

[0160]

[0161]
Thus, even if there is a rotational movement of the step base 103 from the above equation, it is possible to obtain the exact traveling inherent to the traveling device.

[0162]
In addition, since the traveling device that travels with two wheels arranged in parallel performs the turning by the rotation difference between the left and right wheels 101 and 102, the average value of the left and right wheels is regarded as the traveling speed of the traveling device.

[0163]
Expressing this in terms of a formula, the running speed S is

[0164]

[0165]

Thus, the average traveling speed of the left and right wheels can be obtained from the above equation.

In [Equation 26], rmR is the rotational speed of the right wheel drive motor.

[0166]

Further, the travel distance of the travel device can be obtained from the integral value of the travel speed obtained by the above equation.

Expressing this in the formula, the mileage O is

[0167]

[0168]

となる。

In [Equation 27], S is the traveling speed, and t is the time.

[0169]

The travel speed and travel distance calculated as described above can be viewed on the indicator 106 attached to the handle post at the upper end of the stay 104.

FIG. 7 is a plan view of the display meter 104 as viewed from above. The display meter 106 displays a speedometer 126 and an odometer 127 in an integrated manner.

[0170]
As described above, the traveling device according to the present invention does not require the installation of a new sensor, and the traveling speed and the traveling distance based on sensor information such as a rotary plate that detects wheel rotation and a rotary encoder that includes a detection unit. Can be calculated and displayed on the display meter 106.

[0171]
In addition, the travel speed and travel distance can be displayed on the display meter 106, so that the travel safety of the travel device and the traffic regulations can be complied with, so that the travel state can be grasped and the travel time can be used as a guideline for the maintenance time. Maintenance and inspection of the equipment becomes easy.

[0172]
The present invention is not limited to the embodiment described above and shown in the

drawings, and various modifications can be made without departing from the scope of the invention.

[0173]

1 is an external perspective view showing the configuration of an embodiment of a coaxial two-wheeled vehicle to which a traveling device according to the present invention is applied.

It is a front view of the whole traveling device by the present invention similarly.

It is a side view of the whole traveling apparatus by this invention.

It is sectional drawing of the detailed structure of a wheel and a step stand.

It is a side view of the positional relationship between a wheel and a step base.

It is a block diagram of the system configuration of a traveling device.

It is the top view which looked at the indicator of travel speed and the odometer from the top.

It is an external appearance perspective view which shows embodiment of the coaxial two-wheeled vehicle which this inventor proposed previously.

It is a sectional side view for demonstrating the base of a coaxial two-wheeled vehicle. It is a figure which shows the pressure sensor provided in the base of the coaxial two-wheeled vehicle, The figure (A) shows a top view, The figure (B) shows a side view. It is a figure which shows the positional relationship of the weight center of a coaxial two-wheeled vehicle, and a wheel shaft. It is a figure explaining balance of load load torque and motor torque. It is a figure explaining posture control in case a human boarded. It is a figure explaining the dynamic model for maintaining an attitude | position on a base. It is a figure explaining the dynamic model for maintaining an attitude | position on a base. It is a figure explaining the dynamic model for maintaining an attitude | position on a base. It is a figure explaining the dynamic model in a coaxial two-wheeled vehicle. It is a figure which shows the control mechanism for attitude | position stability control. It is a figure which shows the control mechanism for attitude | position stability control and driving | running | working control in case there is one wheel. It is a figure explaining the attitude | position command in a coaxial two-wheeled vehicle. It is a block diagram which shows the control mechanism for attitude | position stability control and driving | running | working control in case there is one wheel. It is a figure which shows the block diagram shown in FIG. 22 as a mathematical model. It is a figure which shows the detailed specific example of the mathematical model shown in FIG. It is a block diagram which shows the control mechanism for attitude | position stability control and driving | running | working control in case there are two wheels. It is a figure explaining traveling speed control in the case of advance / retreat. It is a figure explaining the traveling speed control in the case of turning. It is a figure explaining the control method in case the gyro sensor signal around a yaw axis is detected when going straight.

Explanation of symbols

[0174]
DESCRIPTION OF SYMBOLS 101,102 ... Wheel, 103 ... Step stand, 100L, 100R ... Wheel drive motor, 104 ... Stay, 105 ... Handle, 106 ... Indicator, 107 ... Reduction gear, 109 ... Motor rotor, 110 ... Rotating plate, 111 ... Detection unit , 113: motor stator, 115L, 115R ... rotor angle detector, 116, 117 ... drive circuit, 120 ... arithmetic unit, 121 ... attitude detection sensor, 122 ... gyro sensor, 123 ... acceleration sensor, 126 ... speedometer, 127 ... Odometer

(19) 日本国特許庁(JP)　　(12) 公 開 特 許 公 報(A)　　(11) 特許出願公開番号
特開2005-335471
(P2005-335471A)
(43) 公開日　平成17年12月8日(2005.12.8)

(51) Int.Cl.[7]	F I		テーマコード（参考）
B62K 3/00	B62K 3/00		3D012
B60L 11/18	B60L 11/18	A	5H115
B62J 39/00	B62J 39/00	E	
B62K 17/00	B62J 39/00	J	
	B62K 17/00		

審査請求 未請求　請求項の数 5　ＯＬ　（全 28 頁）

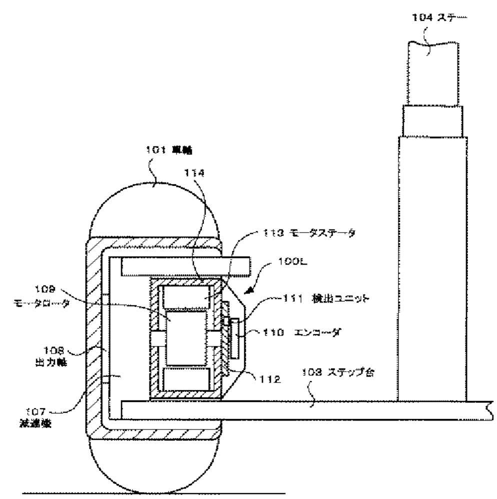
(21) 出願番号　特願2004-154806 (P2004-154806)
(22) 出願日　平成16年5月25日 (2004.5.25)

(71) 出願人　000002185
ソニー株式会社
東京都品川区北品川６丁目７番３５号
(74) 代理人　100122884
弁理士　角田　芳末
(74) 代理人　100113516
弁理士　磯山　弘信
(72) 発明者　柿沼　武一
東京都品川区北品川６丁目７番３５号　ソニー株式会社内

Fターム(参考) 3D012 BB02
5H115 PA01 PC06 PG10 PI16 PU01
QN03 QN04 RB14 SE03 SF30
TB01 TO02 TO04 UB05 UB15

(54)【発明の名称】走行装置

(57)【要約】　　(修正有)
【課題】　ステップ台のピッチ方向の揺動の影響を受けることなく、走行装置の正確な速度や走行距離を算出し、速度計や走行距離計に表示できるようにした走行装置を提供する。
【解決手段】　平行に配置された一対の車輪１０１と、駆動手段と、搭乗者のステップ台１０３と、搭乗者が保持するハンドルと、ステップ台１０３の角速度及び走行加速度を制御する姿勢検出センサとを備え、所定の走行状態を維持するための信号を駆動回路に出力し、車輪を駆動する走行装置であって、車輪１０１側に駆動手段のロータ１０９を介して回転プレート１１０と、ステップ台１０３側に駆動手段のステータ１１３を介して検出ユニット１１１がそれぞれ取り付けられ、検出ユニット１１１によって回転プレート１１０の回転から車輪の回転速度を検出するように構成され、車輪とステップ台との複合された回転情報から走行速度及び走行距離を表示する表示計を備えた。
【選択図】図４



【特許請求の範囲】
【請求項1】
平行に配置された一対の車輪と、
前記車輪を独立に回転駆動する駆動手段と、
前記車輪を回転自在に支持し搭乗者のステップ台を構成する筐体と、
前記筐体にステー及び搭乗者が保持するハンドルと、
前記筐体には、ピッチ軸、ヨー軸、ロール軸の角速度を検出するジャイロセンサと、Ｘ軸、Ｙ軸、Ｚ軸の加速度を検出する加速度センサとを設け、前記筐体の走行時の角速度及び加速度を検出して前記筐体の角速度及び走行加速度を制御する姿勢検出手段と、
を備え、前記姿勢検出手段からの信号から演算装置を介して所定の走行状態を維持するための信号を駆動回路に出力し、前記駆動手段によって前記車輪を駆動する走行装置であって、
前記車輪側に前記駆動手段のロータを介して位置検出用の円盤である回転プレートと、前記筐体側に前記駆動手段のステータを介して検出手段がそれぞれ取り付けられ、前記検出手段によって前記回転プレートの回転から前記車輪の回転速度を検出するように構成され、前記車輪と前記筐体との複合された回転情報から走行装置の走行速度及び走行距離を表示する速度表示計及び走行距離計を備えたことを特徴とする走行装置。
【請求項2】
前記走行速度は、前記姿勢検出手段からのジャイロセンサによるピッチ軸角速度である前記筐体の回転情報を加,減算することにより走行速度を算出し、速度表示計に表示することを特徴とする請求項１に記載の走行装置。
【請求項3】
前記走行速度は、一対の前記車輪の回転平均値をもって走行速度とすることを特徴とする請求項１に記載の走行装置。
【請求項4】
前記走行距離は、走行速度の積分値を算出し、走行距離計に表示することを特徴とする請求項１に記載の走行装置。
【請求項5】
前記速度表示計及び走行距離計は、前記ステーの上端部や前記ハンドル部分に取り付けられていることを特徴とする請求項１に記載の走行装置。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、例えば人間を搭乗させて二輪で走行する乗り物に使用して好適な走行装置に関し、詳しくは、この種の走行装置に速度計及び走行距離計を備えることによって走行の安全や交通法規への対応を実現できるようにしたものである。
【背景技術】
【0002】
例えば人間を搭乗させて二輪で走行する乗り物が提案されている（例えば、特許文献１参照。）。
【0003】
【特許文献1】米国特許第６２８８５０５号明細書
【発明の開示】
【発明が解決しようとする課題】
【0004】
例えば、人間を搭乗させて二輪で走行する乗り物として、本願出願人は先に以下に述べるような走行装置を提案（特願２００３－１６８２２４号）した。
【0005】
先ず、本願出願人が提案した同軸二輪車の一実施形態の外観斜視図を図９に示す。図９に示す同軸二輪車１において、車輪軸２の両端には一対の車輪３（右車輪３Ｒ及び左車輪

３Ｌ）が止着されている。この車輪３は、柔軟な特性を有するゴム材で形成されており、その内部には空気や窒素ガス等が充填される。このガス圧を調整して車輪３の柔軟性を調整することにより、機体の振動を吸収し、路面の凹凸による振動や段差による衝撃を低減することができる。

【0006】

また、車輪軸２には、例えば人間が立ち姿勢で搭乗するための板状体の下に後述する制御装置等が格納される略直方体形状の筐体が接合されたベース４が、車輪軸２回りに傾動可能に支持されている。なお、以下の説明においては、両輪を結ぶ車輪軸２の中間点をＸ－Ｙ－Ｚ座標系の原点Ｏと仮定し、この原点Ｏを通りベース４の主面と平行で且つ車輪軸２に垂直な方向をＸ軸又はロール軸、原点Ｏを通る車輪軸方向をＹ軸又はピッチ軸、原点Ｏを通りベース４の主面と垂直な方向をＺ軸又はヨー軸と定義する。また、同軸二輪車１の前方をＸ軸の正方向、左方をＹ軸の正方向、上方をＺ軸の正方向とそれぞれ定義する。

【0007】

ベース４には、図１０に示すように、正逆回転可能なモータ１０（１０Ｒ及び１０Ｌ）が装着されており、モータ１０に隣接して、モータ１０の回転位置を検出するためのロータリエンコーダ１１（１１Ｒ及び１１Ｌ）が設けられている。また、モータ１０と車輪３との間には、歯車又はタイミングベルトによる減速器１２（１２Ｒ及び１２Ｌ）が介在されており、モータ１０の回転がこの減速器１２及びジョイント（図示せず）を介して車輪３に伝達される。

【0008】

さらに、ベース４には、ベース４のピッチ軸、ヨー軸回りの角速度ωｐ、ωyawを検出するためのジャイロセンサ１３のほか、Ｘ、Ｙ、Ｚ軸方向のリニア加速度Ａｘ、Ａｙ、Ａｚ及びピッチ軸、ロール軸、ヨー軸回りの角加速度αｐ、αｒ、αyawを検出するための加速度センサ１４や、ベース４上の負荷重量を検出するための圧力センサ１５等の各種センサが内蔵されている。

【0009】

このうち、圧力センサ１５は、図１１のAの平面図及び図１１のBの側面図に示すようにベース４の板状体を構成する支持台４ａと可動台４ｂとの間の四隅に設けられており、この４つの圧力センサ$１５_１$、$１５_２$、$１５_３$、$１５_４$のセンサ信号から、ベース４上の負荷の重心座標（Ｘｇ、Ｙｇ）とその負荷重量Ｗｇとを検出することができる。

【0010】

すなわち、圧力センサ$１５_１$～$１５_４$のセンサ信号がそれぞれ$ＰＳ_１$、$ＰＳ_２$、$ＰＳ_３$、$ＰＳ_４$であり、無荷重状態で圧力センサ$１５_１$～$１５_４$にかかる自重がW_0である場合、負荷重量Ｗｇは、以下の式（１）のように求められる。

【0011】

【数1】

$$W_g=PS_1+PS_2+PS_3+PS_4-W_0 \quad \cdots(1)$$

【0012】

また、圧力センサ$１５_１$、$１５_２$、$１５_３$、$１５_４$の座標が、それぞれ（X_{ps}，Y_{ps}）、（$-X_{ps}$，Y_{ps}）、（$-X_{ps}$，$-Y_{ps}$）、（X_{ps}，$-Y_{ps}$）である場合に、重心座標（Ｘｇ，Ｙｇ）は、以下の式（２）のように求められる。

【0013】

【数2】

$$\begin{cases} X_g = X_{ps} * (W1 - W2)/(W1 + W2) \\ Y_g = Y_{ps} * (W3 - W4)/(W3 + W4) \end{cases} \quad \cdots (2)$$

ただし、

$$\begin{cases} W1 = (PS_1 + PS_4)/2 - W_{14} \\ W2 = (PS_2 + PS_3)/2 - W_{23} \\ W3 = (PS_1 + PS_2)/2 - W_{12} \\ W4 = (PS_3 + PS_4)/2 - W_{34} \end{cases}$$

【0014】

この式（２）において、$Ｗ_{１４}$は無荷重状態で圧力センサ$１５_{１}$、$１５_{４}$にかかる自重を示し、$Ｗ_{２３}$は無荷重状態で圧力センサ$１５_{２}$、$１５_{３}$にかかる自重を示し、$Ｗ_{１２}$は無荷重状態で圧力センサ$１５_{１}$、$１５_{２}$にかかる自重を示し、$Ｗ_{３４}$は無荷重状態で圧力センサ$１５_{３}$、$１５_{４}$にかかる自重を示す。

【0015】

このようにして、圧力センサ１５によりベース４上の負荷による負荷荷重トルク$Ｔ_{１}$が計算できるため、モータ１０にその反作用のモーメントを与えることにより、ベース４上でバランスを保ち、姿勢を安定化することが可能となる。

【0016】

さらにまた、ベース４の下部筐体には、マイクロコンピュータからなる制御装置１６が搭載されており、この制御装置１６に各種センサ信号、検出信号が入力される。制御装置１６は、これらの入力信号に基づいて、後述するようにベース４のピッチ軸角度、ヨー軸角度を適切な値に保ちながら、機体を前進・後退・旋回させるモータトルクを発生するように制御する。

【0017】

また、この同軸二輪車１は、図１２に示すように、車輪軸２回りに傾動可能とされるベース４の重量中心Ｍが車輪軸２よりも下方に位置するように構成されている。これにより、停止時にも機体の重心位置が最も安定な位置に保たれ、転倒しにくくなる。なお、この図１２ではベース４の上面の高さが車輪軸２よりも高くなっているが、ベース４の上面が車輪軸２より低くなっていても構わない。

【0018】

ここで、ベース４上で姿勢を保つための制御概念について説明する。図１３に示すように、ベース４上の負荷、例えば人間の体重による負荷荷重トルク$Ｔ_{１}$に対して、同じモーメントを発生するようにモータトルクＴｍを制御すると、ベース４はシーソーのように支点を中心にバランスを保つ。このバランスを保つ支点に相当する点、すなわち車輪軸２回りの回転モーメントがゼロとなる点をＺＭＰ（Zero Moment Point）と呼ぶ。このＺＭＰが車輪３の路面との接地点に一致するとき、或いは路面との接地面内にあるとき、バランスが保たれてベース４上で姿勢を保つことができる。

【0019】

この同軸二輪車１に体重Ｗｈの人間が搭乗した場合、図１４に示すように、人間の傾き角θに応じてベース４の重量中心Ｍが車輪軸２を中心に傾く。このとき、車輪軸２がバランスをとるための車輪軸トルクT_0は以下の式（３）で表され、姿勢を保つためのモータトルクＴｍは減速器１２の減速比をＮ：１としてT_0／Ｎで表される。
【0020】
【数3】

$$T_0=Wh*\sin\theta-Wm*\sin\theta \quad \cdots(3)$$

【0021】
このようにして、上述の同軸二輪車１では、上述の如くベース４の重量中心Ｍが車輪軸２よりも下方に位置するように構成されているため、式（３）のように、人間の体重Ｗｈによるモーメントとベース４の重量Ｗｍによるモーメントとの差分を車輪軸トルクT_0として加えるのみでよく、比較的小さいモータトルクでバランスを保つことができる。
【0022】
さらに、ベース４上で姿勢を保つための力学モデルについて、図１５に示すＸ－Ｚ座標系を用いて詳細に説明する。ここで図１５では簡単のため、車輪３は１つであるものとして説明する。また、車輪３、ベース４、及びベース４上の人間をそれぞれリンクとみなし、その重心位置座標をそれぞれ（x_0，z_0）、（x_1，z_1）、（x_2，z_2）とする。さらに、各リンクの質量をそれぞれm_0、m_1、m_2とし、慣性モーメントをI_0、I_1、I_2とする。
【0023】
定義した点Ω（σ，ϕ）回りの第ｉリンク（ｉ＝０，１，２）の各運動量は、重心位置座標を（x_i，z_i）とすると、以下の式（４）で表される。ここで、式（４）においてｘ、ｚの上に付されている１つの点は、ｘ、ｚの１階微分であることを示している。
【0024】
【数4】

$$Ii*\omega i+mi*\dot{x}i(\phi-zi)-mi*\dot{z}i(\sigma-xi) \quad \cdots(4)$$

【0025】
したがって、全リンクの慣性力によるモーメントは、以下の式（５）で表される。ここで、式（５）においてｘ、ｚの上に付されている２つの点は、ｘ、ｚの２階微分であることを示している。また、全リンクの重力によるモーメントは、重力加速度をｇとして以下の式（６）で表される。
【0026】
【数5】

$$\sum_{i=0}^{n}\left(Ii*\dot{\omega}i+mi*\ddot{x}i(\phi-zi)-mi*\ddot{z}i(\sigma-xi)\right) \quad \cdots(5)$$

$$\sum_{i=0}^{n} mi(\sigma-xi)g \quad \cdots(6)$$

【0027】
この慣性力によるモーメントと重力によるモーメントとの和により、式（７）に示すように、点Ω（σ，ϕ）回りのモーメントＭΩが与えられる。
【0028】

【数6】

$$M\Omega=\sum_{i=0}^{n} Ii*\dot{\omega}i+\sum_{i=0}^{n} mi\left(\ddot{x}i(\phi-zi)-\ddot{z}i(\sigma-xi)\right)+\sum_{i=0}^{n} mi(\sigma-xi)g \quad \cdots(7)$$

【0029】

質量m_0である車輪３の重力によるモーメントを除けば、点Ω（σ，φ）を原点にとることで、上述のモーメントＭΩは車輪軸２回りのモーメントＭａとなる。この車輪軸２回りのモーメントＭａは、以下の式（８）で表される。

【0030】

【数7】

$$Ma=\sum_{i=0}^{n} Ii*\dot{\omega}i+\sum_{i=0}^{n} mi\left(\ddot{z}i*xi-\ddot{x}i*zi\right)-\sum_{i=0}^{n} mi*xi*g \quad \cdots(8)$$

【0031】

このモーメントＭａを用いて上述のモーメントＭΩを表せば、x_0＝０であるとき、すなわち車輪３の重心位置が車輪軸２上にあるとき、以下の式（９）で与えられる。

【0032】

【数8】

$$M\Omega=Ma-\sum_{i=0}^{n} mi\left(\ddot{z}i-g\right)\sigma+\sum_{i=0}^{n} mi*\ddot{x}i*\phi \quad \cdots(9)$$

【0033】

ここで、ＺＭＰはモーメントＭΩが０である床面上の点と定義される。そこで、車輪軸２の高さをｈ、ＺＭＰの座標を（σzmp，－ｈ）として式（７）に代入すると、以下の式（１０）のようになる。この式（１０）をσzmpについて解くことで、ＺＭＰをリンク位置、加速度及び質量により表すことができる。

【0034】

【数9】

$$0=\sum_{i=0}^{n} Ii*\dot{\omega}i+\sum_{i=0}^{n} mi\left(-\ddot{x}i(h+zi)-\ddot{z}i(\sigma zmp-xi)\right)+\sum_{i=0}^{n} mi(\sigma zmp-xi)g \quad \cdots(10)$$

【0035】

また、上述した式（９）にＺＭＰの座標（σzmp，－ｈ）を代入すると、以下の式（１１）のようになる。なお、この式（１１）は、車輪軸２回りのモーメントのつり合いの式を示す。

【0036】

【数10】

$$0 = Ma - \sum_{i=0}^{n} mi\left(\ddot{zi} - g\right)\sigma zmp - \sum_{i=0}^{n} mi * \ddot{xi} * h \qquad \cdots(11)$$

【0037】
ここで、ＺＭＰに作用する力を図１６に図示する。図１６において、ＦＮは床反力、ＦＴは転がり摩擦力、ＦはＦＮとＦＴとの合成ベクトルを表す。なお、床反力ＦＮは実際には車輪３の接地面全体に分布するが、図１６ではＺＭＰに集約するものとして表している。この図から車輪軸２回りのモーメントのつり合いの式を表すと、以下の式（１２）のようになる。
【0038】
【数11】

$$FN * \sigma zmp + FT * h + \tau 0 = 0 \qquad \cdots(12)$$

【0039】
なお、この式（１２）に、以下の式（１３）～（１５）を代入すると、上述した式（１１）と同じものになる。
【0040】
【数12】

$$T_0 = Ma \qquad \cdots(13)$$

$$FN = -\sum_{i=0}^{n} mi\left(\ddot{zi} - g\right) \qquad \cdots(14)$$

$$FT = -\sum_{i=0}^{n} mi * \ddot{xi} \qquad \cdots(15)$$

【0041】
ベース４上の姿勢が安定するには、式（１２）においてσzmp＝０となればよい。すなわち、車輪軸トルクT_0＝－ＦＴ＊ｈが成立すれば姿勢を保つことができる。したがって、T_0＝ＦＴ＝０を満たす以下の式（１６）に示す状態変数を制御することにより、姿勢を安定させることができる。
【0042】
【数13】

$$\left(xi, \dot{xi}, \ddot{xi}\right) = (0, 0, 0,) \qquad \cdots(16)$$

【0043】
このとき、x_0、x_1は、機構構造により一意に定まるが、m_2、I_2、x_2、z_2は、人間であるため不定値である。このm_2、I_2、x_2、z_2によるベース４上でのモーメントＭｔは、以下の式（１７）で与えられる。但し、ベース４は、図１７のように水平に保たれるものとする。
【0044】

【数14】

$$Mt = I_2 * \dot{\omega}_2 + m_2 * \ddot{z}_2 * x_2 - m_2 * \ddot{x}_2 * (z_2 - L) - m_2 * x_2 * g \quad \cdots (17)$$

【0045】
ここで、負荷が人間である場合には角速度ω_2が十分に小さいため、$\omega_2 \fallingdotseq 0$と近似すると、式（１８）において$x_2$とその２階微分値をゼロにするときモーメントＭｔがゼロになる。x_2とその２階微分値をゼロにすることは、ベース４上での負荷荷重トルクT_1がゼロとなるようにx_0及びx_1を制御することと等価と考えてよい。また、この負荷荷重トルクT_1によるモーメントＭｔは、力Ｆ２でベース４上の作用点（ｘｆ，Ｌ）に作用することと等価である。したがって、このｘｆをゼロにするx_0、x_1を与えることができれば$T_1 = 0$となり、姿勢を安定に保つ条件を満足することができる。

【0046】
図１７に示すように、ベース４上のジャイロセンサ信号をフィードバック制御してモータトルクＴｍを与えることにより$x_0 = x_1$を保つように制御されているとき、$xf = x_0$となるようにモータトルクＴｍを制御することで姿勢を安定に保つことができる。

【0047】
具体的には、誤差$Ef = xf - x_0$とするとき、$Ef > 0$であればx_0を正の方向に変位させるためにモータトルクＴｍを負として機体を前進させ、$Ef < 0$であればx_0を負の方向に変位させるためにモータトルクＴｍを正として機体を後退させることで、誤差Ｅｆをゼロに収束させることができる。すなわち、A_0を正の定数として、$Tm = -A_0 * Ef$となるモータトルクＴｍを与えることでＥｆをゼロに収束させ、姿勢を安定に保つことができるようになる。

【0048】
実際には、例えば図１８のようにベース４がピッチ軸回りに角度θ_0だけ傾いた場合、体重Ｍの人間によりT_1（$= M\tau \times L$）の負荷荷重トルクが発生するため、その負荷荷重トルクT_1と逆方向の車輪軸トルクT_0を与えるようにモータトルクＴｍを制御することで、ＺＭＰを車輪３の接地点と一致させ、姿勢を安定に保つことができるようになる。

【0049】
ここで、ベース４上に人間が搭乗した場合、個人差はあるものの通常１～２秒の周期で姿勢を保つために足裏に作用させる力を変動させているため、人間の体重による負荷荷重トルクT_1は不確定に変化する。したがって、リアルタイムにバランスがとれるようなトルクをモータ１０に加算し、負荷変動に対してベース４の角度を一定に保つ必要がある。

【0050】
そこで、上述の同軸二輪車１は、このような負荷変動をリアルタイムに相殺するために、制御装置１６内に図１９に示すような制御機構を有している。図１９において、減算器２０では、姿勢指令であるベース角度指令θrefとジャイロセンサ１３及び加速度センサ１４によって検出した現在のベース角度θ_0との偏差がとられ、この偏差が姿勢制御器２１に供給される。姿勢制御器２１は、このベース角度指令θrefと現在のベース角度θ_0とからモータトルク電流値Ｔgyr［Ａ］を計算する。

【0051】
また、調整器２２では、圧力センサ１５のセンサ信号PS_1、PS_2、PS_3、PS_4を用いて負荷荷重トルクT_1を推定し、これを相殺するための推定負荷荷重トルク電流値T_1' / Km［Ａ］を計算する。ここでＫｍはモータ定数［Ｎｍ/Ａ］である。負荷の重心座標が（Ｘｇ、Ｙｇ）であり、負荷重量がＷｇである場合、推定負荷荷重トルクT_1'は、以下の式（１８）のように与えられる。

【0052】
【数15】

$$T_1{}' = W_g * X_g / 2 \qquad \cdots(18)$$

【0053】
そして減算器２３では、モータトルク電流値Ｔgyrと推定負荷荷重トルク電流値$Ｔ_1$′／Ｋｍとの偏差がとられ、この偏差がモータ電流Ｉ［Ａ］としてモータ２４に与えられる。モータ２４はこのモータ電流Ｉによって回転することによりモータトルクＴｍを発生し、加算器２５では、このモータトルクＴｍと負荷荷重トルク$Ｔ_1$とが加算されてベース２６に伝えられる。
【0054】
このように、負荷荷重トルク$Ｔ_1$を相殺するためのモータトルクＴｍをモータ２４に加算することにより、停止時においては負荷変動に対してベース角度を一定に保つことができる。
【0055】
以上の制御機構により姿勢安定制御を行うことができるが、この状態で走行するには、さらに走行制御のための制御機構が必要となる。そこで、上述の同軸二輪車１は、実際には姿勢安定制御のためのモータトルクと走行制御のためのモータトルクとを独立して求める二輪構造の制御機構を有している。
【0056】
このような二輪構造の制御機構の物理モデルを図２０に示す。なお、この図２０においても、簡単のため、車輪３は１つであるものとして説明する。図２０に示すように、ベース４にはジャイロセンサ１３、加速度センサ１４、圧力センサ１５等の各種センサが内蔵されており、その下部にはモータステータ３０、ロータリエンコーダ３１、モータロータ３２が存在し、モータロータ３２の回転は減速器３３及びジョイント３４を介して車輪３に伝達される。
【0057】
姿勢制御／調整器４０は、姿勢指令であるベース角度指令θref、ジャイロセンサ１３及び加速度センサ１４によって検出した現在のベース角度$θ_0$、及び圧力センサ１５のセンサ信号$ＰＳ_1$、$ＰＳ_2$、$ＰＳ_3$、$ＰＳ_4$から、上述したモータトルクＴgyr及び推定負荷荷重トルク$Ｔ_1$′を計算する。また、モータ制御器４１は、走行指令であるモータロータ３２の回転位置指令Ｐrefとロータリエンコーダ３１によって検出したモータロータ３２の現在の回転位置θｒとから、走行のためのモータトルクを計算する。
【0058】
そして、加算器４２において、モータトルクＴgyr及び推定負荷荷重トルク$Ｔ_1$′と走行のためのモータトルクとが加算され、この加算値がモータロータ３２に供給される。
【0059】
ここで、上述したベース角度指令θrefとは、搭乗者が安定に乗ることができるように、Ｘ軸方向の加速度Ａｘに応じて設定されるベース角度の目標値である。具体的には、Ｘ軸加速度Ａｘがゼロのときベース４が水平になるように、Ｘ軸加速度Ａｘが正のときベース４を前方に傾けるように、Ｘ軸加速度Ａｘが負のときベース４を後方に傾けるように、それぞれ設定される。
【0060】
そこで、例えばＸ軸加速度Ａｘが正の場合、図２１に示すように、慣性力と重力との合成ベクトルの方向にＺＭＰが位置するようにベース４を傾けると、搭乗者は姿勢を安定に保つことができる。なお、このベース角度指令θrefは、Ｘ軸加速度Ａｘに比例して変化する。
【0061】
制御機構のブロック図を図２２に示す。減算器５０では、姿勢指令であるベース角度指令θrefとジャイロセンサ１３（及び加速度センサ１４）によって検出した現在のベース

角度θ_0との偏差がとられ、この偏差が姿勢制御器５１に供給される。姿勢制御器５１は、このベース角度指令θrefと現在のベース角度θ_0とからモータトルクTgyrを計算し、このモータトルクTgyrを加算器５４に供給する。

【0062】

一方、減算器５２では、走行指令であるモータロータ５７の回転位置指令Prefとロータリエンコーダ５８によって検出したモータロータ５７の現在の回転位置θｒとの偏差がとられ、この偏差がモータ制御器５３に供給される。モータ制御器５３は、この回転位置指令Prefと現在の回転位置θｒとから、走行のためのモータトルクを計算し、このモータトルクを加算器５４に供給する。

【0063】

また、ベース４に負荷荷重トルクT_1が加えられると、圧力センサ１５のセンサ信号PS_1、PS_2、PS_3、PS_4が調整器５５に供給され、調整器５５は、このセンサ信号に基づいて上述した推定負荷荷重トルクT_1'を計算する。

【0064】

加算器５４では、姿勢制御器５１からのモータトルクTgyrとモータ制御器５３からのモータトルクとが加算され、減算器５６では、この加算値から推定負荷荷重トルクT_1'が減算される。これが最終的なモータトルクＴｍとなり、モータロータ５７に与えられる。加算器５９では、このモータトルクＴｍの反作用力と負荷荷重トルクT_1とが加算され、この加算値がモータステータ／ベース６０に与えられる。

【0065】

モータロータ５７は、モータトルクＴｍに応じて回転制御される。このモータロータ５７の回転位置θｒは、減速比Ｎ：１の減速器６１によって１／Ｎに変換され車輪３に伝達される。すなわち、車輪３の回転位置θｗは、モータロータ５７の回転位置θｒの１／Ｎである。ロータリエンコーダ５８は、このモータロータ５７の回転位置θｒを検出し、検出信号を減算器５２に供給する。

【0066】

一方、モータステータ／ベース６０には、上述したように、モータトルクＴｍの反作用力と負荷荷重トルクT_1との加算値が加わるが、それらが相互に打ち消されるため、モータステータ／ベース６０の傾動は抑えられる。

【0067】

図２３は、図２２に示したブロック図における処理を、ラプラス演算子を用いて数学モデルとして表現したものである。上述の如く、姿勢制御器５１には、ベース角度指令θrefと現在のベース角度θ_0との偏差が与えられ、モータ制御器５３には、モータロータ５７の回転位置指令Prefと現在の回転位置θｒとの偏差が与えられる。この姿勢制御器５１及びモータ制御器５３では、例えばＰＩＤ（比例・積分・微分）演算を行うフィードバック制御により各モータトルクが計算される。

【0068】

すなわち、Kp_0、Kp_1が比例ゲインとなり、Ki_0、Ki_1が積分ゲインとなり、Kd_0、Kd_1が微分ゲインとなる。これらの制御ゲインによって、モータが姿勢指令θref及び走行指令Prefに対して応答する追従性が変化する。例えば、モータロータ５７は、比例ゲインKp_0，Kp_1を小さくすると、ゆっくりとした追従遅れをもって動くようになり、比例ゲインKp_0、Kp_1を大きくすると、高速に追従するようになる。このように、制御ゲインを変化させることにより、姿勢指令θref、走行指令Prefと、実際の動きの誤差の大きさや応答時間とを調整することが可能となる。

【0069】

また、モータロータ５７には、姿勢制御器５１からのモータトルクとモータ制御器５３からのモータトルクとの加算値から推定負荷荷重トルクT_1'が減算されたモータトルクＴｍが与えられ、回転角度θｒだけ回転する。ここで、Ｊｒはモータロータ５７のイナーシャ（inertia）であり、Ｄｒはモータロータ５７の粘性抵抗（ダンパ係数）である。

【0070】

一方、モータステータ／ベース６０には、上述の如くモータトルクＴｍの反作用力と負荷荷重トルクT_1 との加算値が加わるが、それらが相互に打ち消されるため傾動が抑えられる。ここで、Ｊはモータステータ／ベース６０のイナーシャであり、Ｄはモータステータ／ベース６０の粘性抵抗（ダンパ係数）である。

【0071】

この図２３に示した数学モデルは、より詳細には例えば図２４に示すようになる。図２４に示すように、姿勢制御器７０は、ベース角度指令θrefと現在のベース角度θ_0 との偏差に対してＰＩＤ制御を行うことで姿勢制御のためのモータトルクＴgyrを生成し、モータ制御器７１は、モータ１０の回転位置指令Ｐrefと現在の回転位置θｒとの偏差に対してＰＩＤ制御を行うことで走行制御のためのモータトルクを生成する。

【0072】

また、調整器７２は、圧力センサ１５のセンサ信号から推定負荷荷重トルクT_1' を生成する。加算器７３ではこれらの各トルクが加算され、得られたモータトルクＴｍがモータ１０に与えられる。モータ１０は、このモータトルクＴｍにより回転駆動され、その回転が減速比１６：１の減速器７４によって１／１６に変換され車輪３に伝達される。

【0073】

以上、図２０乃至図２４では、簡単のため車輪３が１つであるものとして説明したが、左右２つの車輪３Ｒ，３Ｌを有する実際の同軸二輪車１では、例えば図２２における姿勢制御器５１が左右の車輪３Ｒ，３Ｌで共通に用いられる一方で、モータ制御器５３が左右独立に設けられる。

【0074】

この場合の制御機構のブロック図を図２５に示す。ジャイロセンサ１３からのセンサ値ωｐは例えば通過帯域が０．１～５０Ｈｚであるバンドパスフィルタ（ＢＰＦ）８０を介して角度算出器８２に送られ、加速度センサ１４からのセンサ値αｐは例えば遮断周波数が０．１Ｈｚのローパスフィルタ（ＬＰＦ）８１を介して角度算出器８２に送られる。角度算出器８２では、これらのセンサ値に基づいて現在のベース角度θ０が算出される。

【0075】

また、減算器８３では、姿勢指令であるベース角度指令θrefと現在のベース角度θ_0 との偏差がとられ、この偏差が姿勢制御器８４に供給される。姿勢制御器８４は、このベース角度指令θrefと現在のベース角度θ_0 とから、上述したモータトルクＴgyrを計算する。

【0076】

一方、減算器８５Ｒでは、右車輪３Ｒ用の走行指令であるモータロータ９２Ｒの回転位置指令Ｐrefrとロータリエンコーダ９３Ｒによって検出したモータロータ９２Ｒの現在の回転位置θｒとの偏差がとられ、この偏差が位置比例制御器８６Ｒに供給される。位置比例制御器８６Ｒは、この偏差に対して位置比例（Ｐ）制御を行い、比例制御結果を減算器８７Ｒに供給する。

【0077】

また、微分器８８Ｒは、ロータリエンコーダ９３Ｒから供給されたモータロータ９２Ｒの回転位置θｒを微分し、微分結果を減算器８７Ｒに供給する。そして減算器８７Ｒでは、位置比例制御器８６Ｒからの比例制御結果と微分器８８Ｒからの微分結果との偏差がとられ、この偏差が速度比例制御器８９Ｒに供給される。速度比例制御器８９Ｒは、この偏差に対して速度比例（Ｐ）制御を行い、比例制御結果を加算器９０Ｒに供給する。

【0078】

加算器９０Ｒでは、この比例制御結果とモータトルクＴgyrと調整器９４において圧力センサ１５のセンサ信号PS_1 、PS_2 、PS_3 、PS_4 から求めた推定負荷荷重トルクT_1' とが加算され、加算値が電流制御アンプ９１Ｒに供給される。電流制御アンプ９１Ｒは、この加算値に基づいてモータ電流を生成し、モータロータ９２Ｒを駆動する。このモータロータ９２Ｒの回転位置は、減算器８５Ｒと共に微分器８８Ｒに供給される。左車輪３Ｌについても同様であるため、説明を省略する。

【0079】
このように、上述の同軸二輪車１では、左右の車輪３Ｒ，３Ｌで共通な姿勢安定制御用の制御機構と、左右独立な走行制御用の制御機構とを有し、それらが独立した制御を行うため、姿勢安定制御と走行制御とを安定して両立することができる。
【0080】
次に、上述の同軸二輪車１における速度制御について説明する。
【0081】
上述したように、上述の同軸二輪車１では、ベース４の四隅に設けられた４つの圧力センサ１５_1～１５_4のセンサ信号$ＰＳ_1$、$ＰＳ_2$、$ＰＳ_3$、$ＰＳ_4$からベース４上の負荷の重心座標（Ｘｇ，Ｙｇ）とその負荷重量Ｗｇとを検出し、負荷荷重トルクＴ１を求めているが、さらに、この重心座標（Ｘｇ，Ｙｇ）を走行する方向、速度の制御指令として用いる。具体的には、負荷重量Ｗｇが所定の値以上である場合に、重心位置のＸ座標Ｘｇに基づき速度指令Ｖｘを変化させる。
【0082】
その様子を図２６に示す。ここで図２６において、$Ｘ_3$から$Ｘ_1$までの範囲は停止領域であり、この範囲内では指令走行速度をゼロとする。この停止領域は、車輪３の路面との接地面のＸ座標範囲とすることが好ましい。この場合、例えば負荷重量Ｗｇが大きいときや車輪３のガス圧が低いときには車輪３の路面との接地面積が大きくなるため、停止領域の範囲も大きくなる。このように停止領域（不感帯）を設けることで、搭乗者の意図しない僅かな重心移動によって機体が前進・後退することを防止することができる。
【0083】
Ｘ座標が$Ｘ_1$以上になると、前進最大速度ＳfMAX に達するまで、Ｘ座標の大きさに応じて指令速度が増加する。また、Ｘ座標が$Ｘ_2$以上になると強制的に減速停止し、再び停止領域内で姿勢を安定させるまで停止する。このように、強制的に減速停止する領域を設けることで、最大速度で走行している際の搭乗者の安全性を確保することができる。
【0084】
同様に、Ｘ座標が$Ｘ_3$以下になると、後退最大速度ＳbMAXに達するまで、Ｘ座標の大きさに応じて指令速度が増加する。なお、この後退最大速度ＳbMAXは、前進最大速度ＳfMAXよりも小さいことが好ましい。また、Ｘ座標が$Ｘ_4$以下になると強制的に減速停止し、再び停止領域内で姿勢を安定させるまで停止する。
【0085】
Ｘ座標が$Ｘ_1$から$Ｘ_2$まで、或いは$Ｘ_3$から$Ｘ_4$までの間では、そのＸ座標Ｘｇに応じて、例えば以下の式（１９）により、モータ１０Ｒの回転位置指令Ｐrefrとモータ１０Ｌの回転位置指令Ｐreflとが生成される。ここで、式（１９）において、$Ｇ_0$は正の一定ゲインであり、例えば負荷重量Ｗｇに応じて可変にすることができる。
【0086】
【数16】

$$Pref\ r = Pref\ l = X_g * G_0 \quad \cdots (19)$$

【0087】
なお、時刻ｔ＝０での速度指令が$Ｖｘ_0$であり、時刻ｔ＝$ｔ_1$での速度指令が$Ｖｘ_1$である場合、加速度を連続的に変化させ、機構的な共振振動を生じさせないように走行することが好ましい。この場合、$Ｖｘ_1$に到達するまでの時間をΔｔとすると、時刻ｔ（０≦ｔ≦$ｔ_1$）での走行速度指令Vref(ｔ)は、例えば以下の式（２０）により算出することができる。
【0088】
【数17】

$$\mathrm{Vref}(t)=(1/4)t^4-(2/3)\Delta t*t^3+(1/2)\Delta t^2*t^2+Vx_0 \quad \cdots(20)$$

【0089】
このとき、モータ１０の回転位置指令Pref(ｔ)は、式（２０）の走行速度指令Vref(ｔ)を積分した値となり、以下の式（２１）に示すような５次関数で与えられる。ここで、式（２１）において、Pref_0 は時刻ｔ＝０での回転位置指令である。
【0090】
【数18】

$$\begin{aligned}\mathrm{Pref}(t)&=\int \mathrm{Vref}(t)dt+\mathrm{Pref}_0\\&=(1/20)t^5-(2/12)\Delta t*t^4+(1/6)\Delta t^2*t^3+\mathrm{Pref}_0 \quad \cdots(21)\end{aligned}$$

【0091】
また、前進・後退させるのみでなく、負荷重量Ｗｇが所定の値以上である場合、重心位置のＹ座標Ｙｇに基づき、例えば図２７に示すように旋回速度指令Ｖｒを変化させることもできる。ここで図２７において、$-Y_1$ からY_1 までの範囲は停止領域であり、この範囲内では指令旋回速度をゼロとする。
【0092】
なお、この停止領域は、原点Ｏ近傍で任意に設定することができる。このように停止領域（不感帯）を設けることで、搭乗者の意図しない僅かな重心移動によって機体が旋回することを防止することができる。Ｙ座標がY_1 以上になると、右回り最大速度ＣWMAXに達するまで、Ｙ座標の大きさに応じて指令旋回速度が増加する。同様に、Ｙ座標が$-Y_1$ 以下になると、左回り最大速度ＣＣWMAXに達するまで、Ｙ座標の大きさに応じて指令旋回速度が増加する。
【0093】
Ｙ座標がY_1 以上又は$-Y_1$ 以下では、そのＹ座標Ｙｇに応じて、モータ１０Ｒの回転位置指令Rrefrとモータ１０Ｌの回転位置指令Rreflとが生成される。走行速度がゼロである場合、モータ１０Ｒの回転位置指令Rrefrとモータ１０Ｌの回転位置指令Rreflとは、例えば以下の式（２２）に示すような逆位相指令となる。ここで、式（２２）において、G_1 は正の一定ゲインであり、例えば負荷重量Ｗｇに応じて可変にすることができる。
【0094】
【数19】

$$\mathrm{Rref\ r}=-\mathrm{Rref\ l}=Y_g*G_1 \quad \cdots(22)$$

【0095】
一方、走行速度がゼロでない場合、モータ１０Ｒの回転位置指令Rrefrとモータ１０Ｌの回転位置指令Rreflとは、例えば以下の式（２３），（２４）に示すような同位相指令となる。ここで、式（２３），（２４）において、Ｇ２は正の一定ゲインであり、例えば負荷重量Ｗｇに応じて可変にすることができる。
【0096】
【数20】

$$\mathrm{Rref\ r}=\mathrm{Pref\ r}+Y_g*G_2 \quad \cdots(23)$$

$$\mathrm{Rref\ l}=\mathrm{Pref\ l}-Y_g*G_2 \quad \cdots(24)$$

【0097】
ここで、不整地路面等の凹凸を有する路面や傾斜路面を走行する場合には、左右のモータ１０Ｒ，１０Ｌの回転位置指令で与えられる目標方向に走行することが困難になり、目標方向と実際の走行方向とにずれが生じる虞がある。また、左右の車輪３Ｒ，３Ｌのガス圧の違いにより車輪３の有効直径が異なる場合にも、同様に目標方向と実際の走行方向とにずれが生じる虞がある。
【0098】
そこで、上述の同軸二輪車１では、ヨー軸回りの角速度ωyawを検出するジャイロセンサ１３により実際の走行方向を検出し、左右のモータ１０Ｒ，１０Ｌの回転速度を独立に制御することで、目標方向と実際の走行方向とのずれを解消する。
【0099】
一例として、図２８のＡに示すように右車輪３Ｒよりも左車輪３Ｌの方の有効直径が短く、図２８のＢに示すように、直進する際にヨー軸回りのジャイロセンサ信号としてωyaw_1［rad/sec］が検出される場合について説明する。このような場合、回転速度指令Ｖrefr，Ｖreflの加算平均をＶref_0としたとき、以下の式（２５）、（２６）に示すように、左右のモータ１０Ｒ、１０Ｌに与える回転速度指令Ｖrefr，Ｖreflを補正することにより、機体を直進させることができる。ここで、式（２５）、（２６）において、K_0は正の定数である。
【0100】
【数21】

$$\mathrm{Vref\ r} = \mathrm{Vref}_0 - K_0 * \omega_{yaw1} \qquad \cdots(25)$$

$$\mathrm{Vref\ l} = \mathrm{Vref}_0 + K_0 * \omega_{yaw1} \qquad \cdots(26)$$

【0101】
また、図２８のＣに示すように目標方向としてＤref［rad/sec］が与えられている場合には、以下の式（２７）、（２８）に示すように左右の車輪に回転速度指令Ｖrefr、Ｖreflを与える。
【0102】
【数22】

$$\mathrm{Vref\ r} = \mathrm{Vref}_0 - K_0 \left(\mathrm{Dref} - \omega_{yaw1}\right) \qquad \cdots(27)$$

$$\mathrm{Vref\ l} = \mathrm{Vref}_0 + K_0 \left(\mathrm{Dref} - \omega_{yaw1}\right) \qquad \cdots(28)$$

【0103】
このようにして得られた回転速度指令Ｖrefr、Ｖreflは、それぞれ以下の式（２９）、（３０）により車輪の回転位置指令Ｐrefr、Ｐreflに変換される。ここで、式（２９）、（３０）において、ｋはサンプリング回数を表す整数であり、Ｐref(ｋ)はｋサンプリングでの回転位置指令を示す。
【0104】
【数23】

$$\mathrm{Rref\ r}(K) = \mathrm{Pref\ r}(K) + \mathrm{Vref}_0 \qquad \cdots(29)$$

$$\mathrm{Rref\ l}(K) = \mathrm{Pref\ l}(K) + \mathrm{Vref}_0 \qquad \cdots(30)$$

【0105】

同様に、旋回する場合についても、左右の車輪３Ｒ、３Ｌのガス圧の違いや路面状況の違いなどから、旋回速度にずれが生じる虞がある。この場合にも、ヨー軸回りの角速度ωyawを検出するジャイロセンサ１３により実際の旋回速度を検出し、左右のモータ１０Ｒ、１０Ｌの回転速度を独立に制御することで、目標となる旋回速度と実際の旋回速度とのずれを解消することができる。

【0106】

一例として、右車輪３Ｒよりも左車輪３Ｌの方の有効直径が短く、旋回する際にヨー軸回りのジャイロセンサ信号としてωyaw_2［rad/sec］が検出されている場合について説明する。右車輪３Ｒの回転位置指令Rrefr及び左車輪３Ｌの回転位置指令Rreflを微分した信号をそれぞれVrefr、Vreflとすると、旋回速度の誤差ωerrは以下の式（３１）で表される。

【0107】

【数24】

$$\omega_{err}=(\mathrm{Vref\ l}-\mathrm{Vref\ r})-\omega_{yaw2} \quad \cdots(31)$$

【0108】

この場合、以下の式（３２）、（３３）に示すように、左右のモータ１０Ｒ、１０Ｌに与える回転位置指令Rrefr、Rreflを補正することにより、機体を目標通りに旋回させることができる。ここで、式（３２）、（３３）において、G_3は正の一定ゲインであり、例えば負荷重量Ｗｇに応じて可変にすることができる。

【0109】

【数25】

$$\mathrm{Rref\ r}=\mathrm{Pref\ r}+Y_g*G_2-\omega_{err}*G_3 \quad \cdots(32)$$

$$\mathrm{Rref\ l}=\mathrm{Pref\ l}-Y_g*G_2-\omega_{err}*G_3 \quad \cdots(33)$$

【0110】

このように、上述の同軸二輪車１では、ヨー軸回りの角速度ωyawを検出するジャイロセンサ１３により実際の走行方向、旋回速度を検出し、左右のモータ１０Ｒ、１０Ｌの回転速度を独立に制御することで、目標方向（旋回速度）と走行方向（旋回速度）とのずれを解消することができる。

【0111】

さらにこのような同軸二輪車１のソフトウェア構成を、図２９を用いて説明する。図２９に示すように、最下位層のハードウェア・レイヤ１５０から順に、カーネル・レイヤ１５１、オンボディ・レイヤ１５２、ネットワーク・レイヤ１５３、そして最上位層のアプリケーション・レイヤ１５４という階層構造で構成される。

【0112】

ハードウェア・レイヤ１５０は、回路の階層であり、例えばモータ制御回路、中央制御回路、センサ回路の制御回路等が含まれる。カーネル・レイヤ１５１は、モータサーボ演算や姿勢制御演算、走行制御演算、或いはリアルタイム走行目標値演算等の各種演算を行う階層である。このハードウェア・レイヤ１５０及びカーネル・レイヤ１５１において、基本的な姿勢安定制御と走行制御とが実現される。オンボディ・レイヤ１５２は、走行目標値演算、障害物回避軌道の生成等を行う階層である。

【0113】

これらの各階層は、それぞれ異なるサンプリングの制御周期で実行され、上位階層ほどその周期は長くなる。例えば最下位層のハードウェア・レイヤ１５０では、その制御周期が０．１msecと短い周期であるのに対して、カーネル・レイヤ１５１では１msec、オンボ

ディ・レイヤ１５２では１０msecと長い周期になっている。
【0114】
続いて、同軸二輪車１における回路の全体構成について説明する。図３０に示すように、センサ回路２００には、圧力センサ１５_1～１５_4からのセンサ信号ＰＳ１，ＰＳ２，ＰＳ３，ＰＳ４が供給される。センサ回路２００は、このセンサ信号のほか、ピッチ軸回り及びヨー軸回りの角速度を検出するジャイロセンサ１３からのセンサ信号ωｐ，ωyawと、Ｘ，Ｙ，Ｚ軸方向のリニア加速度及びピッチ軸，ロール軸，ヨー軸回りの角加速度を検出する加速度センサ１４からのセンサ信号Ａｘ，Ａｙ，Ａｚ，αｐ，αｒ，αyawとを合わせて、制御装置１６に供給する。
【0115】
制御装置１６は、これらのセンサ信号に基づいて、上述したようにモータトルクＴgyrや、走行指令であるモータロータの回転位置指令Ｐrefを生成し、これらを左右のモータドライバ２０３Ｒ，２０３Ｌに供給する。モータドライバ２０３Ｒ，２０３Ｌは、このモータトルクＴgyr、モータロータの回転位置指令Ｐref等に基づいて、例えば２００Ｗのモータ１０Ｒ，１０Ｌを駆動するための最適なモータ電流を算出し、モータ１０Ｒ，１０Ｌに供給する。このモータ１０Ｒ，１０Ｌの回転位置は、ロータエンコーダ１１Ｒ，１１Ｌによって求められ、モータドライバ２０３Ｒ，２０３Ｌにフィードバックされる。
【0116】
サーボオン／パワースイッチ２０４は、制御装置１６及び電源スイッチ２０５と接続されており、電源スイッチ２０５からの信号は電源管理回路２０６に供給される。この電源管理回路２０６は、バッテリ２０７と接続されており、制御装置１６、音声処理回路２０１及び画像処理回路２０２に２４Ｖの制御用電源を供給するほか、モータドライバ２０３Ｒ，２０３Ｌにモータ電源を供給する。電源管理回路２０６には、モータドライバ２０３Ｒ，２０３Ｌを介してモータ１０Ｒ，１０Ｌの回生電力が供給され、電源管理回路２０６は、この回生電力を用いてバッテリ２０７を充電する。
【0117】
図３０に示した全体構成の詳しい内部構成を、図３１を用いて説明する。図３１に示すように、センサ回路２００には、圧力センサ１５_1～１５_4からのセンサ信号ＰＳ１，ＰＳ２，ＰＳ３，ＰＳ４、ジャイロセンサ１３_1，１３_2からのセンサ信号ωｐ，ωyaw、加速度センサ１４からのセンサ信号Ａｘ，Ａｙ，Ａｚ，αｐ，αｒ，αyawが供給される。センサ回路２００は、圧力センサ１５からのセンサ信号ＰＳ１，ＰＳ２，ＰＳ３，ＰＳ４を例えば１０mv/Nの圧力ゲインでゲイン調整し、さらに図示しないアナログ－デジタル変換器を介してデジタル信号に変換した後、制御装置１６の重心演算部２１０に供給する。
【0118】
また、センサ回路２００は、ジャイロセンサ１３_1，１３_2からのセンサ信号ωｐ，ωyawを例えば１．６V／（rad/sec）の姿勢ゲインでゲイン調整すると共に、加速度センサ１４からのセンサ信号Ａｘ，Ａｙ，Ａｚ，αｐ，αｒ，αyawを例えば１．６V／（rad/sec^2）の姿勢ゲインでゲイン調整し、さらに図示しないアナログ－デジタル変換器を介してデジタル信号に変換した後、信号前処理部２１１に供給する。この信号前処理部２１１は、入力された信号に対してデジタルフィルタを施したり、オフセット調整や姿勢位置すなわちベース角度θ０の算出をしたりする前処理を行う。
【0119】
重心演算部２１０は、圧力センサ１５_1～１５_4からのセンサ信号ＰＳ１，ＰＳ２，ＰＳ３，ＰＳ４に基づいて前述したようにベース４上の負荷の重心位置座標（Ｘｇ、Ｙｇ）とその負荷重量Ｗｇとを計算し、この重心位置座標（Ｘｇ、Ｙｇ）及び負荷重量Ｗｇの情報を走行指令算出器２１２に供給すると共に、重心位置のＹ座標Ｙｇ及び負荷重量Ｗｇの情報を旋回指令発生器２１５に供給する。
【0120】
走行指令算出器２１２は、例えば図２６に示したような重心位置Ｘ座標－走行速度特性

に基づき速度指令Ｖｘを生成し、回転速度指令発生器２１３は、この速度指令Ｖｘに基づいて前述した５次関数演算を行うことにより、回転速度指令Vref(ｔ)を生成する。回転速度指令発生器２１３は、回転位置指令Ｐref(ｔ)を回転位置指令発生器２１４、旋回指令発生器２１５、及び姿勢指令発生器２１６に供給する。

【0121】

旋回指令発生器２１５は、重心演算部２１０から供給された重心位置のＹ座標Ｙｇ及び負荷重量Ｗｇ、信号前処理部２１１から供給されたヨー軸回りの回転角速度ωyaw、及び回転速度指令発生器２１３から供給された回転速度指令Vref(ｔ)に基づいて旋回する際の位相指令、例えばＹｇ＊Ｇ１を生成し、この位相指令を回転位置指令発生器２１４に供給する。

【0122】

回転位置指令発生器２１４は、回転速度指令発生器２１３から供給された回転速度指令Vref(ｔ)を積分して回転位置指令Ｐref(ｔ)を生成し、左右のモータドライバに回転位置指令Ｐrefr(ｔ)，Ｐrefl(ｔ)を供給する。この際、回転位置指令発生器２１４は、旋回指令発生器２１５からの位相指令を考慮して回転位置指令Ｐrefr(ｔ)，Ｐrefl(ｔ)を生成する。

【0123】

姿勢指令発生器２１６は、回転速度指令発生器２１３から供給された回転速度指令Ｖref(ｔ)に基づき、図２１を用いて説明したように姿勢指令であるベース角度指令θrefを計算し、このベース角度指令θrefを減算器２１７に供給する。減算器２１７では、このベース角度指令θrefから信号前処理部２１１で求められた現在のベース角度θ０が減算され、偏差が姿勢制御器２１８に供給される。姿勢制御器２１８は、この偏差を元にしてＰＩＤ制御を行い、モータトルクＴgyrを求める。

【0124】

なお、ＰＩＤ制御を行う際には、ベース４上の負荷重量Ｗｇに応じてＰＩゲインを変更するようにしてもよい。具体的には、負荷重量Ｗｇが大きくなると比例ゲインを大きくし、積分ゲインを小さくすることが好ましい。姿勢制御部２１８は、このモータトルクＴgyrを左右のモータドライバ２０３Ｒ，２０３Ｌに供給する。

【0125】

右車輪３Ｒ用のモータドライバ２０３Ｒにおいて、減算器２３０Ｒでは、モータ１０Ｒ用の走行指令である回転位置指令Ｐrefrとロータリエンコーダ１１Ｒによって検出したモータ１０Ｒの現在の回転位置θｒとの偏差がとられ、この偏差が位置比例制御器２３１Ｒに供給される。位置比例制御器２３１Ｒは、この偏差に対して位置比例（Ｐ）制御を行い、比例制御結果を減算器２３２Ｒに供給する。また、微分器２３３Ｒは、ロータリエンコーダ１１Ｒから供給されたモータ１０Ｒの回転位置θｒを微分し、微分結果を減算器２３２Ｒに供給する。

【0126】

そして減算器２３２Ｒでは、位置比例制御器２３１Ｒからの比例制御結果と微分器２３３Ｒからの微分結果との偏差がとられ、この偏差が速度比例・積分制御器２３４Ｒに供給される。速度比例・積分制御器２３４Ｒは、この偏差に対して速度比例・積分（ＰＩ）制御を行い、比例・積分制御結果を加算器２３５Ｒに供給する。加算器２３５Ｒでは、この比例・積分制御結果とモータトルクＴgyrとが加算され、加算値が電流制御アンプ２３６Ｒに供給される。

【0127】

電流制御アンプ２３６Ｒは、この加算値に基づいてモータ電流を生成し、例えば２００Ｗのモータ１０Ｒを駆動する。このモータ１０Ｒの回転位置は、減算器２３０Ｒと共に微分器２３３Ｒに供給される。左車輪３Ｌについても同様であるため、説明を省略する。

【0128】

電源管理回路２０６は、例えば２４Ｖのバッテリ２０７と接続されており、制御装置１６に２４Ｖ，１Ａの制御用電源を供給するほか、モータドライバ２０３Ｒ，２０３Ｌにそ

れぞれ２４Ｖ，３０Ａのモータ電源を供給する。電源管理回路２０６には、モータドライバ２０３Ｒ，２０３Ｌを介してモータ１０Ｒ，１０Ｌの回生電力が供給され、電源管理回路２０６は、この回生電力を用いてバッテリ２０７を充電する。

【0129】

以上説明したように、本願発明者が先に提案した同軸二輪車１では、ジャイロセンサ１３及び加速度センサ１４を用いてベース４の角度制御を行うモータトルクＴgyrと、圧力センサ１５を用いて負荷荷重トルクを相殺するモータトルクＴ１'とを生成する、左右の車輪３Ｒ，３Ｌで共通な姿勢制御器と、圧力センサ１５を用いて走行制御を行うモータトルクを生成する、左右独立なモータ制御器とを設け、それらが独立した制御を行うため、姿勢安定制御と走行制御とを安定して両立することができる。

【0130】

また、本願発明者が先に提案した同軸二輪車１では、ベース４上の負荷の重心座標に応じて走行制御を行うが、車輪３の路面との接地面のＸ座標範囲、Ｙ座標範囲に停止領域（不感帯）を設けているため、搭乗者の意図しない僅かな重心移動によって機体が前進・後退・旋回することを防止することができる。

【0131】

さらに、本願発明者が先に提案した同軸二輪車１では、ヨー軸回りの角速度ωyawを検出するジャイロセンサ１３により実際の走行方向、旋回速度を検出し、左右のモータ１０Ｒ，１０Ｌの回転速度を独立に制御することで、目標方向（旋回速度）と走行方向（旋回速度）とのずれを解消することができる。

このような同軸二輪車による走行装置を、本願出願人は先に提案した。

また、上述したような同軸二輪車による走行装置であって、搭乗者が握るハンドルや着座するシートを備えた走行装置として、例えば、特開平４－２０１７９３号公報に記載した技術で提案されている。

【0132】

ところで上述したような走行装置では、速度表示計や走行距離表示計がなく、このため、走行の安全や走行装置のメンテナンスを考慮した場合、非常に不便であり、かつ交通法規への対応もできない。また、速度表示計や走行距離表示計を取り付けたことを想定した場合、単に車輪の回転速度から走行装置の速度や走行距離を算出すると、走行装置そのものが平行に配置された二輪構造のため人間が搭乗するステップ台のピッチ軸角速度、すなわち、ステップ台のピッチ方向の揺動の影響を受け、正確な速度や走行距離を算出することができないといった問題がある。

【0133】

本発明は上述したような点に鑑みてなされたものであって、新たなセンサの設置を必要とせず、また、ステップ台のピッチ方向の揺動の影響を受けることなく、走行装置の正確な速度や走行距離を算出し、速度計や走行距離計に表示できるようにした走行装置を得ることを目的とする。

【課題を解決するための手段】

【0134】

本発明の目的を達成するため、請求項１の走行装置は、車輪と前記筐体との複合された回転情報から走行装置の走行速度及び走行距離を表示する速度表示計及び走行距離計を備えたことを特徴とする。

【0135】

また、請求項２の走行装置によれば、走行速度は、姿勢検出手段からのジャイロセンサによるピッチ軸角速度、つまり筐体の回転情報を加,減算することにより走行速度を算出し、速度表示計に表示することを特徴とする。

【0136】

また、請求項３の走行装置によれば、走行速度は、一対の前記車輪の回転平均値をもって走行速度とすることを特徴とする。

【0137】

また、請求項４の走行装置によれば、走行距離は、走行速度の積分値を算出し、走行距離計に表示することを特徴とする。
【0138】
また、請求項５の走行装置によれば、速度表示計及び走行距離計は、ステーの上端部や前記ハンドル部分に取り付けられていることを特徴とする。
【発明の効果】
【0139】
請求項１の発明によれば、ステップ台のピッチ方向の揺動の影響を受けることなく、走行装置の正確な速度や走行距離を算出し、速度計や走行距離計に表示することができる。これによって、走行装置の走行の安全や交通法規への対応、走行状態の把握が行え、走行装置のメンテナンス時期の目安が可能となり保守,点検に好適である。
【0140】
また、請求項２の発明によれば、ステップ台のピッチ軸方向の揺動があっても正確な速度や走行距離を算出し、速度計や走行距離計に表示することができる。
【0141】
また、請求項３の発明によれば、走行装置の旋回時においても内輪と外輪との回転平均値から容易に走行速度を算出することができる。
【0142】
また、請求項４の発明によれば、走行速度の積分値をもって容易に走行距離を算出することができる。
【0143】
また、請求項５の発明によれば、走行装置の走行中において、速度表示計及び走行距離計を容易に視認でき、走行の安全性を確保することができる。
【発明を実施するための最良の形態】
【0144】
以下、本発明による走行装置の実施の形態を図面を参照して説明する。図１は本発明による走行装置を適用した同軸二輪車の一実施形態の構成を示す全体の外観斜視図、図２は同じく全体の背面図、図３は同じく全体の右側面図である。
【0145】
図１乃至図３において、左右一対の車輪１０１、１０２が設けられる。これらの左右の車輪１０１、１０２は、それぞれの車輪中心が一直線上になるように配置されると共に、搭乗者が乗るステップ台(筐体)１０３によって支持されている。このステップ台１０３は車輪１０１、１０２の車輪中心より重心を低くした位置にある。車輪１０１、１０２とステップ台１０３との構成とそれぞれの関係は後述する。
【0146】
ステップ台１０３の端部（走行装置の進行方向である図3において右端側）には、上方にステー１０４が垂設され、このステー１０４の上端部にハンドル１０５が設けられている。ステー１０４の上端部のハンドルポストには速度計と走行距離計とが一体化された表示計１０６が取り付けられている。
【0147】
ここで、車輪１０１,１０２とステップ台１０３との構成について説明する。なお、車輪１０１,１０２は同一構成であるので、一方の車輪１０１とステップ台１０３を図4乃至図５について説明する。
【0148】
車輪１０１はステップ台１０３に固定された減速機１０７の出力軸１０８を介して車輪駆動モータ１００Ｌを構成するモータ軸及びモータロータ１０９に結合され、モータロータ１０９の他端部にはロータ角度検出用の円盤である回転プレート１１０が取り付けられている。この回転プレート１１０の回転速度は検出ユニット１１１により検出される。
【0149】
検出ユニット１１１は回路基板１１２に実装され、この回路基板１１２は車輪駆動モー

タ１００Ｌを構成するモータステータ１１３が固定されたモータケース１１４に固定されている。そして、モータケース１１４は減速機１０７のハウジングを介してステップ台１０３に固定されている。

【0150】

このように構成することで、上述した車輪１０１とステップ台１０３とは、車輪１０１側がモータロータ１０９と一体に回転し、ステップ台１０３側がモータステータ１１３と一体にされることで、ステップ台１０３が走行装置の走行方向に図５の矢印で示すように車輪の軸中心Ｏを中心としてピッチ回転（揺動移動）されるように構成されている。したがって、回転プレート１１０と検出ユニット１１１とは相対的に影響を及ぼし合うようにされている。

【0151】

図６は上述した走行装置のシステム構成のブロック図を示し、ロータ角度検出器１１５Ｌを有する車輪駆動モータ１００Ｌ、ロータ角度検出器１１５Ｒを有する車輪駆動モータ１００Ｒは、それぞれ駆動回路１１６,１１７を介して演算回路（ＣＰＵ）１１８及び記憶装置（メモリ）１１９を有する演算装置１２０に接続され、演算装置１２０には走行装置のステップ台１０３に搭乗した搭乗者の姿勢を検出するための姿勢検出センサ１２１が接続されている。

【0152】

姿勢検出センサ１２１は、ステップ台１０３の姿勢を検出するためにジャイロセンサ１２２によるピッチ軸角速度、ヨー軸角速度、ロール軸角速度と、加速度センサ１２３によるＸ軸加速度、Ｙ軸加速度、Ｚ軸加速度を検出する。これにより、走行装置は上述した姿勢検出センサ１２１からの信号から演算装置１２０は所定の走行状態を維持するための信号を駆動回路１１６，１１７に出力し、車輪１０１，１０２を駆動する。

【0153】

なお、駆動回路１１６，１１７と演算装置１２０との間には二次電池からなる電源１２４と、走行装置を非常停止するためのスイッチ１２５が接続されている。

【0154】

次に、上述のように構成した走行装置における走行速度と走行距離の算出方法について説明する。

【0155】

本発明の走行装置によれば、車輪１０１,１０２の回転速度はモータロータ１０９と共に回転する回転プレート１１０の回転速度を検出ユニット１１１によって検出することによって可能であるが、走行装置の走行中ではステップ台１０３のピッチ軸角速度の影響を受け、正確な速度や走行距離を算出することができないといったことは、先の発明が解決しようとする課題で説明した。

【0156】

そこで、本発明は車輪１０１,１０２とステップ台１０３の複合された回転情報から、姿勢検出センサ１２１からのジャイロセンサ１２２によるステップ台１０３のピッチ軸角速度、つまり、ステップ台１０３の回転情報を加,減算することにより、ステップ台１０３の影響を受けずに、走行装置本来の正確な走行が可能となる。

【0157】

例えば、減速機１０７の入出力回転が同方向の場合、車輪１０１が所定の速度で反時計回り方向に回転し、走行装置が矢印方向に走行している状態において、ステップ台１０３が搭乗者の体重移動によって一点鎖線で示すように進行方向とは反対の後ろに傾いた瞬間には、車輪の回転速度を検出している検出ユニット１１１は車輪の回転速度が増速したと見做される。この場合、ステップ台１０３が後ろに傾いたピッチ軸角速度分減算する。

【0158】

これに対して、ステップ台１０３が搭乗者の体重移動によって二点鎖線で示すように進行方向に前に傾いた瞬間には、車輪の回転速度を検出している検出ユニット１１１は車輪の回転速度が減速したと見做される。この場合、ステップ台１０３が前に傾いたピッチ軸

角速度分加算するというものである。
【0159】
　ここで、数式を当てはめて説明すると、左車輪駆動モータの回転速度をrmＬ、ジャイロセンサのピッチ軸角速度をrｊＰ、減速機の減速比をn、車輪の直径をdとすると、走行速度Ｓは、
【0160】
【数26】

$$S=((rmL/n)-riP)\cdot d\cdot \pi \qquad \cdots(34)$$

【0161】
となり、上式からステップ台１０３の回転移動があっても走行装置本来の正確な走行を求めることができる。
【0162】
　また、平行に配置された二輪で走行する走行装置は、左右の車輪１０１，１０２の回転差により旋回走行を行うため、左右車輪の平均値をもって走行装置の走行速度とみなす。
【0163】
　これを式で表すと、走行速度Ｓは、
【0164】
【数26】

$$S=((((rmL/n)+(-rmR/n))/2)-riP)\cdot d\cdot \pi \qquad \cdots(35)$$

$$=(((rmL-rmR)/2n)-riP)\cdot d\cdot \pi$$

【0165】
　となり、上式から左右車輪の平均値の走行速度を求めることができる。〔数２６〕でrmR は 右車輪駆動モータの回転速度である。
【0166】
　また、走行装置の走行距離は、上式で求めた走行速度の積分値から求めることができる。
　これを式で表すと、走行距離Oは、
【0167】
【数27】

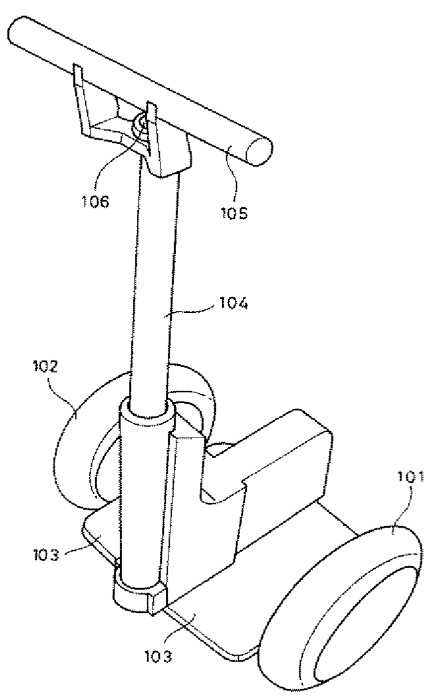
$$O=\int sdt \qquad \cdots(36)$$

【0168】
　となる。〔数２７〕でＳは走行速度、tは時間である。
【0169】
　上述のように算出された走行速度及び走行距離は、ステー１０４の上端部のハンドルポストに取り付けられた表示計１０６で見ることができる。図7はこの表示計１０４を上から見た平面図であって、表示計１０６には速度計１２６と走行距離計１２７とが一体化されて表示されている。
【0170】
　以上、説明したように本発明による走行装置は、新たにセンサの設置を必要とせず、車輪の回転を検出する回転プレートや検出ユニットからなるロータリエンコーダ等のセンサ情報に基づいて走行速度及び走行距離を算出し、表示計１０６に表示することができると

いうものである。
【0171】
　また、走行速度及び走行距離を表示計１０６に表示できることにより、走行装置の走行の安全や交通法規への対応ができ、このことから走行状態の把握が可能となり、しかも、メンテナンス時期の目安となり走行装置の保守,点検が容易となる。
【0172】
　本発明は、上述しかつ図面に示された実施の形態に限定されるものでなく、その要旨を逸脱しない範囲内で種々の変形実施が可能である。
【図面の簡単な説明】
【0173】
【図1】本発明による走行装置を適用した同軸二輪車の一実施形態の構成を示す外観斜視図である。
【図2】同じく本発明による走行装置の全体の正面図である。
【図3】同じく本発明による走行装置の全体の側面図である。
【図4】車輪とステップ台との詳細な構成の断面図である。
【図5】同じく車輪とステップ台との位置関係の側面図である。
【図6】走行装置のシステム構成のブロック図である。
【図7】走行速度と走行距離計の表示計を上から見た平面図である。
【図8】本願発明者が先に提案した同軸二輪車の実施形態を示す外観斜視図である。
【図9】同軸二輪車のベースを説明するための側断面図である。
【図10】同軸二輪車のベースに設けられた圧力センサを示す図であり、同図（Ａ）は平面図を示し、同図（Ｂ）は側面図を示す。
【図11】同軸二輪車の重量中心と車輪軸との位置関係を示す図である。
【図12】負荷荷重トルクとモータトルクとのつり合いを説明する図である。
【図13】人間が搭乗した場合の姿勢制御を説明する図である。
【図14】ベース上で姿勢を保つための力学モデルを説明する図である。
【図15】ベース上で姿勢を保つための力学モデルを説明する図である。
【図16】ベース上で姿勢を保つための力学モデルを説明する図である。
【図17】同軸二輪車における力学モデルを説明する図である。
【図18】姿勢安定制御のための制御機構を示す図である。
【図19】車輪が１つである場合における姿勢安定制御及び走行制御のための制御機構を示す図である。
【図20】同軸二輪車における姿勢指令を説明する図である。
【図21】車輪が１つである場合における姿勢安定制御及び走行制御のための制御機構を示すブロック図である。
【図22】図２２に示すブロック図を数学モデルとして示す図である。
【図23】図２３に示す数学モデルの詳細な具体例を示す図である。
【図24】車輪が２つである場合における姿勢安定制御及び走行制御のための制御機構を示すブロック図である。
【図25】前進・後退する場合の走行速度制御を説明する図である。
【図26】旋回する場合の走行速度制御を説明する図である。
【図27】直進する際にヨー軸回りのジャイロセンサ信号が検出される場合の制御方法を説明する図である。
【符号の説明】
【0174】
　１０１，１０２…車輪、１０３…ステップ台、１００Ｌ,１００Ｒ…車輪駆動モータ、１０４…ステー、１０５…ハンドル、１０６…表示計、１０７…減速機、１０９…モータロータ、１１０…回転プレート、１１１…検出ユニット、１１３…モータステータ、１１５Ｌ,１１５Ｒ …ロータ角度検出器、１１６,１１７…駆動回路、１２０…演算装置、１２１…姿勢検出センサ、１２２…ジャイロセンサ、１２３…加速度センサ、１２６…速度

計、１２７…走行距離計

【図1】



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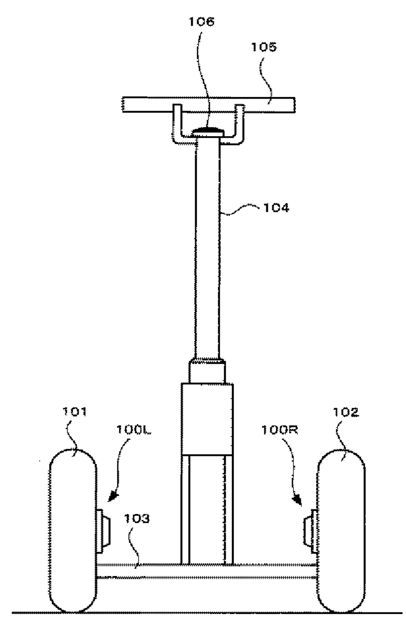

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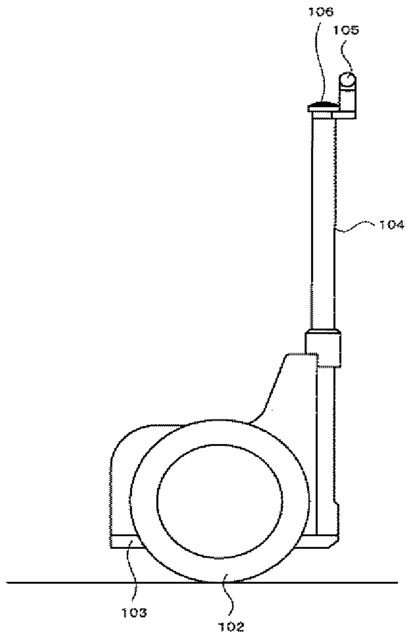
106
105
104
103
102

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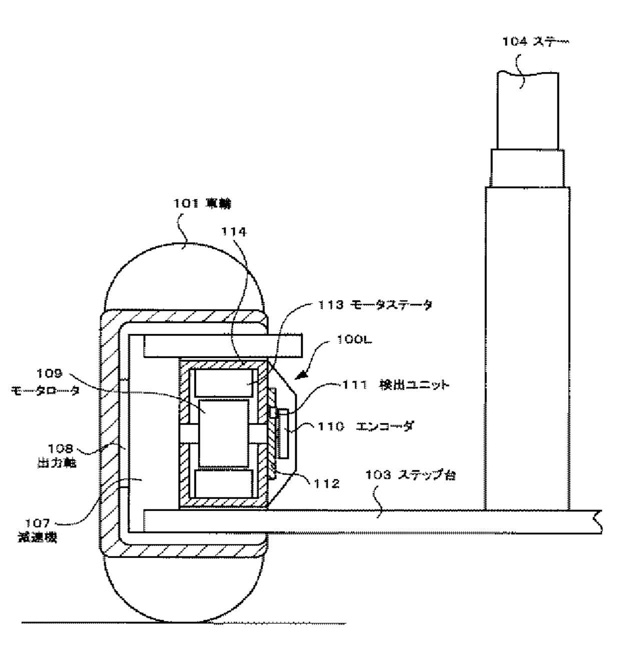
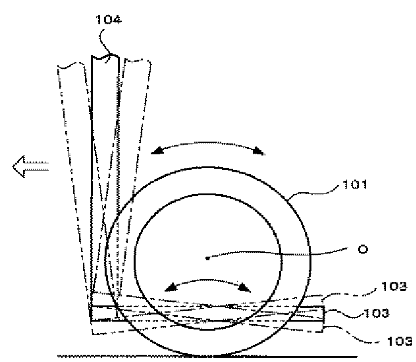
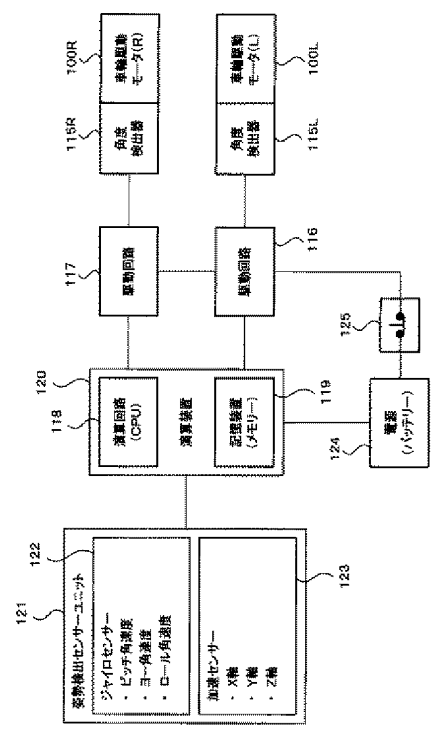

104 ステー
101 車輪
114
113 モータステータ
100L
109
モータロータ
111 検出ユニット
110 エンコーダ
108
出力軸
112
103 ステップ台
107
減速機

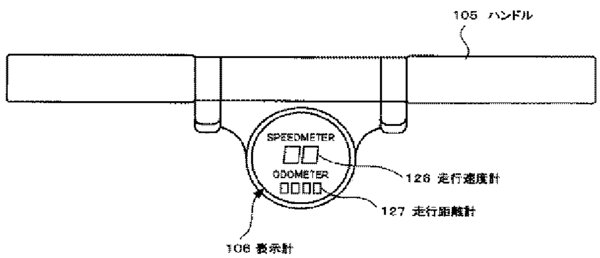
【図5】


104
101
O
103
103
103

【図6】


100R
車輪駆動モータ(R)
100L
車輪駆動モータ(L)
115R
角度検出器
115L
角度検出器
117
駆動回路
116
駆動回路
125
120
118
演算回路(CPU)
演算装置
119
記憶装置(メモリー)
124
電源(バッテリー)
121
122
姿勢検出センサーユニット
ジャイロセンサー
・ピッチ角速度
・ヨー角速度
・ロール角速度
123
加速センサー
・X軸
・Y軸
・Z軸

【図7】



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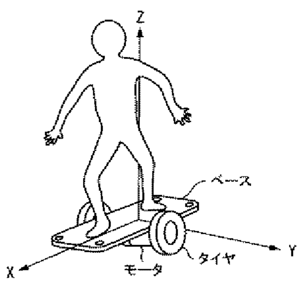

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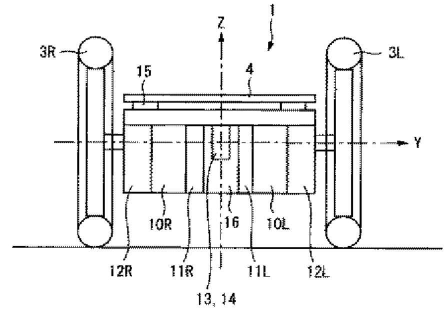

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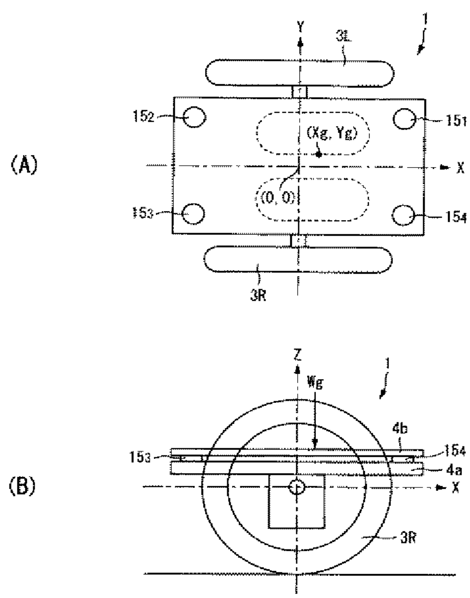

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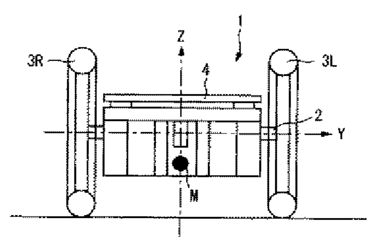

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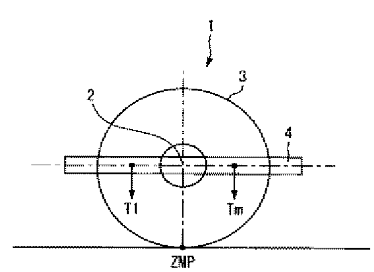

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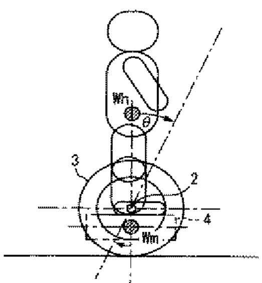

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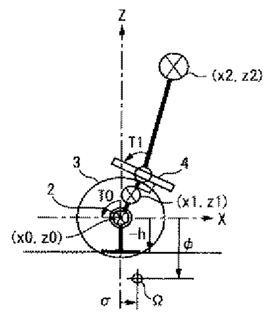

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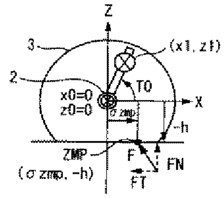

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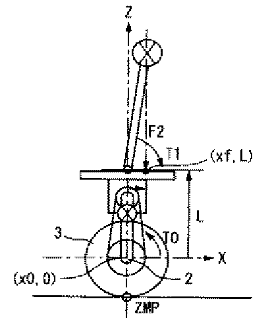

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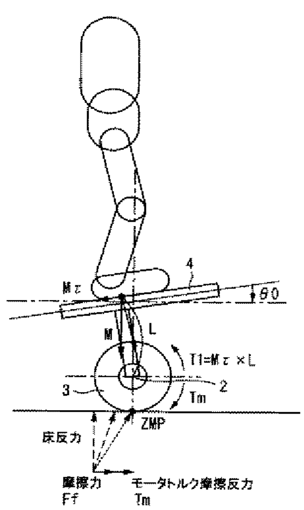

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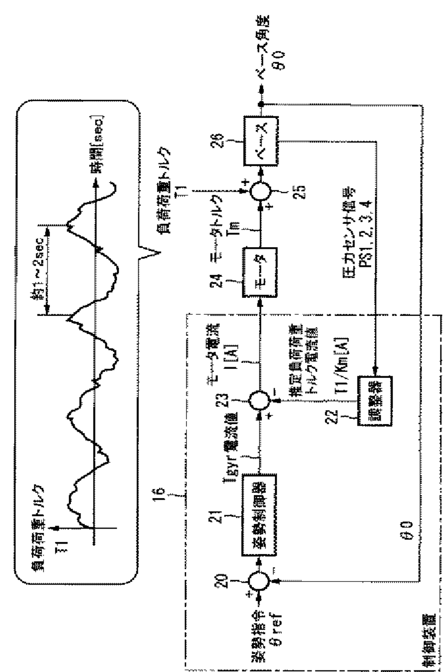

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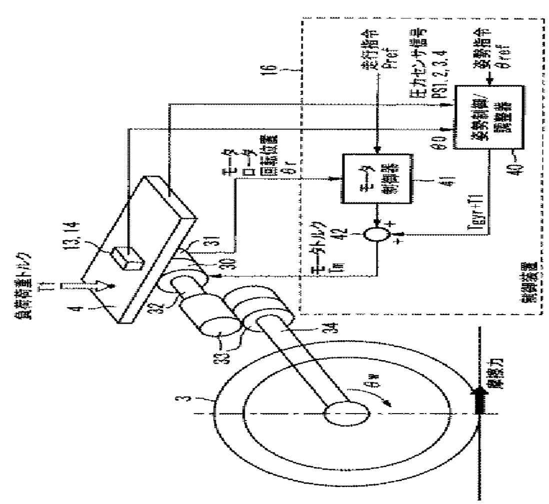

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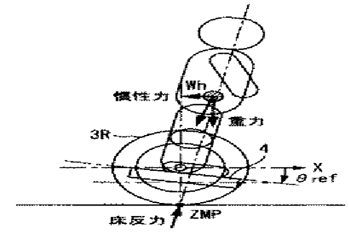

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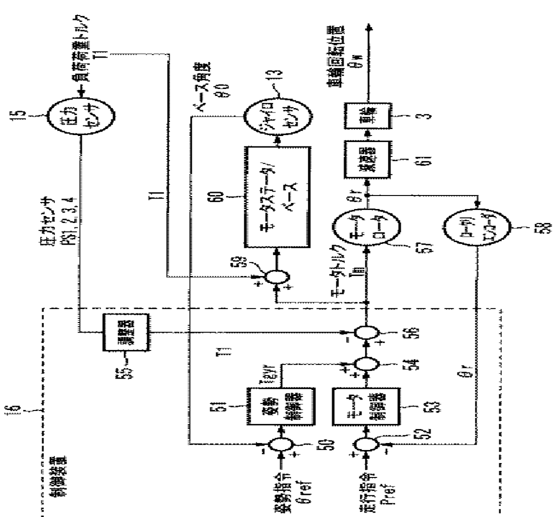

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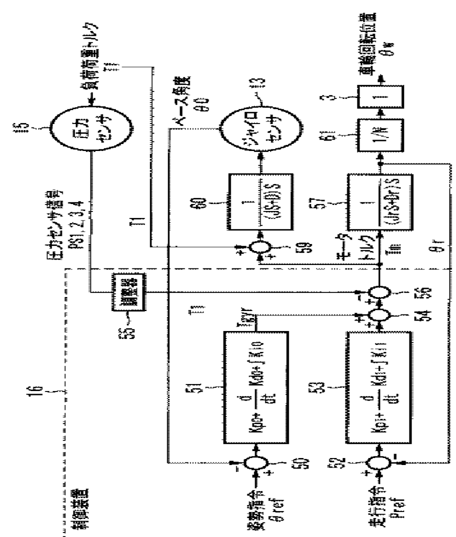

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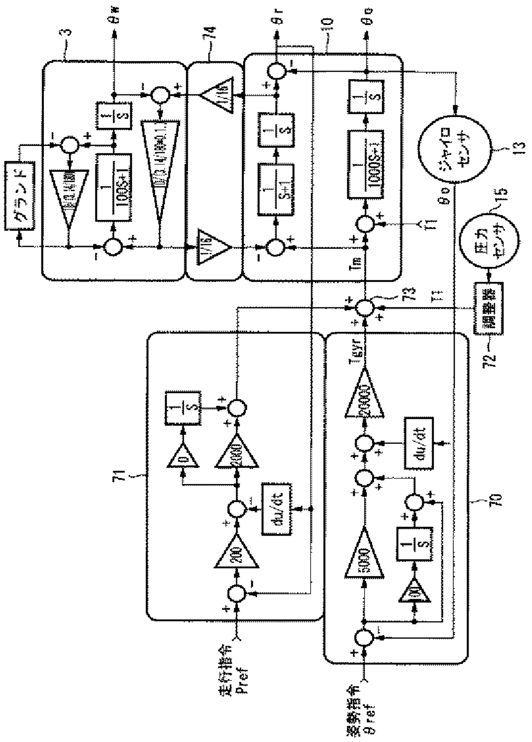

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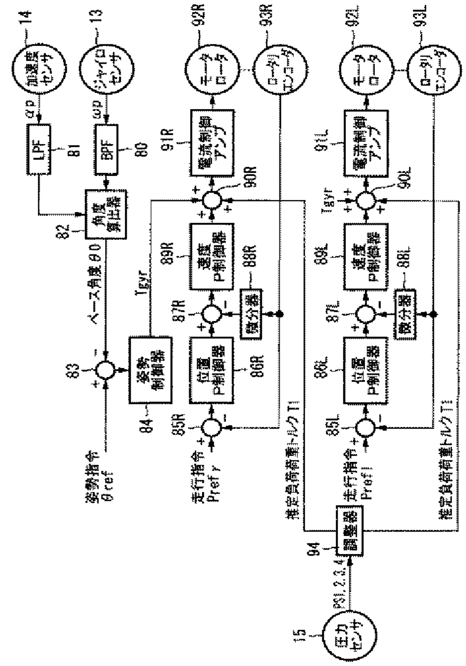

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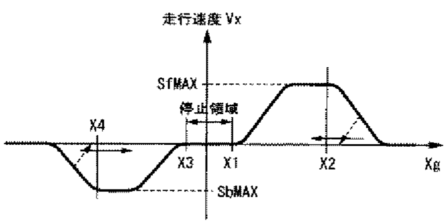
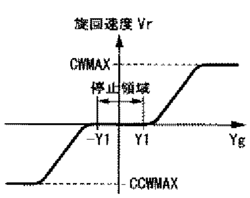


【図26】



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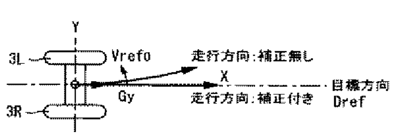


Espacenet

Bibliographic data: JP2006008013 (A) — 2006-01-12

TRAVELING DEVICE

Inventor(s): KAKINUMA BUICHI ± (KAKINUMA BUICHI)

Applicant(s): SONY CORP ± (SONY CORP)

Classification: - international: ***B60L15/20; B62J11/00; B62J99/00; B62K15/00; B62K17/00; B62K3/00; B62L3/02***
- cooperative: Y02T10/7275 (EP)

Application number: JP20040190086 20040628 Global Dossier

Priority number (s): JP20040190086 20040628

Also published as: JP4599907 (B2)

Abstract of JP2006008013 (A)

PROBLEM TO BE SOLVED: To provide a traveling device not only capable of storing and restoring a two-wheel traveling at parallel two wheels by making a projection floor area to a small shape by folding the two-wheel but also capable of also realizing toeing movement while riding a person in the folded state. SOLUTION: The traveling device is provided with a pair of wheels 3L, 3R arranged in parallel; a traveling device body 1 having step bases 2L, 2R getting on with an occupant; a handle bar 6 retained by the occupant; and an attitude detection sensor for controlling angular velocity and traveling acceleration of the traveling device body 1 by detecting the angular velocity and the acceleration of the traveling device body 1 during traveling. The traveling device outputs a signal for maintaining the predetermined traveling state to a drive circuit and drives the wheels. The step bases 2L, 2R are divided to left and right parts from the traveling device body to the wheels 3L, 3R sides and are turnably connected. The step bases are folded with a link mechanism making a connection part with the traveling device body side from the state that the step bases 2L, 2R are spread as an apex by pulling up a lock lever 70 of the traveling device body. Thereby, the folded structure that in-wheel width is contracted is realized.

Notice

CLAIMS JP2006008013

1.

A pair of wheels arranged in parallel; drive means for independently rotating and driving the wheels; a traveling device main body having a step base on which the wheels are rotatably supported and on which a passenger rides; and stands from the traveling device main body A handle post provided and a handle held by a passenger; a gyro sensor for detecting an angular velocity of at least one of a pitch axis, a yaw axis, and a roll axis; an Xaxis, a Yaxis, and a Z; An attitude sensor for detecting an acceleration of at least one of the axes and detecting an angular velocity and acceleration of the traveling device body during traveling to control the angular velocity and traveling acceleration of the traveling device body; Asignal for maintaining a predetermined traveling state from a signal from the attitude detection sensor via an arithmetic unit to a driving circuit, and the vehicle is driven by the driving means. The travel device main body is located in a central portion between the wheels, and the step base is divided from the travel device main body to the wheel side and is pivotally connected. In addition, a link mechanism is connected between the traveling device main body side and the wheel side on the back surface side of the step table so as to be rotatable, and the step table is expanded by pulling up the traveling device main body portion. The traveling device is configured to be folded together with the link mechanism with the connecting portion with the traveling device main body side as an apex from the state where the width between the wheels is reduced.

2.

The traveling device according to claim 1, wherein a power source battery for the driving unit and the posture detection sensor are accommodated in the traveling device main body.

3.

The traveling device according to claim 1, wherein the traveling device detects the spread state and the folded state, and the control mode is changed.

4.

The traveling device according to claim 1, wherein the traveling device is capable of being moved by a person riding in both the expanded state and the folded state.

5.

The control mode can be changed to any of the riding mode, the traction power assist mode, and the traction regenerative power charging mode with the traveling device expanded, the riding mode, traction when the traveling device is folded. The travel device according to claim 3, wherein the travel device can be changed to any one of a power assist mode and a traction regenerative power charging mode.

6.

The traveling device according to claim 1, wherein when the traveling device is in a folded state, a stand plate projects toward the grounding surface side of the wheel to become a stand for parking.

7.

The stand plate is composed of two plate plates that can be rotated by hinges. When the traveling device is unfolded, the two plate plates are stored in a flat shape, and when the traveling device is folded, 7. A traveling apparatus according to claim 6, wherein a plate plate pivots and protrudes about the hinge.

8.

The travel device according to claim 7, wherein when the travel device is folded, the stand plate is locked at a stand position by a lock mechanism, and the lock is released by operating a release button.

9.

The traveling device according to claim 1, wherein the handle post is configured to be extendable and contractible.

10.
The traveling apparatus according to claim 9, wherein the handle post is locked in an extended position and a short position by an operation of a lock lever.

11.
The traveling device according to claim 1, wherein the traveling device detects the unfolded state and the folded state by an open /close confirmation sensor.

12.
11. The lock lever is detected by a lock lever confirmation sensor, and when the lock lever is unlocked, an abnormality is notified by a warning sound or a display, and the traveling device is decelerated and stopped. Traveling device.

13.
The traveling device according to claim 1, further comprising a pressure sensor on the left and right step bases, wherein the traveling device can be turned by a difference in detected weight due to a weight shift of a passenger.

14.
The travel device according to claim 1, wherein the handle includes an operation lever that performs a turning operation and a brake operation of the travel device.

15.
The travel device according to claim 14, wherein the turning operation and the brake operation can be performed by operating one operation lever.

16.
The traveling device body is provided with a seating seat, and a pedal step is attached to the tire wheel of the wheel, and the traveling device is seated on the seating seat in a folded state, and the pedaling step is allowed to ride on the pedal step. The traveling device according to claim 1.

Notice

DESCRIPTION JP2006008013

PROBLEM TO BE SOLVED: To provide a traveling device capable of pulling and moving a person in a folded state, as well as storing and storing a projection floor area in a small form by folding a two-wheeled vehicle traveling in parallel two wheels. SOLUTION: A traveling device body 1 having a pair of wheels 3L, 3R arranged in parallel, step bases 2L, 2R on which a passenger rides, a handle 6 held by the passenger, and traveling of the traveling device body 1 And a posture detection sensor for controlling the angular velocity and acceleration of the traveling apparatus body 1 by detecting the angular velocity and acceleration of the vehicle, and outputting a signal for maintaining a predetermined traveling state to the drive circuit to drive the wheel The step bases 2L and 2R are divided into left and right wheels 3L and 3R from the traveling device main body and are pivotally connected to each other. By pulling up the lock lever 70 of the traveling device main body, the step bases 2L and 2R are From the expanded state, the folding device is folded together with the link mechanism with the connecting portion with the traveling device main body side as the apex, and the width between the wheels is reduced. [Selection] Figure 4

Traveling device

[0001]

The present invention relates to a traveling device suitable for use in, for example, a vehicle that travels in parallel two wheels on which a person is mounted, and more specifically, this type of traveling device can be reduced to a foldable structure so that the person can be reduced in a folded state. It can be moved on board and can be stored easily in a space-saving manner when the traveling device is stored.

[0002]

For example, a vehicle that travels on two parallel wheels with a human being on board has been proposed (see, for example, Patent Document 1 and Patent Document 2).

[0003]
Japanese Patent Laid-Open No. 4-201793 U.S. Pat. No. 5,791,425

[0004]
The above-described two-wheeled two-wheeled vehicle is excellent in terms of mobility, but it must secure a minimum floor area from the boarding area where people ride and the distance between wheels. When considering use in a place, storage, bicycle parking, or bringing into public transportation will naturally be restricted.

[0005]
In the case of a general traveling device including the above-described two-wheeled vehicle, the folded state is intended to be stored or stored, and the function as the traveling device is lost in the folded state.

[0006]
The present invention has been made in view of the above-described points. In addition to folding a two-wheeled vehicle traveling in parallel two-wheels, the projected floor area can be reduced and stored and stored. It is an object of the present invention to obtain a traveling device that can be pulled and moved.

[0007]
In order to achieve the object of the present invention, a traveling device according to claim 1 includes a pair of wheels arranged in parallel, driving means for independently rotating and driving the wheels, and a vehicle on which a passenger rides while rotatably supporting the wheels. The traveling device body having a step base, the handle post erected from the traveling device body, the handle held by the passenger, and the traveling device body have an angular velocity of at least one of a pitch axis, a yaw axis, and a roll axis. A gyro sensor for detecting and an acceleration sensor for detecting the acceleration of at least one of the X-axis, Y-axis, and Z-axis are provided, and the angular velocity and acceleration of the traveling device body during traveling are detected to detect the angular velocity of the traveling device body. And an attitude detection sensor for controlling the running acceleration, and outputs a signal for maintaining a predetermined running state from the signal from the attitude detection sensor to the drive circuit via the arithmetic unit. The traveling device main body is located in the central part

between the two wheels, the step base is divided from the traveling device main body to the wheel side and is pivotally connected, It is configured to be rotatable by connecting a link mechanism between the traveling device main body side and the wheel side on the back side of the step base, and the traveling device main body side from the state where the step base is widened by pulling up the traveling device main body part It is folded together with the link mechanism with the connecting part as the apex, and has a folding structure in which the width between the wheels is reduced.

[0008]
According to the second aspect of the present invention, the power source battery of the driving means and the posture detection sensor are housed in the central portion of the traveling device between the wheels.

[0009]
According to the traveling device of claim 3, the traveling device detects the expanded state and the folded state, and the control mode is changed.

[0010]
According to the traveling device of claim 4, the traveling device is capable of being moved by a person on board in both the expanded state and the folded state.

[0011]
According to the traveling device of claim 5, the control mode can be changed to any one of a boarding traveling mode, a traction power assist mode, and a traction regenerative power charging mode with the traveling device expanded. The apparatus can be changed to any one of a boarding traveling mode, a traction power assist mode, and a traction regenerative power charging mode in a folded state of the apparatus.

[0012]
According to a sixth aspect of the present invention, when the traveling device is in a folded state, the stand plate protrudes toward the ground contact surface of the wheel, and serves as a stand for parking.

[0013]
According to the traveling device of the seventh aspect, the stand plate is composed of two plate

plates that can be rotated by a hinge, and the two plate plates are stored in a planar shape when the traveling device is unfolded. When the traveling device is folded, the plate plate is pivoted about the hinge and protrudes.

[0014]
According to another aspect of the present invention, the stand plate is locked at the stand position by the lock mechanism when the travel device is folded, and the lock is released by operating the release button.

[0015]
According to the traveling device of the ninth aspect, the handle post is configured to be extendable and contractible.

[0016]
According to the traveling device of the tenth aspect, the handle post is locked to the extended position and the short position by operating the lock lever.

[0017]
According to another aspect of the present invention, the travel device detects the expanded state and the folded state by the open / close confirmation sensor.

[0018]
According to the traveling device of claim 12, the lock lever is detected by the lock lever confirmation sensor, and when the lock lever is unlocked, the travel device is decelerated and stopped while notifying the abnormality by a warning sound or a display. It is characterized by that.

[0019]
According to a thirteenth aspect of the present invention, a pressure sensor is provided on the left and right step bases, and the turning operation of the traveling device is made possible by the difference in the detected weight due to the weight shift of the passenger.

[0020]
According to the traveling device of the fourteenth aspect, the handle is provided with an

operation lever for performing a turning operation and a brake operation of the traveling device.

[0021]
According to the traveling device of the fifteenth aspect, the turning operation and the brake operation can be performed by operating one operation lever.

[0022]
According to the traveling device of the sixteenth aspect, the traveling device body is provided with the seating seat, the pedal step is attached to the tire wheel of the wheel, the seating device is seated in the folded state of the traveling device, and the foot is placed on the pedal step. It is characterized by being able to travel on board.

[0023]
According to the first aspect of the present invention, it is possible to easily store and store the folded floor area by folding a traveling device that travels in parallel two wheels, and to carry a person in the folded state. Can move.

[0024]

According to the invention of claim 2, since the power source battery of the driving means is accommodated in the traveling device main body, the space of the traveling device itself can be saved.

In addition, since the posture detection sensor is housed in the traveling device main body at the center between the wheels, it is possible to accurately detect the tilt posture of the traveling device during traveling.

[0025]
According to the invention of claim 3, since the control device can be changed by detecting the extended state and the folded state of the traveling device, the mode can be changed accurately to the control mode corresponding to the extended state and the folded state. Can do.

[0026]

According to the invention of claim 4, since the person can board and move in both the expanded state and the folded state of the traveling device, the convenience of the traveling device can be improved.

[0027]
According to the invention of claim 5, the control mode can be changed to any one of a boarding travel mode, a traction power assist mode, and a traction regenerative power charging mode with the travel device expanded. It is possible to change to the riding mode in the folded state, traction power assist mode, or traction regenerative power charging mode, so it is effective in both the expanded state and the folded state It is possible to run.

[0028]
Further, according to the invention of claim 6, since the stand plate protrudes on the ground contact surface side of the wheel in the folded state of the traveling device and the stand for parking is provided, the traveling device at the time of folding does not fall down. It can be stored stably when parking.

[0029]
According to the seventh aspect of the present invention, the stand plate is composed of two plate plates that can be rotated by a hinge, and the two plate plates are stored in a flat shape when the traveling device is unfolded. When the traveling device is folded, the plate plate is configured to pivot and protrude from the hinge as the apex, so that the traveling device can be easily used as a stand in conjunction with the folding operation of the traveling device.

[0030]
According to the invention of claim 8, the stand plate is locked at the stand position by the lock mechanism when the traveling device is folded, and the lock is released by operating the release button. Stable parking is possible without being dismissed.

[0031]
According to the invention of claim 9, since the handle post is configured to be extendable and retractable, when the traveling device is folded, the handle post can be contracted and further compacted to be parked or stored. it can.

[0032]

Further, according to the invention of claim 10, the handle post is locked to the extended position and the short position by operating the lock lever, thereby ensuring the safety of the passenger during the traveling of the traveling device. Can do.

[0033]
According to the eleventh aspect of the present invention, since the traveling device detects the opened state and the folded state by the open / close confirmation sensor, the setting mode for the opened state and the setting mode for the folded state are surely established. Can be executed.

[0034]
According to the invention of claim 12, when the lock lever is detected by the lock lever confirmation sensor and the lock lever is unlocked, an abnormality is notified by a warning sound or a display, and the traveling device is decelerated and stopped. By doing so, it is possible to ensure the safety of the passenger while the traveling device is traveling.

[0035]
According to the invention of claim 13, since the pressure sensor is provided on the left and right step bases and the turning operation of the traveling device is made possible by the difference in the detected weight due to the passenger's weight shift, the passenger's weight shift can be controlled. The turning operation of the traveling device can be easily performed only by doing so.

[0036]
According to the invention of claim 14, the handle is provided with the operation lever for performing the turning operation and the brake operation of the traveling device, so that traveling with high safety is possible.

[0037]
According to the fifteenth aspect of the invention, the turning operation and the brake operation can be performed by operating one operation lever, so that the maneuvering becomes easy.

[0038]
According to the sixteenth aspect of the present invention, the traveling device body is provided with the seating seat, the pedal step is attached to the tire wheel of the wheel, the seating device

is seated in the folded state of the traveling device, and the pedal step is applied. This makes it possible for passengers to ride in a comfortable posture.

[0039]

Embodiments of a foldable traveling device according to the present invention will be described below with reference to the drawings.

FIG. 1 is an overall perspective view showing the configuration of an embodiment of a state in which a coaxial two-wheeled vehicle to which a traveling device according to the present invention is applied is in a normal traveling use state, and FIG. 2 is a rear view of the entire state in the same expanded state. 3 is a right side view of the whole in the same expanded state, FIG. 4 is an external perspective view of the coaxial two-wheeled vehicle, FIG. 5 is a rear view of the same folded state, and FIG. 6 is a right side of the same folded state. FIG.

[0040]

First, the configuration of the main part of the entire traveling device will be described with reference to FIGS. 1 to 3.

Reference numeral 1 denotes a traveling device main body composed of a relatively flat housing, and a pair of parallel left and right foldable step bases 2L and 2R for a passenger to board from the bottom surface of the traveling device main body 1 are arranged. ing.

There are a pair of wheels 3L, 3R on both outer ends of both step bases 2L, 2R.

The wheels 3L and 3R are arranged so that the center of each wheel is aligned, and the wheels 3L and 3R are wheel drive motors 4L and 4R (hereinafter referred to as wheel drive units 4L and 4R) provided on the respective axles. Rotation drive independently.

Further, the step bases 2L, 2R are located at positions where the center of gravity is lower than the axle center of the wheels 3L, 3R.

[0041]

Further, a handle post 5 is vertically suspended at the front end portion of the traveling device body 1 (the right end side in FIG. 3 which is the traveling direction of the traveling device), and a handle 6 is provided horizontally at the upper end portion of the handle post 5. It has been.

[0042]

FIG. 7 shows a block diagram of the system configuration of the traveling device described above. The wheel drive motor 4L having the rotor angle detector 7L and the wheel drive motor 4R having the rotor angle detector 7R are respectively connected via drive circuits 8 and 9. It is connected to an arithmetic device 12 having an arithmetic circuit (CPU) 10 and a storage device (memory) 11.

The computing device 12 detects a posture state of the traveling device, and detects a pitch axis angular velocity, a yaw axis angular velocity, a roll axis angular velocity by a gyro sensor, and an X axis acceleration, a Y axis acceleration, and a Z axis acceleration by an acceleration sensor. A detection sensor 13, a lever lock confirmation sensor 14 for detecting a folded state, an opening / closing confirmation sensor 15 for detecting a folded (open / closed) state of the step base, a pressure sensor 16 for recognizing boarding on the step bases 2L and 2R, A control start switch 17 is connected.

From these signals, the arithmetic unit 12 outputs a signal for maintaining a predetermined traveling state to the drive circuits 8 and 9 to drive the wheels 3L and 3R.

[0043]

In addition, a lever lock fixed electromagnetic plunger 19 is connected to the arithmetic unit 12 via a drive circuit 18.

Further, a power source 20 made of a secondary battery and a switch 21 for emergency stop of the traveling apparatus are connected between the arithmetic circuit 12 and the drive circuit 8 and the drive circuit 18.

[0044]
The arithmetic circuit 12 described above recognizes the folded state of the traveling device by the detection lever lock confirmation sensor 14 and the opening / closing confirmation sensor 15 and the load state (whether a person is on board) by the pressure sensor 16, and in a predetermined control mode. Take control.

[0045]
The control modes are: • Riding mode with the travel device extended • Traction power assist mode with the travel device extended • Traction regenerative power charging mode with the travel device extended • State with the travel device folded Riding power mode with traction power assist mode when the traveling device is folded. Traction regenerative power charging mode when the traveling device is folded.

[0046]
Here, the riding travel mode refers to traveling at a predetermined travel speed by rotating the wheels 3L and 3R by the operation of the passenger in either of the state where the travel device is expanded or the state where the travel device is folded.

[0047]
In addition, the traction power assist mode refers to the transport state (traction force or the posture state of the travel device) when the travel device is pulled and transported in either the expanded state or the folded state of the travel device. A reference value set in advance is compared, and a wheel is rotated by a wheel drive motor in accordance with the difference, so that the towing vehicle or the person to be pulled is transported with a small transport force.

[0048]
The traction regenerative power charging mode refers to charging the regenerative power to the power source (battery) 20 when the traveling device is being pulled and transported in either the expanded state or the folded state of the traveling device. It means that you can.

[0049]
The lever lock confirmation sensor 14, the open / close confirmation sensor 15, and the pressure sensor 16 will be described when detailed descriptions of each mechanism section are given.

[0050]

[Arrangement of Control Device] A power source 20, an attitude detection sensor 13, and a calculation device 12 are housed in the traveling device body 1, and drive circuits 8 and 9 are arranged inside the step bases 2L and 2R.

Here, since the attitude detection sensor 13 is housed in the traveling apparatus body 1, the sensor detection axis direction does not change even if the step bases 2L and 2R are folded, and coordinate conversion on the software is unnecessary.

[0051]
[Folding mechanism of step stand] FIG. 8 is a partial cross-sectional view of the traveling device main body 1, the step bases 2L and 2R, and the mechanisms of the wheels 3L and 3R, as seen from the front side when the traveling device is unfolded. Similarly, FIG. 10 is a partial cross-sectional view of the step bases 2L and 2R in the middle of folding, FIG. 10 is a partial cross-sectional view of the step bases 2L and 2R, and FIG. FIG.

[0052]
The step bases 2L and 2R have a front end side (the handle post 5 side) coupled to the traveling device body 1 at the end of the traveling device body 1 via the support portions 2a and 2a, respectively, by shaft portions 22 and 23, respectively. The rear end side is connected to the end portion of the traveling apparatus body 1 via the support portions 2b and 2b so as to be rotatable by the shaft portions 24 and 25, respectively, and to the shaft portions 24 and 25. The gears 26 and 27 are coupled so that the gears 26 and 27 mesh with each other.

[0053]
Motor brackets 30 and 30 to which wheel drive units 4L and 4R are fixed are rotatably coupled to shafts 32 and 33 via arms 28 and 29 on the side of the wheels 3L and 3R of the step bases 2L and 2R. .

[0054]

In addition, a link mechanism is provided at the center of the back surface of the step bases 2L and 2R to assist in expanding and folding the step bases 2L and 2R.

This link mechanism has two link bars 35, 36 connected by a central support shaft 34, and ends of both link bars 35, 36 extend from motor brackets 30, 30 of the wheel drive units 4L, 4R. The other arms 37 and 37 are rotatably connected by shafts 38 and 38.

Further, two support links 39, 40 are coaxially connected to the support shaft 34, and the other ends of the support links 39, 40 are connected to plates 41, 42 fixed to the step bases 2L, 2R by shafts 43, 44. Has been.

In other words, the link bar 35 and the support link 40, and the link bar 36 and the support link 39 are straight lines, and are formed in the shape of a tack with the support shaft 34 as a fulcrum.

[0055]
In the state in which the step bases 2L and 2R configured as described above are expanded, the step bases 2L and 2R are closer to the shaft portions 24 and 25 side with respect to the weight applied when the passenger gets on the step bases 2L and 2R. The stopper surfaces 45 and 46 are positioned at the rear end portions 1a and 1a of the traveling apparatus body 1 to restrict the rotation, and the stopper pieces 48 and 49 provided on the step bases 2L and 2R are motors close to the shafts 32 and 33. The rotation is restricted by contacting the arms 28 and 29 of the brackets 30 and 30, and the step bars 2L and 2R are kept horizontal by the link bars 35 and 36, and the wheels 3L and 3R are kept parallel. Be drunk.

[0056]

The folding of the step bases 2L and 2R operates as follows.

As shown in FIG. 8, when the traveling device body 1 is pulled up from the state in which the step bases 2L and 2R are widened, the step bases 2L and 2R have the shaft portions 24 and 25 symmetrically with the gears 26 and 27 engaged. It turns around the center of rotation and is folded.

As the step bases 2L and 2R operate, the link bars 35 and 36 rotate in the folding direction with the support shaft 34 as a fulcrum as shown in FIG.

In other words, the link bars 35 and 36 are folded while maintaining a relatively constant positional relationship in conjunction with the folding operation of the step bases 2L and 2R, so that the wheels 3L and 3R are pulled in a state of maintaining a substantially parallel posture. The folding operation is completed at the position shown in FIG.

That is, in the folded state shown in FIG. 10 from the state in which the wheels 3L and 3R are widened, the projected floor area can be reduced by half.

[0057]

[Stand when parking and lock mechanism when folding] It is composed of two stand plates 50 and 51 that are opposed to the handle post 5 side and are made to abut against the back of the step bases 2L and 2R. .

One end of each of the stand plates 50 and 51 is connected to the step bases 2L and 2R by hinge shafts 52 and 53, and the end to be abutted is also connected by the hinge shaft 54.

[0058]
12 is a side view when the stand is not used, that is, when the step bases 2L and 2R are expanded, and FIG. 13 is a side view when the stand is used, ie, when the step bases 2L and 2R are folded. It is.

[0059]

The stand described above performs the operation of folding the step bases 2L and 2R, so that the stand plates 50 and 51 jump out downward with the hinge shaft 54 as the apex, so that the function as a stand can be obtained.

This is shown in FIG.

In other words, in the folded state of the traveling device, parking can be performed in a stable state by grounding at the three points of the grounding of the two wheels 3L and 3R and the installation of the stand.

[0060]

In addition, a lock mechanism is provided to prevent the step bases 2L, 2R from opening unreasonably when the traveling device is folded.

14 is a front view when the step bases 2L and 2R are opened, FIG. 15 is a front view when the lock mechanism is locked when the step bases 2L and 2R are folded, and FIG. 16 is a line AA in FIG. It is sectional drawing.

[0061]

A fixed-side lock claw 56 having a lock claw piece 55 is fixed to the end of one step base 2L with a screw (not shown).

On the other hand, a movable side lock claw 57 is provided at the end of the other step base 2R.

As shown in FIG. 16, the movable side lock claw 57 includes a lock claw base 58 screwed to the step base 2R, and a lock claw operation unit 60 rotatably supported on the lock claw base 58 by a shaft pin 59. And a compression spring 61 that is interposed between the lock claw base 58 and biases the lock claw operating portion 60 in the lock direction.

[0062]

The lock mechanism configured as described above is folded as indicated by the arrow from the state in which the step bases 2L and 2R shown in FIG. Immediately before 2L and 2R are folded, a slope 60b formed on the lock claw 60a at the tip of the lock claw operating portion 60 is a slope 55a formed on the tip of the lock claw piece 55 of the fixed side lock claw 56. After that, the lock claw 60 a of the lock claw operating portion 60 gets over the lock claw piece 55 of the fixed side lock claw 56, and the lock claw 60 a is locked to the lock claw piece 55 by the spring biasing force of the compression spring 61. .

Thereby, the step bases 2L and 2R maintain the folded state.

[0063]

When releasing the lock mechanism, the lock claw 60a is pressed against the spring urging force of the compression spring 61 by pressing the pressing surface 57a opposite to the lock claw 60a side of the lock claw operation unit 60, so that the lock claw 60a is locked. Is released and the locked state is released.

As a result, the step bases 2L and 2R can be widened.

[0064]
[Extension Mechanism of Handle Post] FIG. 17 is a side cross-sectional view of the main part of the traveling apparatus with the handle post 5 extended, and FIG. 18 is a side cross-sectional view of the main part of the travel apparatus with the handle post 5 contracted. 19 is a detailed view of the lock lever, and is a cross-sectional view of the lock position when the handle post is extended, FIG. 20 is a cross-sectional view when the lock is released, FIG. 21 is a cross-sectional view of the lock position when the handle post is contracted, FIG. 22 is a cross-sectional view when the lock is similarly released.

[0065]

The handle post 5 is inserted into a fixed post 63 erected from the traveling apparatus main body 1 and attached to be extendable.

The fixed post 63 is fixed to a frame 1 </ b> A that is integrally raised from the traveling device body 1.

A fixed-side end cap 64 is fixed to the upper end portion of the fixed post 63, and a tapered surface 64a is formed on the inner wall surface of the cap.

An end cap 65 is attached to the lower end portion of the handle post 5.

The end cap 65 is provided with a tapered surface 65 a that engages with the tapered surface 64 a of the fixed end cap 64 described above, and an inclined holding surface 66 is formed at a part of the lower end portion of the end cap 65.

[0066]

A shaft rod 67 is inserted between the end cap 65 and the traveling device main body 1 through the fixed end cap 64 so that a stopper block 67a provided at the upper end of the shaft rod 67 can be engaged with the bottom surface of the end cap 65. A stopper plate 67 b is provided at the lower end of the shaft rod 67.

Further, a V-shaped engaging portion 68 is formed in the middle of the handle post 5.

An intermediate stopper 69 is provided in the middle of the shaft rod 67 at a low position.

[0067]

Here, the lock lever 70 is provided on the upper surface of the traveling apparatus body 1 in an inclined manner.

One end side of the lock lever 70 is rotatably supported by the frame 1 a of the traveling apparatus main body 1 by a pin 71, and a plunger 73 provided on an arm portion 72 that is integrally bent from the lock lever 70 is attached to the fixed post 63. It is pressed against the holding surface 66 of the end cap 65 through the formed groove 63a.

As a result, the end cap 65 is pushed up, and the handle post 5 can be maintained in an extended state, and the tapered surface 65a of the end cap 65 is pressed against the tapered surface 64a of the fixed-side end cap 64. 5, the movement in the rotational direction is restricted by the friction of both the taper surfaces 64a and 65a.

[0068]
Further, by pushing up the holding surface 66 of the end cap 65 by the plunger 73, even if a gap is generated on the contact surface between the arm portion 72 of the lock lever 70 and the holding surface 66 of the end cap 65 due to an assembly error, for example, the end cap. 65 can always be pushed upward.

[0069]

Further, the other end side of the lock lever 70 is made detachable by a connecting mechanism 74 provided on the upper surface of the traveling apparatus main body 1.

The connecting mechanism 74 includes a hooked member 75 provided on the traveling apparatus main body 1 side, a hook member 77 rotatably supported by a pin 76 on the lock lever 70 side, and a compression spring that urges the hook portion 77 in the locking direction. 78.

[0070]

When the hook member 77 is engaged with the hooked member 75 as shown in FIG. 19, the lock lever 70 is locked, and the lock lever 70 maintains its position.

Therefore, the handle post 5 is pushed up by the plunger 73 of the arm portion 72 on one end side, and the handle post 5 is fixed at the extended position.

[0071]
Here, when the handle post 5 is extended, the plate plates 79 and 80 projecting from the step bases 2L and 2R are sandwiched between the bottom surface of the traveling device body 1 and the stopper plate 67b provided at the lower end of the shaft rod 67, respectively. Then, the step

bases 2L and 2R can be fixed at the extended position.

[0072]
In order to shrink the handle post 5, the pressing surface 77a of the hook member 77 is pressed, the lock of the hook member 77 is released from the hooked member 75, and the lock lever 70 is rotated as shown in FIG. The push-up of the end cap 65 by the plunger 73 of the portion 72 is released, and the handle post 5 becomes free and can be contracted.

[0073]

Then, when the handle post 5 is retracted, the end cap 65 moves down along the shaft rod 67 together with the handle post 5, and then the end cap 65 hits the intermediate stopper 69 to push down the shaft rod 67, and the stopper plate 67b The clamping of the plate plates 79 and 80 is released, and the intermediate stopper 69 of the shaft rod 67 comes into contact with the bottom surface of the traveling apparatus main body 1 so that the handle post 5 is in the most contracted position.

The operating state at this time is shown in FIG.

Here, the V-shaped engaging portion 68 of the handle post 5 is positioned at the height of the plunger 73 of the arm 72 of the lock lever 70.

That is, after the handle post 5 is contracted, the handle post 5 is rotated to the locked position, whereby the plunger 73 is engaged with the V-shaped engaging portion 68 as shown in FIG. It is fixed at the position.

Moreover, in the state where the plunger 73 is engaged with the V-shaped engaging portion 68, the handle post 5 is also restricted from moving in the rotational direction.

[0074]
In the operation of extending or contracting the handle post 5, the sliding member 81 made of resin or the like formed on the inner peripheral surface of the fixed-side end cap 64 and the sliding member made of resin or the like formed on the outer peripheral surface of the end cap

65. The member 82 can move the inside of the fixed post 63 smoothly.

[0075]

[Step Opening / Closing Confirmation Sensor] FIG. 23 is a partial view when the step bases 2L and 2R are expanded (hereinafter, only one step base 2R side will be described), and FIG. 24 is a partial view when the step base 2R is folded. It is.

[0076]

According to this, for example, the switch main body 84 of the micro switch 83 is attached to the step base 2R, and the movable contact 85 of the switch main body 84 is arranged so as to protrude to the back side of the step base 2R.

That is, in the state where the step base 2R is folded, the micro switch 83 is configured such that the movable contact 85 protrudes as shown in FIG. 24, and when the step base 2R is widened, the operation of the step base 2R as shown in FIG. The movable contact 85 is pushed by the portion 2Ra to perform a switching operation (ON).

[0077]

By using the above-described micro switch 83, it is electrically detected that the step base 2R is expanded by the on operation of the micro switch 83.

Since the micro switch 83 is turned off when the step base 2R is folded, it is electrically detected that the step base 2R is folded in this off state.

[0078]

Further, although the step switch open / close confirmation sensor has been described in the case of using the micro switch 83 in this example, the step base 2R is provided with a reflecting plate (not shown) so as to receive the light reflected by the reflecting plate. It is also possible to detect the opening / closing of the step base using the photosensor.

Further, it is possible to use a proximity sensor that detects a metal part of the step base.

[0079]

[Lever Lock Confirmation Sensor] FIG. 25 is a sectional view of the lever lock confirmation sensor.

The lever lock confirmation sensor is a switch that is turned on when the lock lever 70 is in the locked position. In this example, the lever lock confirmation sensor 86 is irradiated from the light emitting element to the light receiving element when the lock lever 70 is in the locked position. The photo sensor 87 is configured such that the switch is turned on by shielding light.

As the sensor, in addition to the photo sensor 87, a reflection type sensor by reflection or a proximity sensor for detecting metal can be used.

[0080]
If the lever lock confirmation sensor 87 detects that the lever lock confirmation sensor 87 is unlocked when the traveling device is controlled by the control start switch 17, the lever lock confirmation sensor 87 informs the passenger of the abnormality by an alarm sound or display, Safety can be ensured by decelerating and stopping the speed of the traveling device.

[0081]

The lock lever 70 is provided with an electromagnetic plunger solenoid 88 that forcibly restricts the hook member 77 of the coupling mechanism 74 to the lock position.

By disposing the electromagnetic plunger solenoid 88, when the lock lever 70 is in the locked position and the lever lock confirmation sensor 87 is turned on and control is performed by the control start switch 17, the electromagnetic plunger solenoid 88 moves forward and backward. By restricting the movement of the hook member 77 by the lot 89 to be performed, it is possible to prevent a risk due to unlocking due to vibration during traveling of the traveling device or a folding operation error.

[0082]
[Pressure sensor] The pressure sensor is arranged on the upper surface of the step bases 2L and 2R, detects the weight of the passenger, and drives the traveling device using a control parameter (control gain) according to the weight. Further, by determining the turning direction and turning amount of the traveling device based on the difference in the detected weights of the step bases 2L and 2R, the turning operation can be performed by moving the body weight without using the operation lever.

[0083]

Here, the detailed structure of the pressure sensor will be described with reference to FIGS. 26 and 27 for one step base 2L.

On the step base 2L, a base plate 90 made of resin or the like for shielding noise from an electric circuit inside the step base, a sensor sheet 91 for detecting pressure on the base plate 90, and a surface thereon A protective sheet 92 that protects the sensor sheet 91 by attaching a rubber sheet 92a for preventing a passenger from slipping is used.

[0084]
The sensor sheet 91 is described in a pressure-sensitive conductive elastomer (Japanese Patent Publication No. 7-79006), a film-type pressure sensor (Japanese Patent Laid-Open No. 11-118633), or a pressure-sensitive ink (Japanese Patent Publication No. 2000-503767). Can be used.

[0085]

[Turning and Brake Operating Mechanism] The operating mechanism enables a turning operation and a brake operation of the traveling device with one operating lever.

28 is a side sectional view of the operating mechanism, FIG. 29 is a sectional view taken along line BB in FIG. 28, and FIG. 30 is a sectional view taken along line CC in FIG.

[0086]

The operating mechanism is attached to a stay 93 that supports the handle 6, and the operating lever 94 is fixed to a shaft 96 that is rotatably attached to a frame 95 via a fixing block 97. , The pin 98 coupled to the fixed block 97 rotates about the shaft 96 and pushes and spreads the torsion spring 99 disposed on the shaft 96 to provide an appropriate operating force (200 to 300 g). When the hand is released, it returns to its original position by the restoring force of the torsion spring 99.

At this time, the potentiometer 100 for detecting the turning operation amount is fixed to the frame 95 and detects the amount of rotation of the shaft 96 relative to the frame 95.

Further, the arm position of the torsion spring 99 is restricted by the shaft 101 coupled to the frame 95 so that the operation lever 94 returns to the neutral position when the hand is released.

[0087]

Further, when the brake is operated, when the operation lever 94 is operated in the direction of arrow b, the frame 95 rotates with the base block 103 fixed to the stay 93 of the handle 6 and the shaft 104 fixed to the block 103 as the rotation axis.

Further, a torsion spring 105 is attached to the shaft 104, and the frame 95 is pushed in the direction opposite to the arrow b by the torsion spring 105, and an appropriate operating force (300 to 400g) is generated during operation. Return to position.

At this time, the potentiometer 106 for detecting the brake operation amount is fixed to the frame 95, and the rotation amount of the shaft 104 relative to the frame 95 can be detected.

[0088]
[Riding in a seated posture when folded] This embodiment shows a traveling device that can be

seated in a seated posture in a folded state. FIG. 31 is a rear view of the traveling device in an expanded state, and FIG. FIG. 33 is a side view, FIG. 33 is a rear view of the traveling device in a folded state, and FIG. 34 is a side view.

[0089]

A seating sheet 107 is provided on the upper surface of the traveling apparatus body 1, and a sensor sheet 107 a similar to that described with reference to FIG. 26 is disposed in the seating sheet 107.

A pair of left and right pedals 108 are provided so as to be supported by the wheels 3L and 3R.

According to this, the passenger can sit on the seat 107 with the traveling device folded, and can travel by placing his / her foot on the pedal 108.

[0090]

FIG. 35 is a detailed cross-sectional view of the mounted state of the wheels 3L, 3R and the pedal 108 as viewed from the back side of the traveling device. The other components are the same as those shown in FIG. The description is omitted.

The pedal 108 is rotatably attached to the tire wheel 109 via the bearing 110, so that the pedal 108 is not affected by the rotation of the tire wheel 109.

[0091]

FIG. 36 shows a detailed sectional view of the pedal 108 on the wheel 3L side.

A pedal step 111 for placing a foot is rotatably supported on a pedal base 113 via a shaft 112, and the pedal base 113 is rotatably supported on a tire wheel 109 via a bearing 110.

[0092]

FIG. 37 shows a cross-sectional view in a state where the pedal step 111 is folded so as not to get in the way when the step base is unfolded.

According to this, as shown in FIG. 38, the pedal step 111 is engaged with the plunger ball 115 urged by the compression coil spring 114 provided on the pedal base 113 to the recess 116 provided on the pedal step 111. As a result, the folded state is maintained.

The plunger balls 115 urged by the compression coil spring 114 are formed in pairs on opposite sides.

[0093]

FIG. 39 shows a flowchart of mode selection of the traveling device.

First, in step 201, if the control start switch 17 is on, a warning or a display device is urged to warn the passenger when the lock lever 70 is not fixed by the lever lock confirmation sensor 14 in step 202.

（ステップ２０３）。 If the lever lock 70 is fixed, the process proceeds to step 204. Next, in step 205, the open / close confirmation sensor 15 determines whether the step base is folded or unfolded. In step 206, parameters are read, and then in step 207, the presence or absence of a passenger is detected by the pressure sensor 16 disposed in the step bases 2L and 2R and the pressure sensor 107a in the seating seat 107. If the weight is 5 kg or more, it is considered that a person is on board, and the traveling device is in the riding mode. （ステップ２０９）。 When the pressure sensor output is 5 kg or less, the traction power assist mode is set as an empty vehicle. （ステップ２０９）。

[0094]

On the other hand, if it is determined in step 205 that the step base is in a folded state, parameters are read in step 210. Thereafter, in step 211, the pressure sensor 16 and the seating seat 107 arranged on the step bases 2L and 2R are read. The presence or absence of a passenger is detected by the pressure sensor 107a. For example, when the pressure sensor output is 5 kg or more, it is considered that a person is on board, and the traveling device is in a riding traveling mode in a folded state. （ステップ２１２）。 When the pressure sensor output is 5 kg or less, the traction power assist mode is set as an empty vehicle. （ステップ２１３）。

[0095]

In step 201, when the control start switch 17 is off, the regenerative power charging mode is set, and the power source (battery) is charged using the regenerative power generated by the rotation of the wheel drive motor when the traveling device is towed. . （ステップ２１４）。

[0096]
Here, in the traction power assist mode in the folded or unfolded state, the output limit value is changed in software by the arithmetic unit 12 or in the drive circuits 8 and 9 for safety to the towed object and surrounding pedestrians. The circuit is switched and regulated.

[0097]
The present invention is not limited to the embodiment described above and shown in the drawings, and various modifications can be made without departing from the scope of the invention.

[0098]

BRIEF DESCRIPTION OF THE DRAWINGS FIG. 1 is an external perspective view showing a configuration of an embodiment of a coaxial two-wheeled vehicle to which a traveling device according to the present invention is applied, in a state where a step base is widened.

It is a rear view of the state which expanded the step stand similarly.

It is a side view of the state which expanded the step stand similarly. It is an external appearance perspective view of the state which folded the step stand. It is a rear view of the state which similarly folded the step stand. It is a side view of the state which similarly folded the step stand. It is a block diagram of the system configuration of a traveling device. It is the fragmentary sectional view which looked at the state which the traveling device expanded, the traveling device main part, the step stand, and the mechanism part of a wheel opened. It is the fragmentary sectional view in the middle of folding of a step stand similarly. It is a fragmentary sectional view at the time of folding of a step stand. It is the bottom view which looked at the state where the step stand was expanded from the bottom. It is a side view of the non-use state of a stand. FIG. 13 is a side view of the stand in use, that is, when the step bases 2L and 2R are folded. It is a side view of the use condition of a stand. It is a front view when a step stand is opened. It is a front view of the state where the lock mechanism when the step base was folded was locked. It is AA sectional view taken on the line of FIG. It is side sectional drawing of the principal part of the traveling apparatus of the state which extended the handle post. It is side sectional drawing of the principal part of the traveling apparatus of the state which shrunk the handle post. It is sectional drawing of a locked position when a handle post is extended in the detailed figure of a lock lever. It is sectional drawing when a lock is similarly released. It is sectional drawing of a locked position when a handle post is shrunk. It is sectional drawing when a lock is similarly released. It is a partial view when a step stand is extended. It is a partial view when the step base 2R is folded. Sectional drawing of a lever lock confirmation sensor is shown. It is each top view which isolate | separated each member which comprises a pressure sensor. It is each side view which similarly separated each member. It is a sectional side view of an operation mechanism. It is the BB sectional view taken on the line of FIG. It is the C-CB sectional view taken on the line of FIG. It is a rear view of the state which extended the traveling device provided with the seat. It is a side view similarly. It is a rear view of the folded state similarly. It is a side view similarly. It is the detailed sectional view which looked at the attachment state of a wheel and a pedal from the back side of a traveling device. It is a more detailed sectional view of a wheel and a pedal. It is sectional drawing of the state which folded the pedal step. It is sectional drawing of the latching | locking part when a pedal step is folded. It is a flowchart figure of the mode selection of a traveling apparatus.

Explanation of symbols

[0099]
DESCRIPTION OF SYMBOLS 1 ... Traveling device main body, 2L, 2R ... Step base, 3L, 3R ... Wheel, 5 ... Handle post, 6 ... Handle, 13 ... Posture detection sensor, 14 ... Lever lock confirmation sensor, 15 ... Opening / closing confirmation sensor, 16 ... Pressure Sensor, 17 ... Control start switch, 19 ... Lever lock fixed electromagnetic plunge, 35, 36 ... Link bar, 50, 51 ... Stand plate, 70 ... Lock lever, 94 ... Operation lever, 107 ... Seating seat, 108 ... Pedal

(19)日本国特許庁(JP)　　(12)公開特許公報(A)　　(11)特許出願公開番号

特開2006-8013

(P2006-8013A)

(43)公開日　平成18年1月12日(2006.1.12)

(51) Int.Cl.		F I			テーマコード（参考）
B62K 17/00	**(2006.01)**	B62K	17/00		3D012
B60L 15/20	**(2006.01)**	B60L	15/20	T	5H115
B62J 11/00	**(2006.01)**	B62J	11/00	G	
B62J 39/00	**(2006.01)**	B62J	39/00	J	
B62K 3/00	**(2006.01)**	B62K	3/00		

審査請求 未請求　請求項の数 16　ＯＬ　（全 25 頁）　最終頁に続く

(21)出願番号　特願2004-190086 (P2004-190086)

(22)出願日　平成16年6月28日 (2004.6.28)

(71)出願人　000002185

ソニー株式会社

東京都品川区北品川６丁目７番３５号

(74)代理人　100122884

弁理士　角田　芳末

(74)代理人　100113516

弁理士　磯山　弘信

(72)発明者　柿沼　武一

東京都品川区北品川６丁目７番３５号　ソニー株式会社内

Fターム(参考)　3D012 BA01

5H115 PG06 PI16 PI29 PO06 PO17 PU01 PV01 QE20 QN03 RB14 SE03 TO02 TO21 TO30 UI32 UI34 UI35

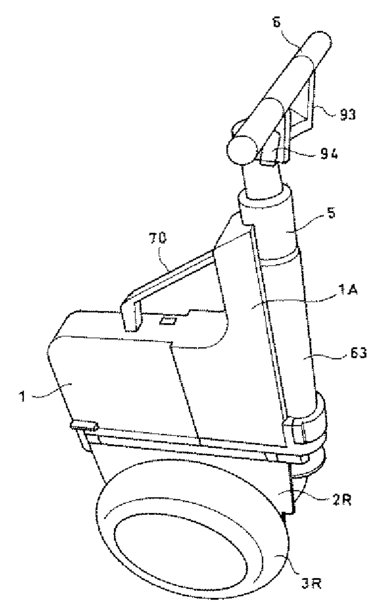
(54)【発明の名称】走行装置

(57)【要約】　（修正有）

【課題】　平行な二輪で走行する二輪車を折り畳むことで投影床面積を小形体にして格納や保管できることはもとより、折り畳み状態において人を乗せて牽引移動も可能にした走行装置を提供する。

【解決手段】　平行に配置された一対の車輪３Ｌ，３Ｒと、搭乗者が搭乗するステップ台２Ｌ，２Ｒを有する走行装置本体１と、搭乗者が保持するハンドル６と、走行装置本体１の走行時の角速度及び加速度を検出して走行装置本体１の角速度及び走行加速度を制御する姿勢検出センサとを備え、所定の走行状態を維持するための信号を駆動回路に出力し、車輪を駆動する走行装置であって、　ステップ台２Ｌ，２Ｒは走行装置本体から車輪３Ｌ，３Ｒ側に左右に分割され回動可能に連結され、走行装置本体のロックレバー７０を引き上げることで、ステップ台２Ｌ，２Ｒを広げた状態から走行装置本体側との連結部を頂点にしてリンク機構と共に畳まれ、車輪間幅が縮小される折り畳み構造にした。

【選択図】図４



【特許請求の範囲】
【請求項1】
平行に配置された一対の車輪と、
前記車輪を独立に回転駆動する駆動手段と、
前記車輪を回転自在に支持し搭乗者が搭乗するステップ台を有する走行装置本体と、
前記走行装置本体から立設したハンドルポスト及び搭乗者が保持するハンドルと、
前記走行装置本体には、ピッチ軸、ヨー軸、ロール軸の少なくともいずれかの軸の角速度を検出するジャイロセンサと、Ｘ軸、Ｙ軸、Ｚ軸の少なくともいずれかの軸の加速度を検出する加速度センサとを設け、前記走行装置本体の走行時の角速度及び加速度を検出して前記走行装置本体の角速度及び走行加速度を制御する姿勢検出センサと、
を備え、前記姿勢検出センサからの信号から演算装置を介して所定の走行状態を維持するための信号を駆動回路に出力し、前記駆動手段によって前記車輪を駆動する走行装置であって、
前記走行装置本体は、前記両車輪間の中央部に位置し、前記ステップ台は前記走行装置本体から前記車輪側に左右に分割され回動可能に連結されると共に、前記ステップ台の裏面側で前記走行装置本体側と前記車輪側との間にリンク機構を連結して回動可能に構成され、
前記走行装置本体部分を引き上げることで、前記ステップ台を広げた状態から前記走行装置本体側との連結部を頂点にして前記リンク機構と共に畳まれ、前記車輪間幅が縮小される折り畳み構造にされることを特徴とする走行装置。
【請求項2】
前記走行装置本体内に、前記駆動手段の電源用バッテリーと、前記姿勢検出センサが収容されていることを特徴とする請求項１に記載の走行装置。
【請求項3】
走行装置は、前記広げた状態と折り畳み状態を検出し、制御モードが変更されることを特徴とする請求項１に記載の走行装置。
【請求項4】
走行装置は、前記広げた状態と折り畳み状態のいずれにおいても人が搭乗して移動が可能であることを特徴とする請求項１に記載の走行装置。
【請求項5】
前記制御モードは、走行装置を広げた状態での搭乗走行モード、牽引パワーアシストモード、牽引回生電力充電モードのいずれかのモードに変更可能であり、走行装置の折り畳み状態での搭乗走行モード、牽引パワーアシストモード、牽引回生電力充電モードのいずれかのモードに変更可能であることを特徴とする請求項３に記載の走行装置。
【請求項6】
走行装置の折り畳み状態では前記車輪の接地面側にスタンドプレートが突き出し、駐輪時のスタンドとなることを特徴とする請求項１に記載の走行装置。
【請求項7】
前記スタンドプレートは、ヒンジにより回動可能の２枚のプレート板からなり、走行装置が広げられた状態では前記２枚のプレート板が平面状となって格納され、走行装置が折り畳まれると、前記プレート板が前記ヒンジを頂点に回動し突き出すようにしたことを特徴とする請求項６に記載の走行装置。
【請求項8】
前記スタンドプレートは、走行装置が折り畳まれると、ロック機構によりスタンド位置にロックされ、解除ボタンを操作することでロックが解除されることを特徴とする請求項７に記載の走行装置。
【請求項9】
前記ハンドルポストが伸縮可能に構成されることを特徴とする請求項１に記載の走行装置。

【請求項10】
前記ハンドルポストは、ロックレバーの操作により伸長位置と、短小位置とにロックされることを特徴とする請求項９に記載の走行装置。
【請求項11】
走行装置は、前記広げた状態と折り畳み状態を開閉確認センサで検出されることを特徴とする請求項１に記載の走行装置。
【請求項12】
前記ロックレバーは、ロックレバー確認センサにより検出され、前記ロックレバーのロックが外れていると、警告音や表示により異常を知らせると共に、走行装置を減速停止させることを特徴とする請求項１０に記載の走行装置。
【請求項13】
前記左右のステップ台上には圧力センサを備え、搭乗者の体重移動による検出重量の差により走行装置の旋回操作を可能にしたことを特徴とする請求項１に記載の走行装置。
【請求項14】
前記ハンドルには、走行装置の旋回操作とブレーキ操作を行う操作レバーを備えたことを特徴とする請求項１に記載の走行装置。
【請求項15】
前記旋回操作とブレーキ操作は、１つの操作レバーの操作で行えることを特徴とする請求項１４に記載の走行装置。
【請求項16】
前記走行装置本体に着座シートを備えると共に、前記車輪のタイヤホイールにペダルステップが取り付けられ、走行装置の折り畳み状態において前記着座シートに着座し、前記ペダルステップに足をかけて乗車走行を可能にしたことを特徴とする請求項１に記載の走行装置。
【発明の詳細な説明】
【技術分野】
【0001】
本発明は、例えば人間を搭乗させて平行な二輪で走行する乗り物に使用して好適な走行装置に関し、詳しくは、この種の走行装置を折り畳み構造にして縮小可能にし、折り畳んだ状態で人を乗せて移動したり、走行装置の収納時、省スペースで保管を容易にきるようにしたものである。
【背景技術】
【0002】
例えば人間を搭乗させて平行な二輪で走行する乗り物が提案されている（例えば、特許文献１及び特許文献２参照。）。
【0003】
【特許文献1】特開平４－２０１７９３号公報
【特許文献2】米国特許第５７９１４２５号明細書
【発明の開示】
【発明が解決しようとする課題】
【0004】
上述した二輪で走行する二輪車は機動性の面で優れているが、人が乗る搭乗エリアや車輪間の間隔から最低限必要な床面積を確保しなければならず、このため、日常生活のあらゆる場所での使用を考えた場合、収納や駐輪あるいは公共交通機関への持ち込みにおいては、おのずから制限ができてしまう。
【0005】
また、上述した二輪車を含め一般的な走行装置の場合、折り畳んだ状態は収納したり、保管するのが目的であって、折り畳み状態では走行装置としての機能は失われてしまう。
【0006】
本発明は上述したような点に鑑みてなされたものであって、平行な二輪で走行する二輪車を折り畳むことで投影床面積を小形体にして格納や保管できることはもとより、折り畳

み状態において人を乗せて牽引移動も可能にした走行装置を得ることを目的とする。
【課題を解決するための手段】
【0007】
本発明の目的を達成するため、請求項１の走行装置は、平行に配置された一対の車輪と、車輪を独立に回転駆動する駆動手段と、車輪を回転自在に支持し搭乗者が搭乗するステップ台を有する走行装置本体と、走行装置本体から立設したハンドルポスト及び搭乗者が保持するハンドルと、走行装置本体には、ピッチ軸、ヨー軸、ロール軸の少なくともいずれかの軸の角速度を検出するジャイロセンサと、Ｘ軸、Ｙ軸、Ｚ軸の少なくともいずれかの軸の加速度を検出する加速度センサとを設け、走行装置本体の走行時の角速度及び加速度を検出して走行装置本体の角速度及び走行加速度を制御する姿勢検出センサとを備え、姿勢検出センサからの信号から演算装置を介して所定の走行状態を維持するための信号を駆動回路に出力し、駆動手段によって車輪を駆動する走行装置であって、
走行装置本体は、両車輪間の中央部に位置し、ステップ台は走行装置本体から車輪側に左右に分割され回動可能に連結されると共に、ステップ台の裏面側で走行装置本体側と車輪側との間にリンク機構を連結して回動可能に構成され、走行装置本体部分を引き上げることで、ステップ台を広げた状態から走行装置本体側との連結部を頂点にしてリンク機構と共に畳まれ、車輪間幅が縮小される折り畳み構造にされることを特徴とする。
【0008】
また、請求項２の走行装置によれば、車輪間の中央部の走行装置本体内に駆動手段の電源用バッテリーと、姿勢検出センサが収容されていることを特徴とする。
【0009】
また、請求項３の走行装置によれば、走行装置は、広げた状態と折り畳み状態を検出し、制御モードが変更されることを特徴とする。
【0010】
また、請求項４の走行装置によれば、走行装置は、広げた状態と折り畳み状態のいずれにおいても人が搭乗して移動が可能であることを特徴とする。
【0011】
また、請求項５の走行装置によれば、制御モードは、走行装置を広げた状態での搭乗走行モード、牽引パワーアシストモード、牽引回生電力充電モードのいずれかのモードに変更可能であり、走行装置の折り畳み状態での搭乗走行モード、牽引パワーアシストモード、牽引回生電力充電モードのいずれかのモードに変更可能であることを特徴とする。
【0012】
また、請求項６の走行装置によれば、走行装置の折り畳み状態では車輪の接地面側にスタンドプレートが突き出し、駐輪時のスタンドとなることを特徴とする。
【0013】
また、請求項７の走行装置によれば、スタンドプレートは、ヒンジにより回動可能の２枚のプレート板からなり、走行装置が広げられた状態では２枚のプレート板が平面状となって格納され、走行装置が折り畳まれると、プレート板がヒンジを頂点に回動し突き出すようにしたことを特徴とする。
【0014】
また、請求項８の走行装置によれば、スタンドプレートは、走行装置が折り畳まれると、ロック機構によりスタンド位置にロックされ、解除ボタンを操作することでロックが解除されることを特徴とする。
【0015】
また、請求項９の走行装置によれば、ハンドルポストが伸縮可能に構成されることを特徴とする。
【0016】
また、請求項１０の走行装置によれば、ハンドルポストは、ロックレバーの操作により伸長位置と、短小位置とにロックされることを特徴とする。
【0017】

また、請求項１１の走行装置によれば、走行装置は、広げた状態と折り畳み状態を開閉確認センサで検出されることを特徴とする。

【0018】

また、請求項１２の走行装置によれば、ロックレバーは、ロックレバー確認センサにより検出され、ロックレバーのロックが外れていると、警告音や表示により異常を知らせると共に、走行装置を減速停止させることを特徴とする。

【0019】

また、請求項１３の走行装置によれば、左右のステップ台上には圧力センサを備え、搭乗者の体重移動による検出重量の差により走行装置の旋回操作を可能にしたことを特徴とする。

【0020】

また、請求項１４の走行装置によれば、ハンドルには、走行装置の旋回操作とブレーキ操作を行う操作レバーを備えたことを特徴とする。

【0021】

また、請求項１５の走行装置によれば、旋回操作とブレーキ操作は、１つの操作レバーの操作で行えることを特徴とする。

【0022】

また、請求項１６の走行装置によれば、走行装置本体に着座シートを備えると共に、車輪のタイヤホイールにペダルステップが取り付けられ、走行装置の折り畳み状態において着座シートに着座し、ペダルステップに足をかけて乗車走行を可能にしたことを特徴とする。

【発明の効果】

【0023】

請求項１の発明によれば、平行な二輪で走行する走行装置を折り畳むことで投影床面積を小形体にして格納や保管を容易にすることができ、また、折り畳んだ状態において人を乗せて移動を行うことができる。

【0024】

また、請求項２の発明によれば、走行装置本体内に駆動手段の電源用バッテリーを収容するようにしたので、走行装置自体の省スペースが可能となる。また、車輪間の中央部の走行装置本体内に姿勢検出センサが収容されるようにしたので、走行中の走行装置の傾き姿勢を正確検出することができる。

【0025】

また、請求項３の発明によれば、走行装置の広げた状態と折り畳み状態を検出し、制御モードを変更できるようにしたので、広げた状態と折り畳み状態に応じた制御モードに的確にモード変更ができる。

【0026】

また、請求項４の発明によれば、走行装置の広げた状態と折り畳み状態のいずれにおいても人が搭乗して移動が可能にしたので、走行装置の利便性が向上できる。

【0027】

また、請求項５の発明によれば、制御モードは、走行装置を広げた状態での搭乗走行モード、牽引パワーアシストモード、牽引回生電力充電モードのいずれかのモードに変更可能であり、走行装置の折り畳み状態での搭乗走行モード、牽引パワーアシストモード、牽引回生電力充電モードのいずれかのモードに変更可能にできるようにしたので、広げた状態と折り畳み状態のいずれの場合においても、効果的な走行が可能である。

【0028】

また、請求項６の発明によれば、走行装置の折り畳み状態では車輪の接地面側にスタンドプレートが突き出し、駐輪時のスタンドを備えるようにしたので、折り畳み時の走行装置が転倒することなく駐輪時等において安定して保管できる。

【0029】

また、請求項７の発明によれば、スタンドプレートは、ヒンジにより回動可能の２枚の

プレート板からなり、走行装置が広げられた状態では２枚のプレート板が平面状となって格納され、走行装置が折り畳まれると、プレート板がヒンジを頂点に回動し突き出すようにした構成であるので、走行装置の折り畳み操作に連動して簡単にスタンドとして使用することができる。

【0030】

また、請求項８の発明によれば、スタンドプレートは、走行装置が折り畳まれると、ロック機構によりスタンド位置にロックされ、解除ボタンを操作することでロックが解除されるようにしたので、スタンド状態がみだりに外れることもなく、安定した駐輪が可能となる。

【0031】

また、請求項９の発明によれば、ハンドルポストが伸縮可能に構成されるようにしたことで、走行装置の折り畳み時、ハンドルポストを縮め、さらに小形体にして駐輪、あるいは収納させることができる。

【0032】

また、請求項１０の発明によれば、ハンドルポストはロックレバーの操作により伸長位置と、短小位置とにロックされるようにしたことで、走行装置の走行中、搭乗者の安全を確保することができる。

【0033】

また、請求項１１の発明によれば、走行装置は広げた状態と折り畳み状態を開閉確認センサで検出されるようにしたことで、広げた状態の設定モードと、折り畳み状態の設定モードとを確実に実行できる。

【0034】

また、請求項１２の発明によれば、ロックレバーは、ロックレバー確認センサにより検出され、ロックレバーのロックが外れていると、警告音や表示により異常を知らせると共に、走行装置を減速停止させるようにしたことで、走行装置の走行中、搭乗者の安全を確保することができる。

【0035】

また、請求項１３の発明によれば、左右のステップ台上に圧力センサを備え、搭乗者の体重移動による検出重量の差により走行装置の旋回操作を可能にしたので、搭乗者の体重移動をするだけで走行装置の旋回動作を容易に行うことができる。

【0036】

また、請求項１４の発明によれば、ハンドルには走行装置の旋回操作とブレーキ操作を行う操作レバーを備えたことで、安全性の高い走行が可能となる。

【0037】

また、請求項１５の発明によれば、旋回操作とブレーキ操作は、１つの操作レバーの操作で行えるようにしたことで、操縦が容易となる。

【0038】

また、請求項１６の発明によれば、走行装置本体に着座シートを備えると共に、車輪のタイヤホイールにペダルステップが取り付けられ、走行装置の折り畳み状態において着座シートに着座し、ペダルステップに足をかけて乗車走行を可能にしたので、搭乗者が楽な姿勢での乗車走行ができる。

【発明を実施するための最良の形態】

【0039】

以下、本発明による折り畳み可能な走行装置の実施の形態を図面を参照して説明する。図１は本発明による走行装置を適用した同軸二輪車を通常の走行使用状態である広げた状態の一実施形態の構成を示す全体の外観斜視図、図２は同じく広げた状態の全体の背面図、図３は同じく広げた状態の全体の右側面図、図４は同軸二輪車を折り畳んだ状態の外観斜視図、図５は同じく折り畳んだ状態の背面図、図６は同じく折り畳んだ状態の右側面図である。

【0040】

まず、図１乃至図３において走行装置の全体の主要部の構成について説明する。
符号１が比較的に扁平状な筐体からなる走行装置本体であり、この走行装置本体１の底面から搭乗者が搭乗するための平行な左右一対の折り畳み可能なステップ台2L，２Rが配置されている。両ステップ台2L，２Rの両外端側には一対の車輪3L，３Rがある。両車輪3L，３Rは、それぞれの車輪中心が一直線上になるように配置されると共に、車輪3L，３Rはそれぞれの車軸に備えた車輪駆動モータ4L，４R（以下、車輪駆動ユニット4L，４Rともいう）によって独立に回転駆動される。また、ステップ台2L，２Rは、車輪3L，３Rの車軸中心より重心を低くした位置にある。
【0041】
また、走行装置本体１の前端部（走行装置の進行方向である図３において右端側）には、ハンドルポスト５が上方に垂設され、このハンドルポスト５の上端部に水平にハンドル６が設けられている。
【0042】
図７は上述した走行装置のシステム構成のブロック図を示し、ロータ角度検出器７Ｌを有する車輪駆動モータ４Ｌ、ロータ角度検出器７Ｒを有する車輪駆動モータ４Ｒは、それぞれ駆動回路８，９を介して演算回路（ＣＰＵ）１０及び記憶装置（メモリ）１１を有する演算装置１２に接続されている。演算装置１２には走行装置の姿勢状態を検出するための、ジャイロセンサによるピッチ軸角速度、ヨー軸角速度、ロール軸角速度及び、加速度センサによるＸ軸加速度、Ｙ軸加速度、Ｚ軸加速度を検出する姿勢検出センサ１３と、折り畳み状態を検出するレバーロック確認センサ１４と、ステップ台の折り畳み（開閉）状態を検出する開閉確認センサ１５と、ステップ台2L，２Rへの搭乗を認識する圧力センサ１６と、制御開始スイッチ１７が接続されている。これらの信号から演算装置１２は所定の走行状態を維持するための信号を駆動回路８，９に出力し車輪3L，３Rを駆動する。
【0043】
また、演算装置１２には駆動回路１８を介してレバーロック固定電磁プランジャー１９が接続されている。また、演算回路１２と駆動回路８及び駆動回路１８との間には二次電池からなる電源２０と、走行装置を非常停止するためのスイッチ２１が接続されている。
【0044】
上述した演算回路１２は、検出レバーロック確認センサ１４、開閉確認センサ１５により走行装置の折り畳み状態及び圧力センサ１６により負荷荷重状態（人が搭乗しているか）を認識し、所定の制御モードでの制御を行う。
【0045】
制御モードは、
・走行装置を広げた状態での乗車走行モード
・走行装置を広げた状態での牽引パワーアシストモード
・走行装置を広げた状態での牽引回生電力充電モード
・走行装置を折り畳んだ状態での乗車走行モード
・走行装置を折り畳んだ状態での牽引パワーアシストモード
・走行装置を折り畳んだ状態での牽引回生電力充電モード
である。
【0046】
ここで、乗車走行モードとは、走行装置を広げた状態及び折り畳んだ状態のいずれの場合において、搭乗者の操作によって車輪3L，３Rを回転駆動し、所定の走行速度で走行することをいう。
【0047】
また、牽引パワーアシストモードとは、走行装置を広げた状態及び折り畳んだ状態のいずれの場合において、走行装置が牽引されて搬送されているとき、その搬送状態（牽引力や走行装置の姿勢状態）と予め設定された基準値を比較し、その差に応じて車輪駆動モータにより車輪が回転駆動されることで、牽引車あるいは牽引する人が小さな搬送力で走行装置が搬送されるというものである。

【0048】
　また、牽引回生電力充電モードとは、走行装置を広げた状態及び折り畳んだ状態のいずれの場合において、走行装置が牽引されて搬送されているとき、回生電力を電源（バッテリー）２０に充電することができることをいう。
【0049】
　なお、レバーロック確認センサ１４、開閉確認センサ１５、圧力センサ１６については各機構部の詳細な記載のときに説明する。
【0050】
　〔制御装置の配置〕
　走行装置本体１内には電源２０、姿勢検出センサ１３、演算装置１２が収納され、ステップ台2L,２Rの内部に駆動回路８，９が配置されている。ここで、姿勢検出センサ１３は走行装置本体１内に収納されているため、ステップ台2L,２Rを折り畳んでもセンサ検出軸方向は変化せずソフト上での座標変換等は不要である。
【0051】
　〔ステップ台の折り畳み機構〕
　図８は走行装置本体１とステップ台２L,２R及び車輪3L,３Rの機構部を示した、走行装置の広げた状態を正面側から見た部分断面図、図９は同じくステップ台２L,２Rの折り畳み途中の部分断面図、図１０はステップ台２L,２Rの折り畳み完了時の部分断面図、図１１はステップ台２L,２Rを広げた状態を底面から見た底面図である。
【0052】
　ステップ台２L,２Rは、走行装置本体１に結合される側の前端側（ハンドルポスト５側）が、支承部２ａ,２ａを介して走行装置本体１の端部にそれぞれ軸部２２,２３により回動可能に連結され、後端側は同じく支承部２ｂ,２ｂを介して走行装置本体１の端部にそれぞれ軸部２４,２５により回動可能に連結されると共に、軸部２４,２５にはギア２６,２７を結合し、両ギア２６,２７噛み合うようにされている。
【0053】
　ステップ台２L,２Rの車輪3L,３R側には、車輪駆動ユニット4L,４Rが固定されたモータブラケット３０,３０がそのアーム２８，２９を介して軸３２，３３に回転可能に結合されている。
【0054】
　また、ステップ台２L,２Rの裏面中央部には、ステップ台２L,２Rを広げたり、折り畳みの動作を補助するためのリンク機構が設けられている。このリンク機構は中央の支承軸３４により連結された２本のリンクバー３５,３６を有し、両リンクバー３５,３６の端部は車輪駆動ユニット4L,４Rのモータブラケット３０,３０から伸びた別のアーム３７,３７に軸３８,３８により回動可能に連結されている。また、支承軸３４には二枚のサポートリンク３９,４０が同軸に連結され、サポートリンク３９,４０の他端がステップ台２L,２Rに固定されたプレート４１,４２に軸４３,４４により連結されている。つまり、リンクバー３５とサポートリンク４０及びリンクバー３６とサポートリンク３９はそれぞれ直線をなし、支承軸３４を支点にしてタスキ状をなすようにされている。
【0055】
　このように構成したステップ台２L,２Rの広げた状態では、ステップ台２L,２R上に搭乗者が乗ったときにかかる重量に対して、ステップ台２L,２Rは軸部２４,２５側に近いストッパ面４５,４６が走行装置本体１の裏面端部１ａ,１ａに位置決めされて回動が規制され、また、ステップ台２L,２Rに設けたストッパ片４８,４９が軸３２，３３に近いモータブラケット３０,３０のアーム２８，２９部分に接触して回動が規制され、また、リンクバー３５,３６とにより、ステップ台２L,２Rを水平状態に保つと共に、車輪3L,３Rが平行に保たれる。
【0056】
　ステップ台２L,２Rの折り畳みは次のように動作する。
　図８に示すようにステップ台２L,２Rが広げられた状態から走行装置本体１を引き上げ

ることで、ステップ台2L，２Ｒはギア２６，２７が噛み合った状態で左右対称に軸部２４，２５を回転中心にして回動して折り畳まれていく。このステップ台2L，２Ｒの動作に伴って、図9に示すようにリンクバー３５，３６は支承軸３４を支点にして折り畳み方向に回動する。すなわち、ステップ台2L，2Ｒの折り畳み動作に連動してリンクバー３５，３６が相対的に一定の位置関係を保って折り畳まれることで、車輪3L，3Ｒはほぼ平行な姿勢を保った状態で引き寄せられ、折り畳み動作は図１０で示した位置で完了する。すなわち、車輪3L，３Ｒが図8の広げた状態から図１０に示した折り畳み状態では投影床面積を二分の一に縮小させることができる。

【0057】

〔駐輪時のスタンド及び折り畳み時のロック機構〕

ハンドルポスト５側とは反対側で、ステップ台2L，２Ｒの裏面に二枚の突き合わされるようにしたスタンドプレート５０，５１から構成されている。両スタンドプレート５０，５１の一方の端はステップ台2L，２Ｒにヒンジ軸５２，５３により接続され、突き合わされる端同士もヒンジ軸５４により接続されている。

【0058】

図１２はスタンドの非使用状態、つまり、ステップ台2L，２Ｒを広げた状態のときの側面図、図１３はスタンドの使用状態、つまり、ステップ台2L，２Ｒを折り畳んだ状態のときの側面図である。

【0059】

上述したスタンドはステップ台2L，２Ｒを折り畳む操作を行うことで、スタンドプレート５０，５１がヒンジ軸５４を頂点として下方側に飛び出してほぼ重なり合いスタンドとしての機能を得ることができる。この様子を示したのが図6である。すなわち、走行装置の折り畳み状態では二つの車輪3L，3Ｒの接地とスタンドの設置との三点の接地により安定した状態で駐輪ができるというものである。

【0060】

また、走行装置の折り畳み状態ではステップ台2L，２Ｒが妄りに開かないようにするためのロック機構が備えてある。図１４はステップ台2L，２Ｒを開いたときの正面図、図１５はステップ台2L，２Ｒを折り畳んだときのロック機構がロックされた状態の正面図、図１６は図１５のＡ－Ａ線断面図である。

【0061】

一方のステップ台2Lの端部には、ロック爪片５５を有する固定側ロック爪５６がステップ台2Lに図示しないねじにより固定されている。これに対して他方のステップ台２Ｒの端部には可動側ロック爪５７が設けられている。この可動側ロック爪５７は、図１６に示すようにステップ台２Ｒにねじ固定されたロック爪ベース５８と、ロック爪ベース５８に軸ピン５９により回動可能に支持されたロック爪操作部６０と、ロック爪ベース５８との間に介在されてロック爪操作部６０をロック方向へ付勢する圧縮ばね６１とから構成されている。

【0062】

このように構成したロック機構は、図１４に示したステップ台2L，２Ｒが広げられた状態から、軸部２４，２５を回動支点にして矢印で示したように折り畳まれていき、ステップ台2L，2Ｒが折り畳まれ直前になると、ロック爪操作部６０の先端部のロック爪６０ａに形成された斜面６０ｂロック爪が固定側ロック爪５６のロック爪片５５の先端部に形成された斜面５５ａに接触し、この後、ロック爪操作部６０のロック爪６０ａが固定側ロック爪５６のロック爪片５５を乗り越え、ロック爪６０ａが圧縮ばね６１のばね付勢力によりロック爪片５５にロックされる。これにより、ステップ台2L，２Ｒは折り畳み状態を維持するというものである。

【0063】

ロック機構を解除するときは、ロック爪操作部６０のロック爪６０ａ側とは反対側の押し面５７ａを圧縮ばね６１のばね付勢力に抗して押圧することで、ロック爪６０ａがロック爪５５から外れロック状態が解除される。これにより、ステップ台2L，２Ｒを広げるこ

とが可能となる。
【0064】
〔ハンドルポストの伸縮機構〕
図１７はハンドルポスト５を伸ばした状態の走行装置の要部の側断面図、図１８はハンドルポスト５を縮めた状態の走行装置の要部の側断面図、図１９はロックレバーの詳細な図でハンドルポストを伸ばしたときのロック位置の断面図、図２０は同じくロック解除したときの断面図、図２１はハンドルポストを縮めたときのロック位置の断面図、図２２は同じくロック解除したときの断面図である。
【0065】
ハンドルポスト５は、走行装置本体１から立設した固定ポスト６３に挿入され伸縮可能に取り付けられているものである。固定ポスト６３は走行装置本体１から一体に立ち上がったフレーム１Ａに固定されている。固定ポスト６３の上端部には固定側エンドキャップ６４が固設され、キャップ内壁面にはテーパー面６４ａが形成されている。ハンドルポスト５の下端部にはエンドキャップ６５が取り付けられている。エンドキャップ６５には上記した固定側エンドキャップ６４のテーパー面６４ａと係合するテーパー面６５ａが設けられ、エンドキャップ６５の下端部の一部に傾斜状の保持面６６が形成されている。
【0066】
エンドキャップ６５と走行装置本体１との間には固定側エンドキャップ６４内を通じて軸棒６７が貫通され、軸棒６７の上端部に設けたストッパブロック６７ａがエンドキャップ６５の底面に係合可能にされ、軸棒６７の下端部にはストッパプレート６７ｂが設けられている。また、ハンドルポスト５の途中位置にはＶ字状の係合部６８が形成されている。また、軸棒６７の途中には低い位置に中間ストッパ６９が設けられている。
【0067】
ここで、走行装置本体１の上面部に傾斜状にロックレバー７０が設けられている。ロックレバー７０の一端側は走行装置本体１のフレーム１ａにピン７１により回動可能に支持され、ロックレバー７０から一体に曲げ成形されたアーム部７２に設けられたプランジャー７３が固定ポスト６３に形成した溝孔６３ａを通じてエンドキャップ６５の保持面６６に押し当てられている。これにより、エンドキャップ６５は押し上げられ、ハンドルポスト５は伸びた状態を保つことができると共に、エンドキャップ６５のテーパー面６５ａが固定側エンドキャップ６４のテーパー面６４ａに押し当てられることで、ハンドルポスト５は両テーパー面６４ａ，６５ａの摩擦により回転方向の動きが規制される。
【0068】
また、プランジャー７３によりエンドキャップ６５の保持面６６を押し上げることで、ロックレバー７０のアーム部７２とエンドキャップ６５の保持面６６との接触面に例えば、組み付け誤差により隙間が生じてもエンドキャップ６５を常に上方に押し上げることができる。
【0069】
また、ロックレバー７０の他端側は走行装置本体１の上面に設けた連結機構７４により着脱可能にされている。連結機構７４は走行装置本体１側に設けた被フック部材７５と、ロックレバー７０側にピン７６により回動可能に支持されたフック部材７７と、フック部７７をロック方向に付勢する圧縮ばね７８とから構成されている。
【0070】
フック部材７７は、図１９に示すように被フック部材７５に係合された状態ではロックレバー７０はロックされ、ロックレバー７０はその位置を保持している。したがって、一端側のアーム部７２のプランジャー７３によってハンドルポスト５は押し上げられ、ハンドルポスト５は伸びた位置に固定されている。
【0071】
ここで、ハンドルポスト５が伸びた状態では、走行装置本体１の底面と軸棒６７の下端部に設けたストッパプレート６７ｂとでステップ台2L，２Ｒからそれぞれ張り出しているプレート板７９，８０が挟持され、ステップ台2L，２Ｒを広げた状態の位置で固定するこ

とができる。
【0072】
ハンドルポスト５を縮めるにはフック部材７７の押し面７７ａを押圧操作し、被フック部材７５からフック部材７７のロックを解除してロックレバー７０を図２０に示すように回動させることで、アーム部７２のプランジャー７３によるエンドキャップ６５の押し上げが解除され、ハンドルポスト５はフリーとなって縮めることが可能となる。
【0073】
そして、ハンドルポスト５を縮める操作を行うと、ハンドルポスト５と共にエンドキャップ６５が軸棒６７に沿って下降し、この後、エンドキャップ６５が中間ストッパ６９に当たって軸棒６７を押し下げ、ストッパプレート６７ｂによるプレート板７９，８０の挟持を解除し、そして、軸棒６７の中間ストッパ６９が走行装置本体１の底面に当接し、ハンドルポスト５は最も縮んだ位置になる。このときの動作状態が図２２である。ここで、ハンドルポスト５のＶ字状の係合部６８がロックレバー７０のアーム７２のプランジャー７３の高さに位置する。すなわち、ハンドルポスト５を縮めた後、ハンドルポスト５をロック位置に回動することで、図２１に示すようにプランジャー７３がＶ字状の係合部６８に係合されハンドルポスト５を縮めた位置で固定される。しかも、プランジャー７３がＶ字状の係合部６８に係合された状態ではハンドルポスト５は回転方向の動きも規制される。
【0074】
なお、ハンドルポスト５を伸ばしたり、縮めたりする動作においては、固定側エンドキャップ６４の内周面に形成した樹脂等の摺動部材８１及びエンドキャップ６５の外周面に形成した樹脂等の摺動部材８２により固定ポスト６３内をスムーズに移動可能にすることができる。
【0075】
〔ステップ台の開閉確認センサ〕
図２３はステップ台2L,２Ｒを広げたとき（以下、一方のステップ台２Ｒ側について説明する）の部分図、図２４はステップ台２Ｒを折り畳んだときの部分図である。
【0076】
これによれば、ステップ台２Ｒには例えば、マイクロスイッチ８３のスイッチ本体部８４が取り付けられ、スイッチ本体部８４の可動接点８５がステップ台２Ｒの裏面側に突出するようにして配置されている。すなわち、マイクロスイッチ８３はステップ台２Ｒが折り畳まれている状態では図２４に示すように可動接点８５が突き出すようにされ、ステップ台２Ｒが広げられると、図２３に示すようにステップ台２Ｒの操作部２Ｒａにより可動接点８５が押されてスイッチング操作（オン）されるものである。
【0077】
上述したマイクロスイッチ８３を使用することによって、ステップ台２Ｒが広げられたことをマイクロスイッチ８３のオン動作により電気的に検出される。なお、マイクロスイッチ８３は、ステップ台２Ｒが折り畳まれたときではオフ状態になるので、このオフ状態でステップ台２Ｒが折り畳まれたことを電気的に検出されることにもなる。
【0078】
また、ステップ台の開閉確認センサは、この例ではマイクロスイッチ８３を使用した場合について説明したが、その他、図示しないがステップ台２Ｒに反射板を備え、反射板に反射した光を受光するようにしたフォトセンサを使用してステップ台の開閉を検出するようにすることも可能である。さらに、ステップ台の金属部分を検出する近接センサの使用も可能である。
【0079】
〔レバーロック確認センサ〕
図２５にレバーロック確認センサの断面図を示す。
レバーロック確認センサは、ロックレバー７０がロック位置でスイッチがオンされるものであり、この例ではレバーロック確認センサ８６は、ロックレバー７０がロック位置に

されたとき発光素子から受光素子に照射される光が遮蔽されることでスイッチがオンされるようにしたフォトセンサ８７である。センサとしてはフォトセンサ８７以外、反射による反射型センサや、金属を検出する近接センサの使用も可能である。

【0080】

レバーロック確認センサ８７は走行装置が制御開始スイッチ１７により制御が行われているときに、レバーロック確認センサ８７のロック外れを検出した場合には、警報音や表示により搭乗者に異常を知らせ、走行装置の速度を減速停止させるようにして安全性を確保することができる。

【0081】

また、ロックレバー７０にはその連結機構７４のフック部材７７をロック位置に強制的に規制する電磁プランジャーソレノイド８８が設けられている。この電磁プランジャーソレノイド８８を配置することで、ロックレバー７０がロック位置でレバーロック確認センサ８７がオンにされ、制御開始スイッチ１７により制御が行われている場合、電磁プランジャーソレノイド８８の進退移動するロット８９によりフック部材７７の動きを規制することにより、走行装置の走行中の振動によるロック外れや折り畳み作業ミスによる危険が防止できる。

【0082】

〔圧力センサ〕

圧力センサは、ステップ台2L,２Rの上面に配置され、搭乗者の重量を検出し、その重量に応じた制御パラメータ（制御ゲイン）を使用し走行装置を駆動するものであり、また、ステップ台2L,２Rの検出された重量の差により走行装置の旋回方向及び旋回量を決定することにより、操作レバーを使用せずに体重移動での旋回操作が可能になるものである。

【0083】

ここで、圧力センサの詳細な構造を一方のステップ台2Lについて図２６及び図２７を参照して説明する。ステップ台2Lの上にはステップ台内部の電気回路からのノイズを遮蔽するための樹脂等からなるベース板９０と、このベース板９０上に圧力を検出するセンサシート９１と、その上である表面側に厚さ０．１㎜程度のステンレスプレート等を基板にし、搭乗者の滑り止めのためのゴムシート９２ａを貼り合わせてセンサシート９１を保護する保護シート９２とから構成されている。

【0084】

センサシート９１としては感圧導電性エラストマー（特公平７－７９００６号公報）、フイルム形圧力センサー（特開平１１－１１８６３３号公報）、あるいは感圧インキ（特表２０００－５０３７６７号公報）に記載されているものが使用可能である。

【0085】

［旋回とブレーキの操作機構］

操作機構は走行装置の旋回操作とブレーキ操作とを一つの操作レバーで可能にするものである。 図２８は操作機構の側断面図、図２９は図２８のＢ－Ｂ線断面図、図３０は同じく図２８のＣ－Ｃ線断面図である。

【0086】

操作機構はハンドル６を支持しているステー９３に取り付けられ、操作レバー９４はフレーム９５に回転可能に取り付けられたシャフト９６に固定ブロック９７を介して固定され、旋回操作時に操作レバー９４を図３０において矢印ａ方向に操作すると、固定ブロック９７に結合されたピン９８がシャフト９６を回転中心に回転し、シャフト９６に配置された捩りばね９９を押し広げることにより適度な操作力（２００～３００ｇ）が発生し、手を離すと捩りばね９９の復帰力により元の位置に戻る。この際、旋回操作量を検出するポテンショメータ１００はフレーム９５に固定され、フレーム９５に対するシャフト９６の回転量を検出する。また、操作レバー９４は手を離したときに中立位置に戻るようにフレーム９５に結合されたシャフト１０１により捩りばね９９のアーム位置が規制されている。

【0087】
　また、ブレーキ操作時は、操作レバー９４を矢印ｂ方向に操作すると、フレーム９５はハンドル６のステー９３に固定されたベースブロック１０３及びこのブロック１０３に固定されたシャフト１０４を回転軸として回転する。また、シャフト１０４には振りばね１０５が取り付けられ、フレーム９５は振りばね１０５により矢印ｂとは反対方向に押され、操作時に適度な操作力（３００～４００ｇ）が発生し、手を離すと元の位置に戻る。この際、ブレーキ操作量を検出するポテンショメータ１０６はフレーム９５に固定され、フレーム９５に対するシャフト１０４の回転量を検出することができる。
【0088】
〔折り畳み時の着座姿勢での乗車〕
　この実施の形態は折り畳み状態で着座姿勢での乗車が可能な走行装置を示したもので、図３１は走行装置を広げた状態の背面図、図３２は同じく側面図、図３３は走行装置を折り畳んだ状態の背面図、図３４は同じく側面図である。
【0089】
　走行装置本体１の上面には着座シート１０７が設けられ、この着座シート１０７内には図２６で説明したものと同様のセンサシート１０７ａが配置されている。車輪3L,３Ｒのホイールに支持されるようにした左右一対のペダル１０８が設けられたものである。これによれば、搭乗者は走行装置を折り畳んだ状態で着座シート１０７に着座し、ペダル１０８に足をかけ走行が可能となる。
【0090】
　図３５は車輪3L,３Ｒとペダル１０８との取り付け状態を走行装置の背面側から見た詳細な断面図であり、その他の構成部分は図１０に示した部分と同一であるので同じ符号を付して説明は省略する。ペダル１０８はタイヤホイール１０９にベアリング１１０を介して回転自在に取り付けられ、これによって、ペダル１０８はタイヤホイール１０９の回転の影響を受けることはない。
【0091】
　図３６は車輪３L側のペダル１０８の詳細な断面図を示す。足を乗せるペダルステップ１１１は軸１１２を介してペダルベース１１３に回動可能に支持され、ペダルベース１１３がベアリング１１０を介してタイヤホイール１０９に回転可能に支持されている。
【0092】
　図３７はステップ台を広げたとき、ペダルステップ１１１が邪魔にならないように折り畳んだ状態の断面図を示す。これによれば、ペダルステップ１１１は図３８に示すようにペダルベース１１３に設けられた圧縮コイルばね１１４によって付勢されたプランジャーボール１１５がペダルステップ１１１に設けられた凹部１１６に係合されることによって折り畳んだ状態が維持される。なお、圧縮コイルばね１１４によって付勢されるプランジャーボール１１５は、対向する側に対をなして形成されている。
【0093】
　図３９に走行装置のモード選択のフローチャートを示す。
　まず、ステップ２０１において、制御開始スイッチ１７がオンである場合、ステップ２０２のレバーロック確認センサ１４によりロックレバー７０が固定されていない場合に音又は表示装置で搭乗者に警告を促す。（ステップ２０３）。レバーロック７０が固定されている場合にはステップ２０４に進み、次に、ステップ２０５において開閉確認センサ１５によりステップ台が折り畳まれているか、広げている状態かを判断し、広げた状態であればステップ２０６においてパラメータの読み込みを行い、この後、ステップ２０７においてステップ台２Ｌ,２Ｒに配置された圧力センサ１６及び着座シート１０７内の圧力センサ１０７ａにより搭乗者の有無を検出し、例えば、圧力センサ出力が５kg以上に場合は人が搭乗しているとみなし、走行装置は乗車走行モードとなる。（ステップ２０９）。圧力センサ出力が５kg以下の場合は空車とし牽引パワーアシストモードとなる。（ステップ２０９）。
【0094】

一方、ステップ２０５において、ステップ台が折り畳んだ状態と判断した場合には、ステップ２１０においてパラメータの読み込みを行い、この後、ステップ２１１においてステップ台２Ｌ，２Ｒに配置された圧力センサ１６及び着座シート１０７内の圧力センサ１０７ａにより搭乗者の有無を検出し、例えば、圧力センサ出力が５kg以上に場合は人が搭乗しているとみなし、走行装置は折り畳んだ状態で乗車走行モードとなる。（ステップ２１２）。圧力センサ出力が５kg以下の場合は空車とし牽引パワーアシストモードとなる。（ステップ２１３）。

【0095】

また、ステップ２０１において、制御開始スイッチ１７がオフの場合は、回生電力充電モードとなり、走行装置の牽引時の車輪駆動モータの回転により発生した回生電力を利用して電源（バッテリー）の充電を行う。（ステップ２１４）。

【0096】

ここで、折り畳み若しくは広げた状態での牽引パワーアシストモード時において、牽引物や周囲の歩行者に対し安全のため、演算装置１２によりソフト的に出力リミット値を変更若しくは駆動回路８，９にて回路を切り替え規制を行うようにする。

【0097】

本発明は、上述しかつ図面に示された実施の形態に限定されるものでなく、その要旨を逸脱しない範囲内で種々の変形実施が可能である。

【図面の簡単な説明】

【0098】

【図1】本発明による走行装置を適用した同軸二輪車の一実施形態の構成で、ステップ台を広げた状態の外観斜視図である。

【図2】同じくステップ台を広げた状態の背面図である。

【図3】同じくステップ台を広げた状態の側面図である。

【図4】ステップ台を折り畳んだ状態の外観斜視図である。

【図5】同じくステップ台を折り畳んだ状態の背面図である。

【図6】同じくステップ台を折り畳んだ状態の側面図である。

【図7】走行装置のシステム構成のブロック図である。

【図8】走行装置本体とステップ台及び車輪の機構部を示した、走行装置の広げた状態を正面側から見た部分断面図である。

【図9】同じくステップ台の折り畳み途中の部分断面図である。

【図10】ステップ台の折り畳み完了時の部分断面図である。

【図11】ステップ台を広げた状態を底面から見た底面図である。

【図12】スタンドの非使用状態の側面図である。図１３はスタンドの使用状態、つまり、ステップ台２Ｌ，２Ｒを折り畳んだ状態のときの側面図である。

【図13】スタンドの使用状態の側面図である。

【図14】ステップ台を開いたときの正面図である。

【図15】ステップ台を折り畳んだときのロック機構がロックされた状態の正面図である。

【図16】図１５のＡ－Ａ線断面図である。

【図17】ハンドルポストを伸ばした状態の走行装置の要部の側断面図である。

【図18】ハンドルポストを縮めた状態の走行装置の要部の側断面図である。

【図19】ロックレバーの詳細な図でハンドルポストを伸ばしたときのロック位置の断面図である。

【図20】同じくロック解除したときの断面図である。

【図21】ハンドルポストを縮めたときのロック位置の断面図である。

【図22】同じくロック解除したときの断面図である。

【図23】ステップ台を広げたときの部分図である。

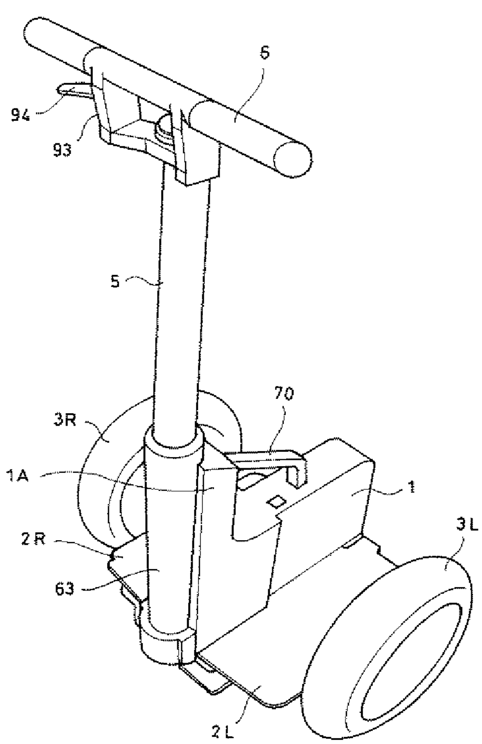
【図24】ステップ台２Ｒを折り畳んだときの部分図である。

【図25】レバーロック確認センサの断面図を示す。

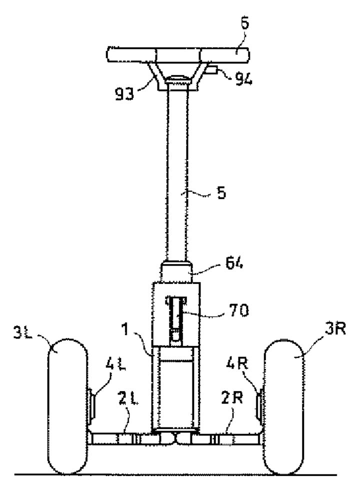
【図26】圧力センサを構成する各部材を分離したそれぞれの平面図である。

【図27】同じく各部材を分離したそれぞれの側面図である。
【図28】操作機構の側断面図である。
【図29】図２８のＢ－Ｂ線断面図である。
【図30】同じく図２８のＣ－ＣＢ線断面図である。
【図31】着座シートを備えた走行装置を広げた状態の背面図である。
【図32】同じく側面図である。
【図33】同じく折り畳んだ状態の背面図である。
【図34】同じく側面図である。
【図35】車輪とペダルとの取り付け状態を走行装置の背面側から見た詳細な断面図である。
【図36】車輪とペダルのさらに詳細な断面図である。
【図37】ペダルステップを折り畳んだ状態の断面図である。
【図38】ペダルステップを折り畳んだときの係止部分の断面図である。
【図39】走行装置のモード選択のフローチャート図である。
【符号の説明】
【0099】
　１…走行装置本体、２Ｌ，２Ｒ…ステップ台、３Ｌ，３Ｒ…車輪、５…ハンドルポスト、６…ハンドル、１３…姿勢検出センサ、１４…レバーロック確認センサ、１５…開閉確認センサ、１６…圧力センサ、１７…制御開始スイッチ、１９…レバーロック固定電磁プランジ、３５，３６ …リンクバー、５０，５１…スタンドプレート、７０…ロックレバー、９４…操作レバー、１０７…着座シート、１０８…ペダル

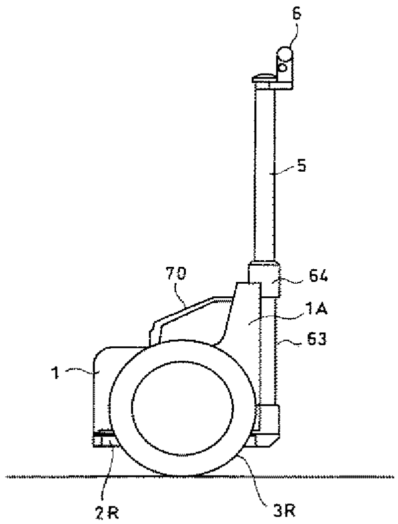
【図1】



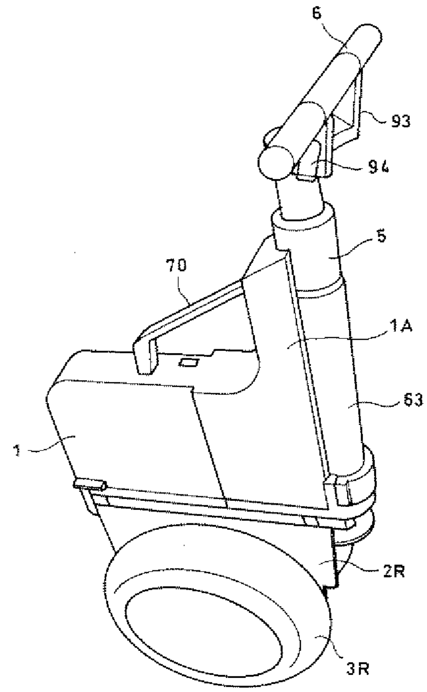
【図2】



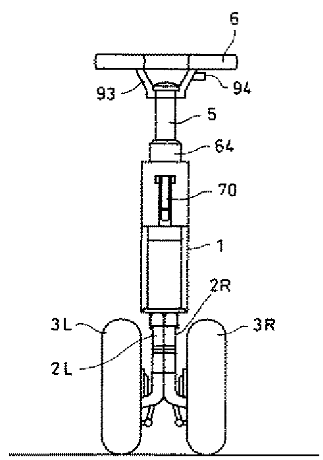
【図3】


6
5
70
64
1A
63
1
2R
3R

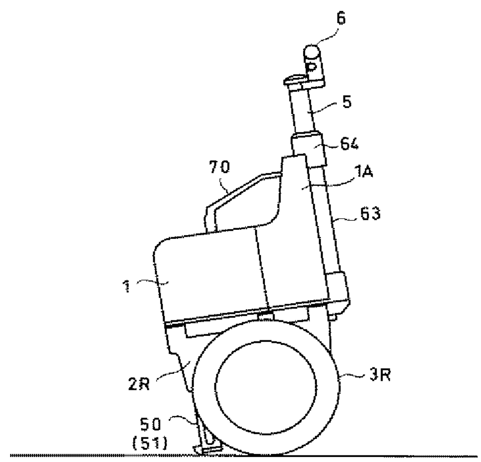
【図4】


6
93
94
5
70
1A
63
1
2R
3R

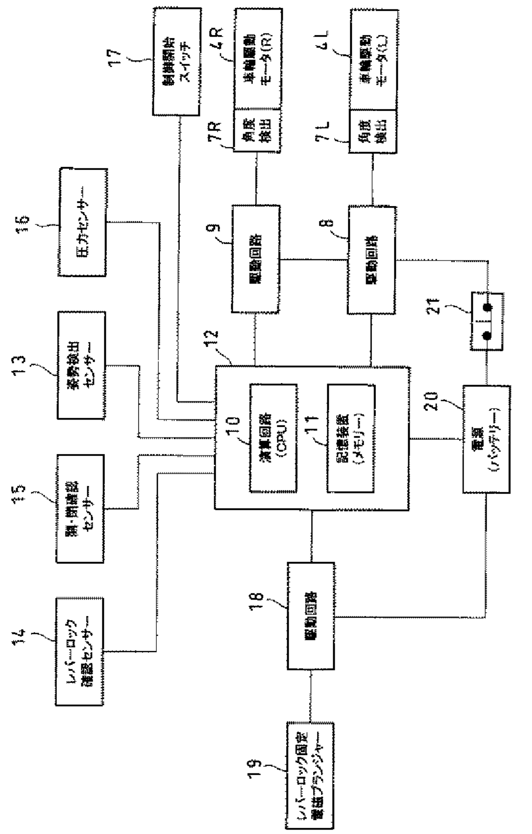
【図5】


6
93
94
5
64
70
1
2R
3L
3R
2L

【図6】


6
5
64
70
1A
63
1
2R
3R
50
(51)

【図7】



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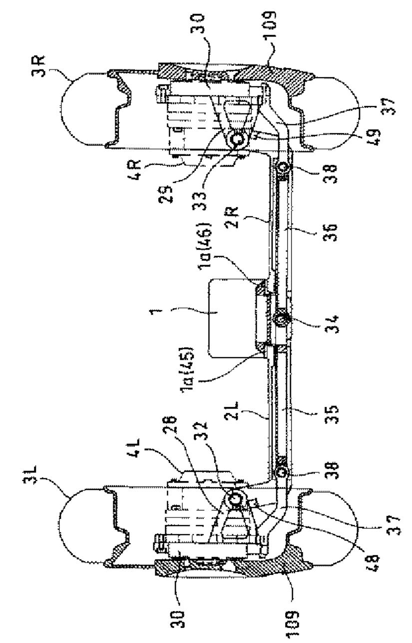

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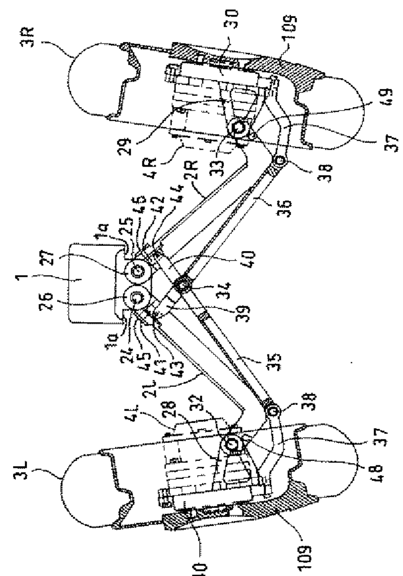

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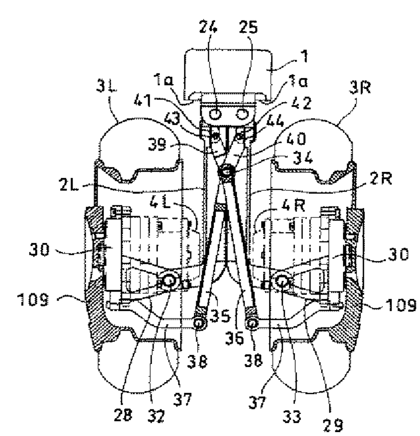

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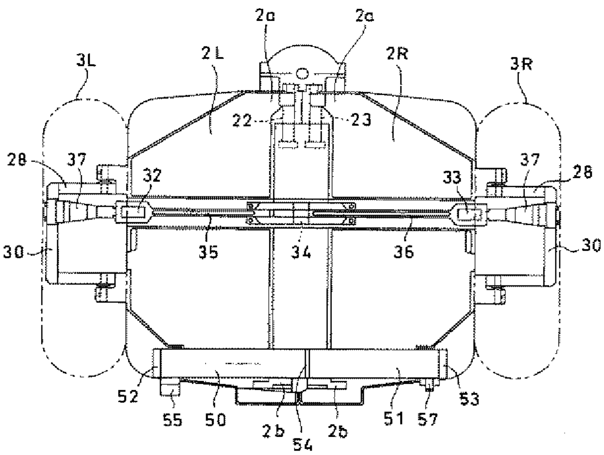
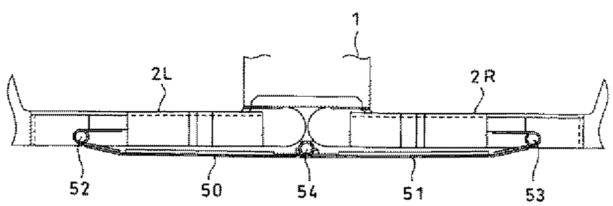
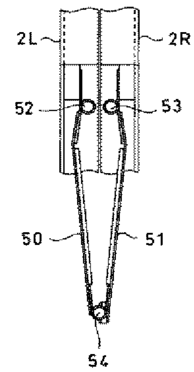


【図12】



【図13】



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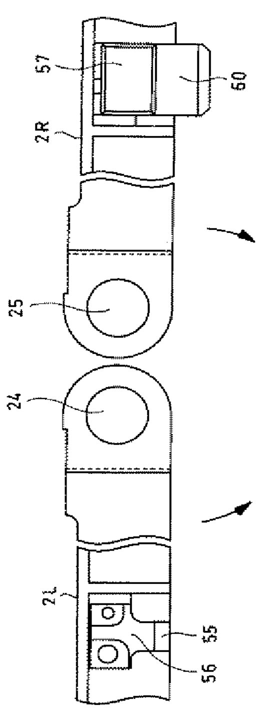

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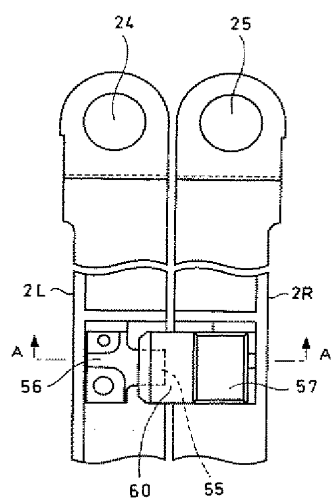

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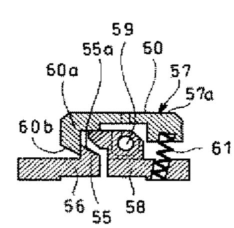

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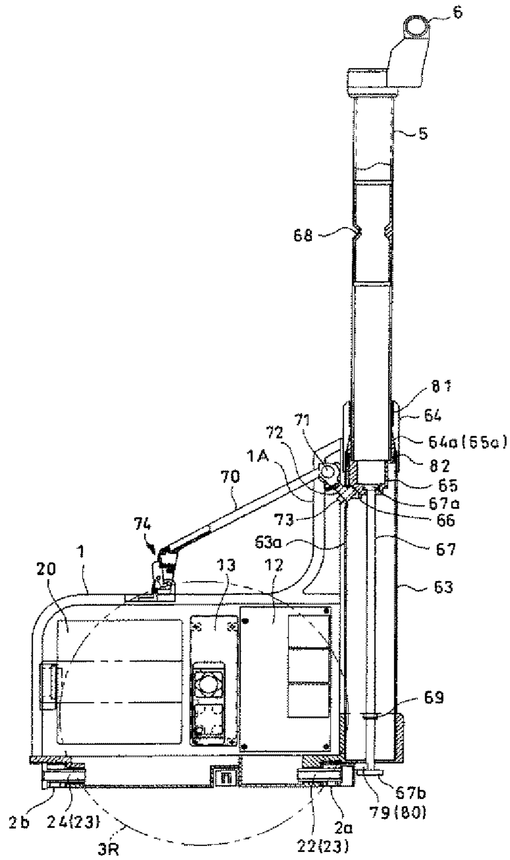

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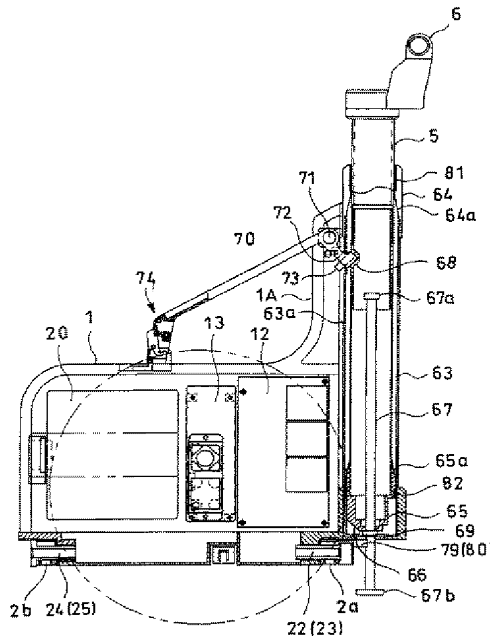

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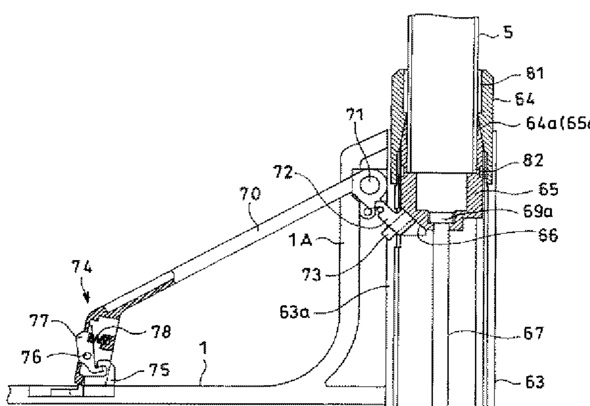

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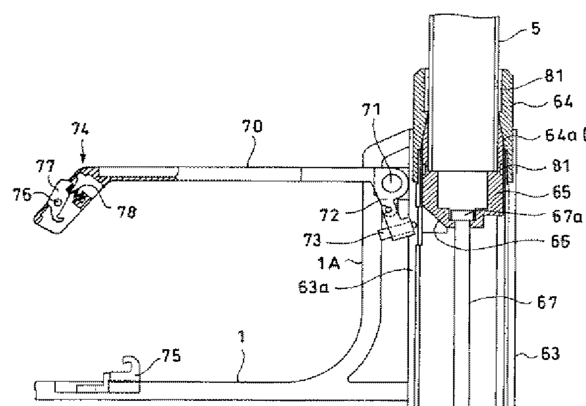

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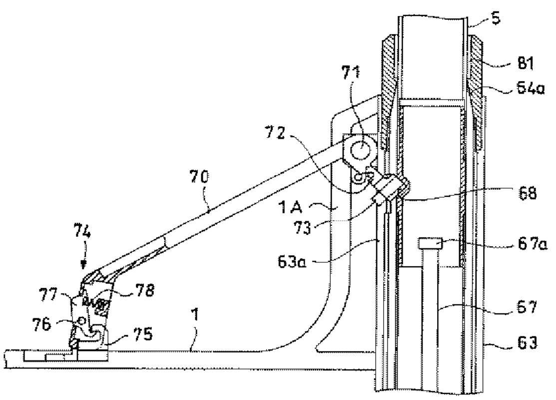

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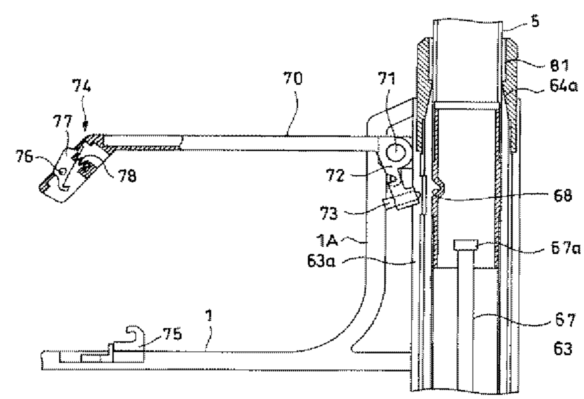

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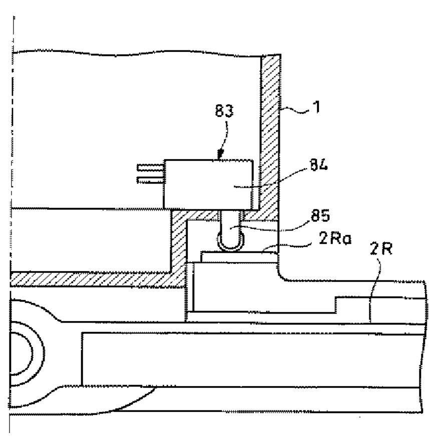

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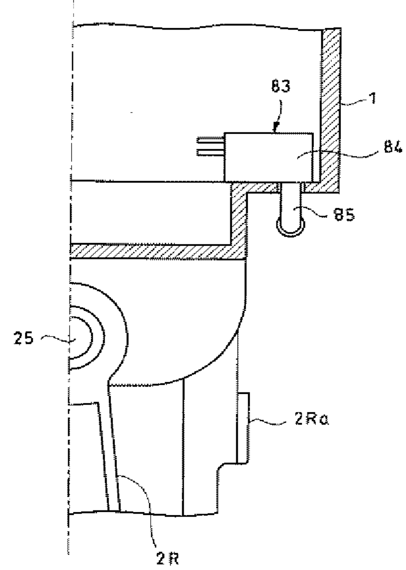

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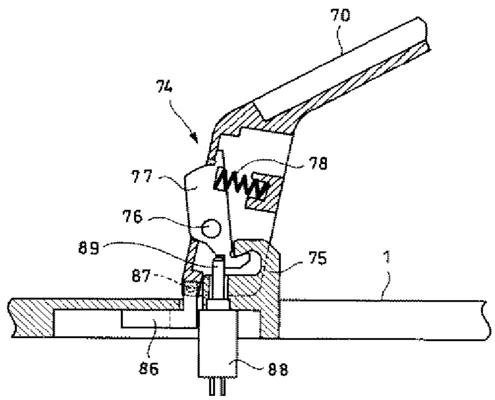

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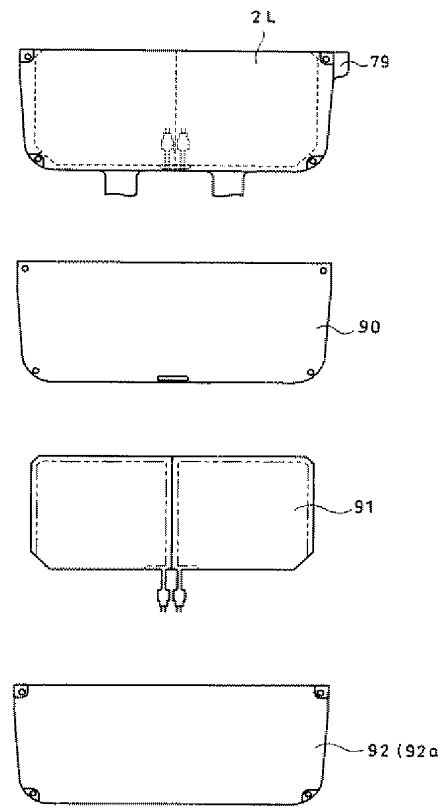

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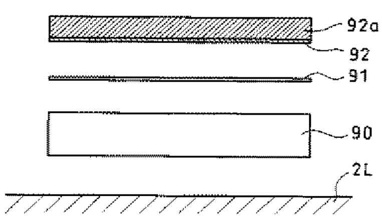

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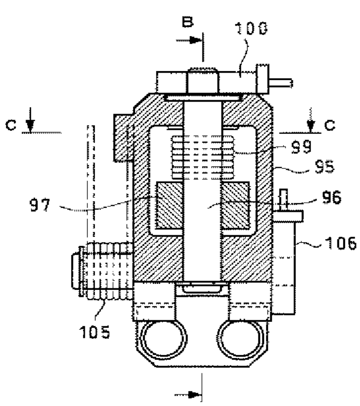

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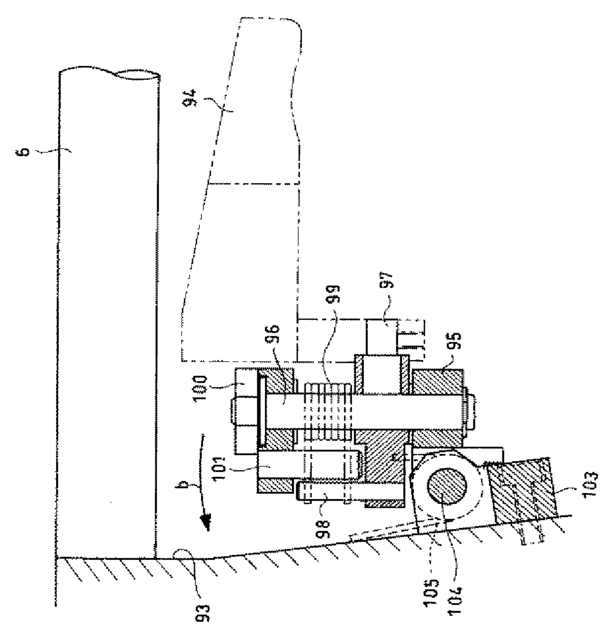

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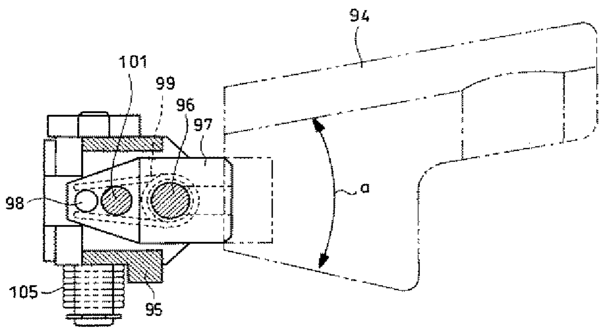

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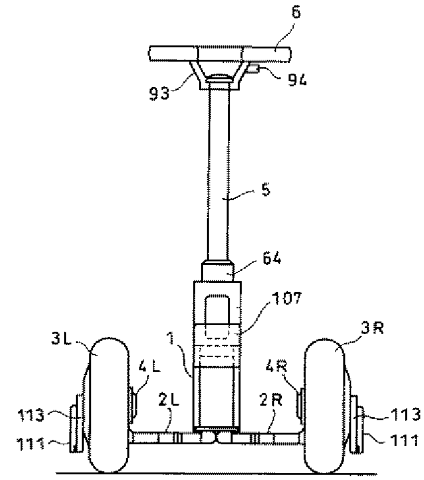
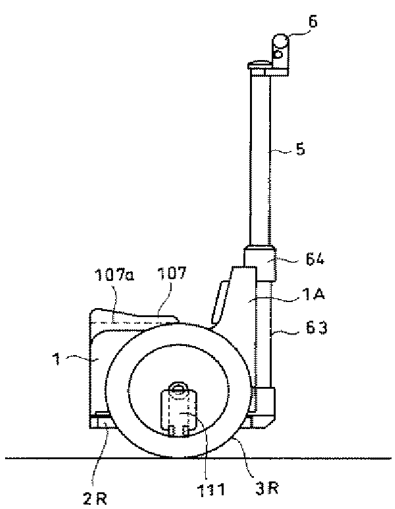


【図32】



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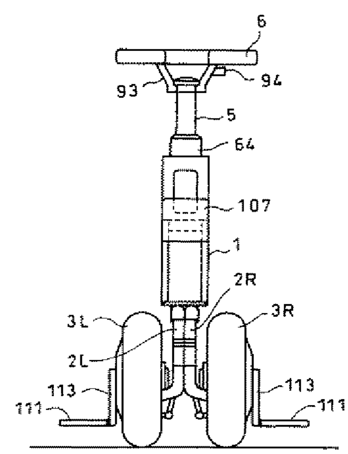

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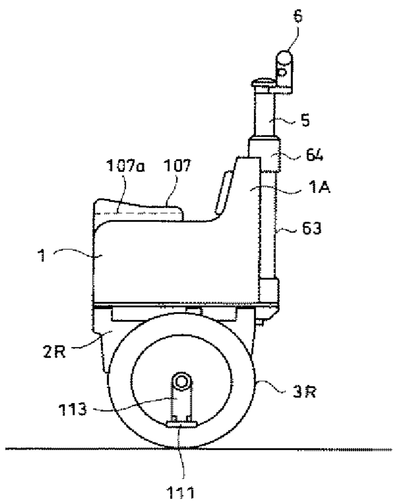

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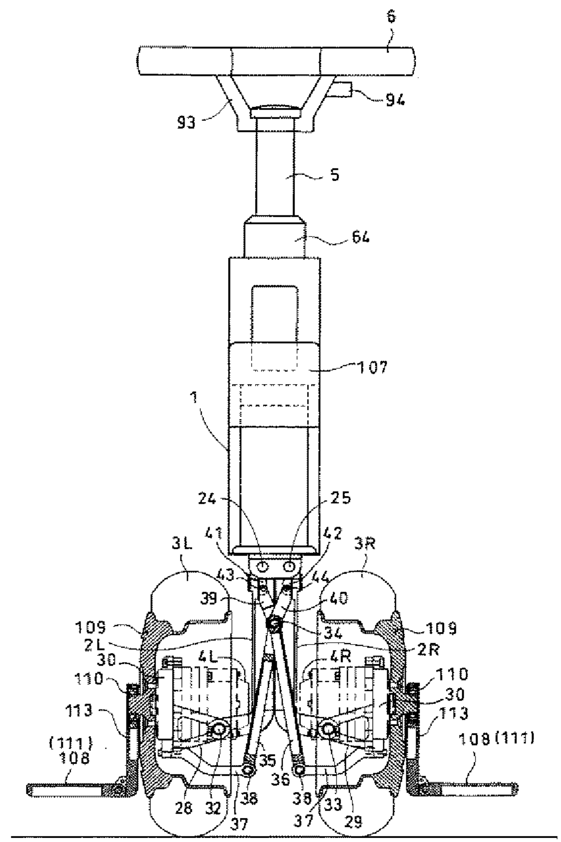

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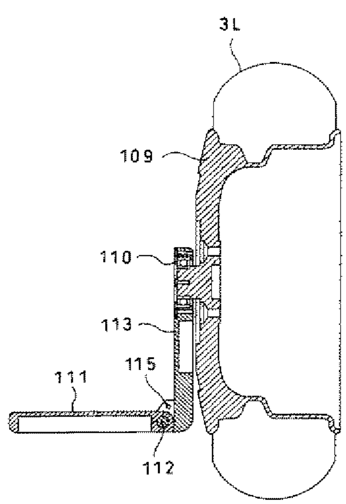

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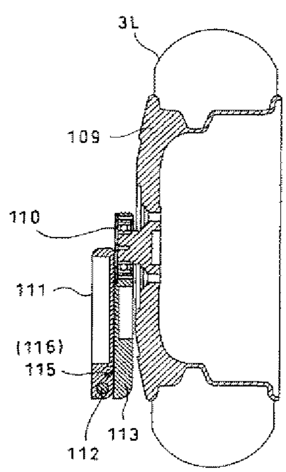

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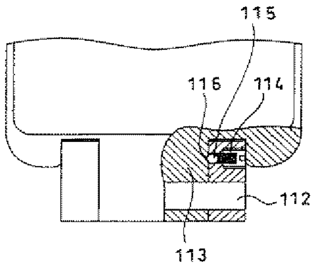
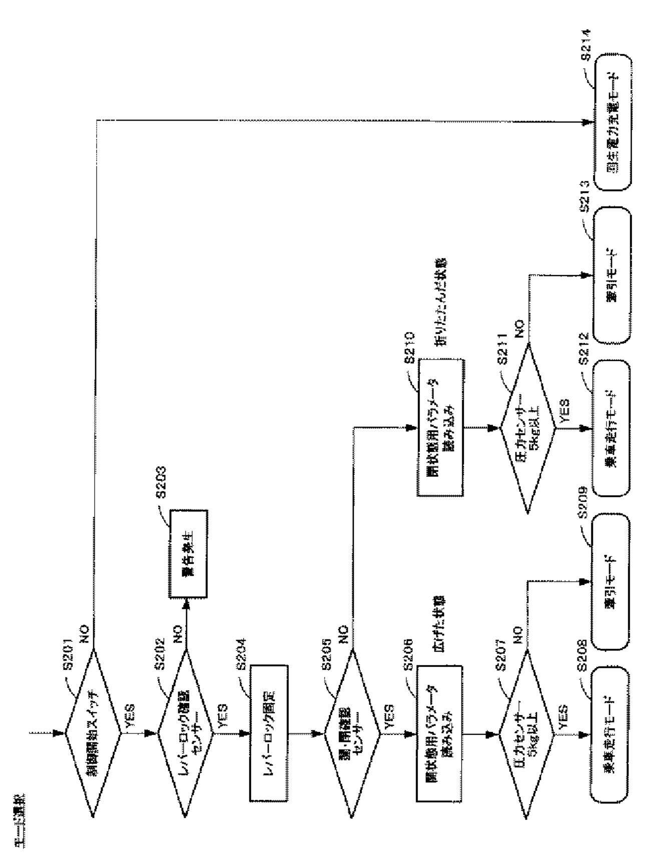

115
116
114
112
113

【図39】


モード選択
S201
制御開始スイッチ
YES
NO
S202
レバーロック確認センサー
S203
警告発生
S204
レバーロック固定
S205
開・閉確認センサー
S206
開状態用パラメータ読み込み
広げた状態
S207
圧力センサー5kg以上
S208
乗車走行モード
S209
牽引モード
S210
閉状態用パラメータ読み込み
折りたたんだ状態
S211
圧力センサー5kg以上
S212
乗車走行モード
S213
牽引モード
S214
回生電力充電モード

(51)Int.Cl.		F I		テーマコード（参考）
Ｂ６２Ｋ　15/00	(2006.01)	Ｂ６２Ｋ　15/00		
Ｂ６２Ｌ　3/02	(2006.01)	Ｂ６２Ｌ　3/02	Ｚ	

Espacenet

Bibliographic data: JP2014151721 (A) — 2014-08-25

WHEEL WALKER

Inventor(s): KOSUGE TETSUYA + (KOSUGE TETSUYA)

Applicant(s): TOYO PARTS KK + (TOYO PARTS KK)

Classification: - **international:** ***B62K17/00; B62K3/00; G05D1/08***
- **cooperative:**

Application number: JP20130021791 20130206 Global Dossier

Priority number(s): JP20130021791 20130206

Abstract of JP2014151721 (A)

PROBLEM TO BE SOLVED: To improve safety of traveling by maintaining stability without moving a body weight basically in traveling, concerning improvement of a self-standing type two-wheeled traveling device that is compact and used for moving people on board.SOLUTION: A wheel walker includes: a frame shaft with wheels 5L, 5R at right-and-left both ends, respectively; motors for driving respective wheels 5L, 5R, individually; a L step pedal 6L where a left foot of a rider is carried on and a R step pedal 6R where a right foot of the rider is carried on, which are turnably mounted independently with each other to the frame shaft; a sensor for driving and controlling the motor of each wheel according to an inclination direction and an inclination angle of each of the L step pedal 6L and the R step pedal 6R, and a control element for performing calculation by receiving a signal of the sensor; and a power supply unit 8 for driving at least the sensor, the control element and the motors.

Notice

CLAIMS JP2014151721

1.

L on which the left foot of the occupant rides on a frame shaft having wheels on both left and right ends, a motor for individually driving each wheel, and a frame shaft that is rotatably attached to the frame shaft. The step pedal and the R step pedal on which the right foot rides, the sensor for driving and controlling the motor of each wheel according to the inclination direction and the inclination angle of the L step pedal and the R step pedal, and the signal of the sensor are received. A wheel walker comprising a control element that calculates and a power supply unit that drives at least a sensor, a control element, and a motor.

2.

The L step pedal on which the rider's left foot rides and the R step pedal on which the right foot rides are mounted so that their substantially central portions are coaxial with respect to the frame axis and at least one of them is rotatable with respect to the frame axis. However, the wheel walker according to claim 1.

3.

The L step pedal on which the left foot of the occupant rides and the R step pedal on which the right foot rides are mounted integrally with the wheel on one side, which are attached to the frame axis so as to be rotatable independently of each other. The wheel walker according to claim 1 or 2.

4.

The L step pedal on which the passenger's left foot rides and the R step pedal on which the right foot rides are attached to the frame shaft via the left and right boards on which the power supply unit and the like are mounted and the respective auxiliary frames of the left and right boards. The wheel walker according to any one of claims 1 to 3.

5.
The wheels attached to the left and right ends of the frame shaft are those in which the axle is attached near the upper end of the hinge via a hinge having a certain length above the portion fixed to both ends of the frame shaft. The wheel walker according to any one of claims 1 to 4.

6.
The wheel walker according to any one of claims 1 to 5, wherein a drive source for driving a wheel provided at both ends of the frame shaft is an in-wheel type wheel provided with a drive motor in the wheel.

7.
The wheel walker according to any one of claims 1 to 6, wherein driving sources for driving wheels provided at both ends of the frame shaft are respectively provided on left and right substrates attached to the frame shaft.

8.
The wheel walker according to any one of claims 1 to 7, wherein the computing element incorporates a setting for synchronizing the rotation of the left and right wheels when the traveling speed exceeds the fast walking speed of a human.

9.
The pair of light shielding sensors is attached to any one of claims 1 to 8, wherein a position of the L step pedal and the R step pedal near each wheel is slightly higher than the upper surface of each pedal. Wheel walker.

DESCRIPTION JP2014151721

Abstract: [PROBLEMS] To improve a compact self-supporting two-wheeled traveling device for carrying a person and to maintain stability without basically moving weight during traveling and to improve traveling safety. A frame shaft having wheels 5L and 5R at left and right ends, a motor for individually driving the wheels 5L and 5R, and a rotatable shaft independently attached to the frame shaft. However, the L step pedal 6L on which the rider's left foot rides and the R step pedal 6R on which the right foot rides, and the motors of the wheels described above according to the respective inclination directions and inclination angles of the L step pedal 6L and the R step pedal 6R. And a control element that calculates the signal received from the sensor, and a power supply unit 8 that drives at least the sensor, the control element, and the motor. [Selection] Figure 1

ホイールウォーカー

[0001]
The present invention relates to an improvement of a compact self-supporting two-wheeled traveling device for carrying a person and enables traveling in a free direction while maintaining stability without basically moving weight when traveling, Another object is to improve driving safety.

[0002]

Several self-supporting two-wheel travel devices have been proposed.

For example, both ends of the coaxial portion are provided with a pair of wheels that are rotated by different driving sources (motors), and are based on an inclination angle signal and an inclination angular velocity signal by an inclination angle sensor of a frame mounted horizontally on the moving shaft portion. The angle detection means is connected to an adder, and the output side of the adder is connected to each of the drive sources described above, and the rotational drive source is driven in response to the tilting operation of the frame. It is known that it is maintained horizontally (Japanese Patent Laid-Open No. 62-181985).

[0003]

Further, the vehicle body inclination angle detected by the detection means is sampled and detected in a short time unit, and the control torque of the wheel driving motor is calculated based on the detected sampling value, and the wheel is adjusted according to the control torque value. A technique has been disclosed in which when the vehicle body is tilted, the wheel is moved in the tilting direction by a necessary amount to restore the vehicle body tilt (Japanese Patent Laid-Open No. 63-305082 / Patent No. 2530652).).

[0004]

In addition, by detecting the tilt angle of the vehicle body by a plurality of gyro sensors, the state of the motor control device is fed back by this gyro sensor signal so that the vehicle body is horizontal, so that the vehicle body state is always kept horizontal. A technique for traveling is also disclosed (US Pat. No. 5,971,091).

[0005]

Further, the conventional riding parallel two-wheel traveling devices described above often include a frame extending upward or a steering rod extending in the longitudinal direction for performing a traveling operation, which increases the overall weight and makes it bulky. In addition, because it is inconvenient to carry and store, a parallel two-wheeled passenger car has been developed that does not have a handle for driving operation and is compact and can freely control the driving direction according to the user's intention. It was.

[0006]

Specifically, a pair of wheels that are driven by individual motors are attached to both ends of the axle extending in the left-right direction of the base, and the upper boarding base is positioned at the center on the upper surface of the base so The board is provided with a tilting support part that is tiltably supported, and the boarding board is supported by springs at the front, back, left and right, and the boarding board tilt sensor described above is provided at the front, back, left and right of the boarding board, and the base is also provided on the left and right By providing a tilt sensor and a circuit board in the base, signals from the base rate gyro, base tilt sensor, etc. are calculated on the circuit board, and balance control is performed by the principle of the wheel-type inverted pendulum. It is made to become independent by doing, thereby detecting the amount of forward and backward weight movement by the user, and controlling the traveling direction while performing forward and backward control according to the weight movement amount Also disclosed that as performed (JP 2005-94898).

[0007]

Japanese Patent Laid-Open No. Sho 62-181985 Japanese Patent Laid-Open No. Sho 63-305082 / Japanese Patent No. 2530652 Japanese Patent No. 5971091 Japanese Patent Laid-Open No. 2005-94898

[0008]

However, what is disclosed in Patent Document 1 is that the frame extends to a considerable height in the vertical direction as compared with the size of the wheel, as is apparent from the drawing of the publication. Since it has a seat (seat) having a backrest for a passenger to get on top, it becomes large as a whole.

In addition, the tilt angle of the vehicle body and the like is detected by a plurality of gyro sensors such as the angle detection means based on the tilt angle signal and the angular velocity signal of the frame and the vehicle body, including those disclosed in Patent Document 2 and Patent Document 3. Based on this, based on data calculated by an adder, computer device, etc., the drive source such as a motor is driven while accelerating / decelerating to keep the frame, the vehicle body, etc. vertical. Therefore, it is designed on the premise of the weight shift of the passenger.

[0009]

In each of the above-described coaxial two-wheeled vehicles, there is a high risk that the occupant will fall because the wheel cannot follow the change in the vertical direction when the road surface is bumpy or overstepped.

In particular, the inertial moment and load weight as seen from the driving source change greatly due to the difference in the weight of different passengers, and the control system that stabilizes the posture of the frame, vehicle body, etc. becomes unstable, resulting in abnormalities before and after boarding. As a result of vibrations or changes in motion due to differences in the weight of the passenger, the movement of the frame, the vehicle body, etc. is not smooth and a situation with danger is likely to occur. In particular, Patent Document 3 having the operation handle described above In such a structure, there is a high risk that the passenger falls while holding the steering wheel.

In addition, a pair of left and right wheels are attached to one chassis, and the operation of the handle that extends upward is performed by moving the weight of the person on board.

[0010]
In that respect, the parallel two-wheeled passenger cart that controls the posture of the platform on which the occupant is placed by providing a plurality of gyro sensors and a control device disclosed in Patent Document 4 does not have a handle. It can be said that the passenger is able to jump off immediately when becomes unstable.

[0011]

However, the one described in Patent Document 4 is basically mounted with a tilting support portion provided at the center of the upper surface of the base as a fulcrum, and springs are interposed between the front and rear, left and right ends, respectively, with the base. A rider rides on a stepping platform that can be tilted freely, and by the weight movement operation of the rider, control of the traveling direction such as forward and backward movement of the entire carriage according to the weight movement amount by the tilt sensor and the rate gyro It is what you do.

Therefore, even in this case, if the sensor does not function as a physically ideal sensor, it is difficult to realize the sensor, and there is a possibility that the self-supporting state cannot be maintained anytime due to accumulation of sensor error due to mechanical friction.

After all, it is the same as that described in Patent Documents 1 to 3 described above, and the principle is that it is driven by a weight shift operation by the passenger.

[0012]
Therefore, in the point that the wheel cannot follow the change in the vertical direction at the time of overcoming the unevenness of the road surface or the level difference, the passenger is liable to lose the balance, and as a result, the risk of falling is high. This is the same as that disclosed in 3.

[0013]
Therefore, in the present invention, although it is a self-supporting two-wheeled traveling device similar to that disclosed in Patent Document 4, the passenger can travel in a free direction without basically moving the weight. It is possible to safely move forward, backward, rotate, especially shaft rotation. As a basic configuration, it has a frame shaft with wheels on both left and right ends, and a motor that drives each wheel individually. And an L step pedal on which the left foot of the passenger rides and an R step pedal on which the right foot rides, and the L step pedal and the R step pedal, which are attached to the frame shaft so as to be rotatable independently of each other. A sensor for driving and controlling the motor of each wheel according to the inclination direction and the inclination angle, and a control element for calculating in response to a signal of the sensor; Both relates wheel Walker comprising a power supply unit for driving the sensor control device motor.

[0014]

According to the present invention, since it has a simple and compact configuration as described above, it is easy to bring it into a train, a bus, etc., or a vehicle. Since it is unnecessary, it has excellent stability and can travel stably in the free direction regardless of the difference in the weight of the passenger.

Further, in the case of adopting a so-called in-wheel motor system in which wheel driving motors are installed inside the left and right wheels, not only the overall shape can be further reduced, but also the appearance is further simplified.

[0015]

More particularly, each of the L step pedal and the R step pedal on which the left foot of the passenger rides and the R step pedal on which the right foot rides, and the L step pedal and the R step pedal, which are rotatably attached to the frame axis, respectively. Since the vehicle is composed of a sensor for driving and controlling the motors of the respective wheels according to the inclination direction and the inclination angle of the vehicle, and a control element for calculating the signal of the sensor, the passenger is always standing upright. It can be moved forward, backward, swivel, and pivoted by pedal operation using only the left and right ankle tips, and can function as a part of the passenger's body. Suitable for handicapped persons or for transporting baggage in large factories, and for a wide range of uses, such as for sports events for disabled persons and caregivers. It is possible.

In addition, when the vehicle speed exceeds a certain speed that is comparable to that of a human running speed, it is possible to further ensure the safety of the passenger by synchronizing the rotation of the left and right wheels.

[0016]

The perspective view of the wheel walker which is one Example of this invention.

The top view of the wheel walker shown in FIG. The front view of the wheel walker shown in FIG. Explanatory drawing seen from the upper surface (plane) of the wheel walker of this invention. Explanatory drawing seen from the side surface side of the wheel walker of this invention. Structure explanatory drawing of the control apparatus used for the wheel walker of this invention. The control flow (initial routine) of the wheel walker of this invention. The control flow (main routine) of the wheel walker of this invention. The wheel walker control flow of the present invention (subroutine when a timer interrupt occurs). The watchdog timer routine (timer 1) in the wheel walker of this invention. The abnormal value count routine in the wheel walker of this invention. The flow of a vehicle falling collision detection in the wheel walker of this invention. The reference figure showing the use condition of the wheel walker of the present invention.

[0017]

Hereinafter, the configuration of a wheel walker as an embodiment of the present invention will be described with reference to the drawings. The basic configuration of the present invention is that the frame shaft 1 and the wheels 5L and 5R each having a pair of individual rotational drive sources attached to both ends thereof so as to be independently rotatable are mutually connected to the frame shaft 1. The pair of left and right L step pedals 6L and R step pedals 6R that are independently pivotably mounted, and the inclination directions of the respective pedals with the frame shaft 1 of the L step pedal 6L and R step pedal 6R as a rotation fulcrum And a sensor for driving and controlling the motor of each wheel according to the inclination angle, a control element for calculating the signal of the sensor, and a power supply unit for driving at least the sensor, control element, and motor. It will be.

[0018]

In this case, the frame shaft 1 is basically made of a strong round steel bar slightly longer than the width of the person who rides. The left and right sides of the frame shaft 1 are provided with L-shaped auxiliary frames 9L and 9R with respect to the frame shaft 1. And at least one is non-integrally attached. Each of the L-shaped auxiliary frames 9L and 9R has hinges 2 and 2 having a predetermined length extending in the longitudinal direction at the respective end portions, and upper portions of the hinges 2 and 2 respectively. The shaft holes 3 and 3 for attaching the wheel shafts are formed, and the shafts of the wheels 5 and 5 are attached to the shaft holes 3 and 3, respectively.

[0019]

In the wheels 5L and 5R, motors for individually driving the wheels 5L and 5R are incorporated as in- stance driving sources (in-wheel motors), and the power is supplied through the shaft holes 3 and 3 described above. And connected to a control unit described later. Also, one hinge 2 is attached with an auxiliary metal fitting 2a having an inverted L-shaped cross section extending upward, a drive key 2b is attached to the upper end surface thereof, and a control unit which will be described later on the power supply of the drive key 2b. It is connected to the. Reference numeral 3a denotes a shaft hole cap attached to the outside of the wheel.

[0020]

The pair of left and right L step pedals 6L and R step pedal 6R are not fixed to at least one of the frame shaft 1 by means such as through a pipe whose inner diameter is slightly larger than the outer diameter of the frame shaft 1, for example. Through the auxiliary frames 9L and 9R that are loosely fitted, the substrates 4L and 4R that are fixed above the auxiliary frames 9L and 9R, and a power supply unit that is stacked and fixed on the substrates 4L and 4R (in this embodiment, Lithium ion batteries are used) 8 and 8 and two power supply units 8 and 8 on the L step pedal 6L side in the left and right direction through a certain distance between the substrates 4L and 4R. Via a total of 4 fixed fixing bolts 7 of a fixed height, 2 in the front-rear direction and 4 in total on the R step pedal 6R side, 2 in the left-right direction and 2 in the front-rear direction. L step pedal 6L The R step pedal 6R can be rotated independently of each other in the forward and reverse directions with respect to the frame axis 1 via the substrate 4L and the auxiliary frame 9L, and the substrate 4R and the auxiliary frame 9R. Is attached.

[0021]

Reference numerals 11 and 11 denote coil springs attached between the protrusions 10 and 10 and between the protrusions 10 and 10 formed in the vicinity of both ends in the front-rear direction of the substrates 4L and 4R. The L-shaped step pedal 6L and the other substantially box-shaped R-step pedal 6R are less likely to change in angle excessively.

Further, the power supply units 8 and 8 respectively attached to the lower portions of the L step pedal 6L and the R step pedal 6R are connected by the connection cable 12, so that both the power supply units 8 and 8 are substantially one power supply unit. Is configured.

[0022]

Further, a control device 20 using a microcomputer is provided on the lower surface of the L step pedal 6L on one side, and an acceleration sensor 13L and a gyro sensor 14L are attached to a position near the wheel 5 on one side, and near the R step pedal 6R. A distance sensor 15L is attached to the front end. 16L represents an alarm device. The alarm device 16L used in this case is not particularly limited as long as it warns by sound or lamp. 17L is near the upper end of the hinge 2 attached to the end of the auxiliary frame 9L to which the L step pedal 6L and the board 4L supporting the L step pedal 6L are attached, and is slightly higher than the upper surface of the L step pedal 6L. Shows the light-shielding sensor installed.

[0023]

On the other hand, on the R step pedal 6R side, an acceleration sensor 13R, a gyro sensor 14R, a distance sensor 15R, an alarm device 16R, and a light shielding sensor 17R are respectively attached at symmetrical positions to those attached to the L step pedal 6L side. . In the figure, reference numeral 18 denotes a main switch for switching the power supply units 8 and 8 to "ON" and "OFF", and 19 denotes a charging terminal for charging the power supply units 8 and 8.

[0024]
In other words, the pair of left and right substantially step-shaped L step pedals 6L and the other substantially box-shaped R step pedal 6R each have a substantially intermediate portion between the left and right wheels (in-wheel motor). By directly attaching to the wheels 5L and 5R via the frame shaft 1), the left and right step angles are detected separately, so the direction is changed by rotation (shaft rotation) on the spot, or extremely low speed. The frame shaft 1 is configured to be rotatable independently of each other so as to be able to freely travel such as meandering.

[0025]

More specifically, in the wheel walker of the present invention, the pair of left and right box-shaped L step pedals 6L and the other box-shaped R step pedal 6R have a left and right wheel (By directly attaching to the shaft (frame shaft 1) between the in-wheel motor), the step angle is detected separately on the left and right, but the step pedals L and R of the present invention are programmed to maintain the level. In fact, it hardly tilts.

In other words, when the step pedal L / R is tilted by the ankle tip, a reaction force is generated by the drive motor, and the force that tries to tilt the step pedal L / R is detected by the sensors so that "running" and "self-supporting" . Both will be compatible. Therefore, the balance of stability is not lost even while the wheels 5 and 5 are rotating.

[0026]

FIG. 6 shows a specific structure of the control device 20 using a microcomputer. Information on distance sensors 15L and 15R, acceleration sensors 13R and 13L, and gyro sensors 14R and 14L is communicated to the central microcomputer via an A / D converter as needed. Further, information on the light shielding sensors 17R and 17L and information on the start switch 2b are communicated at any time via the analog ON / OFF buffer.

[0027]

Most of these pieces of information include the frame axes of the L step pedal 6L and the R step pedal 6R corresponding to the movement of the human foot when a person gets on the left and right pair of the L step pedal 6L and the R step pedal 6R. The information sensed by the various sensors described above is transmitted to the microcomputer as needed according to the inclination direction and inclination angle and inclination speed of each pedal with 1 as the rotation fulcrum. While the main switch 18 is ON, the microcomputer is supplied with current from the battery (power supply unit) via the constant voltage power supply.

[0028]

The microcomputer is connected with an operating lamp (not particularly shown, but preferably installed near the drive key 2b), and if it exceeds the preset normal value range, the alarm device 16L. Alarm by 16R. The in-wheel motor in the wheels 5 and 5 is controlled and driven through a motor driver for the wheels 5 and 5 such as normal rotation / reverse rotation, drive, and stop according to the calculation result within the normal value in the microcomputer.

[0029]

The control flow of the wheel walker according to the present invention described above is shown in FIG. 〔1． Initial Routine] FIG. An initial routine is shown. When the main switch 18 is turned "ON", "START" is started, and the acceleration sensors 13L and 13R and the separately provided a sensor (gravity direction detection sensor) are in a standby state. Next, "system initialization" is performed, the port relation of the microcomputer is activated, and the gyro sensors 14L and 14R and the separately provided g sensor (angle change between the left and right pair of L step pedal 6L and R step pedal 6R are detected.) Goes into standby.

[0030]

Move on to "Timer 1 initialization (watchdog timer)". In this case, the timer time is set by the "stem initialization" described above. Next, after setting the sensor reading cycle by "timer 2 initialization (g sensor interruption)", "system self-diagnosis" is performed. Here, the battery voltage, motor circuit, microcomputer part, etc. are diagnosed for any abnormalities. If there is a problem, the warning light is turned on and the system is stopped. If there is no problem, "reading of the a sensor R side and L side" is performed, and then "calculation of the step angle with respect to the ground" is performed. In this case, R and L are separately calculated.

[0031]

Next, “Output the rotation direction and rotation speed to the motor controller according to the inclination angle of the step” . In this case, both R and L are performed separately. That is, the rotational direction and rotational speed are set to the motor controller that drives the left and right wheels 5L and 5R in accordance with the inclination angle of the pair of left and right L step pedals 6L and R step pedal 6R that are inclined by the operation of the passenger's toes. Travel control is performed by outputting separately to both the left and right wheels.

[0032]

Then, “A sensor R, L both reached the maximum value? "Is confirmed, and if the maximum value has not been reached, the process returns to the" a sensor R, L side reading "described above again. When both the a sensors R and L reach the maximum values, the next “stores the current step position as a horizontal value in the memory” based on the detection values of the a sensors R and L and the g sensors R and L. . In this state, the “start SW” (2b) can be turned “ON” to start. Boarding is confirmed prior to the actual start. Specifically, “Is there a foot near one of the sensors? In other words, when a person gets on the left and right pair of the L step pedal 6L and the R step pedal 6R, the projection of light or the like between the light shielding sensors 17L and 17R is blocked, so that it can be confirmed that the user has boarded. In this case, it is determined whether or not there is a foot near one of the light shielding sensors 17L and 17R. If boarding can be confirmed, the process proceeds to the main routine of FIG.

[0033]

〔2. Main routine〕 “Main” → “Start SW (2b) “ ON ” ” → “Reading the light shielding sensors 17L and 17R” is performed. In this case, if the light is not shielded, it means that the person is not on the step pedal L / R. Here, it is confirmed whether or not there is a foot in the vicinity of the light shielding sensor. If there is no foot, the process proceeds to “C” in FIG. Next, “distance sensors (15L and 15R) reading” before and after the wheel walker is performed to check whether there is an obstacle. If there is an obstacle, the process proceeds to “C” in FIG. Next, “reading a sensor R · L” → “absorbing temperature drift by the average method and correcting the a sensor value” to check whether it is within the normal value range. If the value deviates from the normal value range, the process proceeds to “B” in FIG.

[0034]

If the a sensor value here is normal, “the motor output value is calculated from the g sensor, the a sensor, and the current speed” . In this case, the value of the a sensor is mainly used for horizontal holding, and the value of the g sensor is used for detecting the angle change of the L step pedal 6L and the R step pedal 6R. Furthermore, it is preferable that parameters such as hunting prevention and horizontal holding force can be set so that the vehicle can run while maintaining the level.

[0035]

Next, “calculate coefficient of turning safety by speed” . In this case, do not make a sharp curve when the speed is high, and for example, when the running speed reaches a speed higher than the normal human fast running speed, the left and right calculation values are set to the same output value (synchronization), etc. Safety measures have been taken. Here, the human fast walking speed is a range of 5 to 8 km / h, more preferably 6 to 7 km / h, as a result of a safety confirmation experiment. In addition, “calculate the output value to the motor controller including the turning safety coefficient” and determine whether it is within the normal value range set in advance. In this case, if the value deviates from the normal value range, the process proceeds to “B” in FIG.

[0036]

If it is within the range of the normal value, it will be “output to the motor controller” as it is, and the “safety routine” will be maintained and the initial “start SW “ ON ” state will be repeated. In this case, when the vehicle is traveling for the first time after the “Start SW “ ON ” , it is preferable that the traveling speed is kept low even when the vehicle is kept level. Such settings can be changed arbitrarily according to the parameters.

[0037]

〔3． Timer Interrupt Routine] FIG. 9 shows a flow of the timer interrupt routine. This is a subroutine that comes here at the time of timer interruption. If there is an interruption by the g sensor after the timer initialization in the above-described initial routine of FIG. 7, "sub-timer 1" performs "g sensor reading"., "Compare with last read value" and determine whether it is within the normal value range. If it is outside the range of the normal value, the process proceeds to "A" in the "system self-diagnosis" of the initial routine shown in FIG. 7, and the warning lamp is turned on and the system is stopped. If it is within the normal value range, "store the change amount in the memory" and return to the original value.

[0038]

〔4. (Watchdog Timer Routine) (Timer 1) In the initial routine of FIG. 7, it is determined whether or not the control itself is normal by "Timer 1 Initialization (Watchdog Timer)" at the system initialization stage shown in FIG. In the "dock timer routine", it is determined whether the control value is normal (control itself is normal). If the control value deviates from the preset normal value range, the process proceeds to "A" in the initial routine shown in FIG. 7 as described above. If the control value is within the normal value range, Return. In this case, the a sensor is mainly responsible for detecting the direction of gravity, and the g sensor is mainly responsible for detecting acceleration / deceleration and horizontal holding.

[0039]

〔5. Abnormal Value Counting Routine] In the main routine of FIG. 8, when "absorbing temperature drift by the average method and correcting the a sensor value" or "calculating the output value to the motor controller including the turning safety coefficient" In this case, when the value deviates from the normal value range, the process shifts to the abnormal value count routine of FIG. 11 and "+1 the error counter" is performed to check whether the error counter is equal to or less than the set value. If it is not less than the set value, the process proceeds to "A" in the initial routine of FIG. If it is less than the set value, the process returns to the top of the main routine of FIG.

[0040]

〔6. In the main routine of FIG. 8, if there is no foot as a result of checking whether there is a foot near the light shielding sensor by "reading light shielding sensors R and L" or an obstacle by "reading before and after distance sensor" If there is an obstacle as a result of the confirmation of the presence or absence of the vehicle, the routine goes to the routine "C" for detecting the falling-off collision in FIG. 12, and "outputs a stop signal to the motor controller". It will move to "Return to".

[0041]
In the above embodiment, the in-wheel motors in the wheels 5L and 5R are controlled and driven through a motor driver that faces the wheels 5L and 5R. Separately driven external motors may be provided below the L step pedal 6L and the R step pedal 6R.

[0042]
In the above configuration, with the main switch 18 set to "ON", the start switch 2b is set to "ON" when boarding, and when a person gets on, the acceleration sensors 13L and 13R detect the gravitational acceleration of the earth when stationary. When the center direction of the earth becomes the maximum maximum, the L step pedal 6A and the R step pedal 6R for riding are set in advance so that they are horizontal at this position, and the gravitational acceleration is maximized after riding. The wheels 5L and 5R are rotationally driven via the rotational drive source (motor controller of the in-wheel motor) of the wheels 5L and 5R at a position where

[0043]

At this time, since the moment of inertia of the drive wheels 5L and 5R is larger, the left and right L step pedals 6L and R step pedal 6R are maintained in a horizontal state.

When riding and moving, the left and right L step pedals 6L and R step pedals 6R are both in the same direction (forward or backward) on the frame shaft 1 from the horizontal state, mainly using the part ahead of the ankle. If the angle is tilted at an arbitrary angle, the horizontal balance of the step pedal 6L and / or 6R is lost, and when the load is applied, the acceleration sensor 13L and / or 13R and the gyro sensor 14L and / or 14R detect this, and the inclined step pedal 6L Then, the wheel 5L and / or the wheel 5R is driven to return the 6R to the horizontal.

[0044]

In other words, in order to maintain the level of the step pedals 6L and 6R, the wheels must be driven in a direction that tries to break the horizontal balance of the step pedals. As a result, if the wheels apply weight to the step pedals 6L and / or 6R. Thus, the vehicle can rotate and travel in the direction in which it wants to travel.

In this case, since the left and right step pedals 6L and 6R are independent of each other, it can be moved back and forth and left and right depending on how the weight is applied to the left and right.

[0045]

In this case, when the step pedals 6L and 6R are leveled at the initial stage, only the acceleration sensors 13L and 13R are used, and during running, the horizontal accuracy is improved and the stepping speed of the step pedals 6L and 6R is detected to drive the wheels. A gyro sensor is also used to pick up the acceleration signal. In the embodiment of the present invention, in order to keep the running stable, the left and right wheels are driven in synchronization with each other during straight running at a certain speed or higher. During specific travel, the wheels 5L and 5R can rotate and move forward or backward via the control device 20 while maintaining an upright balance according to the tilt angle and tilt speed.

[0046]

In this case, when the left and right L step pedals 6L and 6R have different inclination angles, the L step pedal 6L and the R step pedal 6R having the larger inclination angles are added according to the difference in the difference angles. Since the wheel walker turns to the side with a gentle slope, the wheel walker runs while curving. Further, when the left and right L step pedals 6L and R step pedal 6R are tilted in opposite directions on the frame shaft 1, the wheels 5L and 5R of the wheel walker move to rotate in opposite directions. The direction can be changed coaxially on the spot, centering on the person who is on board.

[0047]

According to the present invention, since it has a simple and compact configuration as described above, it is easy to bring it into a train, a bus, etc., or a vehicle. Since it is unnecessary, it has excellent stability and can travel stably regardless of the difference in the weight of the passenger. Further, in the case of adopting a so-called in-wheel motor system in which wheel driving motors are installed inside the left and right wheels, not only the overall shape can be further reduced, but also the appearance is further simplified.

[0048]
More particularly, each of the L step pedal and the R step pedal on which the left foot of the passenger rides and the R step pedal on which the right foot rides, and the L step pedal and the R step pedal, which are rotatably attached to the frame axis, respectively. Since the vehicle is composed of a sensor for driving and controlling the motors of the respective wheels according to the inclination direction and the inclination angle of the vehicle, and a control element for calculating the signal of the sensor, the passenger is always standing upright. The step pedal operation with only the left and right ankles can be used to move forward, backward, turn, and rotate the shaft, and it can function as a part of the passenger's body. It is also suitable for handicapped persons or for transporting baggage in large factories, and for sports events for disabled persons, for caregivers, etc. Range of use is possible.

[0049]
DESCRIPTION OF SYMBOLS 1 Frame shaft 2 Hinge 2a Auxiliary metal fitting 2b Drive key 3 Shaft hole 3a Shaft hole cap 4L Board | substrate 4R Board | substrate 5L Wheel 5R Wheel 6L Step pedal 6R Step pedal 7 Connection fixing bolt 8 Power supply part 9L Auxiliary frame 9R Auxiliary frame 10 Protrusion 11 Coil spring 12 Connection cable 13L Acceleration sensor 13R Acceleration sensor 14L Gyro sensor 14R Gyro sensor 15L Distance sensor 15R Distance sensor 16L Alarm device 16R Alarm device 17L Light shielding sensor 17R Light shielding sensor 18 Main switch 19 Charging terminal 20 Control device

(19) **日本国特許庁(JP)**　(12) **公開特許公報(A)**　(11) 特許出願公開番号
特開2014-151721
(P2014-151721A)
(43) 公開日　**平成26年8月25日(2014.8.25)**

(51) Int.Cl.		F I		テーマコード（参考）
B62K 17/00	***(2006.01)***	B62K 17/00		3D012
B62K 3/00	***(2006.01)***	B62K 3/00		5H301
G05D 1/08	***(2006.01)***	G05D 1/08	Z	

審査請求 未請求　請求項の数 9　ＯＬ　（全 15 頁）

(21) 出願番号　特願2013-21791 (P2013-21791)
(22) 出願日　平成25年2月6日 (2013.2.6)

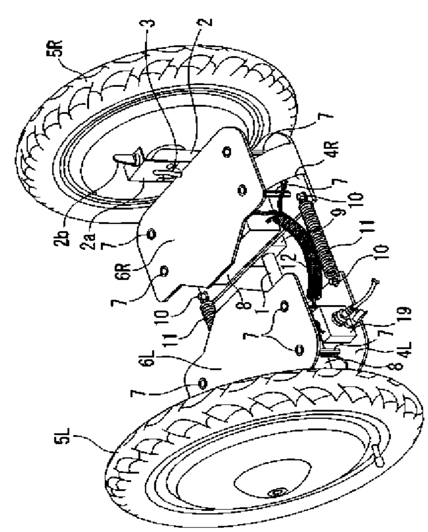
(71) 出願人　594078364
東洋パーツ株式会社
埼玉県秩父郡長瀞町大字岩田８７７番地
(74) 代理人　100070183
弁理士　吉村　公一
(74) 代理人　100131303
弁理士　吉村　徳人
(72) 発明者　小菅　哲也
埼玉県秩父郡長瀞町大字岩田８７７番地
東洋パーツ株式会社内

Ｆターム(参考) 3D012 BB00
5H301 AA01 AA02 BB14 CC08 HH10
JJ01

最終頁に続く

(54) 【発明の名称】ホイールウォーカー

(57)【要約】　(修正有)
【課題】人を乗せて移動するためのコンパクトな自立型二輪走行装置の改良に関し、走行時に基本的に体重の移動をすることなく安定性を維持して走行の安全性を向上させる。
【解決手段】左右両端部にそれぞれ車輪５L，５Rを備えたフレーム軸と、それぞれの車輪５L，５Rを個別に駆動するモーターと、上記フレーム軸に対して互いに独立して回動可能に取り付けたところの、搭乗者の左足が乗るＬステップペダル６Lおよび右足が乗るＲステップペダル６Rと、上記ＬステップペダルＬおよびＲステップペダル６Rのそれぞれの傾斜方向および傾斜角度に応じて前記した各車輪のモーターを駆動制御するためのセンサーおよび該センサーの信号をうけて演算する制御素子と、少なくともセンサー・制御素子・モーターを駆動する電源部８とを備えてなる。
【選択図】図１



【特許請求の範囲】
【請求項１】
左右両端部にそれぞれ車輪を備えたフレーム軸と、それぞれの車輪を個別に駆動するモーターと、上記フレーム軸に対して互いに独立して回動可能に取り付けたところの、搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルと、上記Ｌステップペダルおよびこれらのステップペダルのそれぞれの傾斜方向および傾斜角度に応じて前記した各車輪のモーターを駆動制御するためのセンサーおよび該センサーの信号をうけて演算する制御素子と、少なくともセンサー・制御素子・モーターを駆動する電源部とを備えてなるホイールウォーカー。
【請求項２】
搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルとが、その各々の略中央部をフレーム軸に対して同軸に、且つ少なくともその一方がフレーム軸に対して回転可能に取り付けてあるところの請求項１に記載のホイールウォーカー。
【請求項３】
フレーム軸に対して互いに独立して回動可能に取り付けたところの、搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルが、それぞれ片側の車輪と一体的に構成されているところの請求項１又は請求項２に記載のホイールウォーカー。
【請求項４】
搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルとが、電源部等を載せた左右の基板および該左右の基板のそれぞれの補助フレームを介してフレーム軸に取り付けてあるものである請求項１～３のいずれか１に記載のホイールウォーカー。
【請求項５】
フレーム軸の左右両端に取り付けられる車輪は、フレーム軸の両端部に固定されたところの上方に一定の長さを有するヒンジを介し、該ヒンジの上端付近に車軸が取り付けられているものであるところの請求項１～４のいずれか１に記載のホイールウォーカー。
【請求項６】
フレーム軸の両端部に備えた車輪を駆動する駆動源が、車輪内に駆動モーターを備えたインホイール型の車輪であるところの請求項１～５のいずれか１に記載のホイールウォーカー。
【請求項７】
フレーム軸の両端部に備えた車輪を駆動する駆動源が、フレーム軸に取り付けられた左右の基板上にそれぞれ設けられているところの請求項１～６のいずれか１に記載のホイールウォーカー。
【請求項８】
演算素子には、走行速度がヒトの早足速度を超えたときに左右の車輪の回転を同期させる設定が組み込まれているところの請求項１～７のいずれか１に記載のホイールウォーカー。
【請求項９】
Ｌステップペダルおよびこれらのステップペダルのそれぞれの車輪寄りの位置であって、各ペダル上面よりいくぶん高い位置には、一対の遮光センサーが取り付けられているところの請求項１～８のいずれか１に記載のホイールウォーカー。

【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、人を乗せて移動するためのコンパクトな自立型二輪走行装置の改良に関し、走行時に基本的に体重の移動をすることなく安定性を維持したまま自由方向への走行を可

能にし、また走行の安全性を向上させることを目的とする。

【背景技術】

【０００２】

自立型の二輪走行装置としては、これまでにもいくつか提案されている。たとえば同軸部の両端に、それぞれ別の駆動源（モータ）により回転する一対の車輪を備えるとともに、上記動軸部に水平に取り付けられたフレームの傾斜角度センサによる傾斜角度信号と傾斜角速度信号とによる角度検出手段を加算器に接続し、加算器の出力側を前記したそれぞれの駆動源に接続して前記フレームの傾動動作に対応させて回転駆動源を駆動することにより、フレームを所定の角度（水平）に維持するようにしたものが知られている（特開昭６２－１８１９８５号公報）。

【０００３】

さらに、検出手段により検出される車体の傾斜角度を短時間単位にてサンプリング検出し、検出したサンプリング値に基づいて車輪駆動用モータの制御トルクを算出すると共に、この制御トルク値に応じて車輪を駆動させることにより、車体が傾動した際に車輪を傾動方向に必要量移動させて車体の傾動復元をおこなうようにした技術が公開されている（特開昭６３－３０５０８２号/特許第２５３０６５２号公報）。

【０００４】

また、複数のジャイロセンサにより車体の傾斜角度を検出することにより、このジャイロセンサ信号によって車体が水平となるようにモータの制御装置の状態をフィードバックして常に車体の状態を水平に維持するように走行するようにした技術も開示されている（米国特許第５９７１０９１号公報）。

【０００５】

さらに、上記した在来の乗用平行２輪走行装置は、上方に伸びるフレーム、あるいは走行操作をするための縦方向に伸びるステアリングロッドを備えるものが多く、全体重量が重くなり、しかも嵩張らざるを得ず、持ち運びや収納にも不便であるところから、走行操作用のハンドルを設けず、コンパクトで利用者の意思に沿って走行方向を自在に制御することが可能な平行２輪乗用台車が開発された。

【０００６】

具体的には、基台の左右方向に伸びる車軸両端に個別のモータにより駆動させるようにした一対の車輪を取り付けるとともに、基台の上面には中心に位置して、上方の搭乗台を前後左右に傾動可能に支持する傾動支持部を設け、搭乗台はその前後左右をスプリングにより支持させ、さらに搭乗台の前後左右に上記した搭乗台傾斜センサを設けるとともに、基台にも、左右に基台傾斜センサを設け、さらに基台内には回路基板を備えることにより、基台のレートジャイロ、および基台傾斜センサ等の信号を上記回路基板において演算し、車輪型倒立振り子の原理によりバランス制御をおこなうことにより自立させるようにし、これにより利用者による前後の体重移動量を検出して、体重移動量に応じて前後進制御をおこないつつ走行方向の制御をおこなうようにしたものも開示されている（特開２００５－９４８９８号公報）。

【先行技術文献】

【特許文献】

【０００７】

【特許文献１】特開昭６２－１８１９８５号公報

【特許文献２】特開昭６３－３０５０８２号/特許第２５３０６５２号公報

【特許文献３】米国特許第５９７１０９１号公報

【特許文献４】特開２００５－９４８９８号公報

【発明の概要】

【発明が解決しようとする課題】

【０００８】

しかしながら、特許文献１に開示されているものは、同公報の図面を見ても明らかであるように、車輪の大きさに比べてフレームが垂直方向にかなりの高さにまで伸びており、そ

の頂部に搭乗者が乗るための背もたれを有するシート（座席）を有するために全体として大掛かりなものとなる。それればかりでなく、特許文献２および特許文献３に開示されたものを含め、フレームや車体等の傾斜角度信号と角速度信号とによる角度検出手段など複数のジャイロセンサによって車体等の傾斜角度を検出し、これをもとに加算器やコンピュータ装置等により計算されたデータに基づいてモータ等の駆動源を加・減速しつつ駆動することによりフレームや車体等を垂直に維持するようにしたものであるために、搭乗者の体重移動を前提として設計されたものである。

【０００９】

上記した各同軸二輪車においては路面の凹凸や段差の乗り越え時などにおいて垂直方向の変化に車輪が追随できなくなって搭乗者が転倒する危険性が高い。

とくに異なる搭乗者の体重の相違如何により、駆動源よりみた慣性モーメントや負荷重量が大きく変化し、フレームや車体等の姿勢を安定化させる制御系が不安定となる結果、搭乗の前後において異常な振動を生じたり、あるいは搭乗者の体重の差如何により動作が変化する結果、フレームや車体等の移動がスムースではなくなり危険を伴う事態が生じやすく、なかでも既述した操作ハンドルを有する特許文献３のような構造のものにあっては、搭乗者がハンドルを握ったまま転倒する危険が高い。それればかりでなく、１つのシャーシに左右一対の車輪が取り付けられ、しかも上方に伸びるハンドルの操作を乗車したヒトの体重移動によっておこなうようにしたものである。

【００１０】

その点では特許文献４に開示された、複数のジャイロセンサと制御装置を備え備えることにより搭乗者を乗せる踏み台の姿勢を制御する平行２輪乗用台車にあってはハンドルを有しないために、踏み台が不安定になった場合においては搭乗者は直ちに飛び降りることが可能である点で優れているといえる。

【００１１】

しかし特許文献４に記載のものも、基本的には基台上面中心に設けた傾動支持部を支点として載せられたところの、前後左右各端部付近にそれぞれ基台との間にスプリングを介在させて傾動自在に設けられた踏み台上に搭乗者が乗り、搭乗者の体重移動操作により、傾斜センサーとレートジャイロとによりその体重移動量に応じて台車全体を前進・後退など走行方向の制御をおこなうものである。したがってこの場合にも物理的に理想のセンサーとして機能しなければ実現は難しく、機械摩擦によるセンサーの誤差の蓄積により、いつしか自立状態を維持できなくなるおそれがある。結局のところ既述した特許文献１～３に記載されているものと同様に搭乗者による体重移動操作によって駆動する原理であることには変わらない。

【００１２】

そのために路面の凹凸や段差の乗り越え時などにおいて垂直方向の変化に車輪が追随できなくなって搭乗者がバランスを崩しやすく、その結果転倒する危険性が高いという点においては既述した特許文献１～３に開示されているものと何ら変わらない。

【課題を解決するための手段】

【００１３】

そこで本発明では、前記した特許文献４に開示されたものと同様の自立型二輪走行装置ではあるが、搭乗者が基本的に体重移動をすることなく自由方向に向けた走行を可能にし、しかも安全に前進、後退、回転、とくに軸回転をも可能にしたものであって、基本的な構成としては、左右両端部にそれぞれ車輪を備えたフレーム軸と、それぞれの車輪を個別に駆動するモーターと、上記フレーム軸に対して互いに独立して回動可能に取り付けたところの、搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルと、上記ＬステップペダルおよびＲステップペダルのそれぞれの傾斜方向および傾斜角度に応じて前記した各車輪のモーターを駆動制御するためのセンサーおよび該センサーの信号をうけて演算する制御素子と、少なくともセンサー・制御素子・モーターを駆動する電源部とを備えてなるホイールウォーカーに関する。

【発明の効果】

【００１４】

本発明によれば、上記したような簡単かつコンパクトな構成であるために、電車やバス等、あるいは車輌内に持込みが容易であり、特に搭乗して移動する際に基本的に体重の移動が不要であることから安定性に優れ、また搭乗者の体重の相違に関係なく自由方向に向けた安定した走行が可能である。また、車輪の駆動用モーターを左右のそれぞれの車輪内部に設置する所謂インホイールモーター方式を採用した場合においては、全体形状がより一層小型化できるばかりでなく、外観性もより一層シンプルとなる。

【００１５】

さらにとりわけて、フレーム軸に対して互いに独立して回動可能に取り付けたところの、搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルと、上記ＬステップペダルおよびＲステップペダルのそれぞれの傾斜方向および傾斜角度に応じて前記した各車輪のモーターを駆動制御するためのセンサーおよび該センサーの信号をうけて演算する制御素子とからなるものであるために、搭乗者が常に直立した状態のまま左右の足首先のみによるペダル操作により前進・後退・旋回・軸回転が可能であり、搭乗者の体の一部として機能させることができ、一般的な移動用手段としての使用のみならず、身体障害者用として、あるいは広い工場内での手荷物の運搬にも適し、また障害者のスポーツ競技用、介護者用など、広範な利用が可能である。また、ヒトの駆け足速度に匹敵する程度以上の一定の速度を超えた場合には、左右の車輪の回転を同期させることにより搭乗者の安全性確保を、より確実なものとすることができる。

【図面の簡単な説明】

【００１６】

【図１】本発明の一実施例であるホイールウォーカーの斜視図。

【図２】図１に示すホイールウォーカーの平面図。

【図３】図１に示すホイールウォーカーの正面図。

【図４】本発明のホイールウォーカーの上面（平面）からみた説明図。

【図５】本発明のホイールウォ－カーの側面側からみた説明図。

【図６】本発明のホイールウォーカーに用いられる制御装置の構造説明図。

【図７】本発明のホイールウォーカーの制御フロー（初期ルーチン）。

【図８】本発明のホイールウォーカーの制御フロー（メインルーチン）。

【図９】本発明のホイールウォーカーの制御フロー（タイマー割り込み発生時のサブルーチン）。

【図１０】本発明のホイールウォーカーにおけるウオッチドックタイマールーチン（タイマー１）。

【図１１】本発明のホイールウォーカーにおける異常値カウントルーチン。

【図１２】本発明のホイールウォーカーにおける落車降車衝突検知のフロー。

【図１３】本発明のホイールウォーカーの使用状態をあらわした参考図。

【発明を実施するための形態】

【００１７】

以下に本発明の一実施例としてのホイールウォーカーの構成について図面をもとに説明する。本発明の基本的な形態は、フレーム軸１と、その両端部に各々独立回転可能に取り付けられた一対の各個別の回転駆動源を備えた車輪５Ｌ・５Ｒと、フレーム軸１に対して互いに独立して回動可能に取り付けたところの左右一対のＬステップペダル６ＬとＲステップペダル６Ｒ、および該Ｌステップペダル６ＬとＲステップペダル６Ｒのフレーム軸１を回転支点としたそれぞれのペダルの傾斜方向およびその傾斜角度に応じて、前記した各車輪のモーターを駆動制御するためのセンサーおよび該センサーの信号をうけて演算する制御素子と、少なくともセンサー・制御素子・モーターを駆動する電源部とを備えてなるものである。

【００１８】

フレーム軸１は、この場合に乗車するヒトの幅より少し長めの丈夫な丸棒鋼が基本となり、このフレーム軸１の左右両側にはＬ字状の補助フレーム９Ｌ・９Ｒが、フレーム軸１

に対して少なくとも一方が非一体的に取り付けられている。このＬ字状の補助フレーム９Ｌ・９Ｒには、それぞれの端部に縦方向に伸びる一定の長さを有したヒンジ２・２を有しており、該ヒンジ２・２の上方部にはそれぞれ車輪の軸を取り付ける軸穴３・３が形成され、これらの軸穴３・３に車輪５・５のそれぞれの軸が取り付けられる。

【００１９】

なお、車輪５Ｌ・５Ｒ内にはその回転駆動源として該車輪５Ｌ・５Ｒ自体をそれぞれ個別に駆動するモータが内臓（インホイールモーター）されており、その電源は前記した軸穴３・３を介して後記する制御部に接続される。また一方のヒンジ２には、上方に伸びる断面が倒Ｌ字状をした補助金具２ａが取り付けられ、その上端面には駆動キー２ｂが取り付けられ、該駆動キー２ｂの電源についても後記する制御部に接続されている。なお３ａは車輪の外側に取り付けた軸穴キャップである。

【００２０】

左右一対のＬステップペダル６ＬとＲステップペダル６Ｒは、それぞれフレーム軸１に対して少なくとも一方を固定せずに、例えばフレーム軸１の外径より内径が僅かに大きめのパイプを介する等の手段により遊嵌的に取り付けられた補助フレーム９Ｌ・９Ｒを介し、その上方に固定されたところの基板４Ｌ・４Ｒと、該基板４Ｌ・４Ｒ上に積載固定された電源部（本実施例の場合にはリチウムイオン電池を使用）８・８と、該電源部８・８の上方に位置して前記した基板４Ｌ・４Ｒとの間に一定の間隔を介してＬステップペダル６Ｌ側に左右方向２本、前後方向２本の計４本、またＲステップペダル６Ｒ側にも左右方向２本、前後方向２本の計４本の、それぞれ植立された一定高さの接続固定ボルト７・・・を介してＬステップペダル６ＬとＲステップペダル６Ｒとが、それぞれの略中央部を基板４Ｌと補助フレーム９Ｌ、および基板４Ｒと補助フレーム９Ｒを介してフレーム軸１に対して正・逆方向に向けて互いに独立して回動可能に取り付けられている。

【００２１】

なお１１・１１は、基板４Ｌ・４Ｒの前後方向各両端部寄り付近に形成された突起部１０・１０間、および突起１０・１０間に取り付けられたコイルバネをあらわしており、一方の略箱型状のＬステップペダル６Ｌと、他方の略箱型状のＲステップペダル６Ｒとが互いにあまり極端に角度変化し難いようにしている。さらにＬステップペダル６ＬとＲステップペダル６Ｒの下部にそれぞれ取り付けられた電源部８・８は、接続ケーブル１２により接続されており、これにより両電源部８・８は実質的に１個の電源部を構成している。

【００２２】

さらに片側のＬステップペダル６Ｌの下面にはマイクロコンピューターを用いた制御装置２０を備えるとともに、片側の車輪５寄りの位置に加速度センサー１３Ｌとジャイロセンサー１４Ｌとが取り付けられ、またＲステップペダル６Ｒ寄りの前端部には距離センサー１５Ｌが取り付けられている。なお１６Ｌは警報装置をあらわしている。この場合に使用される警報装置１６Ｌは音やランプにより警告するものであれば格別種類を問わない。また１７ＬはＬステップペダル６Ｌおよびこれを支える基板４Ｌを取付けた補助フレーム９Ｌの車輪寄りの端部に取り付けられたヒンジ２の上端部寄りであって、Ｌステップペダル６Ｌの上面よりいくぶん高い位置に取り付けられた遮光センサーをあらわしている。

【００２３】

一方、Ｒステップペダル６Ｒ側にも、前記したＬステップペダル６Ｌ側に取り付けたのと対称位置に加速度センサー１３Ｒ、ジャイロセンサー１４Ｒ、距離センサー１５Ｒ、警報装置１６Ｒ、遮光センサー１７Ｒがそれぞれ取り付けられている。なお、図中において１８は電源部８・８の電源を“ＯＮ”・“ＯＦＦ”切り替えをするためのメインスイッチ、１９は電源部８・８に充電するための充電用端子をあらわしている。

【００２４】

つまり上記した左右一対の略箱型状のＬステップペダル６Ｌと、他方の略箱型状のＲステップペダル６Ｒとが、そのそれぞれの略中間部を左右の車輪（インホイールモーター）間の軸（フレーム軸１）を介し、それぞれの車輪５Ｌ・５Ｒに直接に取り付けることにより、左右別々にステップ角度を検出するものであるために、その場での回転（軸回転）に

よる方向転換、あるいは極低速での蛇行走行等の自在な走行が可能となるように、フレーム軸１に対して互いに独立して回動可能に構成してある。

【００２５】

さらに述べると、本発明のホイールウォーカーは、上記した左右一対の箱型状のＬステップペダル６Ｌと、他方の箱型状のＲステップペダル６Ｒとが、そのそれぞれの略中間部を左右の車輪（インホイールモーター）間の軸（フレーム軸１）に直接に取り付けることにより、左右別々にステップ角度を検出するものであるが、本発明のステップペダルＬ・Ｒは水平を維持するようにプログラムされているために実際には殆ど傾斜しない。つまりステップペダルＬ・Ｒを足首先により傾斜させようとすると駆動モーターによる反力を生じ、かつステップペダルＬ・Ｒを傾斜させようとする力をセンサー類が検知して「走行」と「自立」の両方を両立させることになる。そのため車輪５・５の回転中でも安定のバランスを崩すことがない。

【００２６】

図６には、マイクロコンピューターを用いた制御装置２０の具体的構造が示されている。中央のマイクロコンピューターには、Ａ／Ｄコンバータを介して距離センサー１５Ｌおよび１５Ｒ、加速度センサー１３Ｒおよび１３Ｌ、ジャイロセンサー１４Ｒおよび１４Ｌの各情報が随時連絡される。またアナログＯＮ／ＯＦＦバッファを介して遮光センサー１７Ｒおよび１７Ｌの情報、およびスタートスイッチ２ｂの各情報が随時連絡される。

【００２７】

これらの情報は、その多くが左右一対のＬステップペダル６ＬとＲステップペダル６Ｒ上にヒトが乗車した場合のヒトの足先の動きに対応してＬステップペダル６ＬとＲステップペダル６Ｒのフレーム軸１を回転支点としたそれぞれのペダルの傾斜方向および傾斜角度ならびに傾斜速度に応じて、上記の各種センサーが感知した情報をマイクロコンピューターに随時伝えるものである。マイクロコンピューターにはメインスイッチ１８がＯＮになっている間定電圧電源器を介してバッテリー（電源部）からの電流が供給される。

【００２８】

マイクロコンピューターには作動中ランプ（特に図示してはいないが、好ましくは駆動キー２ｂ付近への取り付けが好ましい）が接続されているとともに、あらかじめ設定した正常値範囲を超える場合には警報装置１６Ｌ・１６Ｒにより警報をする。マイクロコンピューターでの正常値内での演算結果に応じて正転・逆転、駆動、停止など車輪５・５のモータードライバーを介して車輪５・５内のインホイールモーターを制御駆動する。

【００２９】

上記した本発明にかかるホイールウォーカーの制御フローを図７以下に示す。

〔１．初期ルーチン〕

図７は１．初期ルーチンをあらわしており、メインスイッチ１８を“ＯＮ”にすることで「ＳＴＡＲＴ」開始し、加速度センサー１３Ｌ・１３Ｒおよび別途設けたａセンサー（重力方向検出センサー）がスタンバイ状態となる。ついで「システム初期化」がなされ、マイクロコンピューターのポート関係等が起動し、ジャイロセンサー１４Ｌ・１４Ｒ、および別途設けたｇセンサー（左右一対のＬステップペダル６ＬとＲステップペダル６Ｒとの角度変化を検知）がスタンバイする。

【００３０】

「タイマー１　初期化（ウオッチドッグタイマー）」に移る。この場合に、タイマー時間は前記した「ススナム初期化」にておこなわれる。次いで「タイマー２　初期化（ｇセンサーの割り込み）」によりセンサー読込み周期の設定がおこなわれた後、「システム自己診断」がおこなわれる。ここでバッテリー電圧やモーター回路、マイクロコンピューター部等に異常がないかどうかの診断がおこなわれ、問題があれば警告灯の点灯をおこない、システムを停止する。また問題がなければ「aセンサーＲ側、Ｌ側の読込み」がおこなわれ、続いて「地面に対するステップ角度の演算」がおこなわれる。なお、この場合の演算はＲ、Ｌ共に別々におこなわれる。

【００３１】

続いて「ステップの傾斜角度に応じてモーターコントローラーへ回転方向、回転速度を出力」する。この場合もＲ、Ｌ共に別々におこなわれる。すなわち搭乗者の足先による操作によって傾斜する左右一対のＬステップペダル６ＬとＲステップペダル６Ｒの傾斜角度に応じて左右の各車輪５Ｌ・５Ｒを駆動するモーターコントローラーに対して回転方向および回転速度をそれぞれ左右両輪に対して個別に出力することにより走行制御がおこなわれる。

【００３２】

続いて「ａセンサーＲ，Ｌ共に最大値になったか？」の確認がおこなわれ、最大値に達していない場合には、再度既述した「ａセンサーＲ、Ｌ側読込み」に戻ることになる。ａセンサーＲ，Ｌ共に最大値になった場合には、ａセンサーＲ，Ｌ、およびｇセンサーＲ，Ｌの検出値に基づいて次の「現在のステップ位置を水平値としてメモリーに記憶」される。この状態で「スタートＳＷ」（２ｂ）を“ＯＮ”にすることによりスタート可能となる。実際のスタートに先だって搭乗の確認がおこなわれる。具体的には「遮光センサーＲ・Ｌの読み込み」に続いて「どちらかのセンサー付近に足があるか？」の確認、つまり左右一対のＬステップペダル６ＬとＲステップペダル６Ｒ上にヒトが乗車すると遮光センサー１７Ｌと１７Ｒ間の光等の投射が遮られる結果、乗車したことを確認できる。この場合に、遮光センサー１７Ｌと１７Ｒのどちらかのセンサー付近に足があるかどうかの判定をおこなう。搭乗を確認できた場合には、以後図８のメインルーチンへ移行する。

【００３３】

〔２．メインルーチン〕

「Ｍａｉｎ」→「スタートＳＷ（２ｂ）“ＯＮ”」→「遮光センサー１７Ｌと１７Ｒの読込み」をおこなう。この場合遮光されていなければヒトがステップペダルＬ・Ｒ上に乗っていないことをあらわす。ここで「遮光センサー付近に足が有るか」を確認し、足がない場合には図１２の「Ｃ」へと移行する。つぎにホイールウォーカーの前後の「距離センサー（１５Ｌおよび１５Ｒ）読込み」をおこない、障害物がないかどうかの確認をおこない、障害物がある場合においては図１２の「Ｃ」へと移行する。次いで「ａセンサーＲ・Ｌの読込み」→「平均法で温度ドリフトを吸収し、ａセンサー値を補正」し、正常値の範囲内であるかどうかの確認をおこなう。正常値の範囲から逸脱していれば図１１の「Ｂ」へと移行する。

【００３４】

ここでのａセンサー値が正常である場合には、「ｇセンサーとａセンサー及び現在速度からモーター出力値を演算」する。この場合には、主に水平保持のためにａセンサーを、またＬステップペダル６ＬとＲステップペダル６Ｒの角度変化の検出にｇセンサーの値を用いるものとした。さらに水平を保ったままの状態で走行できるようにハンチングの防止、水平保持力などのパラメーターの設定ができるようにするのが好ましい。

【００３５】

次いで「速度による旋回安全性を係数を算出」する。この場合にスピードが出ている時に急なカーブをしないようにし、また例えば走行速度が通常のヒトの早足走行速度以上の速度に達したときには左右の演算値を同じ出力値（同期）とするなどの安全策が講じられている。なお、ここでヒトの早足速度とは、安全性確認実験の結果、５～８ｋｍ／ｈ、より好ましくは６～７ｋｍ／ｈの範囲としている。さらに「旋回安全性係数を含めてモーターコントローラーへの出力値を演算」し、あらかじめ設定した正常値の範囲内であるかどうかの判定をおこなう。この場合に正常値の範囲から逸脱していれば図１１の「Ｂ」へと移行する。

【００３６】

正常値の範囲内であればそのまま「モーターコントローラーへ出力」することになり、「セイフティルーチン」を維持して当初の「スタートＳＷ“ＯＮ”の状態を繰り返すことになる。なおこの場合に「スタートＳＷ“ＯＮ”後にはじめて走行する場合には水平を保ったままでも走行速度を控えめにするのが好ましい。このような設定はパラメーターにより任意に変更することができる。

【００３７】
〔３．タイマー割込みルーチン〕
図９にはタイマー割込みルーチンのフローが記載されている。これはタイマー割込み時にここにくるサブルーチンであって、既述した図７の初期ルーチンにおいてタイマー初期化後、ｇセンサーによる割込みがあった場合に、「Ｓｕｂ＿タイマー１」において「ｇセンサー読込み」をおこない、「前回読込み値と比較」し、正常値の範囲内であるかどうかの判定をおこなう。正常値の範囲外であれば図７に示した初期ルーチンの「システム自己診断」での「Ａ」に移行し、警告灯を点灯するとともに、システムを停止することになる。正常値の範囲内である場合には「変化量をメモリにストア」し、元に戻ることになる。

【００３８】
〔４．ウオッチドックタイマールーチン〕（タイマー１）
図７の初期ルーチンにおいてシステム初期化の段階で「タイマー１初期化（ウオッチドックタイマー）」により制御自体が正常かどうかの判定は、図１０に示した「ウオッチドックタイマールーチン」で制御値が正常であるかどうか（制御自体が正常か）の判定がおこなわれる。制御値があらかじめ設定した正常値の範囲を逸脱している場合には既述したように図７に示した初期ルーチンの「Ａ」に移行し、正常値の範囲内である場合には元に戻る。なお、この場合にａセンサーは主に重力方向の検知を担当し、またｇセンサーは主に加・減速、水平保持の検出を担当するようにする。

【００３９】
〔５．異常値カウントルーチン〕
図８のメインルーチンにおいて、「平均法で温度ドリフトを吸収し、ａセンサー値を補正」する場合、あるいは「旋回安全性係数を含めてモーターコントローラーへの出力値を演算」する場合に、正常値の範囲を逸脱する場合には図１１の異常値カウントルーチンに移行して「エラーカウンターを+1する」ことによって、エラーカウンターが設定値以下であるかどうかの確認をおこなう。設定値以下ではない場合には図７の初期ルーチンにおける「Ａ」に移行する。また設定値以下である場合には図８のメインルーチンの先頭に戻ることになる。

【００４０】
〔６．落車降車衝突検知〕
図８のメインルーチンにおいて、「遮光センサーＲ，Ｌ読込み」によって遮光センサー付近に足が有るかどうかの確認の結果足がなかった場合、あるいは「距離センサー前後読込み」により障害物の有無の確認の結果障害物が存在する場合には図１２の落車降車衝突検知のルーチン「Ｃ」へと移行し、「モーターコントローラーへ停止信号出力」をし、その後図８の「メインルーチン先頭へ戻る」へと移行することになる。

【００４１】
なお、上記の実施例においては車輪５Ｌ・５Ｒの駆動を車輪に臨ませたモータードライバーを介して車輪５Ｌ・５Ｒ内のインホイールモーターを制御駆動するようにしたが、車輪５Ｌ・５Ｒのそれぞれを個別に駆動する外部モーターをＬステップペダル６ＬとＲステップペダル６Ｒのそれぞれの下部に設けるようにしてもよい。

【００４２】
上記の構成において、メインスイッチ１８を“ＯＮ”にした状態において、乗車時にスタートスイッチ２ｂを“ＯＮ”にし、ヒトが乗車すると、静止時においては加速度センサー１３Ｌと１３Ｒとが地球の重力加速度を検知し、地球の中心方向が最大最大となることにより、乗車用のＬステップペダル６ＡおよびＲステップペダル６Ｒが、この位置で水平となるように左右共にあらかじめセットしておき、乗車後に重力加速度が最大となる位置に車輪５Ｌ・５Ｒの回転駆動源（インホイールモーターのモーターコントローラー）を介して車輪５Ｌ・５Ｒを回転駆動させる。

【００４３】
このとき駆動車輪５Ｌ・５Ｒの慣性モーメントのほうが大きいために左右のＬステップペダル６ＬおよびＲステップペダル６Ｒが水平状態に維持される。乗車して移動する場合

には、主に足首より先の部分を使って左右のＬステップペダル６ＬおよびＲステップペダル６Ｒを水平状態から共にフレーム軸１上において同一方向（前方向又は後方向）に任意の角度傾かせるとステップペダル６Ｌおよび／または６Ｒの水平バランスが崩れ、加重がかかることで加速度センサー１３Ｌおよび／または１３Ｒとジャイロセンサー１４Ｌおよび／または１４Ｒがこれを検知し、傾斜したステップペダル６Ｌおよび／または６Ｒを水平に戻そうとして車輪５Ｌおよび／または車輪５Ｒを駆動させる。

【００４４】

つまりステップペダル６Ｌ・６Ｒの水平を保つためにはステップペダルの水平バランスを崩そうとした方向に車輪を駆動させなければならないため、その結果車輪はステップペダル６Ｌおよび／または６Ｒに加重をかければ走行したい方向に向けて回転し走行することができることになる。この場合に左右のステップペダル６Ｌ・６Ｒは互いに独立しているために、左右への加重のかけかた如何により前後・左右への移動が可能になる。

【００４５】

この場合に初期時のステップペダル６Ｌ・６Ｒの水平出し時においては加速度センサー１３Ｌ・１３Ｒのみで、また走行中においては水平精度の向上とステップペダル６Ｌ・６Ｒの踏み込み速度を検知し車輪駆動への加速度信号を拾うためにジャイロセンサーも用いている。なお、本発明の実施例では走行の安定を保つために一定速度以上の直進走行時には左右の車輪の回転を同期させて駆動するようにしている。具体的な走行に際しては、その傾斜角度および傾斜速度に応じて直立バランスを保った状態のまま制御装置２０を介して車輪５Ｌ・５Ｒが回転し、前進し、または後退することができる。

【００４６】

この場合に左右のＬステップペダル６ＬおよびＲステップペダル６Ｒの傾斜角度を互いに相違させた場合においては、相違角度の相違に応じて傾斜角度の大きいほうのＬステップペダル６ＬおよびＲステップペダル６Ｒが余分に回転するので傾斜の緩い側に向けてホイールウォーカーがカーブしながら走行する。また、左右のＬステップペダル６ＬおよびＲステップペダル６Ｒをフレーム軸１上において互いに反対方向の向きに傾斜させると、ホイールウォーカーの車輪５Ｌ・５Ｒは互いに反対方向に向けて回転するために、移動することなく乗車しているヒトを中心としてその場で同軸的に向きを変えることができる。

【００４７】

本発明によれば、上記したような簡単かつコンパクトな構成であるために、電車やバス等、あるいは車輌内に持込みが容易であり、特に搭乗して移動する際に基本的に体重の移動が不要であることから安定性に優れ、また搭乗者の体重の相違に関係なく安定した走行が可能である。また、車輪の駆動用モーターを左右のそれぞれの車輪内部に設置する所謂インホイールモーター方式を採用した場合においては、全体形状がより一層小型化できるばかりでなく、外観性もより一層シンプルとなる。

【００４８】

さらにとりわけて、フレーム軸に対して互いに独立して回動可能に取り付けたところの、搭乗者の左足が乗るＬステップペダルおよび右足が乗るＲステップペダルと、上記ＬステップペダルおよびＲステップペダルのそれぞれの傾斜方向および傾斜角度に応じて前記した各車輪のモーターを駆動制御するためのセンサーおよび該センサーの信号をうけて演算する制御素子とからなるものであるために、搭乗者が常に直立した状態のまま左右の足首先のみによるステップペダル操作により前進・後退・旋回・軸回転が自在であり、搭乗者の体の一部として機能させることができ、一般的な移動用手段としての使用のみならず、身体障害者用として、あるいは広い工場内での手荷物の運搬にも適し、また障害者のスポーツ競技用、介護者用など、広範な利用が可能である。

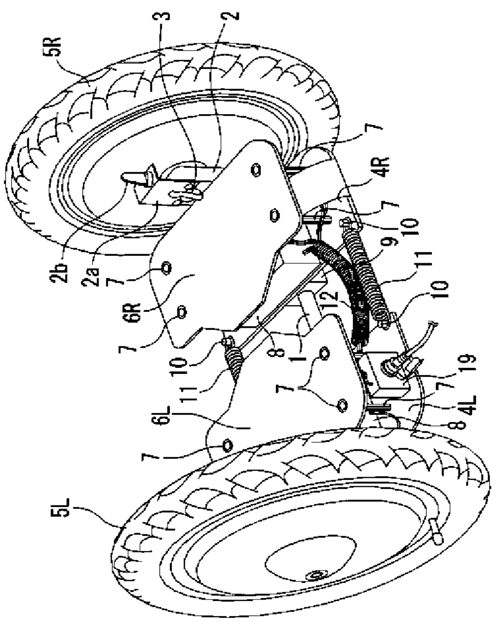
【符号の説明】

【００４９】

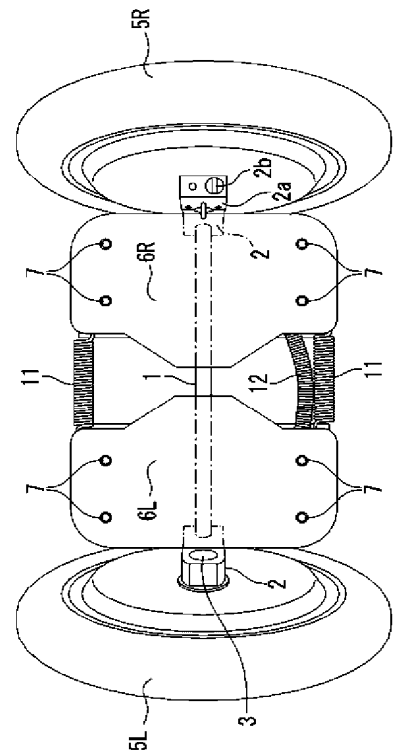
1　　フレーム軸
2　　ヒンジ
２ａ　　補助金具

２ｂ	駆動キー
３	軸穴
３ａ	軸穴キャップ
４Ｌ	基板
４Ｒ	基板
５Ｌ	車輪
５Ｒ	車輪
６Ｌ	ステップペダル
６Ｒ	ステップペダル
７	接続固定ボルト
８	電源部
９Ｌ	補助フレーム
９Ｒ	補助フレーム
１０	突起
１１	コイルバネ
１２	接続ケーブル
１３Ｌ	加速度センサー
１３Ｒ	加速度センサー
１４Ｌ	ジャイロセンサー
１４Ｒ	ジャイロセンサー
１５Ｌ	距離センサー
１５Ｒ	距離センサー
１６Ｌ	警報装置
１６Ｒ	警報装置
１７Ｌ	遮光センサー
１７Ｒ	遮光センサー
１８	メインスイッチ
１９	充電用端子
２０	制御装置

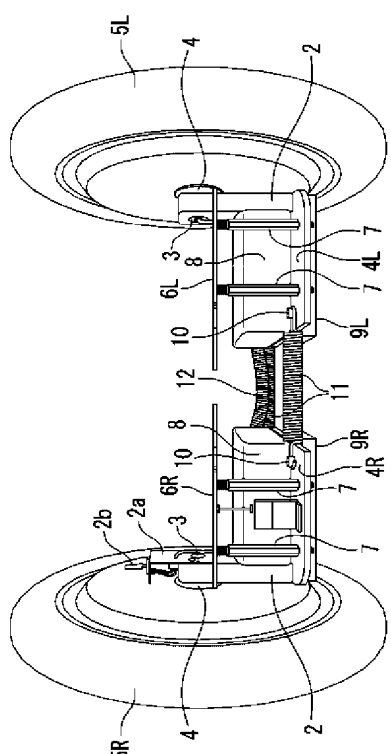
【図１】



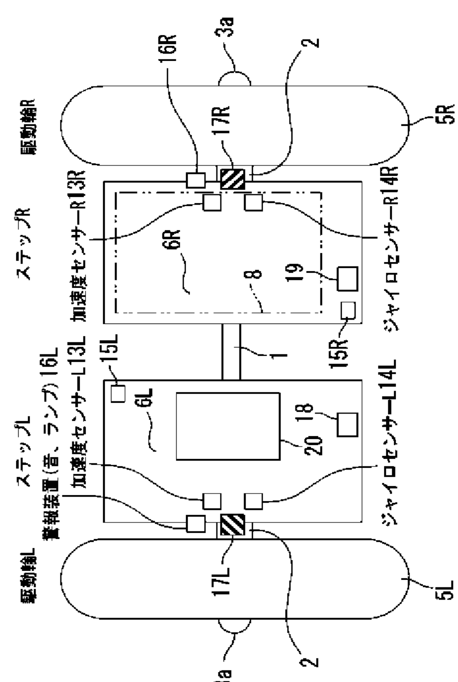
【図２】



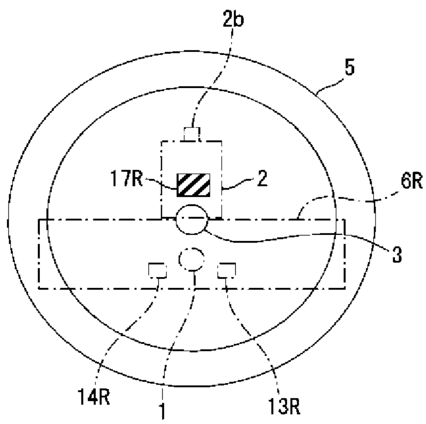
【図３】



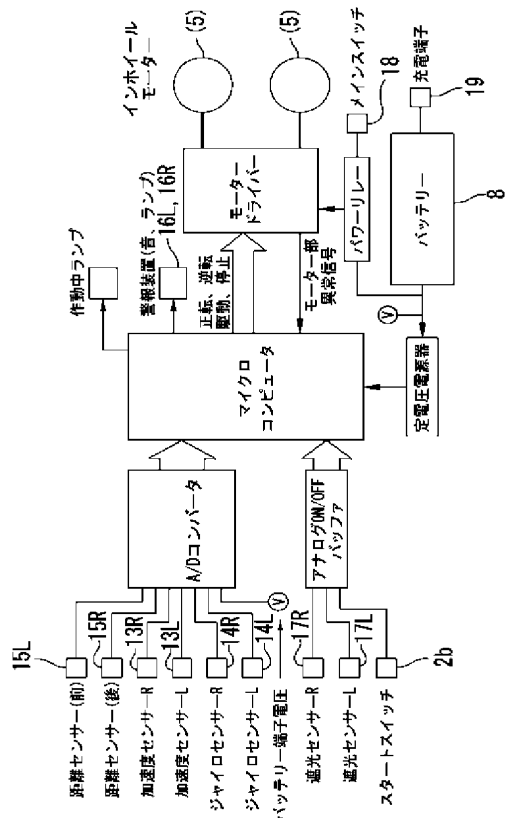
【図４】


駆動輪R
ステップR
加速度センサーR13R
ジャイロセンサーR14R
ステップL
警報装置(音、ランプ)16L
加速度センサーL13L
ジャイロセンサーL14L
駆動輪L

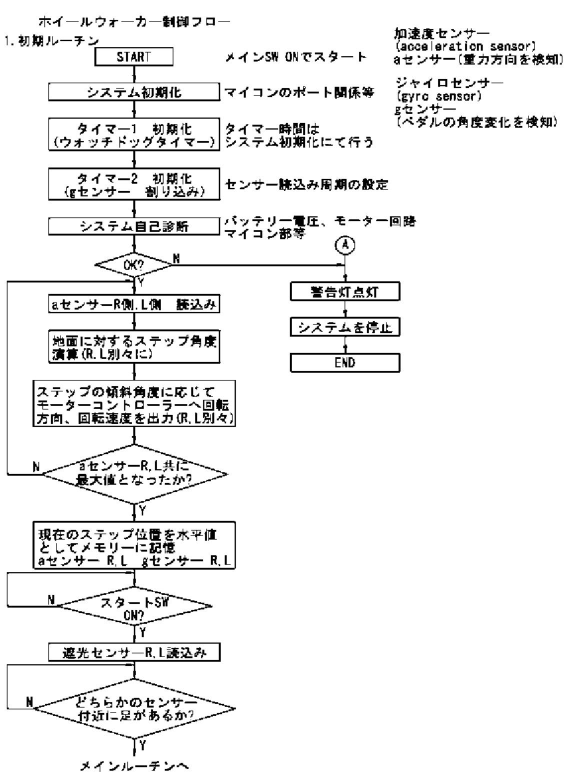
【図５】


2b
5
17R
2
6R
3
14R
1
13R

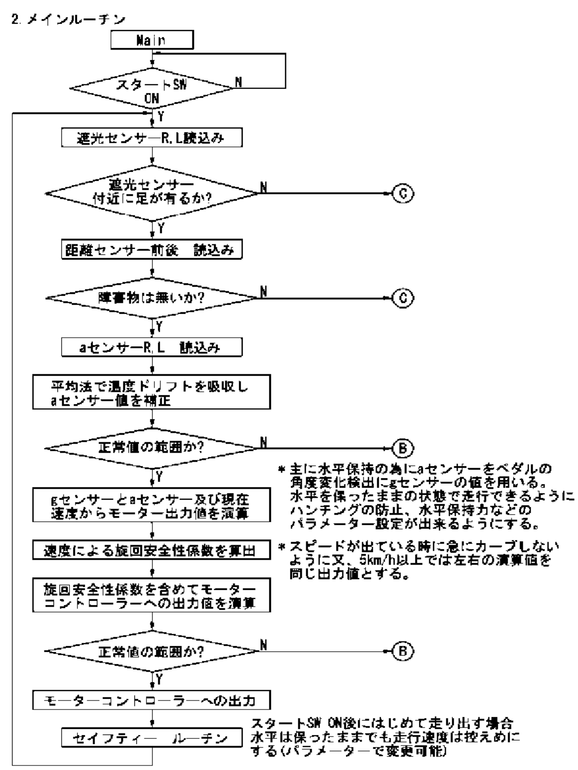
【図６】


インホイールモーター
(5)
(5)
メインスイッチ
18
充電端子
19
モーター
ドライバー
警報装置(音、ランプ)
16L, 16R
パワーリレー
バッテリー
8
作動中ランプ
正転、逆転
駆動、停止
モーター部
異常信号
V
マイクロ
コンピュータ
定電圧電源器
A/Dコンバータ
アナログON/OFF
バッファ
15L
15R
13R
13L
14R
14L
17R
17L
2b
距離センサー(前)
距離センサー(後)
加速度センサーR
加速度センサーL
ジャイロセンサーR
ジャイロセンサーL
バッテリー端子電圧
遮光センサーR
遮光センサーL
スタートスイッチ

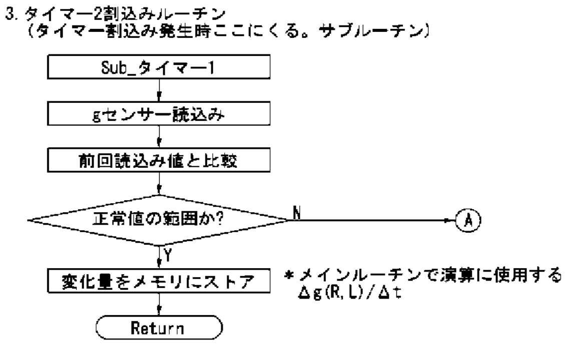
【図７】


ホイールウォーカー制御フロー
1. 初期ルーチン
START
メインSW ONでスタート
加速度センサー
(acceleration sensor)
aセンサー(重力方向を検知)
ジャイロセンサー
(gyro sensor)
gセンサー
(ペダルの角度変化を検知)
システム初期化
マイコンのポート関係等
タイマー1　初期化
(ウォッチドッグタイマー)
タイマー時間は
システム初期化にて行う
タイマー2　初期化
(gセンサー　割り込み)
センサー読込み周期の設定
システム自己診断
バッテリー電圧、モーター回路
マイコン部等
OK?
N
Y
A
警告灯点灯
システムを停止
END
aセンサーR側, L側　読込み
地面に対するステップ角度
演算(R, L別々に)
ステップの傾斜角度に応じて
モーターコントローラーへ回転
方向、回転速度を出力(R, L別々)
aセンサーR, L共に
最大値となったか?
N
Y
現在のステップ位置を水平値
としてメモリーに記憶
aセンサー R, L　gセンサー R, L
スタートSW
ON?
N
Y
遮光センサーR, L読込み
どちらかのセンサー
付近に足があるか?
N
Y
メインルーチンへ

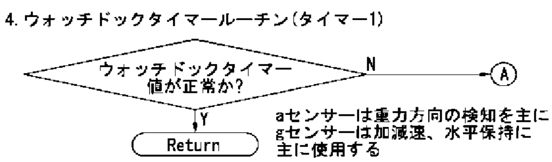
【図８】


2. メインルーチン
Main
スタートSW
ON
N
Y
遮光センサーR, L読込み
遮光センサー
付近に足が有るか?
N
C
Y
距離センサー前後　読込み
障害物は無いか?
N
C
Y
aセンサーR, L　読込み
平均法で温度ドリフトを吸収し
aセンサー値を補正
正常値の範囲か?
N
B
Y
＊主に水平保持の為にaセンサーをペダルの
角度変化検出にgセンサーの値を用いる。
水平を保ったままの状態で走行できるように
ハンチングの防止、水平保持力などの
パラメーター設定が出来るようにする。
gセンサーとaセンサー及び現在
速度からモーター出力値を演算
速度による旋回安全性係数を算出
＊スピードが出ている時に急にカーブしない
ように又、5km/h以上では左右の演算値を
同じ出力値とする。
旋回安全性係数を含めてモーター
コントローラーへの出力値を演算
正常値の範囲か?
N
B
Y
モーターコントローラーへの出力
セイフティー　ルーチン
スタートSW ON後にはじめて走り出す場合
水平は保ったままでも走行速度は控えめに
する(パラメーターで変更可能)

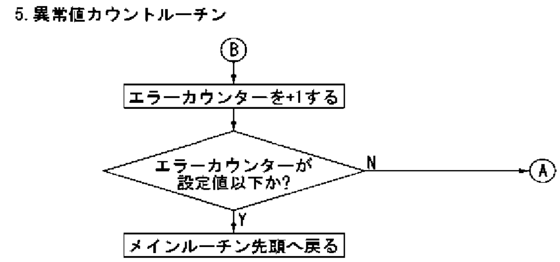
【図９】



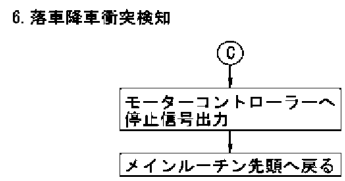
【図１０】



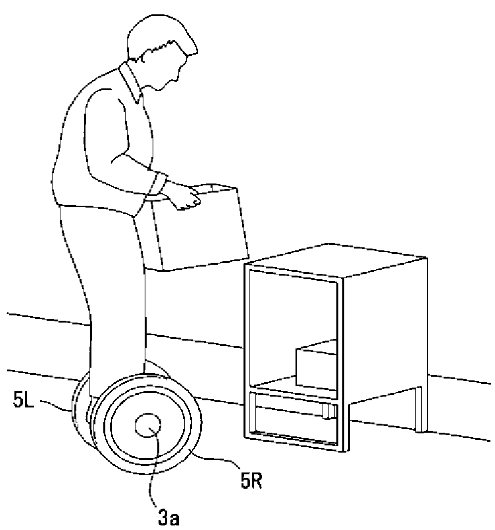
【図１１】



【図１２】



【図１３】



フロントページの続き

特許法第３０条第２項適用申請有り　（１）発行年月日：２０１２年9月２１日　発行者名：日刊工業新聞　刊行物名：日刊工業新聞（２０１２年9月２１日付朝刊）　（２）掲載年月日：２０１２年9月２１日　掲載アドレス：ｈｔｔｐ：／／ｗｗｗ．ｎｉｋｋａｎ．ｃｏ．ｊｐ／ｎｅｗｓ／ｎｋｘ０６２０１２０９２１ｈｈａｓ．ｈｔｍｌ　（３）放送日：２０１２年１０月１０日　放送番組：株式会社テレビ東京　ワールドビジネスサテライト　トレンドたまご　（４）掲載年月日：２０１２年１０月１０日　掲載アドレス：ｈｔｔｐ：／／ｗｗｗ．ｔｖ－ｔｏｋｙｏ．ｃｏ．ｊｐ／ｍｖ／ｗｂｓ／ｔｒｅｎｄ＿ｔａｍａｇｏ／ｐｏｓｔ＿２８３７９／　（５）放送日：２０１２年１０月１１日　放送番組：株式会社テレビ東京　モーニングサテライト　ネタのたね　（６）放送日：２０１２年１２月２５日　放送番組：株式会社テレビ東京　ワールドビジネスサテライト　トレンドたまご

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/092849

A. CLASSIFICATION OF SUBJECT MATTER

B62K 11/00 (2013.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B62K; B62M; A63C 17

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNPAT, WPI, EPODOC: vehicle, double wheels, sense, balance, control+, Electric+, rotat+, cover

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 104029769 A (HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO., LTD.), 10 September 2014 (10.09.2014), description, paragraphs [0018]-[0025], and figures 1-2	1-10, 13-14
PX	CN 104014123 A (HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO., LTD.), 03 September 2014 (03.09.2014), description, paragraphs [0018]-[0025], and figures 1-2	1-10, 13-14
A	CN 203186511 U (NORTHWEST A & F UNIVERSITY), 11 September 2013 (11.09.2013), description, paragraphs [0023]-[0032], and figures 1-3	1-18
A	CN 102602481 A (CHEN, He), 25 July 2012 (25.07.2012), the whole document	1-18
A	CN 102514662 A (CHEN, He), 27 June 2012 (27.06.2012), the whole document	1-18
A	CN 202201103 U (JIUJIANG JIAYUAN TECHNOLOGY CO., LTD.), 25 April 2012 (25.04.2012), the whole document	1-18

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
02 March 2015 (02.03.2015)

Date of mailing of the international search report
11 March 2015 (11.03.2015)

Name and mailing address of the ISA/CN:
State Intellectual Property Office of the P. R. China
No. 6, Xitucheng Road, Jimenqiao
Haidian District, Beijing 100088, China
Facsimile No.: (86-10) 62019451

Authorized officer
SUN, Jie
Telephone No.: (86-10) **62084190**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/092849

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 104029769 A	10 September 2014	None	
CN 104014123 A	03 September 2014	None	
CN 203186511 U	11 September 2013	None	
CN 102602481 A	25 July 2012	None	
CN 102514662 A	27 June 2012	None	
CN 202201103 U	25 April 2012	None	

PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	11.03.2015

Applicant's or agent's file reference	FOR FURTHER ACTION
YY-201412-1	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CN2014/092849	02.12.2014	13.06.2014

International Patent Classification (IPC) or both national classification and IPC

B62K11/00(2013.01)i

Applicant

HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO., LTD

1. This opinion contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☒	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/CN	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CN2014/092849

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
   - [x] the international application in the language in which it was filed
   - [ ] a translation of the international application into ______________________ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. [ ] This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)
   - [ ] on paper
   - [ ] in electronic form

   b. (time)
   - [ ] in the international application as filed
   - [ ] together with the international application in electronic form
   - [ ] subsequently to this Authority for the purposes of search

4. [ ] In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CN2014/092849

Box No. II Priority

1. ☐ The validity of the priority claim has not been considered because the International Searching Authority does not have in its possession a copy of the earlier application whose priority has been claimed or, where required, a translation of that earlier application. This opinion has nevertheless been established on the assumption that the relevant date (Rules 43*bis*.1 and 64.1) is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

[1] Upon verification, the priority claim of claims 1-10, 13 and 14 in the prior application is valid; the features in claims 11, 12 and 15-18 such as "charging interface", "the width of an arc-shaped protrusion", "plastic top and bottom covers and aluminium alloy internal cover", "remote controller" and "storage unit" are not recorded in the earlier application, and therefore the priority claim of claims 11, 12 and 15-18 is invalid.

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/CN2014/092849

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-18	YES
	Claims	None	NO
Inventive step (IS)	Claims	1-18	YES
	Claims	None	NO
Industrial applicability (IA)	Claims	1-18	YES
	Claims	None	NO

2. Citations and explanations:

[1] Cited reference document:

[2] D1: CN 203186511 U, 11 September 2013 (11.09.2013)

[3] 1. Novelty

[4] D1 is considered to be the prior art document closest to the subject matter of claims 1-18. D1 discloses a self-balancing two-wheel electric vehicle without a handle, and discloses the following technical features (see D1, the description, paragraphs [0023]-[0032] and figures 1-3): a vehicle body 1 comprises two pedals 2; wheels 3 are installed on two sides of the vehicle body 1, the wheel 3 is connected to one end of a main shaft 7 via an outer spherical bearing 8, the other end of the main shaft 7 is connected to a motor 5 via a spider coupling 6, a driving motor is installed on the wheel 3, and a tri-axial tilt sensor is provided at the connecting part of the wheel 3 and the vehicle body 1; a storage battery 10 is installed on a battery fixing frame 13 inside a chassis 1; and a control system is also installed on the vehicle body 1 for receiving an

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

input signal from the sensor so as to control the movement of the motor and the wheels.

[5] Therefore, claim 1 differs from D1 in that: the electric balance vehicle further comprises a top cover, a bottom cover and an internal cover, and the positional relationships between various components and the top cover, the bottom cover and the internal cover.

[6] Therefore, the subject matter of claim 1 is novel under PCT Article 33(2), and dependent claims 2-18 are also novel under PCT Article 33(2).

[7] 2. Inventive step

[8] For a person skilled in the art, the technical solution of claim 1 would not be obvious on the basis of D1 or a combination of D1 and the other documents cited in the international search report. Therefore, claim 1 involves an inventive step as provided for in PCT Article 33(3).

[9] Claims 2-18 all refer to claim 1, and therefore claims 2-18 also involve an inventive step as provided for in PCT Article 33(3).

[10] 3. Industrial applicability

[11] The subject matter of claims 1-18 can be made or used in industry, and therefore claims 1-18 are industrially applicable under PCT Article 33(4).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/CN2014/092849

Box No. VII **Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

[1] Multiple dependent claims 7-9, 13, 14 and 16-18 refer to preceding multiple dependent claims and thus do not comply with the requirements of PCT Rule 6.4.

Espacenet

Bibliographic data: RU2456195 (C2) — 2012-07-20

ONE-WHEEL VEHICLE AND VEHICLE STABILISER

Inventor(s): SULIMOV PAVEL SERGEEVICH [RU] + (Сулимов Павел Сергеевич (RU))

Applicant(s): SULIMOV PAVEL SERGEEVICH [RU]; SHUSHURA IGOR VLADIMIROVICH [RU] + (Сулимов Павел Сергеевич (RU) , ; Шушура Игорь Владимирович (RU), ; SULIMOV PAVEL SERGEEVICH, ; SHUSHURA IGOR' VLADIMIROVICH)

Classification: - international: *B62D37/06; B62H1/10; B62K1/00*
- cooperative: B62K1/00 (EP); B62K11/007 (EP)

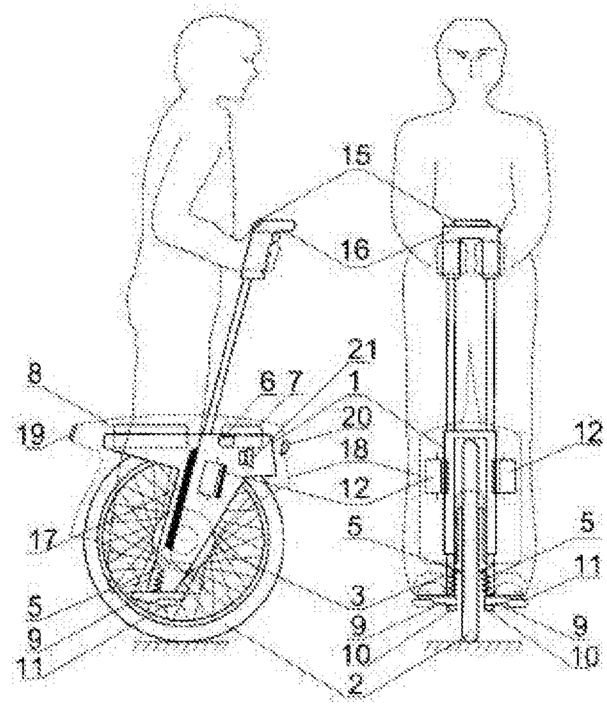
Application number: RU20100140844 20101006

Priority number(s): RU20100140844 20101006

Also published as: RU2010140844 (A) WO2012047127 (A1)

Abstract of RU2456195 (C2)

FIELD: transport. ^ SUBSTANCE: invention relates to gyroscopic stabilisers. Two flywheels 12 are mounted on frame 1 to rotate in opposite directions. In vertical position of vehicle, flywheels 12 have parallel rotational axes. Both flywheels 12 may turn in plane perpendicular to direction of motion. With vehicle inclined from vertical position, rotational axis of one flywheel 12 retains vertical position while that of another flywheel in inclined through angle equal to vehicle inclination angle. ^ EFFECT: higher stability. ^ 13 cl, 6 dwg



ФИГ. 1

Patent Translate

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Notice

CLAIMS RU2456195

1.

A one-wheeled vehicle, consisting of a frame and a wheel mounted on the frame, an electric motor for rotating the wheel, at least one gyro sensor, a vehicle control unit connected to it, intended for processing measurements by the gyro sensor of the angular deviation of the frame from a vertical position in the plane of the direction of movement of the unicycle and changes in the speed and direction of rotation of the electric motor, battery pack, footrests for the driver mounted on the frame on both sides of the wheel, characterized in that the one-wheeled vehicle is additionally equipped with a vehicle stabilization device including two flywheels mounted on a frame that rotate in opposite directions and are mounted with the possibility of deviation in a plane perpendicular to the direction of movement of the vehicle, while the axis the rotations of the flywheels are parallel, both flywheels are equipped with stops set in such a way that when tilting the one-wheeled vehicle to the side from a vertical position, the axis of rotation of the first flywheel maintains a vertical position, and the axis of rotation of the second flywheel deviates by the angle of deviation of the vehicle from the vertical position.

2.

A one-wheeled vehicle according to claim 1, characterized in that the wheel and the electric motor are made in the form of a motor wheel.

3.

A one-wheeled vehicle according to claim 1, characterized in that the vehicle is equipped with a handle for supporting the driver, which has the ability to fix it in the folded and extended positions.

4.
The one-wheeled vehicle according to claim 1, characterized in that the footrests are equipped with sensors for the presence of a driver on the vehicle, which are connected to the vehicle control unit.

5.
A one-wheeled vehicle according to claim 1, characterized in that the vehicle is equipped with indicators of the operation of vehicle systems.

6.
The one-wheeled vehicle according to claim 1, characterized in that the vehicle is additionally equipped with stops-clamps of the lower leg of the driver.

7.
A one-wheeled vehicle according to claim 1, characterized in that each driver's footrest is provided with at least one support roller mounted on the outside of the foot.

8.
A one-wheeled vehicle according to claim 1, characterized in that a suspension system is installed between the frame and the wheel.

9.
A one-wheeled vehicle according to claim 1, characterized in that the vehicle is equipped with a protective casing made of a polymer material.

10.
A one-wheeled vehicle according to claim 9, characterized in that the protective casing is additionally equipped with reflectors.

11.
A one-wheeled vehicle according to claim 9, characterized in that the protective casing is further provided with at least one headlamp.

12.
A one-wheeled vehicle according to claim 9, characterized in that the vehicle is further provided with a sound signal source.

13.
A vehicle stabilization device consisting of two flywheels mounted on a vehicle frame that rotate in opposite directions and can be deflected in a plane perpendicular to the direction of the vehicle's movement, while the axis of rotation of the flywheels are parallel, both flywheels are equipped with stops installed in this way that when the vehicle is tilted away from the vertical position, the axis of rotation of the first flywheel remains vertical, and the axis is rotated the second flywheel deviates by the angle of deviation of the vehicle from the vertical position.

Notice

DESCRIPTION RU2456195

SINGLE-VEHICLE VEHICLE AND DEVICE FOR STABILIZING A VEHICLE

The invention relates to vehicles, in particular to unicycle vehicles, and can be used both for recreation and movement, and for moving goods.

Known vehicle Segway, manufactured by the American company Segway LLC, consisting of two wheels located on the same axle with a foot platform located between them. The driver is standing on the site and holds the control stick of the vehicle. The vehicle uses a sophisticated system of gyroscopes and computers and moves back and forth in accordance with the inclination of the driver's body. The vehicle is rotated by turning the control knob.

The disadvantages of this vehicle is its width, causing restrictions associated with its use in the general flow of pedestrians.

Known vehicle Honda U3-X, consisting of one complex wheel and electronic stabilization of the driver's position. The main wheel has the ability to rotate around its own axis, and also has many small wheels located around its rim with the possibility of rotation. The axles of the small wheels are in the plane of the main wheel, which allows the vehicle to move in the direction perpendicular to the plane of the main wheel, and while rotating the large and small wheels in any direction chosen by the driver. The vehicle is controlled by tilting the driver's body, which is controlled by a system of gyro sensors and an electronic control circuit.

The use of this vehicle due to the presence of small wheels is limited by the surface on which the vehicle moves. The surface should be firm and clean enough, such as an office floor.

The closest to the task and technical essence is the eniCycle vehicle, designed by the inventor from Slovenia Alexander Polutnik, consisting of one wheel with an electric motor built into it. The seat is located above the wheel with a suspension consisting of a shock absorber and a spring. The gyro sensor is rigidly fixed to the seat on which the driver is located. Changing the angle of inclination of the driver relative to the vertical in the plane of the direction of movement determines the gyro sensor. The signal from the gyro sensor enters the electronic system and changes the speed of the engine in such a way as to return the balance to eniCycle. If the driver leans forward, the speed increases, and if he leans back, the speed decreases. Thus, the balance of the vehicle is restored. The disadvantage of this vehicle is that the stabilization of the vehicle on a roll (counteracting a fall on its side) is carried out by the driver himself balancing the body and changing the position of the wheel relative to the vertical axis.

This method of maintaining equilibrium is very difficult and requires great preliminary training of the driver. In addition, a fall from a vehicle from a sedentary state is associated with personal injury.

The objective of the proposed invention is the creation of an easy-to-drive and safe one-wheeled vehicle for use in open spaces, in particular in urban conditions.

The proposed technical solution allows you to stabilize a unicycle on a roll and thereby protect the driver from falling on his side.

The problem is solved in that the vehicle stabilization device consists of two flywheels mounted on the frame of the vehicle. Flywheels rotate in opposite directions and have the ability to deviate in a plane perpendicular to the direction of movement of the vehicle. The axis of rotation of the flywheels are parallel. Both flywheels are equipped with stops set in such a way that when the vehicle is tilted away from the vertical position, the axis of rotation of the first flywheel remains vertical, and the axis of rotation of the second flywheel deviates by the angle of deviation of the vehicle from the vertical position.

Also, the stated technical problem is solved by the fact that a wheel is mounted on the frame of a one-wheeled vehicle and an electric motor is fixed for rotating the wheel. Also, at least one gyro sensor is rigidly mounted on the frame, designed to measure the angular deviation of the frame from a vertical position in the plane of the direction of movement of a one-wheeled vehicle. A vehicle control unit is located on the frame, designed to process the measurement results received from the gyro sensor and change the speed and direction of rotation of the electric motor. In addition, the battery pack is located on the frame, designed to power consumers. On both sides of the wheel on the frame are installed footrests for the driver. Moreover, the one-wheeled vehicle is additionally equipped with a vehicle stabilization device including two flywheels. Flywheels are mounted on the frame, rotate in opposite directions and have the ability to deviate in a plane perpendicular to the direction of movement of the vehicle.

The axis of rotation of the flywheels are parallel. Both flywheels are equipped with stops set in such a way that when the unicycle is tilted away from the vertical position, the axis of rotation of the first flywheel remains vertical, and the axis of rotation of the second flywheel deviates by the angle of deviation of the vehicle from the vertical position.

In a particular case, the wheel and electric motor are made in the form of a motor wheel.

In the particular case, the vehicle is equipped with a handle for supporting the driver's hands with the possibility of fixing it in the folded and extended position.

In the particular case of the footrests of the vehicle are equipped with sensors for the presence of the driver on the vehicle, which are connected to the vehicle control unit.

In a particular case, the vehicle is equipped with a display with indicators located on it. Information on the operation of individual devices, in particular the speed of the flywheel, and the vehicle as a whole, in particular its speed, can be displayed on this display.

In the particular case, the vehicle is equipped with stops-clamps of the lower leg of the driver.

In the particular case, at least one support roller is mounted on each footrest of the vehicle.

In a particular case, a suspension system is installed between the frame and the wheel on the vehicle.

In the particular case, the vehicle is equipped with a protective casing made of a polymer material.

In the particular case, the protective casing is additionally equipped with reflectors.

In the particular case, the protective casing is additionally provided with at least one headlamp.

In the particular case, the vehicle is additionally equipped with a sound source.

The invention is further illustrated by a detailed description of a specific example of execution and drawings, in which:

figure 1 shows an embodiment of a vehicle;

figure 2 shows a schematic diagram of a vehicle;

figure 3 is an embodiment of a vehicle with an engine and transmission;

figure 4 - stand for the feet of the driver with mounted support rollers;

figure 5 is an example of the installation of flywheels on a vehicle;

figure 6 shows a schematic diagram of the operation of the device stabilization of the vehicle.

The inventive one-wheeled vehicle, as shown in FIG. 1 and FIG. 2, comprises a frame 1 with a wheel 2 mounted in the frame and an electric motor 3. The wheel 2 and the electric motor 3 are equipped with a transmission 4 for transmitting torque from the electric motor 3 to the wheel 2 (figure 3). As the transmission 4 can be used, for example, chain or belt transmission.

In the described specific construction, the wheel 2 and the electric motor 3 are mounted on the same axis and together form a motor wheel.

The wheel 2 is attached to the frame 1 through the suspension system 5, which is shown in figure 1 schematically. As an example, in the described construction, a shock absorber and a spring are used as a suspension system.

Also on the frame 1 of the inventive vehicle, as shown in figure 1, a gyro sensor 6 is rigidly mounted. Gyro sensor 6 registers the angle of inclination of the vehicle in the plane of the direction of movement - pitch angle. The gyro sensor 6 is connected to the vehicle control unit 7.

Also, a battery unit 8 is fixed on the vehicle frame 1.

On both sides of the wheel 2 on the frame 1, stands 9 for the driver's feet are installed. Each stand 9 for the driver's legs is equipped with sensors 10 for the presence of the driver on the vehicle and at least one support roller 11, as shown in Fig.4. In the described example, limit switches are used as sensors 10. Sensors 10 availability of the driver is connected to the control unit 7 of the vehicle.

The vehicle has a stabilization device consisting of two flywheels 12 mounted on the frame 1 of the vehicle. An example of the installation of the flywheels 12 on the frame 1 is shown in Fig.5. Both flywheel 12 are equipped with stops 13. Flywheels 12 are equipped with electric motors 14 of the flywheels (Fig. 5), which are connected to the battery unit 8 and are switched on by a separate switch. Flywheels 12 are mounted to rotate in opposite directions (Fig.6) and have the ability to deviate in a plane perpendicular to the direction of movement of the vehicle (Fig.5 and Fig.6). In this case, when the frame 1 deviates from a vertical position in a plane perpendicular to the direction of movement of the vehicle, the axis of one of the flywheels 12 remains in the vertical position, and the axis of the other deviates with the frame 1, holding the stop 13.

The vehicle (figure 1) is equipped with indicators 15, in the described example, located on the handle 16 for supporting the driver. Indicators 15 are made, for example, in the form of a scoreboard. The handle 16 for supporting the driver is mounted on the frame 1 and, for ease of operation of the vehicle, has the ability to fix at least in the extended and folded state.

For convenience, the vehicle can be equipped with stops-clamps 17 of the driver's leg, rigidly attached to the frame 1 of the vehicle, and the casing 18. For the safe operation of the vehicle, the casing 18 is equipped with reflectors 19 and a headlight 20. Also, for safety, a sound source 21 is installed on the vehicle.

The power supply of all electric power consumers of the vehicle, namely the electric motor 3, the gyro sensor 6, the vehicle control unit 7, the flywheel electric motors 12, the indicators 15, the headlights 20, the sound signal source 21, is produced from the battery unit 8.

The vehicle operates as follows.

The vehicle is installed in a vertical position and, holding it by the handle 16, the flywheel motors 12 are turned on. Before the flywheel sets 12 the required speed, the vehicle must be in an upright position. Indicators 15 signal that the flywheels have reached 12 rpm necessary for the stabilization device to operate.

After turning on the vehicle stabilization device, the driver stands on his feet 9. In this case, the sensors 10 for the presence of a driver on a vehicle include a vehicle control unit 7.

The driver on the vehicle begins to move, for example, forward. To do this, it is enough to tilt the vehicle in the direction of the intended movement. The tilt can be made using either the handle 16 to support the driver, and the stops, latches 17, or using them together. The control unit 7 according to the data on the angle of deviation from the vertical in the plane of the direction of movement (pitch angle) received from the gyro sensor 6, seeks to maintain a stable position of the vehicle in pitch by changing the speed and direction of rotation of the electric motor. In the process of uniform rectilinear movement, a balance is established between the speed of the vehicle and the angle of inclination of the vehicle (pitch angle). Any change in the angle of inclination of the vehicle leads to a change in the speed and direction of rotation of the electric motor 3 and, therefore, to restore the necessary balance between the speed of the vehicle and its pitch inclination.

The vehicle is braked by moving the vehicle to a vertical position.

Thus, the vehicle together with the driver maintains a stable position and has the ability to gain speed and braking.

The safety of using the vehicle is enhanced by sensors 10 having a driver on it. In the absence of both legs of the driver on the stands 9 of the vehicle, about which a signal from the sensors 10 is supplied to the vehicle control unit 7, the current supply to the electric motor 3 is completely turned off and the vehicle can only be towed manually.

Also, traffic safety is enhanced by the installation of the support rollers 11 on the supports 9 for the legs. When moving in the immediate vicinity of vertical surfaces, such as a parapet, wall or high curb, the risk of the vehicle engaging in a protruding part, namely, a footrest 9 for the surface, is significantly reduced. In this case, the rollers 11 slide along a vertical surface and prevent the foot supports 9 from engaging with said surface, which can lead to an uncontrolled fall of the vehicle with the driver.

Traffic safety is also increased, and vehicle control is simplified by the presence on the vehicle of the stoppers 16 of the driver's leg. The driver, resting on the stops, latches 17, conveniently fixes the legs on the vehicle, and also has the additional ability to adjust the inclination of the vehicle with the help of the legs and control the speed of the vehicle.

To protect the driver from possible dirt emissions from under the wheel 2, the clothes getting into the wheel 2, the vehicle is equipped with a casing 18. In order to facilitate the design, the casing is made of a polymeric material, for example, of a composite material based on polycarbonate and ABS plastic.

To ensure the safety of movement on the vehicle in conditions of poor visibility, the vehicle is equipped with reflectors 19 and a headlight 20 mounted on the casing 18.

In order to ensure the safety of road users, the vehicle is equipped with an audio signal source 21.

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

(19) **RU** (11) **2 456 195** (13) **C2**

(51) МПК
B62K 1/00 (2006.01)
B62H 1/10 (2006.01)
B62D 37/06 (2006.01)

(12) ОПИСАНИЕ ИЗОБРЕТЕНИЯ К ПАТЕНТУ

(21)(22) Заявка: **2010140844/11, 06.10.2010**

(24) Дата начала отсчета срока действия патента:
06.10.2010

Приоритет(ы):
(22) Дата подачи заявки: **06.10.2010**

(43) Дата публикации заявки: **20.04.2012** Бюл. № 11

(45) Опубликовано: **20.07.2012** Бюл. № 20

(56) Список документов, цитированных в отчете о поиске: **CH 82888 A, 16.03.1920. RU 2001135666 A, 20.08.2003. SU 1230909 A1, 15.05.1986. SU 867758 A1, 30.09.1981. WO 2009120157 A1, 01.10.2009.**

Адрес для переписки:
121096, Москва, а/я 1, О.Б. Салминой

(72) Автор(ы):
Сулимов Павел Сергеевич (RU)

(73) Патентообладатель(и):
Сулимов Павел Сергеевич (RU),
Шушура Игорь Владимирович (RU)

(54) ОДНОКОЛЕСНОЕ ТРАНСПОРТНОЕ СРЕДСТВО И УСТРОЙСТВО СТАБИЛИЗАЦИИ ТРАНСПОРТНОГО СРЕДСТВА

(57) Реферат:

Изобретение относится к средствам гироскопической стабилизации. Два маховика (12) установлены на раме (1) для вращения в противоположных направлениях. При вертикальном положении транспортного средства маховики (12) имеют параллельные оси вращения. Оба маховика (12) имеют возможность отклонения в плоскости, перпендикулярной направлению движения. При наклоне транспортного средства в сторону от вертикального положения ось вращения одного маховика (12) сохраняет вертикальное положение, а ось вращения другого маховика (12) отклоняется на угол отклонения транспортного средства от вертикального положения. Решение направлено на стабилизацию по крену и, соответственно, на предотвращение падения набок. 2 н. и 11 з.п. ф-лы, 6 ил.

RU 2456195 C2

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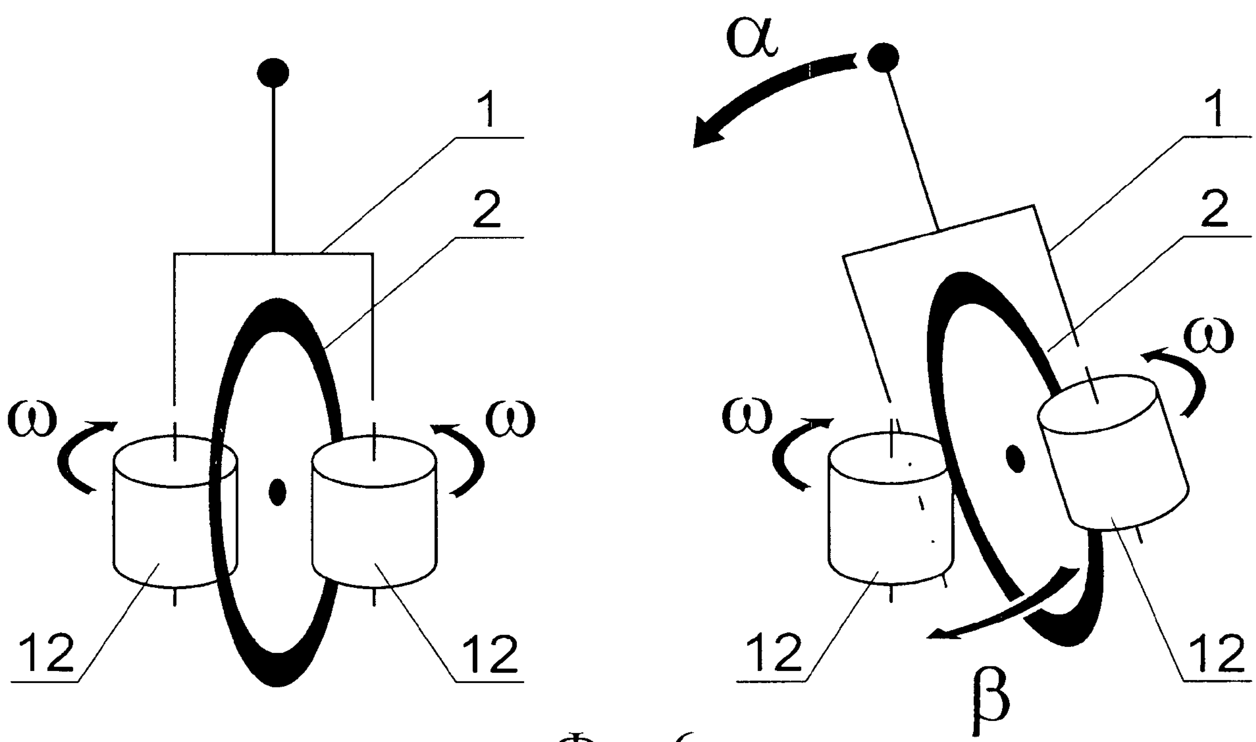

Фиг.6

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RU 2456195 C2

RUSSIAN FEDERATION

FEDERAL SERVICE
FOR INTELLECTUAL PROPERTY

(19) **RU** (11) **2 456 195** (13) **C2**

(51) Int. Cl.
B62K 1/00 (2006.01)
B62H 1/10 (2006.01)
B62D 37/06 (2006.01)

(12) ABSTRACT OF INVENTION

(21)(22) Application: **2010140844/11, 06.10.2010**

(24) Effective date for property rights:
06.10.2010

Priority:
(22) Date of filing: **06.10.2010**

(43) Application published: **20.04.2012** Bull. 11

(45) Date of publication: **20.07.2012 Bull. 20**

Mail address:
121096, Moskva, a/ja 1, O.B. Salminoj

(72) Inventor(s):
Sulimov Pavel Sergeevich (RU)

(73) Proprietor(s):
Sulimov Pavel Sergeevich (RU),
Shushura Igor' Vladimirovich (RU)

RU 2456195 C2

(54) ONE-WHEEL VEHICLE AND VEHICLE STABILISER

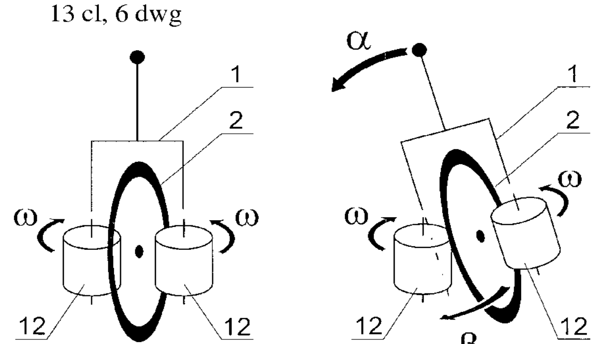
(57) Abstract:

FIELD: transport.

SUBSTANCE: invention relates to gyroscopic stabilisers. Two flywheels 12 are mounted on frame 1 to rotate in opposite directions. In vertical position of vehicle, flywheels 12 have parallel rotational axes. Both flywheels 12 may turn in plane perpendicular to direction of motion. With vehicle inclined from vertical position, rotational axis of one flywheel 12 retains vertical position while that of another flywheel in inclined through angle equal to vehicle inclination angle.

EFFECT: higher stability.

13 cl, 6 dwg



Фиг.6

RU 2456195 C2

Изобретение относится к транспортным средствам, в частности к одноколесным транспортным средствам, и может быть использовано как для целей отдыха и передвижения, так и для перемещения грузов.

Известно транспортное средство Segway, выпускаемое американской фирмой Segway LLC, состоящее из двух колес, расположенных на одной оси с расположенной между ними площадкой для ног. Водитель располагается стоя на площадке и держится за ручку управления транспортным средством. Транспортное средство использует сложную систему гироскопов и компьютеров и двигается вперед и назад в соответствии с наклоном тела водителя. Поворот транспортного средства осуществляется поворотом ручки управления.

Недостатками этого транспортного средства является его ширина, вызывающая ограничения, связанные с его использованием в общем потоке пешеходов.

Известно транспортное средство Honda U3-X, состоящее из одного сложного колеса и системы электронной стабилизации положения водителя. Основное колесо имеет возможность вращения вокруг собственной оси, а также имеет множество маленьких колес, расположенных вокруг его обода с возможностью вращения. Оси маленьких колес находятся в плоскости основного колеса, что позволяет транспортному средству перемещаться в направлении, перпендикулярном плоскости основного колеса, а при одновременном вращении большого и маленьких колес - в любом направлении, выбранном водителем. Управление транспортным средством осуществляется наклоном тела водителя, которое контролируется системой гиродатчиков и электронной схемой управления.

Использование этого транспортного средства из-за наличия маленьких колес ограничено поверхностью, по которой передвигается транспортное средство. Поверхность должна быть твердой и достаточно чистой, например офисный пол.

Наиболее близким по решаемой задаче и технической сущности является транспортное средство eniCycle, сконструированное изобретателем из Словении Александером Полутником, состоящее из одного колеса со встроенным в него электромотором. Над колесом при помощи подвески, состоящей из амортизатора и пружины, расположено сиденье. Гиродатчик жестко укреплен к сиденью, на котором располагается водитель. Изменение угла наклона водителя относительно вертикали в плоскости направления движения определяет гиродатчик. Сигнал от гиродатчика поступает в электронную систему и изменяет скорость двигателя таким образом, чтобы вернуть eniCycle равновесие. В случае если водитель наклоняется вперед, скорость увеличивается, а если откидывается назад, скорость уменьшается. Таким образом баланс транспортного средства восстанавливается. Недостатком данного транспортного средства является то, что стабилизация транспортного средства по крену (противодействие падению на бок) осуществляется самим водителем балансированием тела и изменением положения колеса относительно вертикальной оси. Такой способ сохранения равновесия сильно затруднителен и требует большой предварительной подготовки самого водителя. Кроме того, падение с транспортного средства из сидячего состояния связано с получением травм.

Задачей предложенного изобретения является создание простого в управлении и безопасного одноколесного транспортного средства для использования в условиях открытого пространства, в частности в городских условиях.

Предлагаемое техническое решение позволяет стабилизировать одноколесное транспортное средство по крену и тем самым обезопасить водителя от падения на бок.

Поставленная задача решается тем, что устройство стабилизации транспортного средства состоит из двух маховиков, установленных на раме транспортного средства. Маховики вращаются в противоположных направлениях и имеют возможность отклонения в плоскости, перпендикулярной направлению движения транспортного средства. Оси вращения маховиков параллельны. Оба маховика снабжены упорами, установленными таким образом, что при наклоне транспортного средства в сторону от вертикального положения ось вращения первого маховика сохраняет вертикальное положение, а ось вращения второго маховика отклоняется на угол отклонения транспортного средства от вертикального положения.

Также поставленная техническая задача решается тем, что на раме одноколесного транспортного средства установлено колесо и закреплен электродвигатель для вращения колеса. Также на раме жестко установлен по меньшей мере один гиродатчик, предназначенный для измерения углового отклонения рамы от вертикального положения в плоскости направления движения одноколесного транспортного средств. На раме расположен блок управления транспортным средством, предназначенный для обработки получаемых от гиродатчика результатов измерений и изменения скорости и направления вращения электродвигателя. Кроме того, на раме расположен блок аккумуляторов, предназначенный для питания потребителей электроэнергии. С обеих сторон от колеса на раме установлены подставки для ног водителя. При этом одноколесное транспортно средство дополнительно снабжено устройством стабилизации транспортного средства, включающим в себя два маховика. Маховики установлены на раме, вращаются в противоположных направлениях и имеют возможность отклонения в плоскости, перпендикулярной направлению движения транспортного средства. Оси вращения маховиков параллельны. Оба маховика снабжены упорами, установленными таким образом, что при наклоне одноколесного транспортного средства в сторону от вертикального положения ось вращения первого маховика сохраняет вертикальное положение, а ось вращения второго маховика отклоняется на угол отклонения транспортного средства от вертикального положения.

В частном случае колесо и электродвигатель выполнены в виде мотор-колеса.

В частном случае транспортное средство снабжено ручкой для опоры рук водителя с возможностью фиксирования ее в сложенном и выдвинутом положении.

В частном случае подставки для ног транспортного средства снабжены датчиками наличия водителя на транспортном средстве, которые соединены с блоком управления транспортным средством.

В частном случае транспортное средство снабжено табло с расположенными на нем индикаторами. На это табло может выводиться информация о работе как отдельных приборов, в частности частота оборотов маховиков, так и транспортного средства в целом, в частности скорости его движения.

В частном случае транспортное средство снабжено упорами-фиксаторами голени водителя.

В частном случае на каждой подставке для ног транспортного средства установлен по меньшей мере один опорный ролик.

В частном случае на транспортном средстве между рамой и колесом установлена система подрессоривания.

В частном случае транспортное средство снабжено защитным кожухом, выполненным из полимерного материала.

В частном случае защитный кожух дополнительно снабжен светоотражателями.

В частном случае защитный кожух дополнительно снабжен по меньшей мере одной фарой.

В частном случае транспортное средство дополнительно снабжено источником звукового сигнала.

В дальнейшем изобретение иллюстрируется подробным описанием конкретного примера выполнения и чертежами, на которых:

на фиг.1 изображен вариант выполнения транспортного средства;

на фиг.2 изображена принципиальная схема транспортного средства;

на фиг.3 - вариант выполнения транспортного средства с двигателем и трансмиссией;

на фиг.4 - подставка для ног водителя с установленными опорными роликами;

на фиг.5 - пример установки маховиков на транспортном средстве;

на фиг.6 изображена принципиальная схема работы устройства стабилизации транспортного средства.

Заявляемое одноколесное транспортное средство, как показано на фиг.1 и фиг.2, содержит раму 1 с установленным в раме колесом 2 и электродвигателем 3. Колесо 2 и электродвигатель 3 оборудованы трансмиссией 4 для передачи крутящего момента от электродвигателя 3 к колесу 2 (фиг.3). В качестве трансмиссии 4 могут быть использованы, например, цепная или ременная передачи.

В описываемой конкретной конструкции колесо 2 и электродвигатель 3 установлены на одной оси и совместно образуют мотор-колесо.

Колесо 2 крепится к раме 1 через систему подрессоривания 5, которая на фиг.1 изображена схематически. Как пример, в описываемой конструкции в качестве системы подрессоривания используются амортизатор и пружина.

Также на раме 1 заявляемого транспортного средства, как показано на фиг.1, жестко установлен гиродатчик 6. Гиродатчик 6 регистрирует угол наклона транспортного средства в плоскости направления движения - угол тангажа. Гиродатчик 6 соединен с блоком 7 управления транспортного средства.

Также на раме 1 транспортного средства закреплен блок 8 аккумуляторов.

С обеих сторон от колеса 2 на раме 1 установлены подставки 9 для ног водителя. Каждая подставка 9 для ног водителя снабжена датчиками 10 наличия водителя на транспортном средстве и по меньшей мере одним опорным роликом 11, как это показано на фиг.4. В описываемом примере в качестве датчиков 10 используются концевые выключатели. Датчики 10 наличия водителя соединены с блоком 7 управления транспортного средства.

Транспортное средство имеет устройство стабилизации, состоящее из двух маховиков 12, установленных на раме 1 транспортного средства. Пример установки маховиков 12 на раме 1 показан на фиг.5. Оба маховика 12 снабжены упорами 13. Маховики 12 снабжены электродвигателями 14 маховиков (фиг.5), которые соединены с блоком 8 аккумуляторов и включаются отдельным выключателем. Маховики 12 установлены с возможностью вращения в противоположных направлениях (фиг.6) и имеют возможность отклонения в плоскости, перпендикулярной направлению движения транспортного средства (фиг.5 и фиг.6). При этом при отклонении рамы 1 от вертикального положения в плоскости, перпендикулярной направлению движения транспортного средства, ось одного из маховиков 12 остается в вертикальном положении, а ось другого отклоняется вместе с рамой 1, удерживаясь упором 13.

Транспортное средство (фиг.1) снабжено индикаторами 15, в описываемом примере расположенными на ручке 16 для опоры водителя. Индикаторы 15 выполнены, например, в виде табло. Ручка 16 для опоры водителя установлена на раме 1 и, для удобства эксплуатации транспортного средства, имеет возможность фиксации по меньшей мере в выдвинутом и сложенном состоянии.

Для удобства транспортное средство может быть снабжено упорами-фиксаторами 17 голени водителя, жестко прикрепленными к раме 1 транспортного средства, и кожухом 18. Для безопасности эксплуатации транспортного средства кожух 18 оснащен светоотражателями 19 и фарой 20. Также для безопасности на транспортном средстве установлен источник звукового сигнала 21.

Питание всех потребителей электроэнергии транспортного средства, а именно электродвигателя 3, гиродатчика 6, блока 7 управления транспортного средства, электродвигателей маховиков 12, индикаторов 15, фары 20, источника звукового сигнала 21, производится от блока 8 аккумуляторов.

Транспортное средство работает следующим образом.

Транспортное средство устанавливают в вертикальное положение и, удерживая его за ручку 16, производят включение электродвигателей маховиков 12. До набора маховиками 12 необходимой частоты оборотов транспортное средство должно находиться в вертикальном положении. О достижении маховиками 12 частоты оборотов, необходимых для работы устройства стабилизации, сигнализируют индикаторы 15.

После включения устройства стабилизации транспортного средства водитель встает ногами на подставки 9. При этом датчики 10 наличия водителя на транспортном средстве включают блок 7 управления транспортным средством.

Водитель на транспортном средстве начинает движение, например, вперед. Для этого достаточно наклонить транспортное средство в сторону предполагаемого движения. Наклон можно производить как используя ручку 16 для опоры водителя, так и упоры-фиксаторы 17 или используя их совместно. Блок 7 управления по данным об угле отклонения от вертикали в плоскости направления движения (угол тангажа), получаемым от гиродатчика 6, стремится сохранить устойчивое положение транспортного средства по тангажу, изменяя скорость и направление вращения электродвигателя. В процессе равномерного прямолинейного движения устанавливается баланс между скоростью движения транспортного средства и углом наклона транспортного средства (углом тангажа). Любое изменение угла наклона транспортного средства приводит к изменению скорости и направления вращения электродвигателя 3 и, следовательно, к восстановлению необходимого баланса между скоростью движения транспортного средства и его наклоном по тангажу.

Торможение транспортного средства производится путем перевода транспортного средства в вертикальное положение.

Таким образом, транспортное средство вместе с водителем сохраняет устойчивое положение и имеет возможность набора скорости и торможения.

Безопасность использования транспортного средства повышается за счет датчиков 10 наличия водителя на нем. При отсутствии обеих ног водителя на подставках 9 транспортного средства, о чем подается сигнал от датчиков 10 в блок 7 управления транспортного средства, полностью отключается подача тока на электродвигатель 3 и транспортное средство можно буксировать только вручную.

Также безопасность движения повышается за счет установки опорных роликов 11 на подставках 9 для ног. При движении в непосредственной близости от вертикальных поверхностей, например парапета, стены или высокого бордюра, значительно снижается риск зацепления транспортного средства выступающей частью, а именно подставкой 9 для ног, за поверхность. Ролики 11 осуществляют в этом случае скольжение по вертикальной поверхности и предотвращают зацепление подставок 9 для ног с упомянутой поверхностью, которое может привести к неконтролируемому падению транспортного средства вместе с водителем.

Безопасность движения также повышается, а управление транспортным средством упрощается за счет наличия на транспортном средстве упоров-фиксаторов 16 голени водителя. Водитель, упираясь в упоры-фиксаторы 17, удобно фиксирует ноги на транспортном средстве, а также имеет дополнительную возможность регулировать наклон транспортного средства при помощи ног и управлять скоростью транспортного средства.

Для защиты водителя от возможных грязевых выбросов из-под колеса 2, попадания одежды в колесо 2 транспортное средство снабжено кожухом 18. В целях облегчения конструкции кожух выполнен из полимерного материала, например из композиционного материала на основе поликарбоната и АБС-пластика.

Для обеспечения безопасности передвижения на транспортном средстве в условиях плохой видимости транспортное средство снабжено светоотражателями 19 и фарой 20, установленными на кожухе 18.

В целях обеспечения безопасности участников движения транспортное средство снабжено источником звукового сигнала 21.

Формула изобретения

1. Одноколесное транспортное средство, состоящее из рамы и установленных на раме колеса, электродвигателя для вращения колеса, по меньшей мере одного гиродатчика, соединенного с ним блока управления транспортным средством, предназначенным для обработки измерений гиродатчиком углового отклонения рамы от вертикального положения в плоскости направления движения одноколесного транспортного средства и изменения скорости и направления вращения электродвигателя, блока аккумуляторов, подставок для ног водителя, установленных на раме с обеих сторон от колеса, отличающееся тем, что одноколесное транспортное средство дополнительно снабжено устройством стабилизации транспортного средства, включающим в себя два маховика, установленных на раме, которые вращаются в противоположных направлениях и установлены с возможностью отклонения в плоскости, перпендикулярной направлению движения транспортного средства, при этом оси вращения маховиков параллельны, оба маховика снабжены упорами, установленными таким образом, что при наклоне одноколесного транспортного средства в сторону от вертикального положения ось вращения первого маховика сохраняет вертикальное положение, а ось вращения второго маховика отклоняется на угол отклонения транспортного средства от вертикального положения.

2. Одноколесное транспортное средство по п.1, отличающееся тем, что колесо и электродвигатель выполнены в виде мотор-колеса.

3. Одноколесное транспортное средство по п.1, отличающееся тем, что транспортное средство снабжено ручкой для опоры водителя, которая имеет возможность фиксации ее в сложенном и выдвинутом положениях.

4. Одноколесное транспортное средство по п.1, отличающееся тем, что подставки для ног снабжены датчиками наличия водителя на транспортном средстве, которые соединены с блоком управления транспортным средством.

5. Одноколесное транспортное средство по п.1, отличающееся тем, что транспортное средство снабжено индикаторами работы систем транспортного

средства.

6. Одноколесное транспортное средство по п.1, отличающееся тем, что транспортное средство дополнительно снабжено упорами-фиксаторами голени водителя.

7. Одноколесное транспортное средство по п.1, отличающееся тем, что каждая подставка для ног водителя снабжена по меньшей мере одним опорным роликом, установленным с внешней стороны подставки.

8. Одноколесное транспортное средство по п.1, отличающееся тем, что между рамой и колесом установлена система подрессоривания.

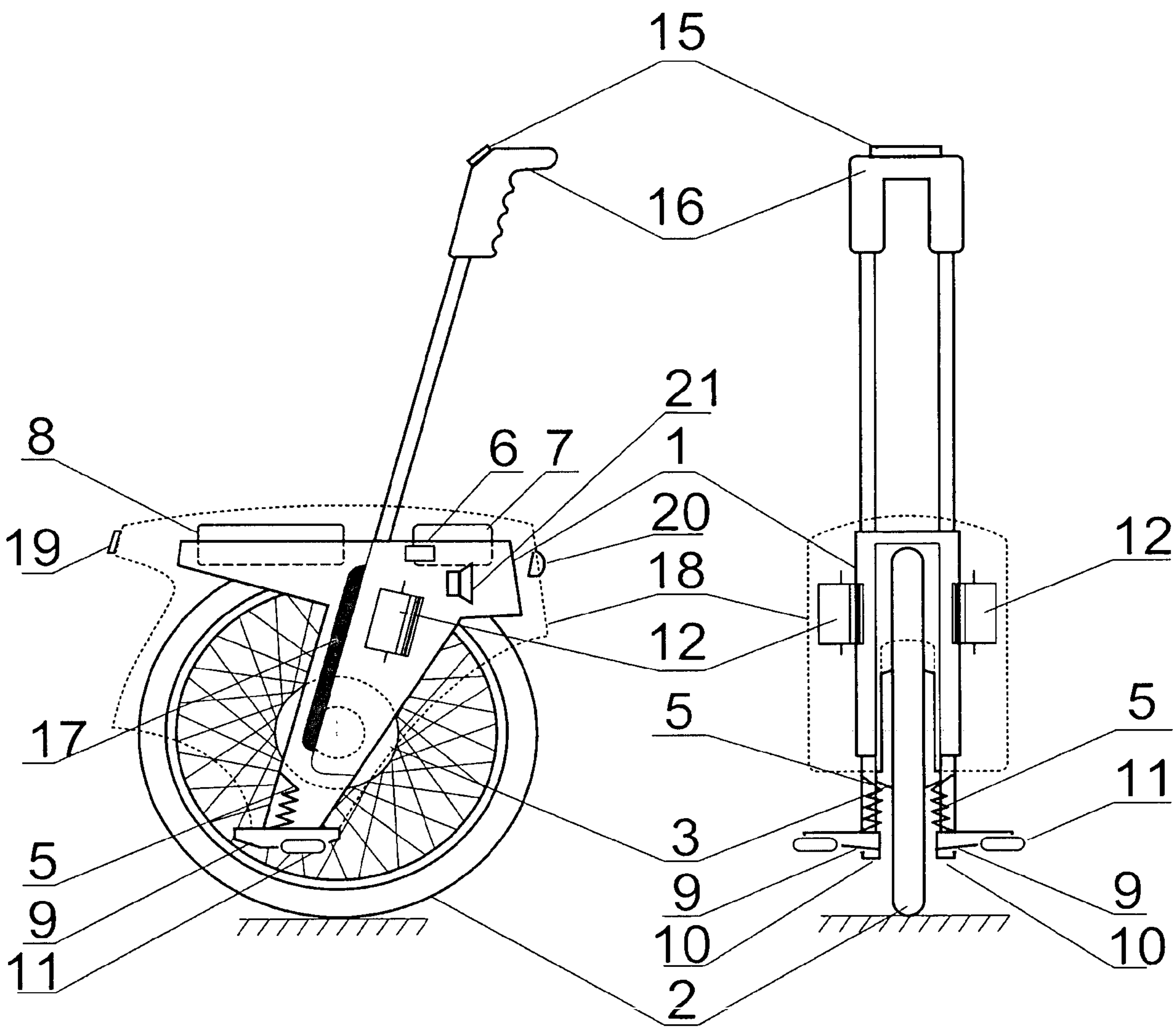
9. Одноколесное транспортное средство по п.1, отличающееся тем, что транспортное средство снабжено защитным кожухом, выполненным из полимерного материала.

10. Одноколесное транспортное средство по п.9, отличающееся тем, что защитный кожух дополнительно снабжен светоотражателями.

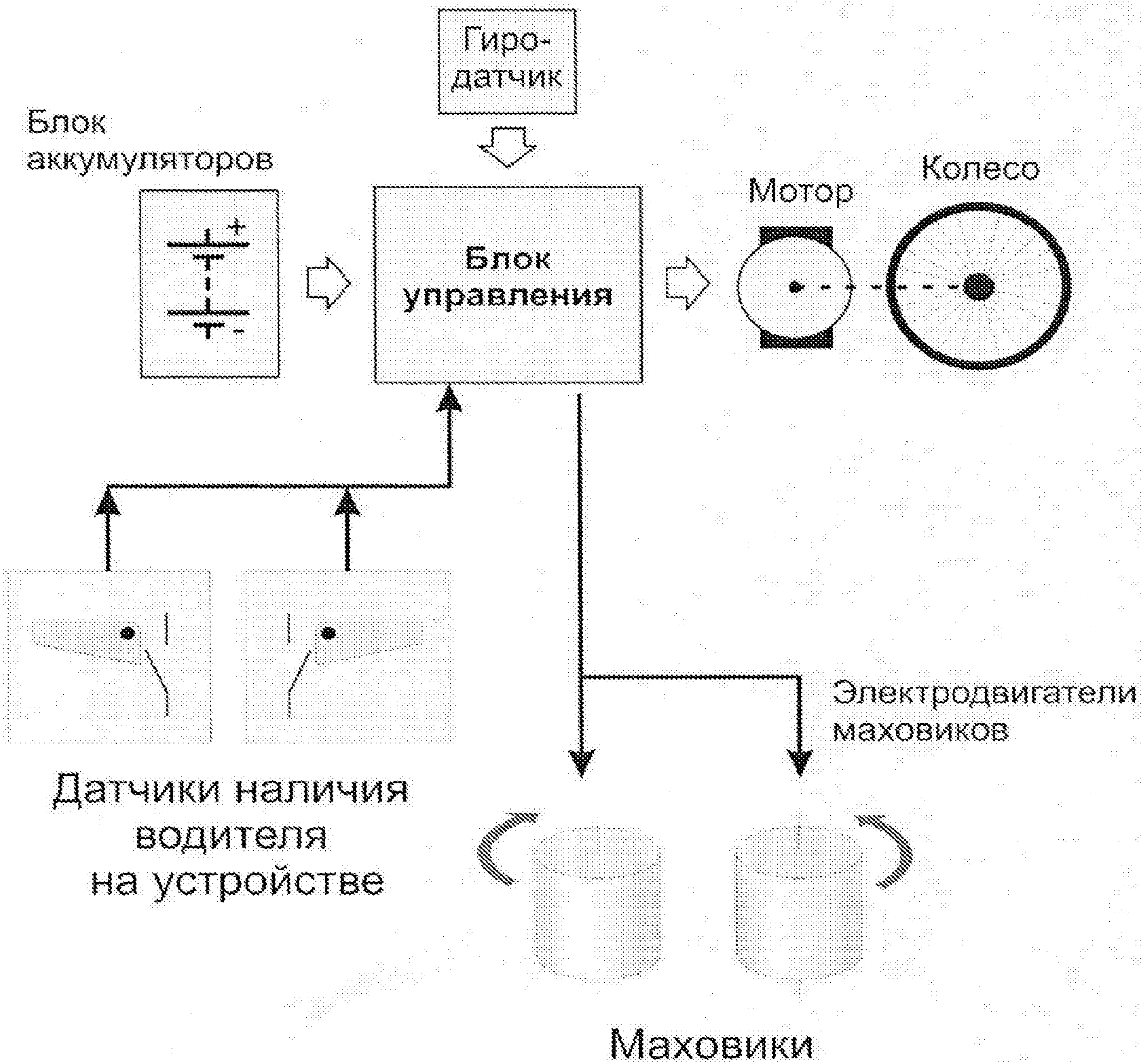
11. Одноколесное транспортное средство по п.9, отличающееся тем, что защитный кожух дополнительно снабжен по меньшей мере одной фарой.

12. Одноколесное транспортное средство по п.9, отличающееся тем, что транспортное средство дополнительно снабжено источником звукового сигнала.

13. Устройство стабилизации транспортного средства, состоящее из двух маховиков, установленных на раме транспортного средства, которые вращаются в противоположных направлениях и имеют возможность отклонения в плоскости, перпендикулярной направлению движения транспортного средства, при этом оси вращения маховиков параллельны, оба маховика снабжены упорами, установленными таким образом, что при наклоне транспортного средства в сторону от вертикального положения ось вращения первого маховика сохраняет вертикальное положение, а ось вращения второго маховика отклоняется на угол отклонения транспортного средства от вертикального положения.



Фиг.1


Гиро-
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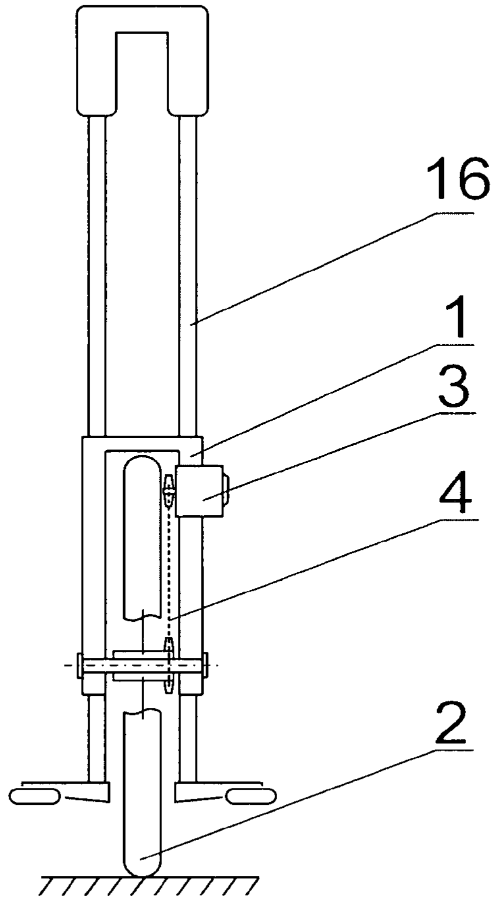
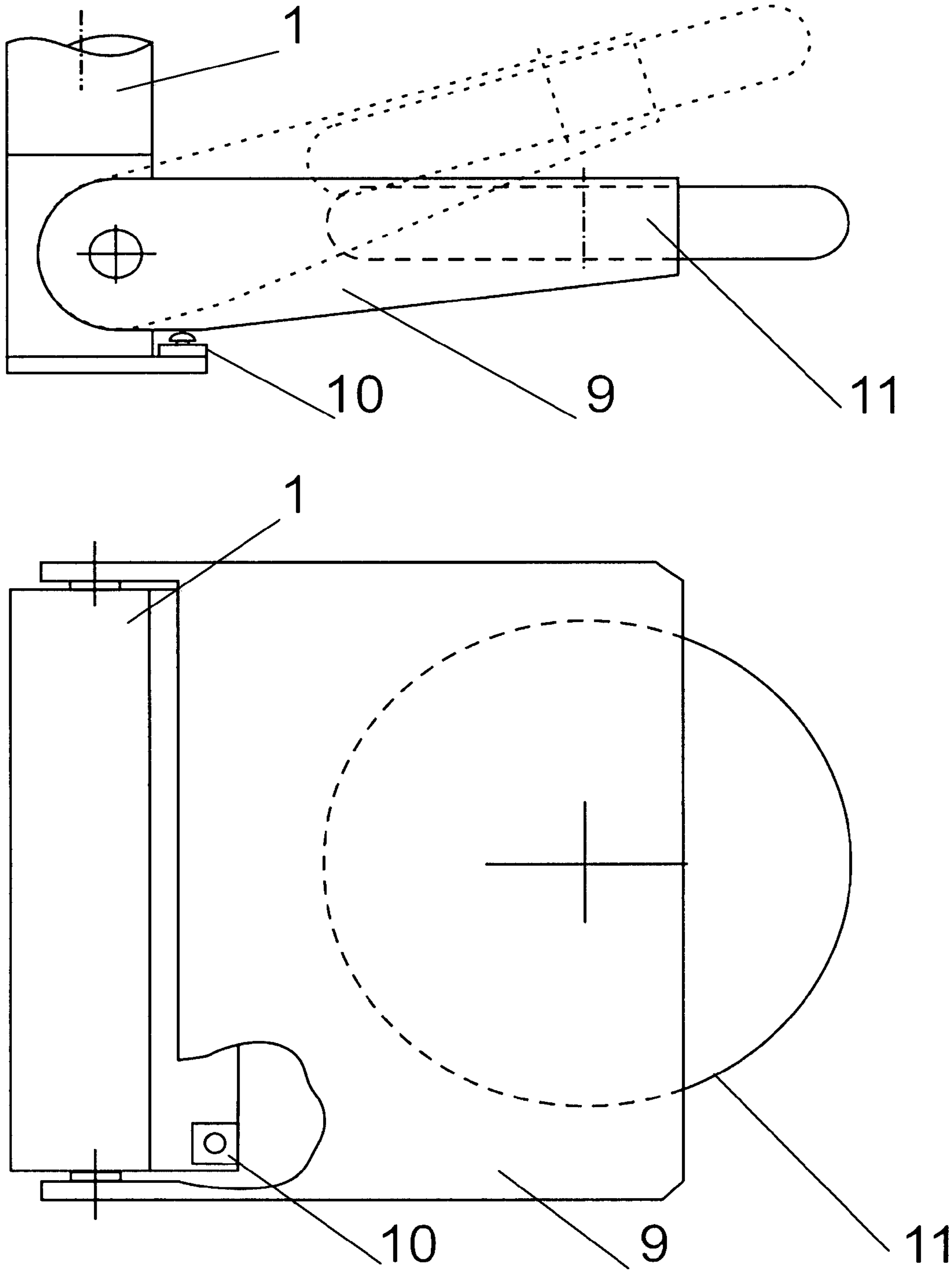
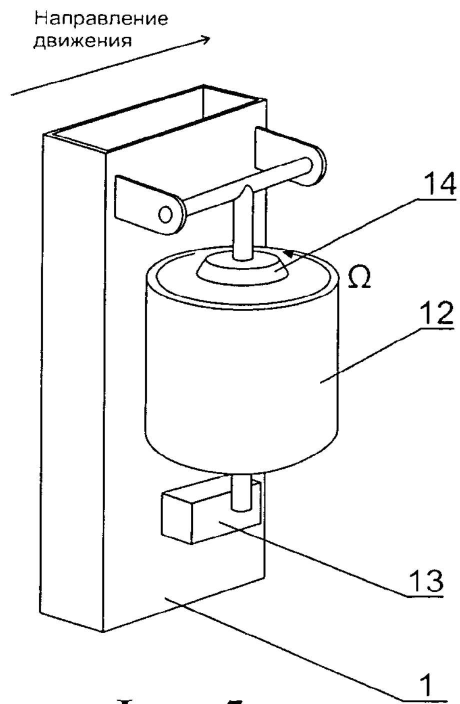
Фиг.2



Фиг.3



Фиг.4



Фиг.5

Espacenet

Bibliographic data: CN202669532 (U) — 2013-01-16

Circuit control device with complex programmable logic device (CPLD) to control motor of balance car

Inventor(s):	YING FANGTIAN; XIE JIANGHU; HONG DINGAN + (YING FANGTIAN, ; XIE JIANGHU, ; HONG DINGAN)
Applicant(s):	HANGZHOU YINAO INTELLIGENT TECHNOLOGY CO LTD + (HANGZHOU YINAO INTELLIGENT TECHNOLOGY CO., LTD)
Classification:	**- international:** ***B60L15/20; G05D1/08*** **- cooperative:** Y02T10/7275 (EP)
Application number:	CN201220367045U 20120727
Priority number (s):	CN201220367045U 20120727

Abstract of CN202669532 (U)

The utility model discloses a circuit control device with a complex programmable logic device (CPLD) to control a motor of a balance car. The circuit control device with the CPLD to control the motor of the balance car comprises a balance signal sensor, a signal detecting device, a signal processing device, a motor control signal setting device, a CPLD motor control output interface, a motor drive device, a motor, a motor velocity detecting device, a motor current detecting sensor and a motor temperature detecting sensor, wherein the balance signal sensor, the signal detecting device, the signal processing device, the motor control signal setting device, the CPLD motor control output interface, the motor drive device and the motor are connected in sequence. One ends of the motor velocity detecting device, the motor current detecting sensor and the motor temperature detecting sensor are connected with the motor, and the other ends of the motor velocity detecting device, the motor current detecting sensor and the motor temperature detecting sensor are connected with the motor control signal setting device. The circuit control device with the CPLD to control the motor of the balance car can solve the technical problems of protecting the motor and high velocity.

Notice

CLAIMS CN202669532

1.

The circuit control device for controlling the balance car motor by using CPLD, including balance signal sensor, motor drive device and motor, is characterized in that: signal detection device, signal processing device, motor control signal setting device, CPLD motor control output interface, motor speed are also included. Detection device, motor current detecting sensor, motor temperature detecting sensor; wherein balance signal sensor, signal detecting device, signal processing device, motor control signal setting device, CPLD motor control output interface, motor driving device, motor are sequentially connected; motor speed detecting device The three devices of the motor current detecting sensor and the motor temperature detecting sensor are connected to the motor at one end and to the motor control signal setting device at the other end.

2

A circuit control apparatus for controlling a balancer motor using a CPLD according to claim 1, wherein said balance signal sensor is mounted in the balance carrier carrying device at an intermediate position of the two wheel bodies disposed oppositely and coaxially.

3

The circuit control device for controlling a balance car motor using a CPLD according to claim 1, wherein the balance signal sensor comprises a gyro chip and an accelerometer chip, and the two chips are respectively connected to the signal processing device.

4

A circuit control device for controlling a balance car motor using a CPLD according to claim 1, wherein said signal processing device is a circuit control board composed of a CPLD control chip.

Notice

DESCRIPTION CN202669532

The utility model discloses a circuit control device for controlling a balance car motor by using a CPLD, which comprises a balance signal sensor, a signal detection device, a signal processing device, a motor control signal setting device, a CPLD motor control output interface, a motor drive device, a motor and a motor. Speed detecting device, motor current detecting sensor, motor temperature detecting sensor; wherein balance signal sensor, signal detecting device, signal processing device, motor control signal setting device, CPLD motor control output interface, motor driving device, motor are connected in sequence; motor speed detection The three devices of the device, the motor current detecting sensor and the motor temperature detecting sensor are connected to the motor at one end and to the motor control signal setting device at the other end. The utility model can solve the technical problem of realizing protection of the motor and fast protection speed.

Circuit control device for controlling balance car motor using CPLD

Technical field

The present invention relates to a circuit control device for controlling a balance motor using a CPLD.

Background technique

The balance car is a self-balanced personal transportation vehicle that is self-balancing. It is a kind of urban transportation and a new vehicle that has never been seen before. The principle of operation of the balance car is mainly the principle of aircraft balance, which is the automatic balancing ability of the vehicle itself. It uses a built-in precision electronic gyroscope to determine the posture of the vehicle body. After calculating the appropriate command through a sophisticated and high-speed central microprocessor, the motor is driven to achieve a balanced effect. However, at present, the application of DC motor in the balance car products is very extensive, and the control requirements for the motor are getting higher and higher. Many related products have many drawbacks for the selection of the motor chip, the cost control, and the control scheme, such as the motor. The protection is not in place, the protection speed is not fast enough.

CPLD is a complex programmable digital logic integrated circuit that allows users to construct their own logic functions according to their needs.

Utility model content

The purpose of the utility model is to provide a circuit control device for controlling a balance motor by using a CPLD, and to solve the technical problem of realizing protection of the motor and fast protection speed.

Use CPLD to control the circuit control device of the balance motor, including balance signal sensor, signal detection device, signal processing device, motor control signal setting device, CPLD motor control output interface, motor drive device, motor, motor speed detection device, motor current detection Sensor, motor temperature detecting sensor; wherein balance signal sensor, signal detecting device, signal processing device, motor control signal setting device, CPLD motor control output interface, motor driving device, motor are connected in sequence; motor speed detecting device, motor current detecting sensor, The three devices of the motor temperature detecting sensor are connected to the motor at one end and to the motor control signal setting device at the other end.

The balance signal sensor is mounted in the balance vehicle carrying device at an intermediate position between the two wheel bodies that are opposite and coaxially disposed.

The balanced signal sensor includes a gyro chip and an accelerometer chip, and the two chips are respectively connected to the signal processing device.

The signal processing device is a circuit control board composed of a CPLD control chip.

The utility model has the beneficial effects that the utility model utilizes the CPLD control chip as the main control chip, which has the advantages of flexible programming, high integration, short design and development period, wide application range, advanced development tools, low design and manufacturing cost, and designer Low hardware experience, standard products without testing, strong confidentiality, popular price, simple circuit structure, low cost, perfect protection mechanism, and synchronous control. Apply CPLD to the motor control of the balance car Protection and high protection speed.

DRAWINGS

1 is a block diagram showing the overall structure of a circuit control device in an embodiment;

Figure 11. Gyro chip, 12. Accelerometer chip, 2 Signal detection device, 3 Signal processing device, 4 Motor control signal setting device, 5 CPLD motor control output interface, 6 Motor drive unit, 7. Motor, 8 Motor speed detecting device, 9 Motor current detection sensor, 10 Motor temperature detection sensor.

detailed description

The balance vehicle to which the circuit control device is applied includes a traveling device mounted on the carrying device, a carrying device and a steering device, and a circuit control device mounted in the carrying device.

The carrying device is installed between the two wheel bodies disposed opposite to each other in the traveling device for carrying the user to walk under the driving of the traveling device.

The circuit control device includes a gyro chip 11 and an accelerometer 12as a balance signal sensor, a signal detecting device 2, a signal processing device 3, a motor control signal setting device 4, a CPLD motor control output interface 5, a motor driving device 6, and a motor 7, Motor speed detecting device 8, motor current detecting sensor 9, motor temperature detecting sensor 10, wherein balance signal sensor 1, signal detecting device 2, signal processing device 3, motor control signal setting device 4, CPLD motor control output interface 5, motor drive The device 6and the motor 7are sequentially connected to receive signals and perform corresponding actions; the three devices of the motor speed detecting device 8, the motor current detecting sensor 9, and the motor temperature detecting sensor 10are connected to the motor 7at one end, and the motor is connected to the motor at the other end. The control signal setting means 4is connected.

The gyro chip 11 and the accelerometer 12are mounted in the balance vehicle carrying device at intermediate positions of the two coaxial bodies disposed opposite each other. The two sensors collect angular velocity and acceleration signals and generate corresponding voltage signals.

The signal detecting device 2, the signal processing device 3, and the motor control signal setting device 4 together form a conventional CPLD chip control circuit board, which uses a preset program to perform corresponding actions, and the CPLD chip controls the circuit board and the circuit board to be used. The procedures are implemented by those skilled in the art and will not be described too much herein.

The signal detecting device 2is a circuit control board capable of detecting signals of the gyro chip 11 and the accelerometer 12and performing preliminary amplification filtering processing.

The signal processing device 3is a circuit control board capable of performing data processing on the signal detected by the signal detecting device 2and converting it into a digital signal usable for communication.

The motor control signal setting device 4is a circuit control board for setting the duty ratio of the pulse width modulation PWM and the direction of rotation required by the motor 7according to the digital signal given by the signal processing device, and the above duty ratio means A series of ideal pulse cycle sequences such as a square wave, the ratio of the duration of a positive pulse to the total pulse period.

The CPLD motor control output interface 5communicates with the motor control signal setting device 4 through the parallel port, and the final pulse width modulation PWM signal and the direction signal are synchronously sent out.

The motor driving device 6is a driving device used by the current balancing vehicle, and power-amplifies the pulse width modulation PWM given by the CPLD motor control output interface 5to drive the motor 7.

The motor 7is controlled by the motor drive unit 6to perform forward and reverse rotation of different numbers of revolutions to maintain the balance of the balance vehicle.

The motor temperature detecting sensor 8is used to detect the temperature of the motor. When the temperature of the motor 7exceeds a certain set value, an alarm signal is generated and the signal is fed back to the motor control signal setting device 4, and the motor control signal setting device 4 is issued. The operation command protects the motor 7.

The motor current detecting sensor 9uses the resistor to detect the current passing through the motor 7. When the motor 7current exceeds a certain set value, an alarm signal is generated and the signal is fed back to the motor control signal setting device 4, and the motor control signal setting device 4will issue an operating command to properly control the current.

The motor rotation speed detecting device 10detects the current rotation speed and the rotation speed direction of the motor 7by using the Hall logic relationship, and feeds back the detected value back to the motor control signal setting device 4, when the speed of the motor 7exceeds a certain set value, according to The speed limit adjustment of the pulse width modulation PWM duty cycle is required.

In summary, the above description is only a preferred embodiment of the present invention, and all changes and modifications made in accordance with the scope of the present invention should be covered by the patent of the present invention.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 202669532 U
(45)授权公告日 2013.01.16

(21)申请号 201220367045.9

(22)申请日 2012.07.27

(73)专利权人 杭州亿脑智能科技有限公司
地址 310013 浙江省杭州市西湖区西斗门路 3 号天堂软件园 E 幢 11 层

(72)发明人 应放天　谢江虎　洪定安

(74)专利代理机构 杭州裕阳专利事务所(普通合伙) 33221
代理人 应圣义

(51)Int.Cl.
B60L 15/20(2006.01)
G05D 1/08(2006.01)

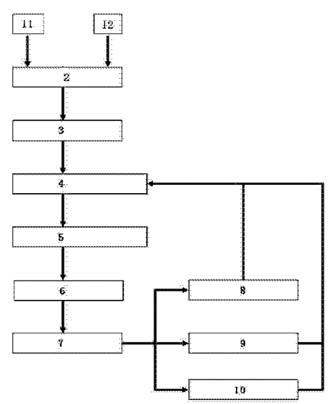
权利要求书 1 页　说明书 3 页　附图 1 页

(54)实用新型名称

使用 CPLD 控制平衡车电机的电路控制装置

(57)摘要

本实用新型公开了一种使用 CPLD 控制平衡车电机的电路控制装置,包括平衡信号传感器、信号检测装置、信号处理装置、电机控制信号设置装置、CPLD 电机控制输出接口、电机驱动装置、电机、电机速度检测装置、电机电流检测传感器、电机温度检测传感器;其中平衡信号传感器、信号检测装置、信号处理装置、电机控制信号设置装置、CPLD 电机控制输出接口、电机驱动装置、电机依次连接;电机速度检测装置、电机电流检测传感器、电机温度检测传感器这三个装置其一端与电机连接,另一端与电机控制信号设置装置连接。本实用新型可解决实现保护电机、保护速度快捷的技术问题。



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1. 使用 CPLD 控制平衡车电机的电路控制装置，包括平衡信号传感器、电机驱动装置、电机，其特征在于：还包括信号检测装置、信号处理装置、电机控制信号设置装置、CPLD 电机控制输出接口、电机速度检测装置、电机电流检测传感器、电机温度检测传感器；其中平衡信号传感器、信号检测装置、信号处理装置、电机控制信号设置装置、CPLD 电机控制输出接口、电机驱动装置、电机依次连接；电机速度检测装置、电机电流检测传感器、电机温度检测传感器这三个装置其一端与电机连接，另一端与电机控制信号设置装置连接。

2. 依据权利要求 1 所述的使用 CPLD 控制平衡车电机的电路控制装置，其特征在于：所述平衡信号传感器安装在平衡车承载装置内，位于相对且同轴设置的两个轮体的中间位置。

3. 依据权利要求 1 所述的使用 CPLD 控制平衡车电机的电路控制装置，其特征在于：所述平衡信号传感器包括陀螺仪芯片及加速度计芯片，这两个芯片分别与信号处理装置连接。

4. 依据权利要求 1 所述的使用 CPLD 控制平衡车电机的电路控制装置，其特征在于：所述信号处理装置为由 CPLD 控制芯片组成的电路控制板。

使用 CPLD 控制平衡车电机的电路控制装置

技术领域

[0001] 本发明涉及一种使用 CPLD 控制平衡车电机的电路控制装置。

背景技术

[0002] 平衡车是一种由电力驱动、具有自我平衡能力的个人用运输载具，是都市用交通工具的一种，是一种前所未见的崭新交通工具。平衡车的运作原理主要是飞机平衡的原理，也就是车辆本身的自动平衡能力。其以内置的精密电子陀螺仪来判断车身所处的姿势状态，透过精密且高速的中央微处理器计算出适当的指令后，驱动马达来做到平衡的效果。然而，目前在平衡车产品中直流电机的应用非常广泛，对电机的控制要求也越来越高，许多相关产品对电机芯片的选择，成本的控制，以及控制方案都有很多弊端，如对电机的保护不到位，保护速度不够快等。

[0003] CPLD 是一种复杂可编程具有逻辑功能的数字集成电路，用户可根据各自需要而自行构造逻辑功能。

实用新型内容

[0004] 本实用新型的目的是提供一种使用 CPLD 控制平衡车电机的电路控制装置，解决实现保护电机、保护速度快捷的技术问题。

[0005] 使用 CPLD 控制平衡车电机的电路控制装置，包括平衡信号传感器、信号检测装置、信号处理装置、电机控制信号设置装置、CPLD 电机控制输出接口、电机驱动装置、电机、电机速度检测装置、电机电流检测传感器、电机温度检测传感器；其中平衡信号传感器、信号检测装置、信号处理装置、电机控制信号设置装置、CPLD 电机控制输出接口、电机驱动装置、电机依次连接；电机速度检测装置、电机电流检测传感器、电机温度检测传感器这三个装置其一端与电机连接，另一端与电机控制信号设置装置连接。

[0006] 所述平衡信号传感器安装在平衡车承载装置内，位于相对且同轴设置的两个轮体的中间位置。

[0007] 所述平衡信号传感器包括陀螺仪芯片及加速度计芯片，这两个芯片分别与信号处理装置连接。

[0008] 所述信号处理装置为由 CPLD 控制芯片组成的电路控制板。

[0009] 本实用新型的有益效果是：本实用新型利用 CPLD 控制芯片作为主控制芯片，其具有编程灵活、集成度高、设计开发周期短、适用范围宽、开发工具先进、设计制造成本低、对设计者的硬件经验要求低、标准产品无需测试、保密性强、价格大众化、电路结构简单，成本低，保护机制完善、控制同步实施等特点，将 CPLD 应用到平衡车的电机控制上面，能够改善对电机的保护，并且具有较高的保护速度。

附图说明

[0010] 图 1 是实施例中电路控制装置的整体结构框图；

[0011] 图中 11. 陀螺仪芯片、12. 加速度计芯片、2. 信号检测装置、3. 信号处理装置、4. 电机控制信号设置装置、5. CPLD 电机控制输出接口、6. 电机驱动装置、7. 电机、8. 电机速度检测装置、9. 电机电流检测传感器、10. 电机温度检测传感器。

具体实施方式

[0012] 该电路控制装置应用的平衡车包括安装于承载装置上的行走装置、承载装置与转向装置以及安装在承载装置内的电路控制装置。

[0013] 承载装置安装于行走装置中相对设置的两个轮体之间，用于在行走装置的带动下承载使用者行走。

[0014] 电路控制装置包括作为平衡信号传感器的陀螺仪芯片 11 及加速度计 12、信号检测装置 2、信号处理装置 3、电机控制信号设置装置 4、CPLD 电机控制输出接口 5、电机驱动装置 6、电机 7、电机速度检测装置 8、电机电流检测传感器 9、电机温度检测传感器 10；其中平衡信号传感器 1、信号检测装置 2、信号处理装置 3、电机控制信号设置装置 4、CPLD 电机控制输出接口 5、电机驱动装置 6、电机 7 依次连接从而接收信号并作出相应动作；电机速度检测装置 8、电机电流检测传感器 9、电机温度检测传感器 10 这三个装置其一端均与电机 7 连接，另一端则均与电机控制信号设置装置 4 连接。

[0015] 陀螺仪芯片 11 及加速度计 12 安装在平衡车承载装置内，位于相对且同轴设置的两个轮体的中间位置，这两个传感器对角速度及加速度信号的采集并产生相应的电压信号。

[0016] 信号检测装置 2、信号处理装置 3、电机控制信号设置装置 4 共同组成一个常规的 CPLD 芯片控制电路板，其利用预先设定好的程序进行相应动作，CPLD 芯片控制电路板、该电路板使用到的程序为本领域的技术人员能够实现，在此不再过多描述。

[0017] 信号检测装置 2 为一个能够对陀螺仪芯片 11 及加速度计 12 产生的信号进行检测并初步放大滤波处理的电路控制板。

[0018] 信号处理装置 3 为一个能够对信号检测装置 2 所检测到的信号进行数据处理，转化为通讯可用的数字信号的电路控制板。

[0019] 电机控制信号设置装置 4 为一个根据信号处理装置给出的数字信号来设置电机 7 所需要的脉冲宽度调制 PWM 的占空比及转动的方向的电路控制板，上述的占空比是指即在一串理想的脉冲周期序列中如方波，正脉冲的持续时间与脉冲总周期的比值。

[0020] CPLD 电机控制输出接口 5 通过和电机控制信号设置装置 4 并口快速通讯，将最终的脉冲宽度调制 PWM 信号及方向信号同步送出。

[0021] 电机驱动装置 6 为目前平衡车使用到的驱动装置，其将 CPLD 电机控制输出接口 5 给出的脉冲宽度调制 PWM 进行功率放大从而驱动电机 7。

[0022] 电机 7 受到电机驱动装置 6 的控制，进行不同转数的正反转，以此来维持平衡车的平衡。

[0023] 电机温度检测传感器 8 用来检测电机的温度，当电机 7 温度超过某个设定值时，将会产生报警信号并且将信号反馈到电机控制信号设置装置 4，电机控制信号设置装置 4 就会发出操作指令对电机 7 进行保护处理。

[0024] 电机电流检测传感器 9 利用电阻采用来检测通过电机 7 的电流，当电机 7 电流超

过某个设定值时，将会产生报警信号并且将信号反馈到电机控制信号设置装置 4，电机控制信号设置装置 4 就会发出操作指令对电流进行合理控制。

[0025] 电机转速检测装置 10 利用霍尔逻辑关系来检测电机 7 的当前转速及转速方向，并且将检测到的数值反馈回电机控制信号设置装置 4，当电机 7 的速度超过某个设定值时，根据需要对脉冲宽度调制 PWM 占空比进行限速调节。

[0026] 总之，以上所述仅为本实用新型的较佳实施例，凡依本实用新型申请专利范围所作的均等变化与修饰，皆应属本实用新型专利的涵盖范围。

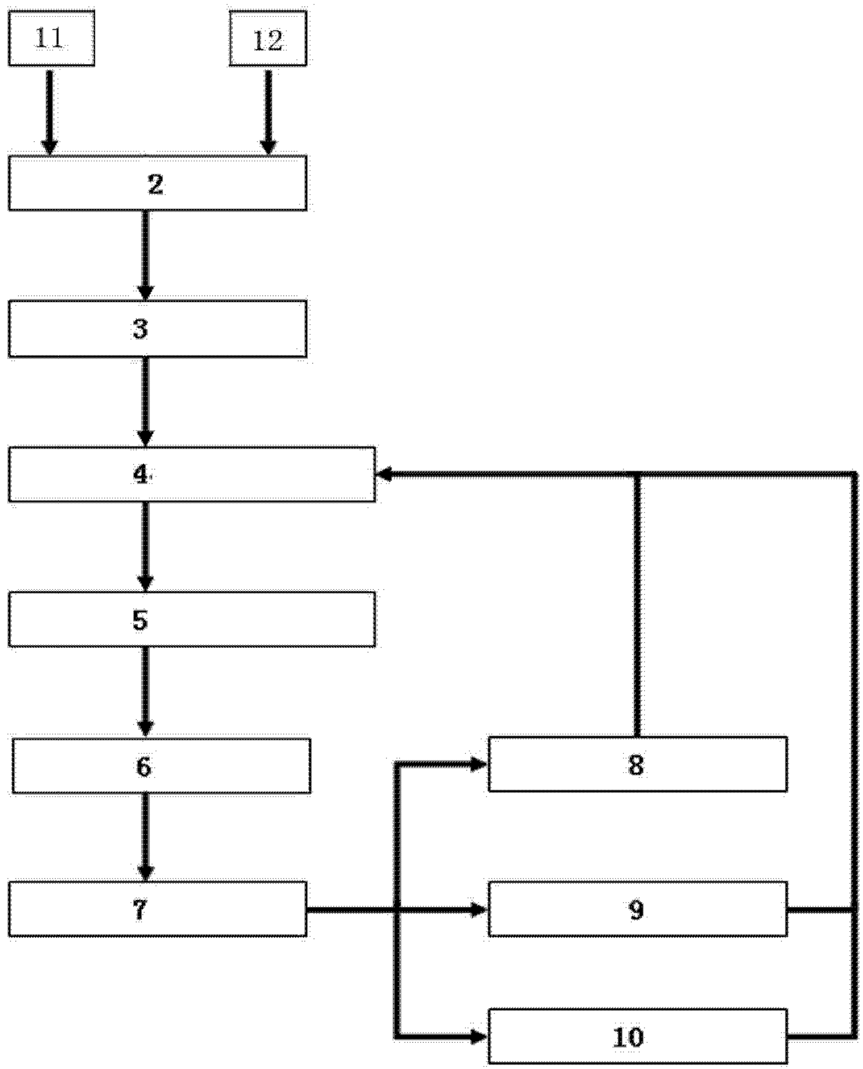

图 1

Electronic Acknowledgement Receipt

EFS ID:	37787019
Application Number:	16658020
International Application Number:	
Confirmation Number:	6585
Title of Invention:	ELECTRIC VEHICLE
First Named Inventor/Applicant Name:	Jiawei YING
Customer Number:	23990
Filer:	Neil Gibson Ferrari/Keith Woods
Filer Authorized By:	Neil Gibson Ferrari
Attorney Docket Number:	HANG01-10008
Receipt Date:	18-NOV-2019
Filing Date:	18-OCT-2019
Time Stamp:	21:14:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	1039695 c2a5c7149f56210e141f16ee2959dad6c840c9bc	no	17

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/658,020	10/18/2019	3782	1265	HANG01-10008	25	4

CONFIRMATION NO. 6585

FILING RECEIPT

OC000000112434416

23990
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P.O. DRAWER 800889
DALLAS, TX 75380

Date Mailed: 11/07/2019

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Inventor(s)

Jiawei YING, Hangzhou, CHINA;
Shaojun CAO, Hangzhou, CHINA;

Applicant(s)

Hangzhou Chic Intelligent Technology Co., Ltd., Hangzhou, CHINA;

Power of Attorney: The patent practitioners associated with Customer Number 23990

Domestic Priority data as claimed by applicant

This application is a CON of 16/429,636 06/03/2019 PAT 10486764
which is a CON of 15/160,589 05/20/2016 PAT 10336392
which is a CON of 14/773,650 09/08/2015 PAT 9376155
which is a 371 of PCT/CN2014/092849 12/02/2014

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
CHINA 201410262353.9 06/13/2014 No Access Code Provided

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/658,020**

Projected Publication Date: 02/13/2020

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

ELECTRIC VEHICLE

Preliminary Class

229

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/658,020

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)		NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A		N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A		N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A		N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	25	minus 20 =	* 5	x 50 =	250	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4	minus 3 =	* 1	x 230 =	230			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					0.00			
				TOTAL	1265		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
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The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/658,020	10/18/2019	Jiawei YING	HANG01-10008	6585

23990 7590 11/07/2019
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DALLAS, TX 75380

EXAMINER

ART UNIT	PAPER NUMBER
3611	

NOTIFICATION DATE	DELIVERY MODE
11/07/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

munckwilson@gmail.com
patents@munckwilson.com

PTOL-90A (Rev. 04/07)

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 16/658,020	**Applicant(s)** YING et al.	
	Examiner BRIAN W BROWN	**Art Unit** OPET	**AIA (FITF) Status** Yes

1. THE REQUEST FILED 18 October 2019 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination
   A. ☑ for an original nonprovisional application (Track I).
   B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

   A. filing a **petition for extension of time** to extend the time period for filing a reply;

   B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

   C. filing a **request for continued examination** ;

   D. filing a notice of appeal;

   E. filing a request for suspension of action;

   F. mailing of a notice of allowance;

   G. mailing of a final Office action;

   H. completion of examination as defined in 37 CFR 41.102; or

   I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to BRIAN BROWN at (571)272-5338.

In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/BRIAN W BROWN/
Petitions Examiner, OPET

U.S. Patent and Trademark Office
PTO-2298 (Rev. 02-2012)

United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C41739

Sale Accounting Date:11/05/2019

Sale Item Reference Number	Effective Date
16658020	10/18/2019

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I2019A5A09306784	2202	CLAIMS IN EXCESS OF 20	$250.00	Deposit Account

SCORE Placeholder Sheet for IFW Content

Application Number: 16658020 Document Date: 10/18/2019

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

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- USPTO employees may access SCORE content via DAV or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

Form Revision Date: March 1, 2019

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	
First Named Inventor	Jiawei YING
Title	ELECTRIC VEHICLE
Art Unit	
Examiner Name	
Attorney Docket Number	HANG01-10008

SIGNATURE of Applicant or Patent Practitioner

Signature	/Neil G. Ferrari/	Date (Optional)	10/18/2019
Name	Neil G. Ferrari	Registration Number	61,484
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of ___________ forms are submitted.

Best Available Copy

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CENTRAL FAX CENTER
OCT 07 2019

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 23990

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Hangzhou Chic Intelligent Technology Co., Ltd.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	Jiawei Ying	Date (Optional)	Sep. 9, 2019
Name	Jiawei Ying		
Title	Chief Executive Officer		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Jiawei YING	Nonprovisional Application Number (if known):	
Title of Invention:	ELECTRIC VEHICLE		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ **<u>Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)</u>**

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **<u>or</u>** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ **<u>Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)</u>**

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Neil G. Ferrari/	Date 10/18/2019
Name (Print/Typed) Neil G. Ferrari	Practitioner Registration Number 61,484

***<u>Note</u>:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☐ *Total of ________ forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	ELECTRIC VEHICLE
First Named Inventor/Applicant Name:	Jiawei Ying
Filer:	Neil Gibson Ferrari/Keith Woods
Attorney Docket Number:	HANG01-10008

Filed as Small Entity

Filing Fees for **Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
REQUEST FOR PRIORITIZED EXAMINATION	2817	1	2000	2000
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	2201	1	230	230
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70

Petition:

Patent-Appeals-and-Interference:

Post-Allowance-and-Post-Issuance:

Extension-of-Time:

Miscellaneous:

Total in USD ($) **3085**

Electronic Acknowledgement Receipt

EFS ID:	37504965
Application Number:	16658020
International Application Number:	
Confirmation Number:	6585
Title of Invention:	ELECTRIC VEHICLE
First Named Inventor/Applicant Name:	Jiawei Ying
Customer Number:	23990
Filer:	Neil Gibson Ferrari/Keith Woods
Filer Authorized By:	Neil Gibson Ferrari
Attorney Docket Number:	HANG01-10008
Receipt Date:	18-OCT-2019
Filing Date:	
Time Stamp:	23:32:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$3085
RAM confirmation Number	E20190HN33468659
Deposit Account	500208
Authorized User	Keith Woods

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	ADS.pdf	1823526 1948b262be9c8ac111abaae8cb45d1463f0e5cca	no	9
Warnings:					
Information:					
2	Oath or Declaration filed	Declaration.pdf	190190 318861d874e1d80424dac68be13843b79acb930a	no	3
Warnings:					
Information:					
3	Drawings-other than black and white line drawings	Drawings.pdf	179086 1195f8738db8b67d37f22741a3bffc785020ad84	no	6
Warnings:					
Information:					
4	Power of Attorney	POA.pdf	450405 a7c1cb9d201c9991bbcd6ecea70a0ee827f04b8c	no	2
Warnings:					
Information:					
5	Preliminary Amendment	PreliminaryAmendment.pdf	157517 5b4fbc031f9c74b153fde6397de09b796b97e10a	no	9
Warnings:					
Information:					
6	Specification	Specification.pdf	1951437 28531c9cca52d88712344aa5867c94c028d0d258	no	22
Warnings:					
Information:					

7	TrackOne Request	TrackOneRequest.pdf	124177 89960d5bdaf964ba8903648780dcd2f8cb17b852	no	2
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	41812 9ecdf7a11398288a33c19f30e84b3b5baa089bbe	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	4918150	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	
Title of Invention	ELECTRIC VEHICLE	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 — Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jiawei		YING	

Residence Information (Select One) US Residency ● Non US Residency Active US Military Service

City	Hangzhou	Country of Residence i	CN

Mailing Address of Inventor:

Address 1	No. 6 Bldg., 3rd Flr., Liangzhu Univ., Keji		
Address 2	Garden, Liangzhu St., Yuhang District		
City	Hangzhou, Zhejiang	**State/Province**	
Postal Code	310000	**Country i**	CN

Inventor 2 — Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Shaojun		CAO	

Residence Information (Select One) US Residency ◉ Non US Residency Active US Military Service

City	Hangzhou	Country of Residence i	CN

Mailing Address of Inventor:

Address 1	No. 6 Bldg., 3rd Flr., Liangzhu Univ., Keji		
Address 2	Garden, Liangzhu St., Yuhang District		
City	Hangzhou, Zhejiang	**State/Province**	
Postal Code	310000	**Country i**	CN

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	

Title of Invention	ELECTRIC VEHICLE

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	23990		
Email Address	patents@munckwilson.com	Add Email	Remove Email

Application Information:

Title of the Invention	ELECTRIC VEHICLE		
Attorney Docket Number	HANG01-10008	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	6	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	23990		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	
Title of Invention	ELECTRIC VEHICLE	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16/429636	2019-06-03

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16/429636	Continuation of	15/160589	2016-05-20	10336392	2019-07-02

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15/160589	Continuation of	14/773650	2015-09-08	9376155	2016-06-28

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14/773650	a 371 of international	PCT/CN2014/092849	2014-12-02

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201410262353.9	CN	2014-06-13	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	
Title of Invention	ELECTRIC VEHICLE	

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐	This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	
Title of Invention	ELECTRIC VEHICLE	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	

Title of Invention	ELECTRIC VEHICLE

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:	
If the Applicant is an Organization check here.	☒
Organization Name	Hangzhou Chic Intelligent Technology Co., Ltd.

Mailing Address Information For Applicant:

Address 1	No. 6 Bldg., 3rd Flr., Liangzhu Univ., Keji		
Address 2	Garden, Liangzhu St., Yuhang District, Zhejiang		
City	Hangzhou	**State/Province**	
Country	CN	Postal Code	310000
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	

Title of Invention	ELECTRIC VEHICLE

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
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Signature:

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NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Neil G. Ferrari/			Date (YYYY-MM-DD)	2019-10-18
First Name	Neil G.	Last Name	Ferrari	Registration Number	61,484

Additional Signature may be generated within this form by selecting the Add button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HANG01-10008
	Application Number	

Title of Invention	ELECTRIC VEHICLE

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Attorney Docket No.

MUNCY, GEISSLER, OLDS & LOWE, PLLC

UNITED STATES PATENT RIGHTS, OR
UNITED STATES PLUS ALL FOREIGN PATENT RIGHTS

COMBINED DECLARATION AND ASSIGNMENT

Title of Invention: ELECTRIC SELF-BALANCING VEHICLE

As a below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application; or

☒ United States application number or PCT international application number PCT/CN2014/092849, filed on December 2, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Direct all correspondence to the address associated with Customer Number 60601.

WHEREAS, HANGZHOU CHIC INTELLIGENT TECHNOLOGY CO., LTD of No.6 Building, 3rd Floor, Liangzhu University Keji Garden, Liangzhu Street, Yuhang District, Hangzhou City, Zhejiang Province, 310000, China, its heirs, successors, legal representatives and assigns (hereinafter designated as the Assignee) is desirous of acquiring the entire right, title and interest in and to said invention and in and to any Letters Patent(s) that may be granted therefor in the United States of America and ☐ in any foreign countries.

NOW, THEREFORE, in consideration of the sum of Ten Dollars ($10.00) to the undersigned in hand paid, the receipt of which is hereby acknowledged, and other good and valuable consideration, the undersigned has (have) sold, assigned and transferred, and by these presents does sell, assign and transfer unto said Assignee the full and exclusive right to the said invention in the United States of America, its territories, dependencies and possessions and the entire right, title and interest in and to any and all Letters Patent(s) which may be granted therefor in the United States of America, its territories, dependencies and possessions, and if the box above is designated, in any and all foreign countries; and to any and all divisions, reissues, continuations, conversions and extensions thereof for the full term or terms for which the same may be granted.

The undersigned agree(s) to execute all papers necessary in connection with this application and any continuing, divisional, conversion or reissue applications thereof and also to execute separate assignments in connection with such applications as the Assignee may deem necessary or expedient.

The undersigned agree(s) to execute all papers necessary in connection with any interference which may be declared concerning this application or continuation, division, conversion or reissue thereof or Letter Patent(s) or reissue patent issued thereon and to cooperate with the Assignee in every way possible in obtaining and producing evidence and proceeding with such interference.

The undersigned agree(s) to execute all papers and documents and to perform any act which may be necessary in connection with claims or provisions of the International Convention for the Protection of Industrial Property or similar agreements.

The undersigned agree(s) to perform all affirmative acts which may be necessary to obtain a grant of a valid United States of America patent(s) or a grant of a valid United States of America and any foreign patent(s) to the Assignee and to vest all rights therein hereby conveyed to said Assignee as fully and entirely as the same would have been held by the undersigned if this Assignment and sale had not been made.

The undersigned hereby authorize(s) and request(s) the Patent and Trademark Office Officials in the United States of America and in any foreign countries to issue any and all Letters Patents resulting from said application or any continuing, divisional, conversion or reissue applications thereof to the said Assignee, as Assignee of the entire interest, and hereby covenants that he has (they have) the full right to convey the entire interest herein assigned, and that he has (they have) not executed, and will not execute, any agreement in conflict herewith.

The undersigned hereby grant(s) the law firm of Muncy, Geissler, Olds & Lowe, PLLC the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the U.S. Patent and Trademark Office for recordation of this document.

The undersigned hereby covenant(s) that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this assignment.

In witness whereof, executed by the undersigned on the date(s) opposite the undersigned name(s).

LEGAL NAME OF FIRST OR SOLE INVENTOR:

Jiawei YING

Signature: 应佳伟 Date: 2015.5.22

LEGAL NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:

Shaojun CAO

Signature: 曹少军 Date: 2015.5.22

LEGAL NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:

Signature: ______ Date: ______

LEGAL NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:

Signature: ______ Date: ______

☐ Additional inventors are being named on separately numbered sheets attached hereto.

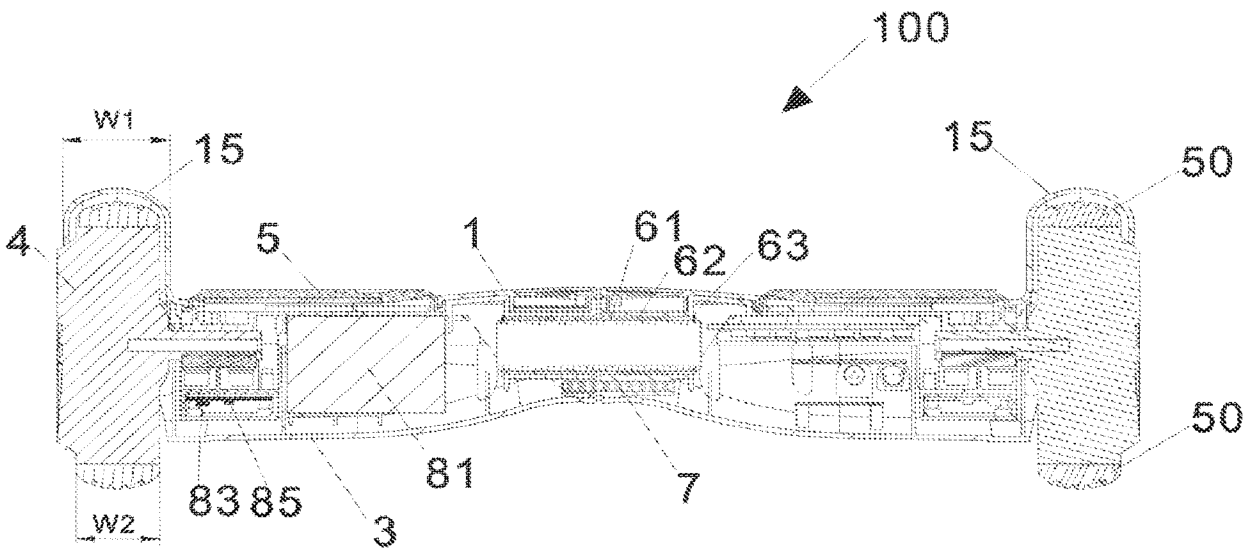

FIG. 1

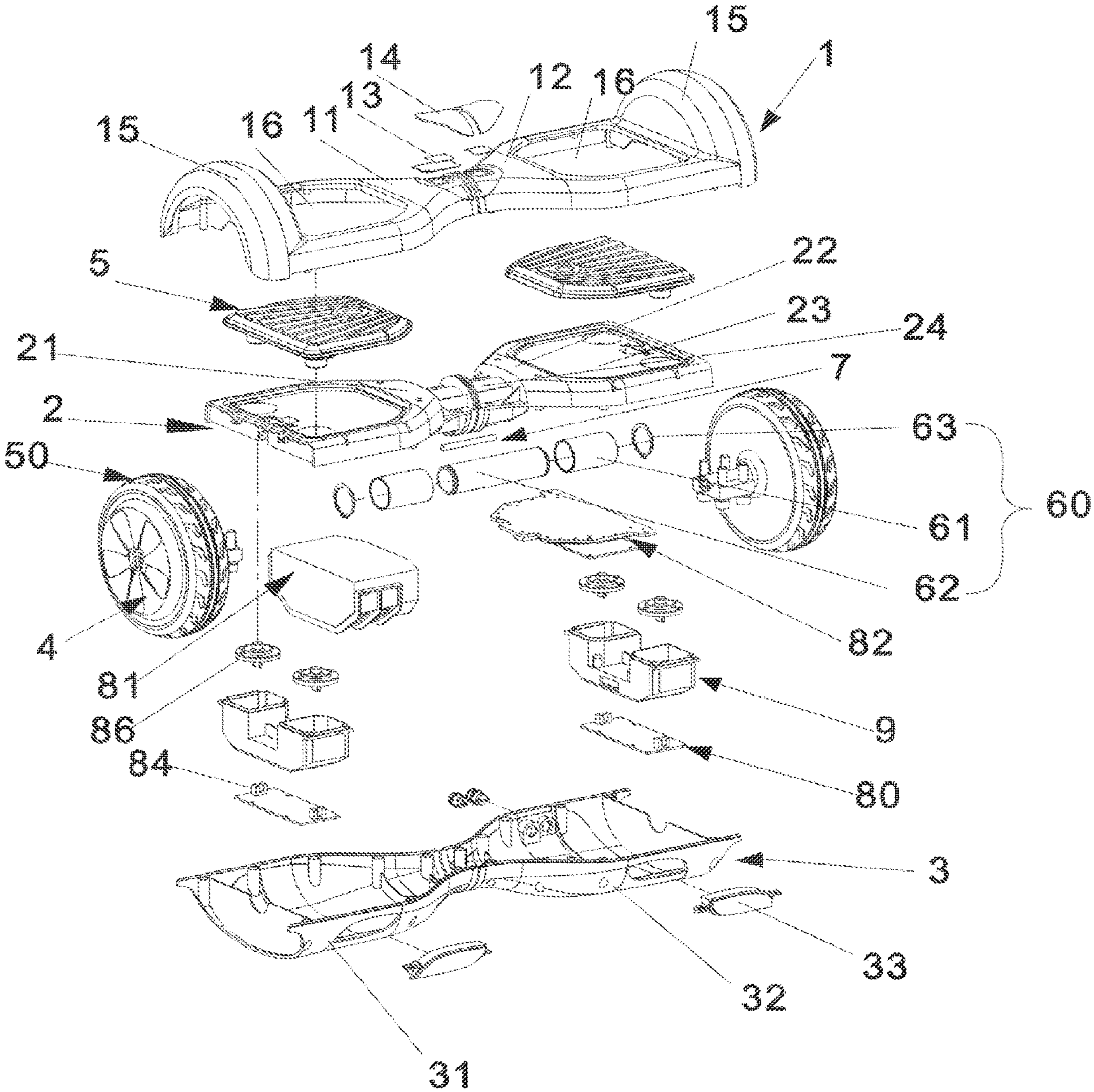
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FIG. 2

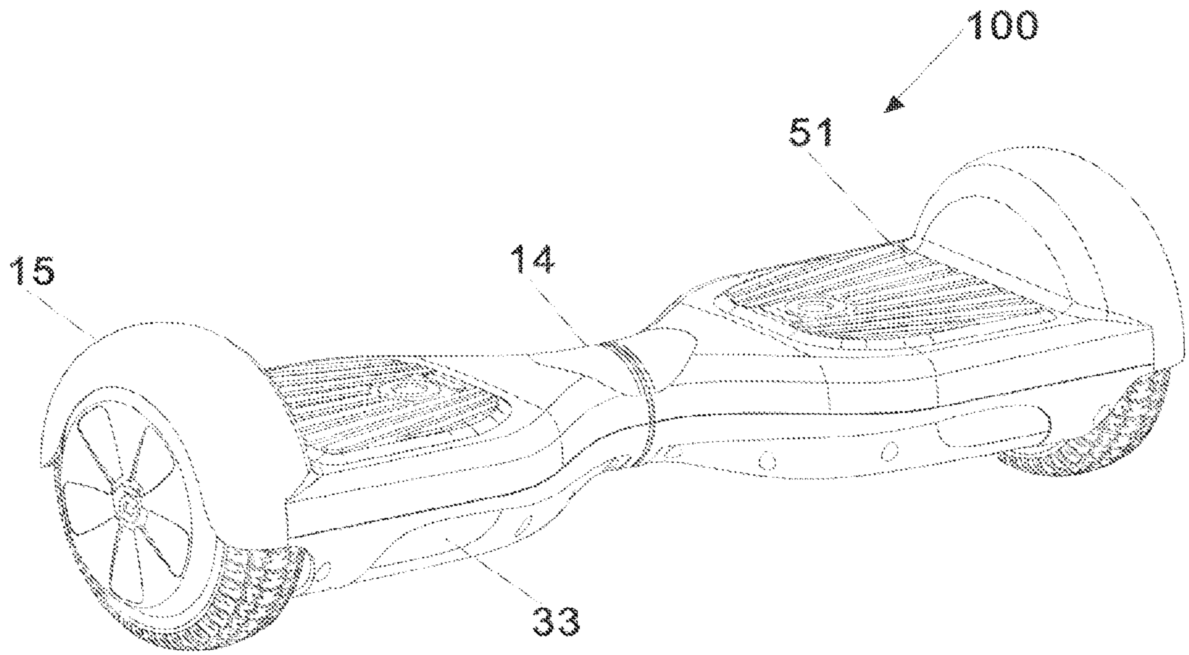

FIG. 3

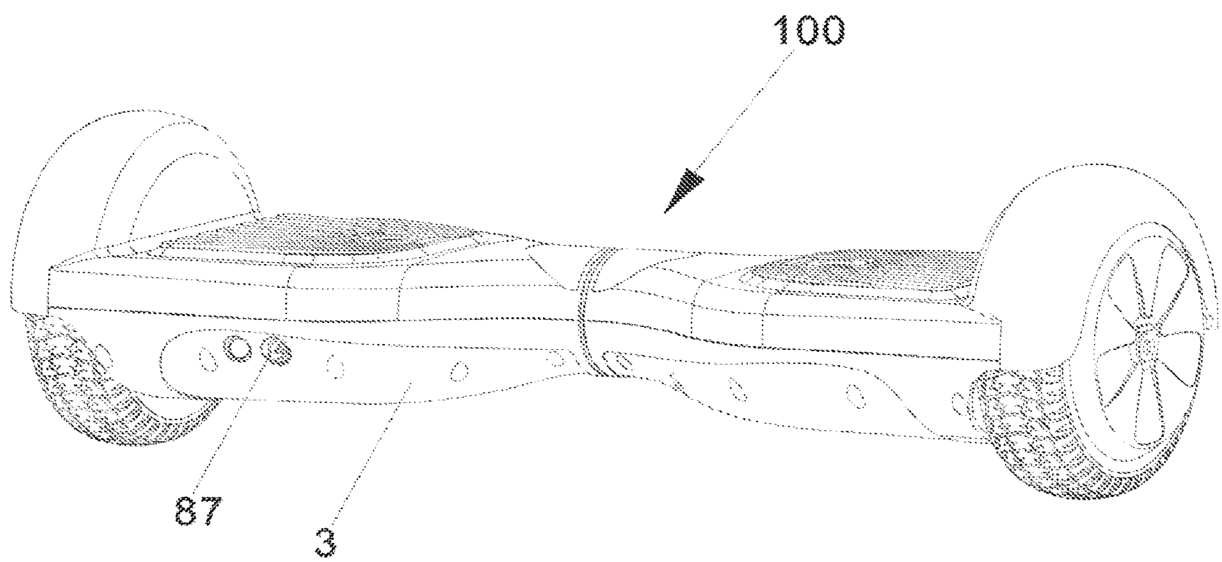

FIG. 4

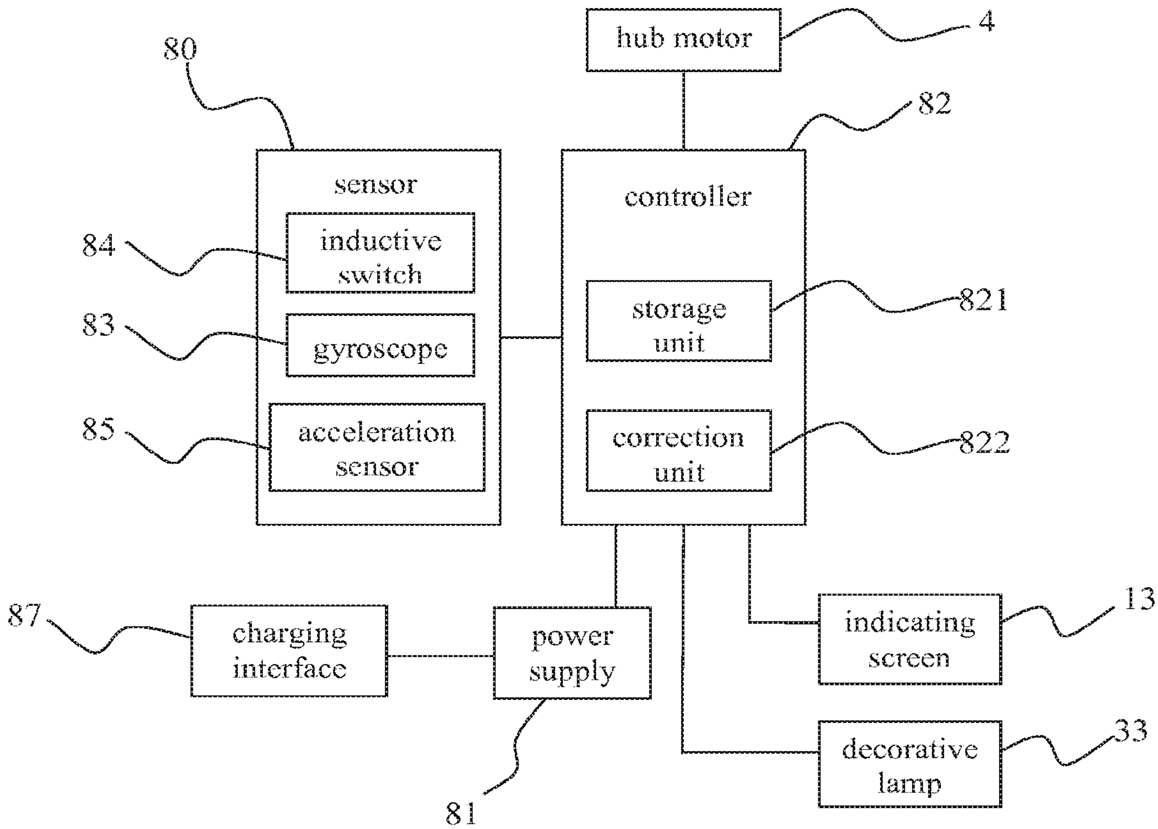
hub motor
4
80
82
sensor
controller
84
inductive switch
83
gyroscope
85
acceleration sensor
storage unit
821
correction unit
822
87
charging interface
power supply
indicating screen
13
decorative lamp
33
81

FIG. 5

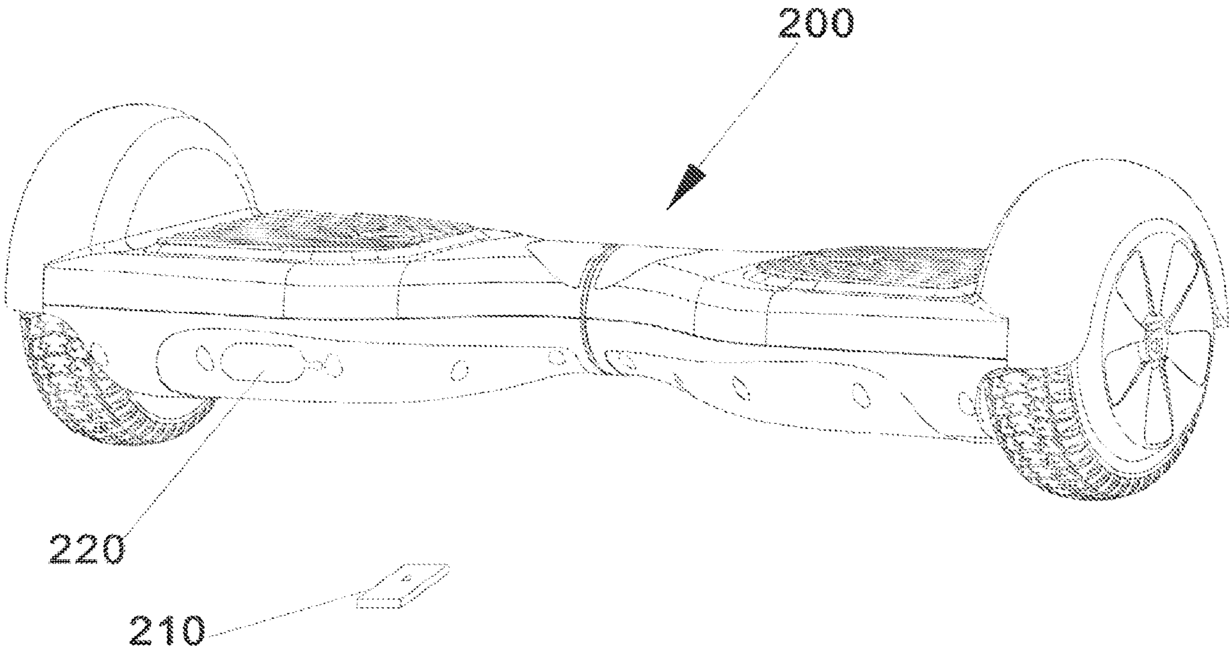

FIG. 6

DOCKET NO.: HANG01-10008 **PATENT**
CUSTOMER NO.: 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	Jiawei Ying et al.
Application No.	:	Not Yet Assigned
Filing Date	:	October 18, 2019
For	:	ELECTRIC VEHICLE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

PRELIMINARY AMENDMENT

Before examination of the above-identified application, please amend the application as follows:

AMENDMENTS TO THE SPECIFICATION

Please amend paragraph **[0001]** as follows:

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 16/429,636 filed on June 3, 2019, which ~~This application~~ is a continuation application of U.S. Patent Application No. 15/160,589~~,~~ filed on May 20, 2016, now U.S. Patent No. 10,336,392 issued on July 2, 2019, which is a continuation application of U.S. Patent Application No. 14/773,650, filed on September 8, 2015, now U.S. Patent No. 9,376,155 issued on June 28, 2016, which is a ~~U.S. national stage under 35 U.S.C. §~~371 of International Application No. PCT/CN2014/092849, filed on December 2, 2014, ~~designating the United States of America,~~ which claims priority ~~of~~ to Chinese Patent Application No. 2014-10262353.9~~,~~ filed on June 13, 2014, the disclosures ~~entire contents~~ of ~~each of~~ which are ~~hereby~~ herein incorporated by reference in their entirety.

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1-30. (Canceled)

31. (New) An electric balance vehicle, comprising:

a top cover;

a bottom cover;

an inner cover fixed between the top cover and the bottom cover, the inner cover comprising a first inner cover and a second inner cover rotatable relative to each other;

a rotating mechanism fixed between the first inner cover and the second inner cover;

two wheels rotatably fixed at two sides of the inner cover, each wheel comprising a hub motor fixed in the wheel;

a plurality of sensors;

a power supply; and

a controller electrically connected with the plurality of sensors, the power supply, and the hub motors, wherein the controller is configured to control the hub motors to drive the two wheels to rotate according to signals from the plurality of sensors.

32. (New) The electric balance vehicle according to any of claim 31, wherein the plurality of sensors comprise a gyroscope, an acceleration sensor, and an inductive switch, the inductive switch senses whether a user stands on the electric balance vehicle, the controller receives signals from the inductive switch, the acceleration sensor, and the gyroscope to control the hub motors.

33. (New) The electric balance vehicle according to claim 32, wherein the inductive switch is an infrared photoelectric sensor.

34. (New) The electric balance vehicle according to claim 31, wherein the controller generates control signals to drive the hub motors when signal from an inductive switch indicates a user is on the vehicle, and wherein the controller does not generate control signals to drive the hub

motors when signal from the inductive switch indicates no user is on the vehicle.

35. (New) The electric balance vehicle according to claim 31, wherein the bottom cover is coupled to the top cover.

36. (New) The electric balance vehicle according to claim 31, wherein the power supply and the controller are disposed at a side of the inner cover, and the side is adjacent to the bottom cover.

37. (New) The electric balance vehicle according to claim 31, wherein the plurality of sensors, the power supply, and the controller are disposed between the bottom cover and the inner cover.

38. (New) An electric balance vehicle, comprising:

a top cover;

a bottom cover;

an inner cover positioned between the top cover and the bottom cover, the inner cover comprising a first inner cover and a second inner cover disposed symmetrically and rotatable relative to each other, the inner cover comprising a left edge and a right edge;

a rotating mechanism disposed between the first inner cover and the second inner cover and comprising a shaft sleeve installed in inner ends of the first inner cover and the second inner cover, the first inner cover and the second inner cover capable of rotating relative to each other through the rotating mechanism; and

wheels rotatably fixed to the left edge and the right edge, respectively.

39. (New) The electric balance vehicle according to claim 38, wherein the rotating mechanism comprises two bearings disposed in the inner ends of the first inner cover and the second inner cover, respectively; and the shaft sleeve is disposed inside the two bearings.

40. (New) An electric balance vehicle, comprising:

an inner cover comprising a first inner cover and a second inner cover disposed symmetrically and rotatable relative to each other;

wheels rotatably fixed at two opposite sides of the inner cover, respectively;

motors configured to drive the wheels, respectively;

a plurality of sensors comprising at least one gyroscope;

a power supply; and

a controller electrically connected with the plurality of sensors, the power supply, and the motors, wherein the controller controls the motors to drive the wheels to rotate in response to signals received from the sensors.

41. (New) The electric balance vehicle according to claim 40, further comprising a top cover and a bottom cover, wherein the inner cover is disposed between the top cover and the bottom cover, the top cover comprises a first top cover and a second top cover disposed symmetrically and rotatable relative to each other, and the bottom cover comprises a first bottom cover and a second bottom cover disposed symmetrically and rotatable relative to each other.

42. (New) The electric balance vehicle according to claim 40, wherein the motors are hub motors fixed in the wheels.

43. (New) The electric balance vehicle according to claim 42, wherein the vehicle comprises only two wheels and two hub motors.

44. (New) The electric balance vehicle according to claim 40, further comprising:

a rotating mechanism, wherein the first inner cover and the second inner cover are capable of rotating relative to each other through the rotating mechanism.

45. (New) The electric balance vehicle according to claim 44, wherein the rotating mechanism comprises a shaft sleeve installed in at least one of inner ends of the first inner cover and the second inner cover.

46. (New) The electric balance vehicle according to claim 45, wherein the at least one of inner ends of the first inner cover and the second inner cover comprises a cylindrical barrel, and the shaft sleeve is installed in the cylindrical barrel.

47. (New) The electric balance vehicle according to claim 46, wherein the rotating mechanism comprises a bearing installed in the cylindrical barrel, and the shaft sleeve is installed in the bearing.

48. (New) The electric balance vehicle according to claim 45, wherein the inner ends of the first inner cover and the second inner cover comprise cylindrical barrels, the rotating mechanism comprises two bearings, and the two bearings and the shaft sleeve are installed in the cylindrical barrels.

49. (New) The electric balance vehicle according to claim 40, wherein the plurality of sensors comprise an acceleration sensor, and an inductive switch; the inductive switch senses whether a user stands on the electric balance vehicle; and the controller receives signals from the inductive switch, the acceleration sensor, and the gyroscope to control the motors.

50. (New) The electric balance vehicle according to claim 40, wherein the controller generates control signals to drive the hub motors when signal from an inductive switch indicates a user is on the vehicle, and wherein the controller does not generate control signals to drive the hub motors when signal from the inductive switch indicates no user is on the vehicle.

51. (New) The electric balance vehicle according to claim 50, wherein the inductive switch is an infrared photoelectric sensor.

52. (New) The electric balance vehicle according to claim 40, further comprising two pedals, wherein the first inner cover and the second inner cover have recesses, respectively; and the two pedals are disposed in the recesses, respectively.

53. (New) The electric balance vehicle according to claim 52, further comprising a top cover, wherein the top cover comprises a first top cover and a second top cover disposed symmetrically and rotatable relative to each other, the first top cover and the second top cover have hollow spaces, respectively; the recesses are at positions corresponding to the hollow spaces, respectively; and the hollow spaces are combined with the recesses to form pedal cavities for containing the pedals.

54. The electric balance vehicle according to claim 40, further comprising a blocking element, wherein the plurality of sensors comprise an inductive switch; the blocking element is configured to block an induction area of the inductive switch to trigger the inductive switch sending signals to the controller; and the controller is configured to receive signals from the inductive switch to control the motors.

55. (New) An electric balance vehicle, comprising:

a top cover;

a bottom cover;

an inner cover positioned between the top cover and the bottom cover, the inner cover comprising a first inner cover and a second inner cover disposed symmetrically and rotatable relative to each other, the inner cover extending from a first outer edge to a second outer edge;

a rotating mechanism disposed between the first inner cover and the second inner cover and comprising a shaft sleeve installed in a first cylindrical barrel at a first inner end of the first inner cover and installed in a second cylindrical barrel at a second inner end of the second inner cover, wherein the first inner cover and the second inner cover capable of rotating relative to each other through the rotating mechanism;

a first wheel rotatably fixed at the first outer edge of the inner cover, the first wheel comprising a first hub motor;

a second wheel rotatable fixed at the second outer edge of the inner cover, the second wheel comprising a second hub motor;

a power supply disposed between the top cover and the bottom cover for providing power to the first hub motor and the second hub motor;

a plurality of sensors disposed between the top cover and the bottom cover, the plurality of sensors comprising a gyroscope and an acceleration sensor; and

a controller electrically connected with the plurality of sensors, the power supply, and the first and second hub motors, the controller configured for controlling the first and second hub motors to drive the first and second wheels to rotate in response to signals received from the sensors.

REMARKS

Claims 1-30 have been canceled.

Claims 31-55 have been added. New Claims 31-54 are similar to issued claims 1-24 in U.S. Patent No. 10,167,036.

The Specification has amended herein.

Applicants respectfully submit that no new matter has been added by these amendments. For the foregoing reasons, Applicants respectfully request entry and consideration of the foregoing amendments to the Specification and claims.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicants respectfully invite the Examiner to contact the undersigned at the telephone number indicated below or at *nferrari@munckwilson.com*.

The Commissioner is hereby authorized to charge any additional fees connected with this communication or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

MUNCK WILSON MANDALA, LLP

Date: 10/18/2019

/Neil G. Ferrari/
Neil G. Ferrari
Registration No. 61,484

P.O. Drawer 800889
Dallas, Texas 75380
Tel.: (972) 628-3600
Fax: (972) 628-3616
E-mail: *nferrari@munckwilson.com*

ELECTRIC VEHICLE

CROSS -REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation application of U.S. Patent Application No. 15/160,589, filed on May 20, 2016, which is a continuation application of U.S. Patent Application No 14/773,650, filed on September 8, 2015, now Patent No. 9,376,155, which is a U.S. national stage under 35 U.S.C. §371 of International Application No. PCT/CN2014/092849, filed on December 2, 2014, designating the United States of America, which claims priority of Chinese Patent Application No. 2014-10262353.9, filed on June 13, 2014, the entire contents of each of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] The present invention relates to an electric balance two-wheeled vehicle, of which two platforms for carrying people can rotate relative to each other to drive.

BACKGROUND

[0003] An electric self-balancing vehicle is also known as a somatosensory vehicle or a sensor controlled vehicle. The operating principle thereof is mainly established on a basic principle called "dynamic stabilization", the change of car attitudes is detected by a gyroscope and an acceleration sensor inside the vehicle body, and a motor is accurately driven by a servo control system to adjust correspondingly, in order to keep the balance of the system.

[0004] The existing electric self-balancing vehicle generally has an operating rod. A user stands on a foot platform of the self-balancing vehicle to operate the operating rod so as to advance, retreat, and stop, and this control is also known as "manual control". The foot platform of the existing self-balancing vehicle is generally a flat plate, and the foot platform is always kept in a horizontal state during use and cannot rotate relatively. Therefore, the user cannot control the self-balancing vehicle merely through the feet.

BRIEF SUMMARY OF THE INVENTION

[0005] In order to overcome at least one defect in the prior art, the present invention provides an electric self-balancing vehicle.

[0006] To achieve the above objective, the present invention provides an electric self-balancing vehicle including a top cover, a bottom cover, an inner cover, a rotating mechanism, two wheels, two hub motors, a plurality of sensors, a power supply, and a controller. The top cover includes a first top cover and a second top cover disposed symmetrically and rotatable relative to each other. The bottom cover is fixed to the top cover, and the bottom cover includes a first bottom cover and a second bottom cover disposed symmetrically and rotatable relative to each other. The inner cover is fixed between the top cover and the bottom cover, and the inner cover includes a first inner cover and a second inner cover disposed symmetrically and rotatable relative to each other. The rotating mechanism is fixed between the first inner cover and the second inner cover. The two wheels are rotatably fixed at two sides of the inner cover, respectively. The two hub motors are fixed in the two wheels, respectively. The plurality of sensors is disposed between the bottom cover and the inner cover, respectively. The power supply is fixed between the first bottom cover and the first inner cover. The controller is fixed between the second bottom cover and the second inner cover. The controller is electrically connected with the plurality of sensors, the power supply, and the hub motors, and the controller controls the hub motors to drive the corresponding wheels to rotate according to sensing signals transmitted by the sensors.

[0007] According to one embodiment of the invention, the electric self-balancing vehicle may further include two pedals fixed to the top cover and the inner cover.

[0008] According to one embodiment of the invention, the pedals may have mutually separated friction strips disposed on upper surfaces of the pedals.

[0009] According to one embodiment of the invention, the first top cover and the second top cover may have hollow spaces, respectively, the first inner cover and the second inner cover may have recesses at positions corresponding to the hollow spaces, respectively, and the hollow spaces may be combined with the recesses to form pedal cavities for containing the pedals.

[0010] According to one embodiment of the invention, the rotating mechanism may include two bearings, a shaft sleeve, and two snap springs, the two bearings may be fixed to the first inner cover and the second inner cover, respectively, and the shaft sleeve may be fixed inside the two bearings and may be fixed to the inner cover via the two snap springs.

[0011] According to one embodiment of the invention, the inner cover may have a cylindrical barrel, and the bearings and the shaft sleeve may be installed in the barrel via the snap springs.

[0012] According to one embodiment of the invention, the electric self-balancing vehicle may further include a decorative lamp disposed at the bottom cover.

[0013] According to one embodiment of the invention, the top cover may further include two indicating screens electrically connected with the controller. One indicating screen may display a remaining capacity of the power supply, and the other indicating screen may display a working state of the electric self-balancing vehicle.

[0014] According to one embodiment of the invention, the sensor may include a gyroscope, an acceleration sensor, and an inductive switch, the inductive switch may sense whether a user stands on the electric self-balancing vehicle so as to be on or off, the controller may receive the sensing signal of the inductive switch to control the hub motors to work or to stop, and the controller may receive the sensing signals of the acceleration sensor and the gyroscope to control the hub motors to change a state or to keep the state.

[0015] According to one embodiment of the invention, the inductive switch may be an infrared photoelectric sensor.

[0016] According to one embodiment of the invention, the electric self-balancing vehicle may further include a charging interface disposed at the bottom cover.

[0017] According to one embodiment of the invention, the electric self-balancing vehicle may further include an interface cover covering the charging interface.

[0018] According to one embodiment of the invention, the electric self-balancing vehicle may further include a limiting shaft disposed between the first inner cover and the second inner cover, and the length of the limiting shaft in the second inner cover may be larger than the length of the limiting shaft in the first inner cover.

[0019] According to one embodiment of the invention, the top cover may have two arc-shaped projections, and the two arc-shaped projections may be located above the two wheels and may cover a part of the wheels, respectively.

[0020] According to one embodiment of the invention, the width of the arc-shaped projections may be larger than the width of the wheels.

[0021] According to one embodiment of the invention, the top cover and the bottom cover may be made of plastic, and the inner cover may be made of aluminum alloy.

[0022] According to one embodiment of the invention, the electric self-balancing vehicle may further include a remote controller, and the controller may receive a control signal sent by the remote controller.

[0023] According to one embodiment of the invention, the controller may have a storage unit and a correction unit, the storage unit may store an initial balance state of the electric self-balancing vehicle, and the correction unit may correct a current balance state of the electric self-balancing vehicle.

[0024] In summary, according to the invention, the inner cover is uniquely disposed between the top cover and the bottom cover of the electric self-balancing vehicle, such that the entire structure of the electric self-balancing vehicle is firmer, and electronic elements inside the vehicle body are protected at the same time. Further, a space for fixing the electronic elements is formed between the inner cover and the bottom cover, such that the electronic elements are installed more compactly. The power supply and the controller are disposed in two parts of the vehicle body, respectively. Therefore, one power supply and one controller can control the two hub motors simultaneously, the assembly is easier, the wiring is more convenient, and more space is saved. Meanwhile, the weights on both sides of the vehicle body are better balanced thus to improve the self-balance of the vehicle body. According to the present invention, the wheels are located at the left and right edges of the vehicle body. Thus, the wheels with larger sizes can be used. Compared with the existing self-balancing vehicle with wheels installed at the bottom of the bottom cover, the electric self-balancing vehicle has considerable movement distance and speed advantages. Further, the hub motors are adopted in the present invention, and the motors are directly installed in the wheels. Accordingly, the structure of the electric self-balancing vehicle is more compact. Compared with the self-balancing vehicle singly installed with a motor, more space is saved and the entire device is more compact.

[0025] These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] FIG. 1 is a sectional view showing an electric self-balancing vehicle according to a first embodiment of the present invention;

[0027] FIG. 2 is an exploded schematic diagram showing the electric self-balancing vehicle according to the first embodiment of the invention;

[0028] FIG. 3 is a schematic diagram showing the electric self-balancing vehicle according to the first embodiment of the invention;

[0029] FIG. 4 is a schematic diagram showing the electric self-balancing vehicle at another angle according to the first embodiment of the invention;

[0030] FIG. 5 is a partial functional block diagram of the electric self-balancing vehicle according to the first embodiment of the invention; and

[0031] FIG. 6 is a schematic diagram showing an electric self-balancing vehicle according to a second embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0032] Please refer to FIG. 1 to FIG. 5 together. An electric self-balancing vehicle 100 in this embodiment includes a top cover 1, an inner cover 2, a bottom cover 3, two hub motors 4, two wheels 50, a rotating mechanism 60, a plurality of sensors 80, a power supply 81, and a controller 82.

[0033] The top cover 1 includes a first top cover 11 and a second top cover 12, and the first top cover 11 and the second top cover 12 are disposed symmetrically and rotatable relative to each other. When the electric self-balancing vehicle 100 is in a using state, the top cover 1 is located at the top. The first top cover 11 may be a left top cover, and the second top cover 12 may be a right top cover. However, the invention is not limited thereto. When the electric self-balancing vehicle 100 is rotated 180 degrees horizontally, the first top cover 11 becomes the right top cover, and the second top cover 12 becomes the left top cover.

[0034] The shapes of the first top cover 11 and the second top cover 12 are basically the same, and the first top cover 11 and the second top cover 12 can rotate relative to each other under the action of the rotating mechanism 60. The inward parts of the first top cover 11 and the second top cover 12 are connected to form an X shape, and two indicating screens 13 are disposed at the inner ends. The indicating screens 13 are electrically connected with the controller 82, wherein one of the indicating screens 13 can display a remaining capacity of the power supply 81, and the other indicating screen 13 can display a working state of the electric self-balancing vehicle 100. In actual application, a transparent outer cover 14 is disposed on each indicating screen 13 for protecting the indicating screen 13 and facilitating reading for a user. The indicating screen 13 displaying the working state can display different icons (for example, a battery icon and the like) according to different modes of the electric self-balancing vehicle 100, for example, a low speed mode, a high speed mode, a normal system state, a locked state and the like, thereby enabling the user to intuitively and clearly understand the working state of the electric self-balancing vehicle 100.

[0035] In the embodiment, outward parts of the first top cover 11 and the second top cover 12 have arc-shaped projections 15, respectively, and the two arc-shaped projections 15 are located above the two wheels 50 and cover a part of the wheels 50, respectively. In the first embodiment, the width W1 of each of the arc-shaped projections 15 is larger than the width W2 of each of the wheels 50. The arc-shaped projections 15 completely cover the tops of the wheels 50. Due to this arrangement, the arc-shaped projections 15 can effectively block muddy water splashed when the wheels 50 walk. Meanwhile, a hanging object (for example, an overlong waistband of the clothes of the user) is prevented from being accidentally rolled into the wheels in a moving process to cause possible injury of the user, so that the safety of the electric self-balancing vehicle 100 is improved. However, the invention is not limited thereto. In other embodiments, the arc-shaped projections 15 can be designed to be narrow at two ends and wide in the middle.

[0036] The bottom cover 3 is fixed to the top cover 1. In actual application, the top cover 1 and the bottom cover 3 can be fixed together by screws. In the present invention, the top cover 1, the inner cover 2, and the bottom cover 3 jointly form the framework of the electric self-balancing vehicle 100, and after the top cover 1 and the bottom cover 3 are fixed together, the inner cover 2 is covered inside the vehicle body and is not exposed. When the electric self-balancing vehicle 100 is in the using state, the bottom cover 3 is located at the bottom.

[0037] The bottom cover 3 includes a first bottom cover 31 and a second bottom cover 32, and the first bottom cover 31 and the second bottom cover 32 are disposed symmetrically and rotatable relative to each other. The shapes of the first bottom cover 31 and the second bottom cover 32 are basically the same, and the first bottom cover 31 and the second bottom cover 32 can rotate relative to each other under the action of the rotating mechanism 60. The inward parts of the first bottom cover 31 and the second bottom cover 32 are connected to form an X shape. Similarly, the first bottom cover 31 may be a left bottom cover, and the second bottom cover 32 may be a right bottom cover. When the electric self-balancing vehicle 100 is rotated 180 degrees horizontally, the first bottom cover 31 becomes the right bottom cover, and the second bottom cover 32 becomes the left bottom cover.

[0038] In the embodiment, the bottom cover 3 has two decorative lamps 33 for increasing the beautiful appearance and playing an illumination role at the same time. The shells of the decorative lamps 33 may be transparent for transmitting light. In actual application, the decorative lamps 33 may be electrically connected with the controller 82, so that the decorative lamps 33 can reflect a driving state of the electric self-balancing vehicle 100 to remind surrounding people, thereby improving the using safety. For example, when the electric self-balancing vehicle 100 advances, the decorative lamps 33 may stay lit; when the electric self-balancing vehicle 100 retreats, the decorative lamps 33 may flash; when the electric self-balancing vehicle 100 turns left, the decorative lamp 33 at the left side may flash or stay lit, and the decorative lamp 33 at the right side may be off; when the electric self-balancing vehicle 100 turns right, the decorative lamp 33 at the right side may flash or stay lit, and the decorative lamp 33 at the left side may be off The lighting states of the decorative lamps 33 are not limited in the invention.

[0039] The inner cover 2 is fixed between the top cover 1 and the bottom cover 3. The inner cover 2 includes a first inner cover 21 and a second inner cover 22, and the first inner cover 21 and the second inner cover 22 are disposed symmetrically and rotatable relative to each other. The shapes of the first inner cover 21 and the second inner cover 22 are basically the same, and the first inner cover 21 and the second inner cover 22 can rotate relative to each other under the action of the rotating mechanism 60. The rotating mechanism 60 may be installed in the middle of the inner cover 2, and the longitudinally installed hub motors 4 are fixed to the left and right edges. In the embodiment, the first inner cover 21 and the second inner cover 22 are interconnected to form an entirety. However, the invention is not limited thereto. In other embodiments, the first inner cover 21 and the second inner cover 22 may be mutually separated and independent components. Similarly, the first inner cover 21 may be a left inner cover, and the second inner cover 22 may be a right inner cover. When the electric self-balancing vehicle 100 is rotated 180 degrees horizontally, the first inner cover 21 becomes the right inner cover, and the second inner cover 22 becomes the left right cover.

[0040] In the embodiment, the electric self-balancing vehicle 100 further includes two pedals 5, and the pedals 5 are fixed to the top cover 1 and the inner cover 2. To enable the user to stand more stably in the moving process, mutually separated friction strips 51 are disposed on the upper surface of each pedal 5 of the self-balancing vehicle 100 in the embodiment to increase the friction force.

[0041] To fix the pedals 5 and reduce the volume of the self-balancing vehicle 100, the first top cover 11 and the second top cover 12 have hollow spaces 16, respectively, the first inner cover 21 and the second inner cover 22 have recesses 23 at positions corresponding to the hollow spaces 16, respectively, and the hollow spaces 16 and the recesses 23 are mutually combined to form pedal cavities (not shown in FIG. 2) for containing the pedals 5. In actual application, the hollow spaces 16 are penetrated in the top cover 1, the recesses 23 are not penetrated in the inner cover 2, and the shapes of the hollow spaces 16 and the recesses 23 are matched with the shapes of the pedals 5. The pedal cavities are containing spaces having bottom surfaces and side walls formed after the combination of the hollow spaces 16 with the recesses 23.

[0042] When in use, the pedals 5 directly carry the user. The inner cover 2 is used as the internal framework of the entire self-balancing vehicle 100 to indirectly bear the weight of the user transferred by the pedals 5, thereby preventing electronic elements between the inner cover 2 and the bottom cover 3 from being extruded by the weight of the user. Therefore, the entire electric self-balancing vehicle 100 is firmer and stronger, and the electronic elements therein are protected, such that the self-balancing vehicle 100 operates more stably and has longer service life. Preferably, the inner cover 2 is made of aluminum alloy. Thus, the strength is higher, and the structure is more stable. The top cover 1 and the bottom cover 3 are made of plastic, so that the weight of the entire vehicle body is reduced, the processes, such as spray coating, coloring and so on, are conveniently carried out on the appearance of the vehicle body, and antifouling and waterproof functions are achieved. Since the conventional electric self-balancing vehicle does not include the inner cover 2, the internal electronic elements directly bear the weight of the user, and due to the shaking generated during the driving process of the conventional self-balancing vehicle, an automatic power off situation is easy to occur, and the user is easy to fall down during driving. The electric self-balancing vehicle 100 in the present invention has solved this technical problem.

[0043] The rotating mechanism 60 is fixed between the first inner cover 21 and the second inner cover 22. In the first embodiment, the rotating mechanism 60 includes two bearings 61, a shaft sleeve 62, and two snap springs 63. The two bearings 61 are fixed to the inner ends of the first inner cover 21 and the second inner cover 22, respectively. The shaft sleeve 62 is fixed inside the two bearings 61 and is fixed to the inner cover 2 via the two snap springs 63. Thus, the left and right inner covers of the inner cover 2 can rotate under the cooperation of the rotating mechanism 60. Due to the arrangement of the rotating mechanism 60, the two parts of the vehicle body of the electric self-balancing vehicle 100 can rotate freely and relatively.

[0044] To install the rotating mechanism 60, a cylindrical barrel 24 may be designed at the inward ends of the first inner cover 21 and the second inner cover 22, and the bearings 61 and the shaft sleeve 62 are installed in the barrel 24 via the snap springs 63 from outside to inside. In order to limit an overlarge relative rotation angle between the first inner cover 21 and the second inner cover 22, the electric self-balancing vehicle 100 further includes a limiting shaft 7, and the length of the limiting shaft 7 in the second inner cover 22 is larger than the length of the limiting shaft 7 in the first inner cover 21. In the embodiment, the limiting shaft 7 is located between the inward ends of the first inner cover 21 and the second inner cover 22.

[0045] The two wheels 50 are rotatably fixed at two sides of the inner cover 2, respectively, and the two hub motors 4 are fixed in the two wheels 50, respectively. The hub motor 4 is also called in-wheel motor, wherein power, transmission, and braking devices are incorporated into a hub, so that a large quantity of transmission components can be omitted, the structure of the self-balancing vehicle can be simpler, a better space utilization rate can be obtained, and the transmission efficiency can be improved at the same time. Since the hub motor 4 have the characteristic of independently driving a single wheel, differential steering similar to a crawler-type vehicle can be achieved by different rotating speeds and even by inversion of the left and right wheels 50, so that the turning radius of the vehicle can be greatly reduced, and in-situ steering can be nearly achieved under a particular condition.

[0046] The plurality of sensors 80 are disposed between the bottom cover 3 and the inner cover 2. In detail, a half of the sensors 80 are disposed between the first bottom cover 31 and the first inner cover 21, and the other half of the sensors 80 are disposed between the second bottom cover 32 and the second inner cover 22. The power supply

81 is fixed between the first bottom cover 31 and the first inner cover 21. The controller 82 is fixed between the second bottom cover 32 and the second inner cover 22. In the present invention, only one power supply 81 and one controller 82 arc required to simultaneously control the two hub motors 4, so that the assembling is easier, the wiring is more convenient, and the repairing of the sold electric self-balancing vehicle 100 returned to the factory is more convenient. Moreover, the power supply 81 and the controller 82 are disposed in two half parts of the vehicle body, respectively. Thus, more space is saved, and the structure of the entire vehicle body is more compact. An electric wire connecting the power supply 81 and the controller 82 and the electric wires connecting the controller 82 and the hub motors 4 can penetrate through the joint of the two half parts of the vehicle body, that is the electric wires penetrate from the left half part (or the right half part) of the vehicle body to the right half part (or the left half part).

[0047] In the embodiment, the sensors 80 include a gyroscope 83, an inductive switch 84, and an acceleration sensor 85. In actual application, to modularize the internal elements of the entire device, the acceleration sensor 85 and the gyroscope 83 are disposed on the same circuit board. Due to a visual angle, only the front surface of the circuit board can be seen in FIG. 2, and the acceleration sensor 85 and the gyroscope 83 (indicated by dotted lines in FIG. 2) are disposed on the back surface of the circuit board in actual application. The controller 82 is electrically connected with the plurality of sensors 80, the power supply 81, and the hub motors 4, and the controller 82 controls the hub motors 4 to drive the corresponding wheels 50 to rotate according to sensing signals transmitted by the sensors 80.

[0048] The inductive switch 84 senses whether the user stands on the electric self-balancing vehicle 100 so as to be on or off, the controller 82 receives the sensing signal (i.e., the on or off signal) of the inductive switch 84 to control the hub motors 4 to work or to stop, and the controller 82 receives the sensing signals of the acceleration sensor 85 and the gyroscope 83 to control the hub motors 4 to change the state or to keep the state. In the first embodiment, the inductive switch 84 is an infrared photoelectric sensor. However, the invention is not limited thereto. In other embodiments, the inductive switch 84 may be a microwave inductive switch, an ultrasonic inductive switch, or any other inductive switches capable of achieving the same function. In the embodiment, the electric self-balancing vehicle 100 further includes a blocking element 86. When the user stamps on the pedals 5, the blocking element 86 will block an infrared induction area of the infrared photoelectric sensor, and thus the infrared photoelectric sensor is started. The controller 82 receives a starting signal sent by the inductive switch 84, thereby driving the hub motors 4 to work.

[0049] The wheels of the self-balancing vehicle in the prior art start rotating automatically once the self-balancing vehicle is enabled, so that the user cannot easily stand on the self-balancing vehicle. When the user gets off from the self-balancing vehicle, the wheels do not stop rotating, and the entire wheels stop rotating only after the power switch is turned off. Thus, a very huge potential risk exists, and the using is very inconvenient. When the electric self-balancing vehicle 100 in the embodiment is enabled, the hub motors 4 do not work, while the wheels 50 are driven by sensing whether the user stands on the pedals 5, thereby avoiding the blind rotating situation of the self-balancing vehicle in the prior art and greatly improving the using safety. On the other hand, the electric self-balancing vehicle 100 in the embodiment achieves automatic balance after sensing the stamping instead of balancing once the power supply is turned on, so that the safety of the vehicle body can be guaranteed, the rotation of the vehicle body is little to avoid the problem in the prior art that automatic balance is achieved once the power supply is turned on to cause a wrong balance point of the vehicle body and the vehicle body rotates to result in unbalance of the user.

[0050] The acceleration sensor 85 and the gyroscope 83 detect the motion state of the self-balancing vehicle 100 together, for example, the acceleration, the angular speed and the like of the self-balancing vehicle 100. The controller 82 drives the hub motors 4 according to the sensing signals transmitted by the acceleration sensor 85 and the gyroscope 83, thereby determining to change the direction or the speed of the self-balancing vehicle 100 or not. The detection technology of the acceleration sensor 85 and the gyroscope 83 is conventional and will not be described herein for a concise purpose.

[0051] In the embodiment, the electric self-balancing vehicle 100 further includes a U-shaped fixing element 9. The sensors 80 and the blocking element 86 are fixed to the U-shaped fixing element 9, in order to achieve modularized installation of the electronic elements of the entire device to facilitate the assembly, wiring and the subsequent maintenance.

[0052] In practice, the user drives a part or two parts of the vehicle body to twist by forces of the feet, in order to drive the sensors 80 to send the sensing signals to the controller 82. The controller 82 drives the hub motors 4 to operate according to an internal control program, to enable the user to turn, advance or retreat, so that "foot control" is achieved, the use is more convenient, and the control is more flexible.

[0053] How the controller 82 in the present invention controls the self-balancing vehicle to achieve a self-balancing state and controls the wheels 50 to advance, retreat or turn belongs to the prior art, and will not be described herein for a concise purpose. Specific reference can refer to currently disclosed self-balancing vehicle control methods and control technologies adopted by self-balancing vehicle production enterprises. For example, the Chinese patent application No. 201320050547.3, entitled BALANCE CONTROL DEVICE FOR INTELLIGENT BALANCING VEHICLE AND INTELLIGENT BALANCING VEHICLE, wherein the control device may be the controller 82 in the embodiment. Or, for example, the Chinese patent application No. 201220367045.9, entitled CIRCUIT CONTROL DEVICE FOR CONTROLLING BALANCING VEHICLE MOTOR BY USING CPLD. Certainly, in actual application, other control devices and control methods can also be selected, for example, the control method described in the Chinese patent application No. 201310516158.X, entitled CONTROL METHOD FOR TWO-WHEELED SELF-BALANCING VEHICLE.

[0054] In the embodiment, the electric self-balancing vehicle 100 further includes a charging interface 87, and the charging interface 87 is disposed at the bottom cover 3. Specifically, the charging interface 87 is disposed at the outer side of the bottom cover 3 for charging the power supply 81 conveniently.

[0055] In the embodiment, the controller 82 has a storage unit 821 and a correction unit 822, the storage unit 821 stores an initial balance state of the electric self-balancing vehicle 100, and the correction unit 822 corrects a current balance state of the electric self-balancing vehicle 100. Specifically, after the electric self-balancing vehicle 100 is delivered out of the factory, the data when the vehicle body is placed horizontally is recorded in the storage unit 821. After the electric self-balancing vehicle 100 is used for a period of time, due to external environments, such as temperature and so on, and using situations such as shaking, the sensors 80 of the electric self-balancing vehicle 100 may deviate to a certain extent, so that the horizontal reference value of the electric self-balancing vehicle 100 will change correspondingly. At that time, if the horizontal data adopted when leaving the factory is still adopted, the electric self-balancing vehicle 100 is controlled inaccurately. After long term use, accidents may happen. A correction program is stored in the correction unit 822 in the embodiment. When the correction program is operated, the electric self-balancing vehicle 100 detects the real-time conditions of the sensors 80 and judges and compares the real-time conditions with the initial horizontal data, so as to determine whether to overwrite the original data for resetting. By setting the correction program, the control accuracy and the service life of the electric self-balancing vehicle 100 are greatly improved, and the problem in the prior art that the flexibility and the accuracy of the self-balancing vehicle decline after the self-balancing vehicle is used for a period of time is solved.

[0056] FIG. 6 is a schematic diagram showing an electric self-balancing vehicle according to a second embodiment of the invention. Please refer to FIG. 6. The only difference between the electric self-balancing vehicle 200 in the second embodiment and the electric self-balancing vehicle 100 in the first embodiment lies in that the electric self-balancing vehicle 200 further includes a remote controller 210, and the controller receives a control signal sent by the remote controller 210. Remote control of the electric self-balancing vehicle 200 can be achieved by the remote controller 210. A startup button and a correction button and the like can be disposed on the remote controller 210. However, the invention is not limited thereto. The electric self-balancing vehicle 200 further includes an interface cover 310, and the interface cover 220 covers the charging interface. The interface cover 220 can prevent muddy water splashed by operating the electric self-balancing vehicle 200 from polluting the charging interface and even entering the vehicle body.

[0057] In summary, according to the invention, the inner cover is uniquely disposed between the top cover and the bottom cover of the electric self-balancing vehicle, such that the entire structure of the electric self-balancing vehicle is firmer, and the electronic elements inside the vehicle body are protected at the same time. Further, the space for fixing the electronic elements is formed between the inner cover and the bottom cover, such that the electronic elements are installed more compactly. The power supply and the controller are disposed in two parts of the vehicle body, respectively. Therefore, one power supply and one controller can control the two hub motors simultaneously, the assembly is easier, the wiring is more convenient, and more space is saved. Meanwhile, the weights on both sides of the vehicle body are better balanced thus to improve the self-balance of the vehicle body. According to the present invention, the wheels are located at the left and right edges of the vehicle body. Thus, the wheels with larger sizes can be used. Compared with the existing self-balancing vehicle with wheels installed at the bottom of the bottom cover, the electric self-balancing vehicle has considerable movement distance and speed advantages. Further, the hub motors are adopted in the present invention, and the motors are directly installed in the wheels. Accordingly, the structure of the electric self-balancing vehicle is more compact. Compared with the self-balancing vehicle singly installed with a motor, more space is saved and the entire device is more compact.

[0058] Although the present invention has been described in considerable detail with reference to certain preferred embodiments thereof, the disclosure is not for limiting the scope of the invention. Persons having ordinary skill in the art may make various modifications and changes without departing from the scope and spirit of the invention. Therefore, the scope of the appended claims should not be limited to the description of the preferred embodiments described above.

WE CLAIM:

1. An electric vehicle, comprising:

a first platform;

a second platform;

a rotation mechanism disposed between the first platform and connecting the second platform, allowing the first platform and the second platform to rotate relative to each other;

two wheels rotatably fixed at two opposite sides of the first platform and the second platform, respectively;

two motors configured to drive the two wheels, respectively;

a plurality of sensors;

a power supply;

a controller electrically connected with the plurality of sensors, the power supply, and the two motors;

wherein the controller is configured to control the two motors to drive the two wheels using power from the power supply and based on signals from the plurality of sensors; and

a limiting mechanism configured to limit an overlarge relative rotation angle between the first platform and the second platform; wherein the limiting mechanism is disposed between the first platform and the second platform.

2. The electric vehicle according to claim 1, wherein the first platform comprises a first inner cover and a first bottom cover; the second platform comprises a second inner cover and a second bottom cover;

wherein the first inner cover and the second inner cover are disposed symmetrically and rotatable relative to each other.

3. The electric vehicle according to claim 2, wherein the power supply is disposed between the first inner cover and the first bottom cover, and the controller is disposed between the second inner cover and the second bottom cover.

4. The electric vehicle according to claim 2, wherein the first inner cover and the second inner cover are made of a first material, the first bottom cover and the second bottom cover are made of a second material, wherein first material has a higher strength than the second material.

5. The electric vehicle according to claim 4, wherein the first material is aluminum alloy, and the second material is plastic.

6. The electric vehicle according to claim 1, wherein the plurality of sensors comprise a gyroscope and an acceleration sensor; and the controller receives signals from the gyroscope and the controls the acceleration sensor to control the motors.

7. The electric vehicle according to claim 2, wherein the plurality of sensors further comprise at least one inductive switch; the at least one inductive switch is configured to sense whether a user is standing on the electric vehicle.

8. The electric vehicle according to claim 2, wherein the first inner cover and the second inner cover each includes an inner end, and the rotating mechanism comprises a shaft sleeve installed in at least one of the inner ends.

9. The electric vehicle according to claim 8, wherein the at least one of inner ends of the first inner cover and the second inner cover comprises a cylindrical barrel, and the shaft sleeve is installed in the cylindrical barrel, wherein the rotating mechanism comprises a bearing installed in the cylindrical barrel, and the shaft sleeve is installed in the bearing.

10. The electric vehicle according to claim 8, wherein the inner ends of the first inner cover and the second inner cover comprise cylindrical barrels, the rotating mechanism comprises two bearings, and the two bearings and the shaft sleeve are

installed in the cylindrical barrels.

11. The electric vehicle according to claim 2, wherein the limiting mechanism comprises a limiting shaft in the first inner cover and a limiting shaft in the second inner, and a length of the limiting shaft in the second inner cover is larger than a length of the limiting shaft in the first inner cover.

12. The electric vehicle according to claim 11, wherein the first inner cover and the second inner cover each includes an inner end, and the limiting shaft is located between inner ends of the first inner cover and the second inner cover.

13. The electric vehicle according to claim 7, wherein the at least one inductive switch is an infrared photoelectric sensor.

14. The electric vehicle according to claim 1, further comprising a blocking element, wherein the plurality of sensors comprise an inductive switch; the blocking element is configured to block an inductive area of the inductive switch to trigger the inductive switch sending signals from the inductive switch to control the motors.

15. The electric vehicle according to claim 1, wherein the first platform comprises a first top cover and a first bottom cover; the second platform comprises a second top cover and a second bottom cover;

wherein the first top cover and the second top cover are disposed symmetrically and rotatable relative to each other.

16. The electric vehicle according to claim 15, wherein the first top cover and the first bottom cover are made of a same material, and the second top cover and second bottom cover are made of a same material.

17. The electric vehicle according to claim 15, wherein the rotating mechanism

comprises a shaft sleeve and two bearings, and the shaft sleeve is disposed inside the two bearings, which are fixed to the first platform and the second platform, respectively.

18. The electric vehicle according to claim 15, wherein the rotating mechanism further comprises two springs, and the two bearings are fixed to the first platform and the second platform via the two springs, respectively.

19. The electric vehicle according to claim 1, further comprising two pedals fixed to the first platform and the second platform, respectively.

20. The electric vehicle according to claim 19, further comprising at least one blocking element, wherein the plurality of sensors comprise at least one inductive switch; and when at least one of the two pedals is stamped on, the at least one blocking element blocks an induction area of the at least one inductive switch to trigger the at least one inductive switch sending signals to the controller.

21. The electric vehicle according to claim 15, further comprising two pedals fixed to the first top cover and the second top cover correspondingly.

22. The electric vehicle according to claim 21, wherein at least one of the two pedals has mutually separated friction strips disposed on the upper surface of each pedal.

23. An electric vehicle, comprising:

a first platform;

a second platform;

a rotation mechanism disposed between the first platform and connecting the second platform, allowing the first platform and the second platform to rotate relative to each other;

two wheels rotatably fixed at two opposite sides of the first platform and the second platform, respectively;

two motors configured to drive the two wheels, respectively;

a plurality of sensors;

a power supply;

a controller electrically connected with the plurality of sensors, the power supply, and the motors;

wherein the controller is configured to control the motors to drive the wheels using power from the power supply and based on signals from the plurality of sensors;

wherein the first platform comprises a first inner cover and a first bottom cover, and the second platform comprises a second inner cover and a second bottom cover;

wherein the first inner cover and the second inner cover are disposed symmetrically and rotatable relative to each other;

wherein the first inner cover and the second inner cover each includes an inner end, respectively, and the rotation mechanism comprises a shaft sleeve installed in at least one of the inner ends of the first inner cover and the second inner cover, two bearings;

wherein the inner ends of the first inner cover and the second inner cover comprise cylindrical barrels, and the two bearings and the shaft sleeve are installed in the cylindrical barrels;

a limiting mechanism configured to limit an overlarge relative rotation angle between the first inner cover and the second inner cover; wherein the limiting mechanism is disposed between the first inner cover and the second inner cover;

wherein the plurality of sensors comprise a gyroscope and an acceleration sensor; and the controller receives signals from the gyroscope and the controls the acceleration sensor to control the motors.

24. The electric vehicle according to claim 23, wherein the power supply is disposed between the first inner cover and the first bottom cover, and the controller is disposed between the second inner cover and the second bottom cover.

25. The electric vehicle according to claim 23, wherein the first inner cover is made of a first material and the second inner cover is made of a second material; wherein the first material has a higher strength than the second material.

26. The electric vehicle according to claim 25, wherein the first material is aluminum alloy, and the second material is plastic.

27. The electric vehicle according to claim 23, wherein the plurality of sensors further comprise at least one inductive switch; the at least one inductive switch is configured to sense whether a user is standing on the electric vehicle.

28. The electric vehicle according to claim 27, wherein the at least one inductive switch is an infrared photoelectric sensor.

29. The electric vehicle according to claim 27, further comprising two pedals; wherein the first inner cover and the second inner cover have recesses, respectively; and the two pedals are fixedly disposed in the recesses, respectively.

30. The electric vehicle according to claim 29, further comprising at least one blocking element; and when at least of the two pedals is stamped on, the at least one blocking element blocks an induction area of the at least one inductive switch, and thus the at least one inductive switch is started.

ABSTRACT

An electric self-balancing vehicle including a top cover, a bottom cover, an inner cover, a rotating mechanism, two wheels, two hub motors, a plurality of sensors, a power supply, and a controller is described herein. The top cover includes a first top cover and a second top cover disposed symmetrically and rotatable relative to each other. The bottom cover is fixed to the top cover and includes a first bottom cover and a second bottom cover disposed symmetrically and rotatable relative to each other. The inner cover is fixed between the top cover and the bottom cover and includes a first inner cover and a second inner cover disposed symmetrically and rotatable relative to each other. The rotating mechanism is fixed between the first inner cover and the second inner cover. The two wheels are rotatably fixed at two sides of the inner cover, respectively. The two hub motors are fixed in the two wheels, respectively. The plurality of sensors is disposed between the bottom cover and the inner cover, respectively. The power supply is fixed between the first bottom cover and the first inner cover. The controller is fixed between the second bottom cover and the second inner cover, the controller is electrically connected with the plurality of sensors, the power supply, and the hub motors, and the controller controls the hub motors to drive the corresponding wheels to rotate according to sensing signals transmitted by the sensors.