AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of Texas, Dallas Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
3:21-cv-00311-G	2/11/2021	Northern District of Texas, Dallas Division

PLAINTIFF	DEFENDANT
Golabs Inc	Unicorn Global Inc et al

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,376,155	6/28/2016	Golabs Inc
2 9,452,802	9/27/2016	Golabs Inc
3 10,597,107	3/24/2020	Golabs Inc
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY
3/3/2021	☐ Amendment ☑ Answer ☐ Cross Bill ☐ Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 10,850,788 B2	12/1/2020	Chic
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGMENT
Joint STIPULATION OF DISMISSAL With Prejudice.

CLERK	(BY) DEPUTY CLERK	DATE
Karen Mitchell	s/ Y. Lehnert	9/2/2021

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court EASTERN DISTRICT OF NEW YORK -- BROOKLYN on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:21-cv-1436	3/18/2021	EASTERN DISTRICT OF NEW YORK -- BROOKLYN

PLAINTIFF	DEFENDANT
Unicorn Global, Inc. et al & Hangzhou Chic Intelligent Technology Co., Ltd.	Jetson Electric Bikes LLC

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 10,597,107	3/24/2020	Hangzhou Chic Intelligent Technology Co., Ltd.
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Douglas C. Palmer	Christine Rocco	3/18/2021

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court EASTERN DISTRICT OF NEW YORK -- BROOKLYN on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:21-cv-1436	3/18/2021	EASTERN DISTRICT OF NEW YORK -- BROOKLYN

PLAINTIFF	DEFENDANT
Unicorn Global, Inc. et al & Hangzhou Chic Intelligent Technology Co., Ltd.	DGL Group, Ltd.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 10,597,107	3/24/2020	Hangzhou Chic Intelligent Technology Co., Ltd.
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Douglas C. Palmer	Christine Rocco	3/19/2021

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of Texas, Dallas Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
3:21-cv-00311-G	2/11/2021	Northern District of Texas, Dallas Division

PLAINTIFF	DEFENDANT
Golabs Inc	Unicorn Global Inc et al

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,376,155	6/28/2016	Golabs Inc
2 9,452,802	9/27/2016	Golabs Inc
3 10,597,107	3/24/2020	Golabs Inc
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Karen Mitchell	s/ O. Hernandez	2/12/2021

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of Texas, Dallas Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
3:20-cv-02023-B	7/30/2020	Northern District of Texas, Dallas Division

PLAINTIFF	DEFENDANT
Unicorn Global Inc et al	Golabs Inc et al

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 10,167,036	1/1/2019	Hangzhou Chic Intelligent Technology Co Ltd
2 10,597,107	3/24/2020	Hangzhou Chic Intelligent Technology Co Ltd
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Karen Mitchell	s/H. Leal	7/30/2020

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/658,020	03/24/2020	10597107	HANG01-10008	6585

23990 7590 03/04/2020

DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Hangzhou Chic Intelligent Technology Co., Ltd., Hangzhou, CHINA;
Jiawei YING, Hangzhou, CHINA;
Shaojun CAO, Hangzhou, CHINA;

IR103 (Rev. 10/09)

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/658,020	10/18/2019	Jiawei YING	HANG01-10008

CONFIRMATION NO. 6585

PUBLICATION NOTICE

OC000000114704208

23990
DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

Title:ELECTRIC VEHICLE

Publication No.US-2020-0047839-A1
Publication Date:02/13/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23990 7590 02/05/2020

DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/658,020	10/18/2019	Jiawei YING	HANG01-10008	6585

TITLE OF INVENTION: ELECTRIC VEHICLE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	05/05/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
HURLEY, KEVIN	3611	180-218000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ______
2 ______
3 ______

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: **Hangzhou Chic Intelligent Technology Co., Ltd.**

(B) RESIDENCE: (CITY and STATE OR COUNTRY): **Hangzhou, China**

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☑ Issue Fee ☑ Publication Fee (if required) ☐ Advance Order - # of Copies ______

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☑ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. **50-0208**

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature **/Neil G. Ferrari/** Date **February 7, 2020**

Typed or printed name **Neil G. Ferrari** Registration No. **61,484**

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.	:	16/658,020
Filed	:	October 18, 2019
For	:	ELECTRIC VEHICLE
Art Unit	:	3611
Examiner	:	Kevin Hurley
Confirmation No.	:	6585

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

In response to the Notice of Allowance dated February 5, 2020, the Applicant provides the following in response to the Statement of Reasons for Allowance. The Applicant believes that the claims and description of the invention are adequately described and set forth in the specification such that Applicant's claimed invention, and terms and features described therein, are readily understood by those of ordinary skill in the art as set forth in the allowed claims. While the Applicant appreciates the Examiner's reasons for allowance, the Applicant believes that other reasons for allowance exist. The Applicant reserves the right to raise these other reasons if ever necessary.

Respectfully submitted,

MUNCK WILSON MANDALA, LLP

Date: February 7, 2020

/Neil G. Ferrari/
Neil G. Ferrari
Registration No. 61,484

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
Email: *nferrari@munckwilson.com*

Electronic Patent Application Fee Transmittal

Application Number:	16658020
Filing Date:	18-Oct-2019
Title of Invention:	ELECTRIC VEHICLE
First Named Inventor/Applicant Name:	Jiawei YING
Filer:	Neil Gibson Ferrari/Pamela Newton
Attorney Docket Number:	HANG01-10008

Filed as Small Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	500	500

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
	Total in USD ($)			**500**

Electronic Acknowledgement Receipt

EFS ID:	38530499
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/Pamela Newton
Filer Authorized By:	Neil Gibson Ferrari
Attorney Docket Number:	HANG01-10008
Receipt Date:	07-FEB-2020
Filing Date:	18-OCT-2019
Time Stamp:	17:17:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$500
RAM confirmation Number	E202027H17386859
Deposit Account	500208
Authorized User	Pamela Newton

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 1.19 (Document supply 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	Issue Fee Payment (PTO-85B)	HANG01-10008-Issue-Fee-Transmittal.pdf	101255 334d3227de1a029f17da4f205e8a1f48e848e8a0	no	1
Warnings:					
Information:					
2	Post Allowance Communication - Incoming	HANG01-10008-Comments-on-Allowance.pdf	95126 4593ff64f6136345d4651a8343aaabd5e08972c3	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	29874 4a32a1942cd8838207d04107b23cfb871bac8588	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	226255		

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.

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

23990 7590 02/05/2020

DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

EXAMINER	
HURLEY, KEVIN	
ART UNIT	**PAPER NUMBER**
3611	

DATE MAILED: 02/05/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/658,020	10/18/2019	Jiawei YING	HANG01-10008	6585

TITLE OF INVENTION: ELECTRIC VEHICLE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	05/05/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23990 7590 02/05/2020

DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/658,020	10/18/2019	Jiawei YING	HANG01-10008	6585

TITLE OF INVENTION: ELECTRIC VEHICLE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	05/05/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
HURLEY, KEVIN	3611	180-218000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ______________________

2 ______________________

3 ______________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies ______________

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. __________

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ______________________ Date ______________________

Typed or printed name ______________________ Registration No. ______________________

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

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 02/05/2020

DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

EXAMINER	
HURLEY, KEVIN	

ART UNIT	PAPER NUMBER
3611	

DATE MAILED: 02/05/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. 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.

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.

Notice of Allowability	Application No. 16/658,020	Applicant(s) YING et al.	
	Examiner Kevin Hurley	Art Unit 3611	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.☑ This communication is responsive to the response viled 17 January 2020.
  ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ______.

2.☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ______; the restriction requirement and election have been incorporated into this action.

3.☑ The allowed claim(s) is/are 31-55 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4.☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☑All b) ☐ Some *c) ☐ None of the:

1. ☑ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ______ .
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ______ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5.☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ______ .

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6.☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1.☐ Notice of References Cited (PTO-892)
2.☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date ______.
3.☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material ______.
4.☐ Interview Summary (PTO-413), Paper No./Mail Date. ______.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other ______.

/KEVIN HURLEY/
Primary Examiner, Art Unit 3611

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Election/Restrictions

2. Applicant's election with traverse of the restriction requirement in the reply filed on 17 January 2020 is acknowledged. The traversal is on the ground(s) that Claim 55 of Group I also recites a similar rotating mechanism as independent Claim 38 of Group II. This is found persuasive.

The requirement is hereby WITHDRAWN.

Reasons for Allowance

3. The following is an examiner’s statement of reasons for allowance:

The reason for the allowance of claim 31 is that the prior art fails to disclose or suggest an electric balance vehicle including 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.

The reason for the allowance of claim 38 is that the prior art fails to disclose or suggest an electric balance vehicle including 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.

The reason for the allowance of claim 40 is that the prior art fails to disclose or suggest an electric balance vehicle including 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.

The reason for the allowance of claim 55 is that the prior art fails to disclose or suggest an electric balance vehicle including 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

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Hurley whose telephone number is (571)272-6646. The examiner can normally be reached on Monday-Friday 9am-5:30pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joe Rocca can be reached on 571-272-5191. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KEVIN HURLEY/
Primary Examiner
Art Unit 3611

January 30, 2020

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/658,020	YING et al.
	Examiner	**Art Unit**
	Kevin Hurley	3611

CPC - Searched*		
Symbol	**Date**	**Examiner**
B62K 11/007; 3/002	01/30/2020	KH

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
Parent Applications Reviewed	01/30/2020	KH
Inventor Search	01/30/2020	KH

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
B62K	11/007; 3/002	01/30/2020	KH

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/658,020	YING et al.
	Examiner	**Art Unit**
	Kevin Hurley	3611

CPC

Symbol					Type	Version
B62K	/	11	/	007	F	2016-11-01
B62D	/	61	/	02	I	2013-01-01
B62D	/	51	/	02	I	2013-01-01
B62D	/	51	/	001	I	2013-01-01
B62K	/	17	/	00	I	2013-01-01
B62K	/	3	/	002	I	2013-01-01
Y02T	/	10	/	7258	A	2013-01-01
B62K	/	2207	/	00	A	2013-01-01
B62K	/	2204	/	00	A	2013-01-01

CPC Combination Sets

Symbol					Type	Set	Ranking	Version
	/		/					

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 25	
/KEVIN HURLEY/ Primary Examiner, Art Unit 3611 30 January 2020 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 2

Issue Classification	Application/Control No. 16/658,020	Applicant(s)/Patent Under Reexamination YING et al.
	Examiner Kevin Hurley	Art Unit 3611

INTERNATIONAL CLASSIFICATION				
CLAIMED				
B62K11/00	/	11	/	00
NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE (Assistant Examiner) (Date)	Total Claims Allowed: 25	
/KEVIN HURLEY/ Primary Examiner, Art Unit 3611 (Primary Examiner) 30 January 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 2

Issue Classification	Application/Control No. 16/658,020	Applicant(s)/Patent Under Reexamination YING et al.
	Examiner Kevin Hurley	Art Unit 3611

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE (Assistant Examiner)	(Date)	Total Claims Allowed: 25	
/KEVIN HURLEY/ Primary Examiner, Art Unit 3611 (Primary Examiner)	30 January 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 2

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5791425	A	1998-08-11	Kamen et al.	
	2	6050357	A	2000-04-18	Staelin et al.	
	3	6113517	A	2000-09-05	Salecker et al.	
	4	6288505	B1	2001-09-11	Heinzmann et al.	
	5	6302230	B1	2001-10-16	Kamen et al.	
	6	6367817	B1	2002-04-09	Kamen et al.	
	7	6538411	B1	2003-03-25	Field et al.	
	8	6581714	B1	2003-06-24	Kamen et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	9	6651763	B1	2003-11-25	Kamen et al.	
	10	6796396	B2	2004-09-28	Kamen et al.	
	11	6920947	B2	2005-07-26	Kamen et al.	
	12	7023330	B2	2006-04-04	Kamen et al.	
	13	7083178	B2	2006-08-01	Potter	
	14	7090040	B2	2006-08-15	Kamen et al.	
	15	7195259	B2	2007-03-27	Gang	
	16	7275607	B2	2007-10-02	Kamen et al.	
	17	7338056	B2	2008-03-04	Chen et al.	
	18	7363993	B2	2008-04-29	Ishii	
	19	7367572	B2	2008-05-06	Jiang	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	20	7467681	B2	2008-12-23	Hiramatsu	
	21	7479872	B2	2009-01-20	Kamen et al.	
	22	7481291	B2	2009-01-27	Nishikawa	
	23	7740099	B2	2010-06-22	Field et al.	
	24	7775534	B2	2010-08-17	Chen et al.	
	25	7783392	B2	2010-08-24	Oikawa	
	26	7857088	B2	2010-12-28	Field et al.	
	27	7926825	B2	2011-04-19	Chen	
	28	7958956	B2	2011-06-14	Kakinuma et al.	
	29	7988159	B2	2011-08-02	Chen	
	30	8014923	B2	2011-09-06	Ishii et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	31	8028777	B2	2011-10-04	Kakinuma et al.	
	32	8047556	B2	2011-11-01	Jang et al.	
	33	8113524	B2	2012-02-14	Karpman	
	34	8157274	B2	2012-04-17	Chen	
	35	8170780	B2	2012-05-01	Field et al.	
	36	8225891	B2	2012-07-24	Takenaka et al.	
	37	8322478	B2	2012-12-04	Kim	
	38	8408565	B2	2013-04-02	An	
	39	8459668	B2	2013-06-11	Yoon	
	40	8467941	B2	2013-06-18	Field et al.	
	41	8469376	B2	2013-06-25	Kristiansen	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	42	8490723	B2	2013-07-23	Heinzmann et al.	
	43	8584782	B2	2013-11-19	Chen	
	44	8606468	B2	2013-12-10	Kosaka	
	45	8684123	B2	2014-04-01	Chen	
	46	8738278	B2	2014-05-27	Chen	
	47	8807250	B2	2014-08-19	Chen	
	48	8960353	B2	2015-02-24	Chen	
	49	8978791	B2	2015-03-17	Ha et al.	
	50	9045190	B2	2015-06-02	Chen	
	51	9211937	B2	2015-12-15	Chen	
	52	9376155	B2	2016-06-28	Ying et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	53	9499228	B2	2016-11-22	Chang	
	54	9682732	B2	2017-06-20	Strack	
	55	9896146	B2	2018-02-20	Lu	
	56	D601922	S	2009-10-13	Imai et al.	
	57	D647991	S	2011-11-01	Sramek	
	58	D737723	S	2015-09-01	Ying et al.	
	59	D738256	S	2015-09-08	Ying et al.	
	60	D739906	S	2015-09-29	Chen	
	61	D786995	S	2017-05-16	Ying	
	62	10167037	B2	2019-01-01	Ying	
	63	10207764	B2	2019-02-19	Li et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	64	10167036	B2	2019-01-01	Ying	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040005958	A1	2004-01-08	Kamen et al.	
	2	20060260857	A1	2006-11-23	Kakinuma et al.	
	3	20070273118	A1	2007-11-29	Conrad	
	4	20080147281	A1	2008-06-19	Ishii et al.	
	5	20090032323	A1	2009-02-05	Kakinuma et al.	
	6	20090115149	A1	2009-05-07	Wallis et al.	
	7	20090200746	A1	2009-08-13	Yamamoto	
	8	20090315293	A1	2009-12-24	Kosaka	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	9	20100025139	A1	2010-02-04	Kosaka et al.	
	10	20100114468	A1	2010-05-06	Field et al.	
	11	20100117316	A1	2010-05-13	Weiner et al.	
	12	20100121538	A1	2010-05-13	Ishii et al.	
	13	20100222994	A1	2010-09-02	Field et al.	
	14	20100225080	A1	2010-09-09	Smith	
	15	20110006497	A1	2011-01-13	Chen et al.	
	16	20110282532	A1	2011-11-17	Kosaka et al.	
	17	20120007331	A1	2012-01-12	Hsieh	
	18	20120035809	A1	2012-02-09	Kosaka	
	19	20120187648	A1	2012-07-26	Chen	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	20	20130228385	A1	2013-09-05	Chen	
	21	20130238231	A1	2013-09-12	Chen	
	22	20150096820	A1	2015-04-09	Strack	
	23	20160129963	A1	2016-05-12	Ying et al.	
	24	20160207584	A1	2016-07-21	Ying et al.	
	25	20160325803	A1	2016-11-10	Waxman et al.	
	26	20170183053	A1	2017-06-29	Zeng et al.	
	27	20180037293	A1	2018-02-08	Chen et al.	
	28	20190031269	A1	2019-01-31	Shang	
	29	20190077479	A1	2019-03-14	Chen et al.	
	30	20190193803	A1	2019-06-27	Desberg et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	100431906	CN	C	2008-11-12	Sony Corp.		☒
	2	2456195	RU	C2	2012-07-20	Sulimov Pavel Sergeevich		☒
	3	101920728	CN	A	2010-12-22	Wuhan Ruobite Robot Co., Ltd.		☒
	4	102514662	CN	A	2012-06-27	He Chen		☒
	5	102602481	CN	A	2012-07-25	He Chen		☒
	6	103529850	CN	A	2014-01-22	Guangzhou College South China Univ. Tech.		☒
	7	103600796	CN	A	2014-02-26	Univ. Shanghai Jiaotong		☒
	8	104014123	CN	A	2014-09-03	Hangzhou Chic Intelligent Tech. Co., Ltd.	Corresponds to U.S. 10,167,036 B2	☒
	9	104029769	CN	A	2014-09-10	Hangzhou Chic Intelligent Tech. Co., Ltd.		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16658020
	Filing Date		2019-10-18
	First Named Inventor	Jiawei Ying	
	Art Unit		3611
	Examiner Name	Hurley, Kevin	
	Attorney Docket Number		HANG01-10008

	10	104149899	CN	A	2014-11-19	Zhu Zhenhai		☒
	11	104163222	CN	A	2014-11-26	Zhu Zhenhai		☒
	12	202201103	CN	U	2012-04-25	Jiujiang Jiayuan Technology Co. Ltd.		☒
	13	202669532	CN	U	2013-01-16	Hangzhou Yinao Intelligent Technology Co Ltd		☒
	14	203158157	CN	U	2013-08-28	Chen He		☒
	15	203186511	CN	U	2013-09-11	Univ. Northwest A&F		☒
	16	203268232	CN	U	2013-11-06	Hangzhou Yinao Intelligent Technology Co., Ltd.		☒
	17	203268242	CN	U	2013-11-06	Hangzhou Yinao Intelligent Technology Co., Ltd.		☒
	18	203381739	CN	U	2014-01-08	Inst. Metal Res. Chinese Acad Sc.		☒
	19	203698535	CN	U	2014-07-09	Shanghai Chuanghui Robot Technology Co., Ltd.		☒
	20	203996649	CN	U	2014-12-10	Hangzhou Chic Intelligent Technology Co., Ltd.		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16658020
	Filing Date		2019-10-18
	First Named Inventor	Jiawei Ying	
	Art Unit		3611
	Examiner Name	Hurley, Kevin	
	Attorney Docket Number		HANG01-10008

	21	204050913	CN	U	2014-12-31	Hangzhou Chic Intelligent Technology Co., Ltd.	(Partial translation)	☒
	22	302534790	CN	No	2014-12-31	No Applicant		☐
	23	1630086	EP	A1	2006-03-01	Sony Corporation		☐
	24	1791609	EP	A1	2007-06-06	Deka Products LP	Corresponds to U.S. 7,275,607 B2	☐
	25	2005094898	JP	A	2005-04-07	Nat. Inst. of Adv. Ind. & Tech.		☒
	26	2005335471	JP	A	2005-12-08	Sony Corp.		☒
	27	2006008013	JP	A	2006-01-12	Sony Corp.		☒
	28	2014151721	JP	A	2014-08-25	Toyo Parts KK		☒

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	International Search Report dated March 11, 2015 in connection with International Patent Application No. for PCT/CN2014/092849, 2 pages.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	2	Written Opinion of the International Searching Authority dated March 11, 2015 in connection with International Patent Application No. for PCT/CN2014/092849, 6 pages.	
	3	Kim, "Development of a Two-Wheeled Mobile Tilting & Balancing (MTB) Robot", 2011 11th International Conference on Control, Automation and Systems (ICCAS)", October 26-29, 2011, 6 pages.	
	4	Kickstarter Website: Hovertrax, by Inventist, as evidenced by a web archive captured by the Internet Archive (www.archive.org) on May 4, 2013, https://web.archive.org/web/20130504083823/http:/www.kickstarter.com/projects/687658339/hovertrax ("Hovertrax Kickstarter"), 11 pages.	
	5	Hovertrax Guide and Manual, 2014, 15 pages.	
	6	Segway Reference Manual, 2013, 52 pages.	
	7	Segway User Manual, April 17, 2014, 144 pages.	
	8	Segway LLC, "Basic Rider Optimization Training for the Segway Human Transporter (HT) i Series, e Series and p Series models", Instructor Guide and Participant Workbook, January 2004, 106 pages.	
	9	Segway, "Segway i2", Bild Segway Explosionszeichnung, (2008-05-09), URL: http://media.bestofmicro.com/3/2/156926/original/segway _i2_technik2.jpg.	
	10	Anonymous, "Ninebot PTR", User Manual Ninebot, (2013-10-12), page 1,3,20,29, URL: https://www.manualslib.com/manual/879594/Ninebot-Personal-Transportation-Robot.html.	
	11	msjifyournasty, "Inventist Inc, Solo Wheel, Orbit wheel @ Toy Fair 2013", YouTube, February 10, 2013, URL: https://www.youtube.com/watch?v=w8rHKCjLAWI.	
	12	Inventist Inc, "Hovertrax by Inventist!", YouTube, May 17, 2013, URL: https://www.youtube.com/watch?v=fu2RH_nsVE0.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	13	Coelho et al., "Development of a Mobile Two-Wheel Balancing Platform for Autonomous Applications", 15th International Conference on Mechatronics and Machine Vision in Practice, December 2-4, 2008, pp. 575–580.	
	14	Choi et al., "Four and Two Wheel Transformable Dynamic Mobile Platform", 2011 IEEE International Conference on Robotics and Automation (ICRA), May 9-13, 2011, 4 pages.	
	15	Chiu et al., "Design and implement of the self-dynamic controller for two wheel transporter", 2006 IEEE International Conference on Fuzzy Systems, July 16-21, 2006, pp. 480–483.	
	16	Abeygunawardhana et al., "Vibration Suppression of Two-Wheel Mobile Manipulator Using Resonance-Ratio-Control-Based Null-Space Control", IEEE Transactions on Industrial Electronics, Vol. 57, No. 12, December 2010, pp. 4137–4146.	
	17	Clark et al. "EDGAR, A Self-Balancing Scooter Final Report", October 27, 2005, 182 pages.	
	18	Azizan et al., "Fuzzy Control Based on LMI Approach and Fuzzy Interpretation of the Rider Input for Two Wheeled Balancing Human Transporter", 2010 8th IEEE International Conference on Control and Automation, June 9-11, 2010, pg. 192–197.	
	19	Cardozo et al., "Prototype for a Self-Balanced Personal Transporter", 2012 Workshop on Engineering Applications, May 2-4, 6 pages.	
	20	Li et al., "A coaxial couple wheeled equilibrium robot with T-S fuzzy equilibrium control, Industrial Robot: An International Journal, Vol. 38, Issue 3, May 3, 2011, 10 pages.	
	21	Li et al., "Controller Design of a Two-Wheeled Inverted Pendulum Mobile Robot", 2008 IEEE International Conference on Mechatronics and Automation, August 5-8, 2008, pp. 7–12.	
	22	Li et al., "Mechanical Design and Dynamic Modeling of a Two-Wheeled Inverted Pendulum Mobile Robot", Proceedings of the 2007 IEEE International Conference on Automation and Logistics, August 18-21, 2007, pp.1614–1619.	
	23	Lin et al., "Adaptive Robust Self-Balancing and Steering of a Two-Wheeled Human Transportation Vehicle", J Intell Robot Syst., August 27, 2010, 21 pages.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	24	Sasaki et al., "Forward and Backward Motion Control of Personal Riding-type Wheeled Mobile Platform", Proceedings of the 2004 IEEE International Conference on Robotics and Automation, April 26 - May 1, 2004, pg. 3331–3336.	
	25	Seo et al., "Simulation of Attitude Control of a Wheeled Inverted Pendulum", International Conference on Control, Automation, and Systems, October 17-20, 2007, pg. 2264–2269.	
	26	Tsai et al., "Intelligent Adaptive Motion Control Using Fuzzy Basis Function Networks for Self-Balancing Two-Wheeled Transporters", 2010 IEEE Conference on Fuzzy Systems, July 18-23, 2010, pg. 1–6.	
	27	Sasaki et al., "Steering Control of Personal Riding-type Wheeled Mobile Platform (PMP)", August 2-6, 2005, 6 pages.	
	28	Vijay Kumar, "What is a Hoverboard – When was the Hoverboard Invented", 8 pages.	
	29	Danielle Frost, "Camas Resident Will Feature Latest Invention At National Show", Camas-Washougal Post-Record, June 5, 2012, 5 pages.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/KEVIN HURLEY/	Date Considered	01/29/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

X A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Neil G. Ferrari/	Date (YYYY-MM-DD)	2019-11-18
Name/Print	Neil G. Ferrari	Registration Number	61,484

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 the Freedom of Information Act requires disclosure of these record s.

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 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.H./

Bibliographic Data

Application No: 16/658,020

Foreign Priority claimed: ◉ Yes ○ No

35 USC 119 (a-d) conditions met: ☑ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: Examiner's Signature Initials

Title: ELECTRIC VEHICLE

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/18/2019	180	3611	HANG01-10008
RULE			

APPLICANTS

Hangzhou Chic Intelligent Technology Co., Ltd., Hangzhou, CHINA

INVENTORS

Jiawei YING Hangzhou, CHINA

Shaojun CAO Hangzhou, CHINA

CONTINUING DATA

This application is a CON of 16429636 06/03/2019 PAT 10486764

16429636 is a CON of 15160589 05/20/2016 PAT 10336392

15160589 is a CON of 14773650 09/08/2015 PAT 9376155

14773650 is a 371 of PCT/CN2014/092849 12/02/2014

FOREIGN APPLICATIONS

CHINA 201410262353.9 06/13/2014

IF REQUIRED, FOREIGN LICENSE GRANTED**

11/05/2019

**** SMALL ENTITY ****

STATE OR COUNTRY

CHINA

ADDRESS

DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380
UNITED STATES

FILING FEE RECEIVED

$3,085

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	1699	(b62k11/007;3/002).cpc.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2020/01/30 12:39

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	538	(b62k11/007;3/002).cpc.	US-PGPUB	ADJ	ON	2020/01/30 12:39

1/ 30/ 2020 12:40:01 PM
C:\ Users\ khurley\ Documents\ EAST\ Workspaces\ 16-658,020.wsp

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.	:	16/658,020
Filed	:	October 18, 2019
For	:	ELECTRIC VEHICLE
Group No.	:	3611
Examiner	:	Kevin Hurley
Confirmation No.	:	6585

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO RESTRICTION REQUIREMENT

In response to the Restriction Requirement mailed November 19, 2019, Applicant provisionally elects the claims of Group I, Claims 31-37 and 40-55, WITH TRAVERSE.

The Restriction Requirement proposed to restrict the application to one of the following identified groups:

Group I. Claims 31-37, 40-55, drawn to an electric balance vehicle including 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., classified in B62K 11/007.

Group II. Claims 38-39, drawn to an electric vehicle including 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, classified in B62D 51/00.

The Office Action contends that a restriction requirement is proper for the following reason:

> The inventions are independent or distinct, each from the other because…the inventions as claimed have a materially different design. Furthermore, the inventions as claimed do not encompass overlapping subject matter, as shown by the above noted mutually exclusive limitations, and there is nothing of record to show them to be obvious variants.
>
> Restriction for examination purposes as indicated is proper because all the inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required.

Thus, the basis for the Restriction Requirement seems to be that the claims of Group II recite an electric vehicle having a rotating mechanism that is not present in the claims of Group I, rendering the inventions distinct and imposing a serious burden upon the Examiner. Applicant notes that independent Claim 55 of Group I also recites a similar rotating mechanism as independent Claim 38 of Group II. Therefore, the search/examination of Claim 38 in Group II would impose no additional burden on the Examiner relative to the search/examination of Claim 55 in Group I. For this reason, Applicant respectfully request that the Examiner withdraw the present Restriction Requirement.

CONCLUSION

As a result of the foregoing, the Applicants assert that the claims in the Application are in condition for allowance, and respectfully request an early allowance of such claims.

If any issue arises, or if the Examiner has any suggestions for expediting allowance of this application, the Applicant respectfully invites 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: January 17, 2020

/Neil G. Ferrari/
Neil G. Ferrari
Registration No. 61,484

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
E-mail: *nferrari@munckwilson.com*

Electronic Acknowledgement Receipt

EFS ID:	38327321
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/Cristina Estrada
Filer Authorized By:	Neil Gibson Ferrari
Attorney Docket Number:	HANG01-10008
Receipt Date:	17-JAN-2020
Filing Date:	18-OCT-2019
Time Stamp:	13:00:40
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	Response to Election / Restriction Filed	HANG01-10008_ResponseToRestrictionRequirement_2020-01-17.pdf	151563 09f37c10dad68f93e2beb0b34b172d3fdad8641e	no	3

Warnings:

Information:	
Total Files Size (in bytes):	151563

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

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 11/19/2019
DOCKET CLERK
P.O. DRAWER 800889
DALLAS, TX 75380

EXAMINER	
HURLEY, KEVIN	
ART UNIT	**PAPER NUMBER**
3611	
NOTIFICATION DATE	**DELIVERY MODE**
11/19/2019	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

Office Action Summary	**Application No.** 16/658,020	**Applicant(s)** YING et al.	
	Examiner Kevin Hurley	**Art Unit** 3611	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 31-55 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☐ Claim(s) _____ is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☑ Claim(s) 31-55 are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a)☐ All b)☐ Some** c)☐ None of the:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

DETAILED ACTION

Election/Restriction

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 31-37, 40-55, drawn to an electric balance vehicle including 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., classified in B62K 11/007.

II. Claims 38-39, drawn to an electric vehicle including 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, classified in B62D 51/00.

The inventions are independent or distinct, each from the other because:

3. Inventions I and II are directed to related apparatus. The related inventions are distinct if: (1) the inventions as claimed are either not capable of use together or can have a materially different design, mode of operation, function, or effect; (2) the inventions do not overlap in scope, i.e., are mutually exclusive; and (3) the inventions as claimed are not obvious variants. See MPEP § 806.05(j). In the instant case, the inventions as claimed have a materially different design. Furthermore, the inventions as claimed do not encompass overlapping subject matter, as

shown by the above noted mutually exclusive limitations, and there is nothing of record to show them to be obvious variants.

4. Restriction for examination purposes as indicated is proper because all the inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because one or more of the following reasons apply:

(a) the inventions have acquired a separate status in the art in view of their different classification;

(b) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);

(c) the prior art applicable to one invention would not likely be applicable to another invention;.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention**.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103 or pre-AIA 35 U.S.C. 103(a) of the other invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be corrected in compliance with 37 CFR 1.48(a) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. A request to correct inventorship under 37 CFR 1.48(a) must be accompanied by an application data sheet in accordance with 37 CFR 1.76 that identifies each inventor by his or her legal name and by the processing fee required under 37 CFR 1.17(i).

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Hurley whose telephone number is (571)272-6646. The examiner can normally be reached on Monday-Friday 9am-5:30pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joe Rocca can be reached on 571-272-5191. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KEVIN HURLEY/
Primary Examiner
Art Unit 3611

November 12, 2019

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5791425	A	1998-08-11	Kamen et al.	
	2	6050357	A	2000-04-18	Staelin et al.	
	3	6113517	A	2000-09-05	Salecker et al.	
	4	6288505	B1	2001-09-11	Heinzmann et al.	
	5	6302230	B1	2001-10-16	Kamen et al.	
	6	6367817	B1	2002-04-09	Kamen et al.	
	7	6538411	B1	2003-03-25	Field et al.	
	8	6581714	B1	2003-06-24	Kamen et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number: 16658020
	Filing Date: 2019-10-18
	First Named Inventor: Jiawei Ying
	Art Unit: 3611
	Examiner Name: Hurley, Kevin
	Attorney Docket Number: HANG01-10008

	9	6651763	B1	2003-11-25	Kamen et al.	
	10	6796396	B2	2004-09-28	Kamen et al.	
	11	6920947	B2	2005-07-26	Kamen et al.	
	12	7023330	B2	2006-04-04	Kamen et al.	
	13	7083178	B2	2006-08-01	Potter	
	14	7090040	B2	2006-08-15	Kamen et al.	
	15	7195259	B2	2007-03-27	Gang	
	16	7275607	B2	2007-10-02	Kamen et al.	
	17	7338056	B2	2008-03-04	Chen et al.	
	18	7363993	B2	2008-04-29	Ishii	
	19	7367572	B2	2008-05-06	Jiang	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	
Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

	20	7467681	B2	2008-12-23	Hiramatsu	
	21	7479872	B2	2009-01-20	Kamen et al.	
	22	7481291	B2	2009-01-27	Nishikawa	
	23	7740099	B2	2010-06-22	Field et al.	
	24	7775534	B2	2010-08-17	Chen et al.	
	25	7783392	B2	2010-08-24	Oikawa	
	26	7857088	B2	2010-12-28	Field et al.	
	27	7926825	B2	2011-04-19	Chen	
	28	7958956	B2	2011-06-14	Kakinuma et al.	
	29	7988159	B2	2011-08-02	Chen	
	30	8014923	B2	2011-09-06	Ishii et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	
Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

	31	8028777	B2	2011-10-04	Kakinuma et al.	
	32	8047556	B2	2011-11-01	Jang et al.	
	33	8113524	B2	2012-02-14	Karpman	
	34	8157274	B2	2012-04-17	Chen	
	35	8170780	B2	2012-05-01	Field et al.	
	36	8225891	B2	2012-07-24	Takenaka et al.	
	37	8322478	B2	2012-12-04	Kim	
	38	8408565	B2	2013-04-02	An	
	39	8459668	B2	2013-06-11	Yoon	
	40	8467941	B2	2013-06-18	Field et al.	
	41	8469376	B2	2013-06-25	Kristiansen	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number: 16658020
	Filing Date: 2019-10-18
	First Named Inventor: Jiawei Ying
	Art Unit: 3611
	Examiner Name: Hurley, Kevin
	Attorney Docket Number: HANG01-10008

	42	8490723	B2	2013-07-23	Heinzmann et al.	
	43	8584782	B2	2013-11-19	Chen	
	44	8606468	B2	2013-12-10	Kosaka	
	45	8684123	B2	2014-04-01	Chen	
	46	8738278	B2	2014-05-27	Chen	
	47	8807250	B2	2014-08-19	Chen	
	48	8960353	B2	2015-02-24	Chen	
	49	8978791	B2	2015-03-17	Ha et al.	
	50	9045190	B2	2015-06-02	Chen	
	51	9211937	B2	2015-12-15	Chen	
	52	9376155	B2	2016-06-28	Ying et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

	53	9499228	B2	2016-11-22	Chang	
	54	9682732	B2	2017-06-20	Strack	
	55	9896146	B2	2018-02-20	Lu	
	56	D601922	S	2009-10-13	Imai et al.	
	57	D647991	S	2011-11-01	Sramek	
	58	D737723	S	2015-09-01	Ying et al.	
	59	D738256	S	2015-09-08	Ying et al.	
	60	D739906	S	2015-09-29	Chen	
	61	D786995	S	2017-05-16	Ying	
	62	10167037	B2	2019-01-01	Ying	
	63	10207764	B2	2019-02-19	Li et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number: 16658020
	Filing Date: 2019-10-18
	First Named Inventor: Jiawei Ying
	Art Unit: 3611
	Examiner Name: Hurley, Kevin
	Attorney Docket Number: HANG01-10008

	64	10167036	B2	2019-01-01	Ying	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040005958	A1	2004-01-08	Kamen et al.	
	2	20060260857	A1	2006-11-23	Kakinuma et al.	
	3	20070273118	A1	2007-11-29	Conrad	
	4	20080147281	A1	2008-06-19	Ishii et al.	
	5	20090032323	A1	2009-02-05	Kakinuma et al.	
	6	20090115149	A1	2009-05-07	Wallis et al.	
	7	20090200746	A1	2009-08-13	Yamamoto	
	8	20090315293	A1	2009-12-24	Kosaka	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number: 16658020
	Filing Date: 2019-10-18
	First Named Inventor: Jiawei Ying
	Art Unit: 3611
	Examiner Name: Hurley, Kevin
	Attorney Docket Number: HANG01-10008

	9	20100025139	A1	2010-02-04	Kosaka et al.	
	10	20100114468	A1	2010-05-06	Field et al.	
	11	20100117316	A1	2010-05-13	Weiner et al.	
	12	20100121538	A1	2010-05-13	Ishii et al.	
	13	20100222994	A1	2010-09-02	Field et al.	
	14	20100225080	A1	2010-09-09	Smith	
	15	20110006497	A1	2011-01-13	Chen et al.	
	16	20110282532	A1	2011-11-17	Kosaka et al.	
	17	20120007331	A1	2012-01-12	Hsieh	
	18	20120035809	A1	2012-02-09	Kosaka	
	19	20120187648	A1	2012-07-26	Chen	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	
Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

	20	20130228385	A1	2013-09-05	Chen	
	21	20130238231	A1	2013-09-12	Chen	
	22	20150096820	A1	2015-04-09	Strack	
	23	20160129963	A1	2016-05-12	Ying et al.	
	24	20160207584	A1	2016-07-21	Ying et al.	
	25	20160325803	A1	2016-11-10	Waxman et al.	
	26	20170183053	A1	2017-06-29	Zeng et al.	
	27	20180037293	A1	2018-02-08	Chen et al.	
	28	20190031269	A1	2019-01-31	Shang	
	29	20190077479	A1	2019-03-14	Chen et al.	
	30	20190193803	A1	2019-06-27	Desberg et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number³	Country Code² i	Kind Code⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T⁵
	1	100431906	CN	C	2008-11-12	Sony Corp.		☒
	2	2456195	RU	C2	2012-07-20	Sulimov Pavel Sergeevich		☒
	3	101920728	CN	A	2010-12-22	Wuhan Ruobite Robot Co., Ltd.		☒
	4	102514662	CN	A	2012-06-27	He Chen		☒
	5	102602481	CN	A	2012-07-25	He Chen		☒
	6	103529850	CN	A	2014-01-22	Guangzhou College South China Univ. Tech.		☒
	7	103600796	CN	A	2014-02-26	Univ. Shanghai Jiaotong		☒
	8	104014123	CN	A	2014-09-03	Hangzhou Chic Intelligent Tech. Co., Ltd.	Corresponds to U.S. 10,167,036 B2	☒
	9	104029769	CN	A	2014-09-10	Hangzhou Chic Intelligent Tech. Co., Ltd.		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

	10	104149899	CN	A	2014-11-19	Zhu Zhenhai		☒
	11	104163222	CN	A	2014-11-26	Zhu Zhenhai		☒
	12	202201103	CN	U	2012-04-25	Jiujiang Jiayuan Technology Co. Ltd.		☒
	13	202669532	CN	U	2013-01-16	Hangzhou Yinao Intelligent Technology Co Ltd		☒
	14	203158157	CN	U	2013-08-28	Chen He		☒
	15	203186511	CN	U	2013-09-11	Univ. Northwest A&F		☒
	16	203268232	CN	U	2013-11-06	Hangzhou Yinao Intelligent Technology Co., Ltd.		☒
	17	203268242	CN	U	2013-11-06	Hangzhou Yinao Intelligent Technology Co., Ltd.		☒
	18	203381739	CN	U	2014-01-08	Inst. Metal Res. Chinese Acad Sc.		☒
	19	203698535	CN	U	2014-07-09	Shanghai Chuanghui Robot Technology Co., Ltd.		☒
	20	203996649	CN	U	2014-12-10	Hangzhou Chic Intelligent Technology Co., Ltd.		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number: 16658020
	Filing Date: 2019-10-18
	First Named Inventor: Jiawei Ying
	Art Unit: 3611
	Examiner Name: Hurley, Kevin
	Attorney Docket Number: HANG01-10008

	21	204050913	CN	U	2014-12-31	Hangzhou Chic Intelligent Technology Co., Ltd.	(Partial translation)	☒
	22	302534790	CN	No	2014-12-31	No Applicant		☐
	23	1630086	EP	A1	2006-03-01	Sony Corporation		☐
	24	1791609	EP	A1	2007-06-06	Deka Products LP	Corresponds to U.S. 7,275,607 B2	☐
	25	2005094898	JP	A	2005-04-07	Nat. Inst. of Adv. Ind. & Tech.		☒
	26	2005335471	JP	A	2005-12-08	Sony Corp.		☒
	27	2006008013	JP	A	2006-01-12	Sony Corp.		☒
	28	2014151721	JP	A	2014-08-25	Toyo Parts KK		☒

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	International Search Report dated March 11, 2015 in connection with International Patent Application No. for PCT/CN2014/092849, 2 pages.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	

Application Number	16658020	
Filing Date	2019-10-18	
First Named Inventor	Jiawei Ying	
Art Unit	3611	
Examiner Name	Hurley, Kevin	
Attorney Docket Number	HANG01-10008	

	2		Written Opinion of the International Searching Authority dated March 11, 2015 in connection with International Patent Application No. for PCT/CN2014/092849, 6 pages.	
	3		Kim, "Development of a Two-Wheeled Mobile Tilting & Balancing (MTB) Robot", 2011 11th International Conference on Control, Automation and Systems (ICCAS)", October 26-29, 2011, 6 pages.	
	4		Kickstarter Website: Hovertrax, by Inventist, as evidenced by a web archive captured by the Internet Archive (www.archive.org) on May 4, 2013, https://web.archive.org/web/20130504083823/http:/www.kickstarter.com/projects/687658339/hovertrax ("Hovertrax Kickstarter"), 11 pages.	
	5		Hovertrax Guide and Manual, 2014, 15 pages.	
	6		Segway Reference Manual, 2013, 52 pages.	
	7		Segway User Manual, April 17, 2014, 144 pages.	
	8		Segway LLC, "Basic Rider Optimization Training for the Segway Human Transporter (HT) i Series, e Series and p Series models", Instructor Guide and Participant Workbook, January 2004, 106 pages.	
	9		Segway, "Segway i2", Bild Segway Explosionszeichnung, (2008-05-09), URL: http://media.bestofmicro.com/3/2/156926/original/segway _i2_technik2.jpg.	
	10		Anonymous, "Ninebot PTR", User Manual Ninebot, (2013-10-12), page 1,3,20,29, URL: https://www.manualslib.com/manual/879594/Ninebot-Personal-Transportation-Robot.html.	
	11		msjifyournasty, "Inventist Inc, Solo Wheel, Orbit wheel @ Toy Fair 2013", YouTube, February 10, 2013, URL: https://www.youtube.com/watch?v=w8rHKCjLAWI.	
	12		Inventist Inc, "Hovertrax by Inventist!", YouTube, May 17, 2013, URL: https://www.youtube.com/watch?v=fu2RH_nsVE0.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	
Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

	13	Coelho et al., "Development of a Mobile Two-Wheel Balancing Platform for Autonomous Applications", 15th International Conference on Mechatronics and Machine Vision in Practice, December 2-4, 2008, pp. 575–580.	
	14	Choi et al., "Four and Two Wheel Transformable Dynamic Mobile Platform", 2011 IEEE International Conference on Robotics and Automation (ICRA), May 9-13, 2011, 4 pages.	
	15	Chiu et al., "Design and implement of the self-dynamic controller for two wheel transporter", 2006 IEEE International Conference on Fuzzy Systems, July 16-21, 2006, pp. 480–483.	
	16	Abeygunawardhana et al., "Vibration Suppression of Two-Wheel Mobile Manipulator Using Resonance-Ratio-Control-Based Null-Space Control", IEEE Transactions on Industrial Electronics, Vol. 57, No. 12, December 2010, pp. 4137–4146.	
	17	Clark et al. "EDGAR, A Self-Balancing Scooter Final Report", October 27, 2005, 182 pages.	
	18	Azizan et al., "Fuzzy Control Based on LMI Approach and Fuzzy Interpretation of the Rider Input for Two Wheeled Balancing Human Transporter", 2010 8th IEEE International Conference on Control and Automation, June 9-11, 2010, pg. 192–197.	
	19	Cardozo et al., "Prototype for a Self-Balanced Personal Transporter", 2012 Workshop on Engineering Applications, May 2-4, 6 pages.	
	20	Li et al., "A coaxial couple wheeled equilibrium robot with T-S fuzzy equilibrium control, Industrial Robot: An International Journal, Vol. 38, Issue 3, May 3, 2011, 10 pages.	
	21	Li et al., "Controller Design of a Two-Wheeled Inverted Pendulum Mobile Robot", 2008 IEEE International Conference on Mechatronics and Automation, August 5-8, 2008, pp. 7–12.	
	22	Li et al., "Mechanical Design and Dynamic Modeling of a Two-Wheeled Inverted Pendulum Mobile Robot", Proceedings of the 2007 IEEE International Conference on Automation and Logistics, August 18-21, 2007, pp.1614–1619.	
	23	Lin et al., "Adaptive Robust Self-Balancing and Steering of a Two-Wheeled Human Transportation Vehicle", J Intell Robot Syst., August 27, 2010, 21 pages.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	

Application Number	16658020
Filing Date	2019-10-18
First Named Inventor	Jiawei Ying
Art Unit	3611
Examiner Name	Hurley, Kevin
Attorney Docket Number	HANG01-10008

	24	Sasaki et al., "Forward and Backward Motion Control of Personal Riding-type Wheeled Mobile Platform", Proceedings of the 2004 IEEE International Conference on Robotics and Automation, April 26 - May 1, 2004, pg. 3331–3336.	
	25	Seo et al., "Simulation of Attitude Control of a Wheeled Inverted Pendulum", International Conference on Control, Automation, and Systems, October 17-20, 2007, pg. 2264–2269.	
	26	Tsai et al., "Intelligent Adaptive Motion Control Using Fuzzy Basis Function Networks for Self-Balancing Two-Wheeled Transporters", 2010 IEEE Conference on Fuzzy Systems, July 18-23, 2010, pg. 1–6.	
	27	Sasaki et al., "Steering Control of Personal Riding-type Wheeled Mobile Platform (PMP)", August 2-6, 2005, 6 pages.	
	28	Vijay Kumar, "What is a Hoverboard – When was the Hoverboard Invented", 8 pages.	
	29	Danielle Frost, "Camas Resident Will Feature Latest Invention At National Show", Camas-Washougal Post-Record, June 5, 2012, 5 pages.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16658020
	Filing Date	2019-10-18
	First Named Inventor	Jiawei Ying
	Art Unit	3611
	Examiner Name	Hurley, Kevin
	Attorney Docket Number	HANG01-10008

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Neil G. Ferrari/	Date (YYYY-MM-DD)	2019-11-18
Name/Print	Neil G. Ferrari	Registration Number	61,484

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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 the Freedom of Information Act requires disclosure of these record s.

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 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.

Espacenet

Bibliographic data: CN100431906 (C) — 2008-11-12

Coaxial two-wheel vehicle

Inventor(s): TAKEKAZU KAKINUMA [JP]; IKUO YAMANO [JP]; KUNIHITO SAWAI [JP] + (KAKINUMA TAKEKAZU,YAMANO IKUO,SAWAI KUNIHITO, ; KAKINUMA TAKEKAZU, ; YAMANO IKUO, ; SAWAI KUNIHITO)

Applicant(s): SONY CORP [JP] + (SONY CORP)

Classification: **- international:** ***B60L15/10; B62K11/00; B62K17/00***
- cooperative:

Application number: CN20061089876 20060414

Priority number (s): JP20050117365 20050414

Also published as: CN101353070 (A) CN1857959 (A) JP2009023652 (A) JP4803231 (B2)

Abstract of CN1857959 (A)

A coaxial two-wheel vehicle with which a rider stably travels without the upper body being swayed left and right in a riding state of the center of gravity being positioned high is provided. The coaxial two-wheel vehicle includes: a step plate for a driver to ride; a vehicle body that supports the step plate to be capable of changing a posture in a roll direction of rotating around a roll axis as the center, when a traveling direction is made the roll axis; a pair of wheels disposed on both sides on the same axis in the direction orthogonal to the traveling direction of the vehicle body and rotatably supported by the vehicle body; a pair of wheel drive means to drive and rotate the pair of wheels independently; and a handle for directly changing a posture of the step plate or indirectly changing the posture through the vehicle body.

Notice

CLAIMS CN100431906

1、

A coaxial two-wheeled vehicle comprising: a pedal for a ride of a driver; a body of the vehicle, when the direction of travel is set to a rolling axis, the body supports the pedal so as to be able to surround the rolling axis as a center Changing the posture of the pedal in the left and right scroll directions of the rotation; a pair of wheels that are located on both sides of the same axis in a direction perpendicular to the traveling direction of the vehicle body and rotatably supported by the vehicle body; a wheel drive device that individually drives and rotates the pair of wheels; and a handle for directly changing the attitude of the pedal or indirectly changing the posture through the vehicle body.

2

The coaxial two-wheeled vehicle according to claim 1, wherein the vehicle body includes a parallel connection mechanism having a vehicle body upper member and a vehicle body lower member which are disposed in parallel with each other, and a pair of side members, A pair of side members are disposed in parallel to each other and rotatably coupled to the vehicle body upper member and the vehicle body lower member, the pedal being divided into two to provide two separate pedals, the two pedals being separately Fixed to the pair of side members, and the pair of wheels are supported by the pair of side members by the pair of wheel drive members.

3

A coaxial two-wheeled vehicle according to claim 1, wherein said pedal is divided into two to provide two separate pedals, said two pedals being separately supported by said vehicle body in a rotatable manner, and Two separate pedals are coupled by a connecting member to be rotatable, and the handle is rotatably coupled to a central portion of the connecting member such that the two separate pedals can be synchronized with the operation of the handle Turn.

4

The coaxial two-wheeled vehicle according to claim 1, wherein the handle is fixed to the pedal, and a posture of the pedal can be changed by an operation of the handle.

5

The coaxial two-wheeled vehicle according to claim 2, wherein an elastic member is located between the vehicle body upper member and the vehicle body lower member for generating an elastic force to be respectively used by the vehicle body The angle formed by the upper member and the vehicle body lower member and the pair of side members is maintained to be perpendicular.

6

A coaxial two-wheeled vehicle according to claim 4, wherein an elastic member that generates an elastic force to keep the pedal parallel to the vehicle body is located between the pedal and the vehicle body.

7

A coaxial two-wheeled vehicle according to claim 1, further comprising: attitude detecting means for detecting an angle between said pedal or said handle and a gravity axis, and outputting said detection signal, wherein said one The driving of the wheel drive device is controlled in accordance with the detection signal of the attitude detecting device to provide a predetermined centrifugal force.

8

The coaxial two-wheeled vehicle according to claim 1, wherein the attitude of the pedal changes in accordance with a control signal outputted to the pair of wheel driving devices to cancel a centrifugal force applied to the rider.

DESCRIPTION CN100431906

Abstract The present invention discloses a coaxial two-wheeled vehicle. In a riding state with a high center of gravity, the rider can stably travel, and the upper part of the body does not wobble from side to side. The coaxial two-wheeled vehicle includes: a pedal for a ride of a driver; and a vehicle body that supports the pedal so as to be rotatable about a rolling axis as a center when the traveling direction is set to a rolling axis Changing the posture in the rolling direction; a pair of wheels that are located on both sides of the same axis in a direction perpendicular to the traveling direction of the vehicle body and rotatably supported by the vehicle body; a pair of individually driving and rotating the pair a wheel drive of the wheel; and a handle for directly changing the attitude of the pedal or indirectly changing the posture through the vehicle body.

Coaxial two-wheeled vehicle

Technical field

The present invention relates to a coaxial two-wheeled vehicle comprising two wheels on the same axis centerline, and more particularly to a coaxial two-wheeled vehicle that can travel freely with the person riding on it.

Background technique

One such coaxial two-wheeled vehicle of the prior art has been disclosed, for example, in Patent Document 1. In Patent Document 1, a coaxial two-wheeled vehicle including a wheel at both ends of the same shaft is described. The coaxial two-wheeled vehicle disclosed in Patent Document 1 is "a coaxial two-wheeled vehicle configured to have a pair of wheels; an axle is disposed between the pair of wheels; and one can be obliquely supported above the axle a base; a pair of drive motors mounted on the base to drive each of the wheels; and a controller to issue an operational command to the pair of drive motors, wherein an acceleration detector is disposed on the base for detecting in the vertical direction The acceleration, and when the absolute value of the acceleration detected by the acceleration detector reaches or exceeds a threshold during travel, the controller issues an operational command to decelerate each of the pair of drive motors. "

According to the coaxial two-wheeled vehicle having the above configuration in Patent Document 1, it is desirable to achieve the effect "when, for example, traveling on a step, since there is an acceleration detector capable of detecting acceleration in the vertical direction and acceleration detection during traveling When the absolute value of the acceleration detected by the device reaches or exceeds a predetermined threshold, an operation command to be decelerated has been sent to each of the pair of drive motors, so that it is safe to travel in the event of a step or the like. "

Further, another coaxial two-wheeled vehicle as in the prior art is disclosed, for example, in Patent Document 2. In Patent Document 2, a method of controlling the posture of a coaxial two-wheeled vehicle is described. In the coaxial two-wheeled vehicle of Patent Document 2, the attitude control method is "in a coaxial two-wheeled vehicle with a pair of wheels; an axle is disposed between the pair of wheels; and a body is rotatable The method is supported above the axle; a wheel drive motor is mounted on the vehicle body; a control computer can send an operation command to the drive motor; and an angle detector detects the tilt angle of the vehicle body, and the angle detector detects The vehicle body tilt angle is sampled at a short time interval, and is calculated by substituting the sample value into a control input calculation equation that is input in advance and set in the control computer, wherein the sampling tilt angle of the vehicle body is used as a state variable, and Using the feedback gain as a coefficient, the control torque for the wheel drive motor is calculated according to the calculation equation; the control computer sends an instruction to the wheel drive motor to perform the same operation as calculating the control torque. "

According to the attitude control method in the coaxial two-wheeled vehicle having the above-described configuration of Patent Document 2, it is desirable to achieve the effect that "when the vehicle is tilted, the wheel immediately moves in the tilt direction of the vehicle body, and the vehicle body is successfully reset. The attitude is calculated by substituting the sampled value into the control input calculation equation that is input in advance and set in the control computer, wherein the sampling tilt angle and the feedback gain of the vehicle body are used as coefficients; The wheel drives the control torque of the motor; and performs feedback control of the wheel drive motor based on the calculation result. "

[Patent Document 1] Japanese Laid-Open Patent Application No. 2005-6436

[Patent Document 2] Japanese Laid-Open Patent Application No. S63-305082

However, in the coaxial two-wheeled vehicle described in the above Patent Documents 1 and 2, one handle is fixed to a pedal (riding member) for human riding, and a supporting member for supporting the wheel is rotatably fixed. On the pedal, and the upper surface (ride surface) of the pedal is parallel to the running surface (road surface). Therefore, when the center of gravity is at a relatively high position, for example, when the rider is in a standing posture, the upper body of the rider becomes unstable, when traveling on an inclined road surface inclined obliquely to the traveling direction Gravity, or when turning, due to the centrifugal force, the rider will be shaken left and right and become unstable, and when the centrifugal force is too large, the body is likely to flip in the lateral direction.

The details of this aspect will be described in detail below with reference to Figs. 1A to 1C are explanatory diagrams respectively showing a coaxial two-wheeled vehicle of the prior art as viewed from the front side of the vehicle. In Figs. 1A to 1C, reference numeral 1 denotes an entirety of a coaxial two-wheeled vehicle in which a vehicle body 2 as a pedal is disposed. Rotatable left and right wheels 3L and 3R are provided on both sides in a direction perpendicular to the traveling direction of the vehicle body 2. Further, reference numeral 4 denotes a rider (for example, a man) riding on the vehicle body 2, reference numeral G denotes the center of gravity of the rider 4, and reference numeral W denotes the weight of the rider 4 (Load).

Fig. 1A shows a state in which the coaxial two-wheeled vehicle 1 travels straight on a flat road surface without the influence of the lateral force and the centrifugal force. In this case, the center of gravity G of the rider 4 is substantially above the center of the coaxial two-wheeled vehicle 1, and the load W acts vertically on the approximate center of the vehicle body 2. Therefore, substantially the same load acts on the left and right wheels 3L and 3R, and the reaction forces at the ground contact points TL and TR where the wheels 3L and 3R are in contact with the road surface E are substantially the same.

FIG. 1B shows a state in which the coaxial two-wheeled vehicle 1 is turned on the flat road surface E. In this case, the centrifugal force (lateral force) F acts on the rider 4 from the right side wheel 3R side, and the gravity vector W of the load W deviates from the angle θ due to the centrifugal force F. When the ground contact point R formed by the intersection of the extension line of the gravity vector W and the road surface E is located inside the ground contact point TL of the left side wheel 3L, the coaxial two-wheeled vehicle 1 can be stably steered. However, when the local contact point R is outside the ground contact point TL as shown in FIG. 1B, the running stability is impaired because the left and right wheels 3L and 3R cannot withstand the centrifugal force F, and when the centrifugal force F becomes excessive, the vehicle It will flip (shown in the lateral direction) as shown in Fig. 1C.

The difficulty in causing the reversing of the two-wheeled vehicle 1 is largely determined by the height of the center of gravity G of the rider 4. Figure 2 is a schematic diagram explaining this phenomenon. When the center of gravity G of the rider 4 is low, the allowable tilt angle of the gravity vector W of the center of gravity G is the angle θ as shown in FIG. 2. However, when the center of gravity G of the rider 4 is high and shifts to the center of gravity G 1, the inclination angle of the center of gravity G 1 becomes smaller than the angle θ 1 of the angle θ (θ 1 < θ) because from the center of the vehicle body 2 to the left and right wheels 3L The distance from the ground contact points TL and TR of the 3R remains unchanged.

As can be seen from the above, it can be understood that the degree of difficulty in causing the two-wheeled vehicle 1 to be reversed is represented by the product of the height of the center of gravity G and the centrifugal force F. Specifically, it is assumed that when the centrifugal force F acts on the center of gravity G, the ground contact point R of the gravity vector W corresponds to the ground contact point TL of the left wheel 3L, and F × H = S (Formula 1) is obtained. Similarly, it is assumed that when the centrifugal force F acts on the center of gravity G 1, the ground contact point R of the gravity vector W1 corresponds to the ground contact point TL of the left wheel 3L, and F1 × H1 = S (Formula 2) is obtained. Therefore, F × H = F1 × H1. Here, since H < H1, F > F1. Therefore, when the center of gravity is higher, even if the centrifugal force is so small, the two-wheeled vehicle 1 may be reversed.

This inversion of the coaxial two-wheeled vehicle 1 can be avoided by the structure shown in FIG. Fig. 3 is a view showing a state in which the vehicle body 2 is inclined toward the road surface E on the right side wheel 3R when the centrifugal force F acts. When the vehicle body 2 is thus tilted to the side where the centrifugal force F acts, it is possible to prevent the reversing of the two-wheeled vehicle 1 and to perform stable steering because the ground contact point R of the gravity vector W1 changes to the ground of the left wheel 3L. The inside of the contact point TL.

Summary of the invention

In the prior art coaxial two-wheeled vehicle, the upper surface (ride surface) of the pedal is continuous, parallel to the running surface (road surface), due to gravity when traveling on an inclined road surface, and when steering and riding When the center of gravity is in a standing position, the upper part of the rider's body will be shaken and unstable due to the centrifugal force, and the vehicle will also turn over when such force becomes excessive.

A coaxial two-wheeled vehicle according to an embodiment of the present invention has a pedal for a ride of a driver; a vehicle body that supports the pedal when the traveling direction is set as a rolling axis so as to be able to surround the center Changing the attitude in the left and right rolling directions of the rotation of the rolling axis; a pair of wheels, the pair of wheels being located on the same axis on both sides in a direction perpendicular to the traveling direction of the vehicle body and rotatably supported by the vehicle body; a wheel drive device for separately driving and rotating the pair of wheels: and a handle for directly changing the posture of the pedal or indirectly changing the posture through the vehicle body.

According to the embodiment of the coaxial two-wheeled vehicle of the present invention, when the gravity vector of the center of gravity of the rider is turned or changed and the ground contact point or the ground contact point of the wheel is inside, the posture of the pedal can be changed to prevent the coaxial The two-wheeled vehicle is turned over so that a stable steering can be formed.

DRAWINGS

Figs. 1A to 1C are views showing the relationship between a coaxial two-wheeled vehicle and centrifugal force, wherein Fig. 1A shows a state in which centrifugal force does not occur, Fig. 1B shows a state in which centrifugal force acts, and Fig. 1C shows a vehicle due to FIG. a state of being flipped by centrifugal force;

Figure 2is a schematic diagram for explaining the relationship between the coaxial two-wheeled vehicle, the centrifugal force, and the height of the rider's center of gravity;

Figure 3is a schematic view of measures for suppressing centrifugal force acting on a coaxial two-wheeled vehicle;

4A and 4B are schematic views showing a first embodiment of a coaxial two-wheeled vehicle according to the present invention, wherein Fig. 4A is a front view and Fig. 4B is a side view;

Figure 5is an explanatory diagram showing, in an enlarged manner, a relevant portion of the coaxial two-wheeled vehicle shown in Figure 4A;

Figure 6is an explanatory diagram showing, in an enlarged manner, a relevant portion of the coaxial two-wheeled vehicle shown in Figure 4B;

Figure 7 is an enlarged cross-sectional view showing a portion of a D-D line in the coaxial two-wheeled vehicle shown in Figure 5;

Figure 8 is an explanatory diagram for explaining the operation of the coaxial two-wheeled vehicle of Figure 4A, showing a state in which a wheel travels on a step;

Figure 9 is an explanatory diagram for explaining the operation of the coaxial two-wheeled vehicle of Figure 4A, showing a state of turning on a flat road surface;

Figure 10 is an explanatory diagram for explaining the operation of the coaxial two-wheeled vehicle of Figure 4A, showing a state of traveling straight on an inclined road surface;

Figure 11 is a schematic block diagram showing the structure of a controller of a first embodiment of a coaxial two-wheeled vehicle according to the present invention;

12A to 12C are explanatory views for explaining a running state of the first embodiment of the coaxial two-wheeled vehicle according to the present invention, wherein Fig. 12A shows straight traveling on a flat road surface; Fig. 12B shows steering on a flat road surface; Fig. 12C Is driving straight on an inclined road;

13A and 13B are schematic views of a second embodiment of a coaxial two-wheeled vehicle according to the present invention, wherein Fig. 13A is a front view and Fig. 13B is a side view;

14A and 14B are explanatory diagrams, showing an enlarged portion of the relevant portion of the coaxial two-wheeled vehicle shown in Fig. 13A, wherein Fig. 14A is a straight traveling state, and Fig. 14B is a turning state;

15A and 15B are schematic views of a third embodiment of a coaxial two-wheeled vehicle according to the present invention, wherein Fig. 15A is a front view and Fig. 15B is a side view;

16A and 16B are explanatory views showing, in an enlarged manner, an relevant portion of the coaxial two-wheeled vehicle shown in Fig. 15A, wherein Fig. 16A is a straight traveling state, and Fig. 16B is a turning state.

detailed description

A coaxial two-wheeled vehicle capable of stabilizing steering without causing inversion can adopt a simplified structure in which the pedal is inclined toward the inner side of the steering direction.

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings. 4 to 16 show an embodiment of the present invention. 4A to 4B are front and side views showing a first embodiment of a coaxial two-wheeled vehicle according to the present invention; and Fig. 5 is an enlarged explanatory explanatory view of a relevant portion of Fig. 4A; 4B is a schematic cross-sectional view of a portion of the coaxial two-wheeled vehicle according to the first embodiment; similarly, FIGS. 9 and 10 are An explanatory diagram of a relevant portion illustrating an operation; FIG. 11 is a block diagram for explaining a circuit of a controller of a coaxial two-wheeled vehicle according to a first embodiment of the present invention; and FIGS. 12A to 12C are diagrams showing rider motion Figure 13A and 13B are front and side views of a second embodiment of a coaxial two-wheeled vehicle in accordance with the present invention; Figures 14A through 14B are explanatory views of a relevant portion illustrating a second embodiment in accordance with the present invention One operation of a coaxial two-wheeled vehicle of an embodiment; FIGS. 15A and 15B are front and side views of a third embodiment of a coaxial two-wheeled vehicle according to the present invention; FIGS. 16A and 16B are explanatory views of a relevant portion Schematic diagram A method of operating a coaxial two-wheeled vehicle out of the third embodiment.

As shown in FIGS. 4A and 4B, FIG. 5 and FIG. 6, the coaxial two-wheeled vehicle 10 of the first embodiment of the present invention includes: two divided pedals 11L and 11R, showing a specific implementation of the pedal that the rider rides. For example, a vehicle body 12 that supports the divided pedals 11L and 11R, respectively, is capable of changing posture in the rolling direction X, a pair of wheels 13L and 13R rotatably supported by the vehicle body 12, and a pair of wheel driving members 14L and 14R, A particular embodiment of a wheel drive that can drive and rotate the pair of wheels 13L and 13R, a handle 15, can indirectly change the attitude of the two split pedals 11L and 11R by the body 12 or the like.

The two divided pedals 11L and 11R are pedals by which the driver places one foot on each of the pedals to facilitate riding, and they are made of a pair of flat plates having a size equal to or slightly larger than the human foot. The vehicle body 12 has a parallel connecting mechanism in which a vehicle body upper member 16 and a vehicle body lower member 17 are disposed in parallel with each other, and a pair of side members 18L and 18R are disposed in parallel to each other and rotatably connected to the vehicle body. Upper part 16 and body lower part 17. A pair of coil springs 19L and 19R are located between the vehicle body upper part 16 of the parallel joint mechanism and the vehicle body lower part 17, which serves as a specific embodiment of the elastic member for generating an elastic force to cause the upper part of the vehicle body 16 and the body lower member 17 maintain a vertical angle with the pair of side members 18L and 18R.

As shown in a portion of Fig. 7, the vehicle body upper member 16and the vehicle body lower member 17have substantially quadrilateral chassis members 16a and 17a, bearing members 16b and 17b, and a pair of spring support members 16c, 16c and 17c, 17c, and a bottom portion. The lower portion of the frame member is open, and the bearing members project in the longitudinal direction at the four corners of each of the chassis members 16a and 17a, and each of the spring support members protrudes toward the side of the other member. The lengths of the vehicle body upper member 16and the vehicle body lower member 17in the left-right direction, that is, the width direction of the vehicle are the same. When the two members 16, 17are overlapped, the bearing members 16b at the four positions of the respective corner portions are 17b also overlaps each other.

In the vehicle body upper member 16, there are bearing holes (three positions on the front and rear sides) at three positions in the longitudinal direction, that is, the middle and the both ends in the left-right direction. Similarly, in the vehicle body lower member 17, there are bearing holes at three positions in the longitudinal direction, that is, the middle and both ends in the left-right direction (there are two positions at both ends of the rear side, so there are five positions). The end bearing holes at both ends of the vehicle body upper member 16 and the both ends of the vehicle body lower member 17are spaced apart from each other, and a pair of side faces are provided between the left and right bearing portions 16b, 16b and 17b, 17b having the bearing holes at the end portions. Parts 18L and 18R.

The pair of side members 18L and 18R are made of a flat member whose width is slidably mounted between the pair of bearing members 16b, 16b in the front-rear direction of the upper portion 16of the vehicle body, and before and after the upper portion 17of the vehicle body Between the pair of bearing members 17b, 17b in the direction, and the pair of side members are located on the left and right sides of the upper portion 16of the vehicle body and the lower portion 17of the vehicle body, with plane portions projecting upward and downward. Further, bearing holes corresponding to the bearing hole pair of the vehicle body upper member 16 and the bearing hole pair of the vehicle body lower member 17are provided at four positions on both sides of each of the side members 18L and 18R.

Among the four bearing holes of the upper one of the eight bearing holes of the pair of side members 18L and 18R, the upper rotary support pins 21L and 21R are rotatably inserted, respectively, which are passed through the upper portion 16of the vehicle body. The bearing hole of the bearing portion 16b in position. Similarly, in the lower four bearing holes of the eight bearing holes of the pair of side members 18L and 18R, the lower rotary support pins 22L and 22R are rotatably inserted, respectively, which are passed through the lower part of the vehicle body. 17bearing holes of the bearing portion 17b at four positions. Therefore, the vehicle body upper member 16, the vehicle body lower member 17, and the left and right side members 18L and 18R constitute a parallel connection mechanism.

Wheel drive members 14L and 14R are coupled to each of the outer surfaces of the pair of side members 18L and 18R, respectively. Each of the wheel drive members 14L and 14R may include an electric motor, a reduction gear set that is coupled to the motor rotating shaft to transmit, for example, power. Each of the wheel drive members 14L and 14R has a fixed member fixed to the side members 18L and 18R, respectively, and a rotatable member rotatably supported by the fixed member, and the wheel pairs 13L and 13R are respectively connected to Rotatable parts. Thus, the wheel pairs 13L and 13R supported by the side member pairs 18L and 18R by the wheel drive member pairs 14L and 14R have rotation centers, and when traveling on a flat road surface, the rotation centers of the two wheels are substantially at the same axis center on-line.

Moreover, the upper end portions of the side member pairs 18L and 18R project substantially upward from the upper surface of the vehicle body upper member 16, and the above-described divided pedals 11L and 11R are respectively connected to the upper surfaces thereof. The pair of divided pedals 11L and 11R extend at the same height level with a predetermined gap therebetween in the left-right direction, that is, in the direction of the axle. The distance between the pair of divided pedals 11L and 11R is the distance between the two feet when a man naturally stands.

The pair of spring support members 17c, 17c of the vehicle body lower member 17 are provided with a predetermined gap in the left-right direction of the center portion. The spring support member pairs 16c, 16c of the vehicle body upper member 16are located at positions corresponding to the pair of spring support members 17c, 17c. Moreover, the coil springs 19L and 19R having appropriate elastic forces are in a sufficiently compressed state between the mutually corresponding spring support members 16c and 17c. Here, although not shown in the drawings, it is preferable that each of the spring supporting members 16c and 17c has a spring supporting projection for supporting each end of the coil springs 19L and 19R, so that the coil spring 19L and the coil spring 19L can be prevented. 19R fell off.

Further, as shown in Fig. 7, a handle bracket 24 is coupled to a central portion of the vehicle body upper member 16and the vehicle body lower member 17 in the left-right direction. The handle bracket 24 is formed of a saddle member that rides on the vehicle body upper member 16in the front-rear direction, and has a lower front surface portion 24a extending toward the vehicle body lower portion 17 at the front portion. The rear portion has a lower rear surface portion 24b that extends toward the upper portion 16of the vehicle body. Moreover, a mounting portion 24c is provided on the upper surface of the handle holder 24 to fix and support a handle 15. In the front surface portion 24a of the handle bracket 24, a bearing hole is provided at a position corresponding to the center bearing hole of the vehicle body upper member 16and the center bearing hole of the vehicle body lower member 17. Further, in the rear surface portion 24b, there is a bearing hole at a position corresponding to the rear center bearing hole of the vehicle body upper member 16.

An upper front rotation support shaft 25 is rotatably mounted in the upper center bearing hole of the front surface portion 24a of the handle bracket 24. Further, an upper rear rotation support shaft 26 is rotatably mounted in the center bearing hole of the rear surface portion 24b. The shaft center line of the upper front rotation support shaft 25 and the shaft center line of the upper rear rotation support shaft 26 are set on the same axis to correspond to each other. A shaft tip end portion of the upper front rotation support shaft 25 is inserted into the hole of the front surface of the vehicle body upper member 16, and is fixed by a fixing bolt 27 passing through the front surface of the vehicle body upper member 16. Similarly, a shaft tip end portion of the upper rear rotation support shaft 26 is inserted into the hole of the rear surface of the vehicle body upper member 16, and is fixed by a fixing bolt 28 passing through the rear surface of the vehicle body upper member 16.

A lower front steering support shaft 29 is inserted into the lower central bearing hole of the front surface portion 24a of the handle bracket 24. The handle holder 24 is rotated along the rolling direction X together with the lower front steering support shaft 29 as a center of rotation. In order to allow the handle bracket 24 to rotate within a predetermined range, there are recesses 16d and 17d on the front surface of the vehicle body upper member 16 and the vehicle body lower member 17 to avoid contact with the handle bracket 24. Moreover, an angle detecting sensor 31 is coupled to the upper front steering support shaft 25 to detect the amount of operation (rotation amount) of the handle 15 by the amount of rotation (steering angle) of the handle bracket 24 in the rolling direction X.

The angle detecting sensor 31 includes a shaft portion 31a fixed to the upper front steering support shaft 25 and a detecting portion 31b for detecting the relative angular displacement amount of the shaft portion 31a. The detecting portion 31b is fixed to one end of the fixing plate 32, and the other end of the fixing plate is fixed to the front surface portion 24a of the handle holder 24 by a fixing bolt 33. For example, a potentiometer, a sensor having a variable capacitor structure, or the like can be used as the angle detecting sensor 31. In such an angle detecting sensor 31, the inclination angle of the handle holder 24 toward the vehicle body upper member 16 can be detected by the change in the resistance value caused by the amount of rotational displacement generated between the shaft portion 31a and the detecting portion 31b.

The lower end portion of the handle 15 is fixed to the mounting portion 24c of the handle holder 24. The handle 15 is constructed to have a handle post 35 mounted and fixed to the mounting portion 24c and a handle bar 36 at the upper end of the handle post 35. The handle post 35 is attached to the vehicle body 12 with a slight forward tilt, and its upper end extends upward. The handlebar 36 is U-shaped with raised portions at both ends facing upwardly toward the upper end of the handlebar 36 and connected to the integrally formed intermediate portion.

Further, a steering operation ring 37 capable of controlling the driving of the wheel drive member pairs 14L and 14R is coupled to the upper end of a boss portion of the handlebar 36. The steering operating ring 37 is used to control the steering action of the vehicle by manual operation and to form an accelerator ring for the steering action. When the steering operation ring 37 is rotated in the direction in which the driver wants to perform steering, a signal corresponding to the operation amount is output to a controller to be described below, which thus controls the driving of the pair of wheel driving members 14L and 14R. The force generates a difference in rotational speed between the left and right wheels 13L and 13R, so that steering can be performed at a desired speed.

As shown in FIG. 7, on the upper surface of the handle holder 24 as the base portion of the handle 15, there is a power storage member 39 which can accommodate the battery 38, the controller, other electronic devices and the specific embodiment of the power source. An electronic device or the like is used to supply electric power to the wheel drive member pairs 14L and 14R. The power storage unit 39 in this embodiment has a box structure and can accommodate a large number of batteries 38. However, the power source is not limited to the battery 38 in this embodiment, but also includes a portable battery, a fuel cell, and other types of power sources. The power storage unit 39 is covered by a power supply cover 41 so that rain, dust, and the like do not enter.

Drive circuits 44L and 44R for driving the wheel drive members 14L and 14R and the like are provided in the chassis portion 16a of the vehicle body upper member 16. Further, the vehicle body lower member 17 is provided with an attitude sensor unit 45 and a controller 46 for detecting the posture of the vehicle body 12, the posture of the handle 15, and the like, and outputting a detection signal, and the controller 46 outputs Control signals are used to drive and control the components of the wheel drive components 14L and 14R. The controller 46 executes a predetermined algorithm program based on the detection signals of the attitude sensor section 45, the detection signals of the angle sensor 31, and the like, and the necessary control signals are output to the components such as the wheel drive component pairs 14L and 14R.

As shown in Fig. 11, the controller 46 has an arithmetic circuit 47 including a microcomputer (CPU), and a storage device 48. The storage device includes a program memory, a data memory, and other memory such as RAM or ROM. The battery 38 and wheel drive circuit pairs 44L and 44R are connected to the controller 46 and are also connected by an emergency brake switch 49. The pair of wheel drive circuits 44L and 44R individually control the rotational speed, the rotational direction, and the wheel pairs 13L and 13R and the like, and the wheel drive member pairs 14L and 14R are separately connected to the circuit.

A detection signal obtained by the angle detecting sensor 31 detecting the tilt angle of the handle 15, a signal corresponding to the steering operation amount of the steering operation ring 37, and a detection signal of the attitude sensor section 45 are supplied to the controller 46. The attitude sensor unit 45 is for detecting angular velocity and acceleration while the coaxial two-wheeled vehicle 10 is traveling, and controls angular velocity and running acceleration, and includes, for example, a gyro sensor and an acceleration sensor.

The gyro sensor detects the angular velocity, the angular velocity and the pitch axis (corresponding to the axes of the wheel pairs 13L and 13R) 51, the rotation axis (passing through the center of the vehicle body 12and parallel to the traveling direction of the vehicle) 52, and the yaw axis of the vehicle body 12 (At least one of passing through the center of the vehicle body 12and perpendicular to the road surface on which the vehicle travels is associated. Moreover, when the vehicle body 12is represented by the above three axes, the acceleration sensor of the attitude sensor section 45detects acceleration associated with at least one of the above three axes (X-axis, Y-axis, and Z-axis).

The coaxial two-wheeled vehicle 10having the above structure can travel in the following manner, for example. 4A and 4B show the state of the vehicle when traveling straight on the flat road surface E, in which a shaft center line CL which is the center of the handle 15is perpendicular to the traveling road surface E as viewed from the front. Further, the left and right divided pedals 11L and 11R are horizontally maintained at the same height.

Fig. 8shows that one wheel (in the present embodiment, the left side wheel 13L) of the vehicle traveling straight on the flat road surface E travels to the step K. In this case, by the handle 15being held vertically by the rider, the vehicle can travel in a state where the left and right divided pedals 11L and 11R are kept horizontal. Therefore, even if the center of gravity of the rider driving in the standing posture is high, the step K of the road surface E can be absorbed by the change in the height direction of the left and right divided pedals 11L and 11R, so that the rider can be in his body The upper part runs stably without shaking left and right.

Fig. 9shows a state of turning on the flat road surface E. In this case, the rider tilts the handle 15and the upper portion of his/her body is inclined toward the steering center side (inside) so that the left and right divided pedals 11L and 11R and the left and right wheels 13L and 13R are inclined in parallel with the handle 15. The entire vehicle, including the rider, can easily offset the centrifugal force.

Further, Fig. 10shows a running state on an inclined road surface (inclined road surface M) which is perpendicular to the tilting direction. In this case, similarly to the state in which the road surface changes in the direction of the rotation axis (that is, the left-right direction with respect to the traveling direction) when traveling to the step K, the rider keeps the handle 15vertical and can separate the pedal 11L and left and right. The 11R stays in a horizontal state. Therefore, even if the center of gravity of the rider driving in the standing posture is high, the inclined road surface M can be absorbed by the change in the height direction of the left and right divided pedals 11L and 11R, so that the rider can have no upper part of the body. Stable driving and driving with shaking from side to side.

Next, a method of steering the coaxial two-wheeled vehicle 10will be described. FIG. 12A shows a state in which the coaxial two-wheeled vehicle 10travels straight on the flat road surface E. Fig. 12B shows a state of turning to the left on the flat road surface E. Moreover, FIG. 12C shows a state in which traveling straight on the inclined road surface M (including traveling on the step K).

When the two-wheeled vehicle 10is steered, basically the following two methods are adopted: one is a method of determining a turning vector (steering speed, steering radius, etc.) only by the inclination of the handle 15, and a method of passing the handle 15The tilt and the rider rotate the steering ring 37 (accelerate the steering speed) to determine the method of the steering vector.

First, a method of determining the steering vector for steering only by the inclination of the handle 15will be described. As shown in FIG. 9, in this case, the steering operation amount is determined based on the actual inclination angle θ h of the handle between the handle 15and the gravity axis V. According to the revolution vector and the vehicle speed, a difference in rotational speed is generated between the left and right wheels 13L and 13R, so that a steering radius at which a predetermined centrifugal force can be generated can be obtained for steering. In this case, the actual tilt angle θ h of the handle can be detected as follows.

The first example is that the above-described posture sensor member 45is attached to the handle 15or to one of a pair of left and right divided pedals 11L and 11R parallel to the handle 15, so that the inclination of the handle 15can be directly detected.

The second example is that the attitude sensor component 45is attached to the vehicle body lower part 17as shown in FIG. In this case, a position sensor is used to detect the relative angle between the handle 15and the vehicle body lower member 17or the relative angle between the handle 15and the vehicle body upper member 16. In the embodiment shown in Fig. 7, the angle sensor 31 in the vehicle body upper member 16corresponds to a position sensor, and a potentiometer or the like can be used as, for example, the angle detecting sensor 31. The output of the angle detecting sensor 31 and the output of the attitude sensor section 45can be used to calculate the difference between the "vehicle tilt angle θ g formed with the gravity axis V" and the "relative tilt angle θ p of the handle 15with respect to the handle of the vehicle body", and The actual tilt angle θ h (θ p - θ g= θ h) of the handle of the handle 15is detected, and "the vehicle tilt angle θ g formed with the gravity axis V" is the output of the posture sensor member 45in the vehicle body 12with respect to the gravity axis V, "handle The relative inclination angle θ p" of the handle with respect to the vehicle body is the output of the angle detecting sensor 31.

For example, when the handle relative inclination angle θ p as the output of the angle detecting sensor 31 coincides with the vehicle inclination angle θ g which is the output of the attitude sensor section 45, the handle 15is vertical, and the vehicle is in a straight traveling state regardless of the road surface condition (A flat road surface, an inclined road surface M, a step K, and the like) are as shown in FIG. 12A and FIGS. 10and 12C. On the other hand, when the two-wheeled vehicle 10is turned as shown in FIG. 9, the handle tilt angle θ g which is the output of the attitude sensor unit 45is subtracted from the handle tilt angle θ p which is the output of the angle detecting sensor 31. The value is the actual inclination angle θ h of the handle formed by the gravity axis V, and the steering operation amount is determined based on the actual inclination angle θ h of the handle.

Next, a method of determining the rotation vector based on the inclination of the driver's rotational steering ring 37and the handle 15will be described. In the case where almost no centrifugal force is generated (for example, centrifugal force is 0.1 G or less), such as low speed steering, super-pivotal brake turn, etc., the rider can use the inclination of the handle 15and The steering ring is steered to select an operation according to the traveling speed because operability is improved by manually rotating the steering operation ring 37located at the top end of the handlebar 36instead of tilting the handle. In this case, according to the steering operation of the steering operation ring 37, the method of determining the steering vector and performing the steering only by the inclination of the handle 15is added to the operation amount, so that the two are combined and used. It is possible to control the amount of operation at the time of steering.

First, when the steering operation ring 37of the handlebar 36is manually rotated, the amount of operation of the steering operation ring 37is detected by a position detecting sensor made of a potentiometer or the like, and the detection signal is sent to the controller 46. Then, the controller 46outputs a control signal to the left and right wheel drive members 14L and 14R, so that a steering radius capable of generating a predetermined centrifugal force (for example, 0.2G) according to the vehicle speed can be obtained, and a predetermined rotational speed difference between the left and right wheels 13L and 13R can be obtained. .

Here, when a sharper turn is to be made, the rider tilts the handle 15toward the steering center. Then, the amount of tilt of the handle 15is detected by the angle detecting sensor 31 as described above, and the posture of the vehicle is detected by the posture sensor unit 45, so that the amount of wheel control corresponding to the amount of tilt of the handle 15is calculated. The wheel control amount obtained by the amount of tilt of the handle 15is added to the wheel control amount by the steering operation of the steering operation ring 37. As a result, the controller 46outputs a control signal to the left and right wheel drive members 14L and 14R, thus changing the rotational speed difference between the left and right wheels 13L and 13R to obtain a steering radius capable of generating a predetermined centrifugal force (for example, 0.4G). Therefore, even if the steering speed is fast, stable steering can be performed, and the upper part of the body of the rider in the standing posture does not shake from side to side.

In the first embodiment, the pedal is divided into two on the left and right sides, because the following advantages can be obtained when the two pedals 11L and 11R are separated in this manner, for example, when traveling on a step, for example, one wheel first travels as shown in Fig. 8The step K is shown, but the wheel on the side can travel to the step K with little driving force, and the rider moves the center of gravity to the side of the lower wheel (non-driving side). Then, the center of gravity moves to the side of the running wheel, and then the lower wheel (non-driving side) travels to the step, so that the rider feels like walking up the steps with the foot, so the vehicle can be driven to the step K with little driving force. .

13A and 13B and Figs. 14A and 14B are schematic views showing a second embodiment of a coaxial two-wheeled vehicle according to the present invention. The coaxial two-wheeled vehicle 60as the second embodiment includes: a body 62with a chassis, two separate pedals 61L and 61R supported by the vehicle body 62in a freely steerable manner, and one for rotation The way of connecting the two separate pedals 61L, 61R and a handle bracket 64is the connector 68 In the second embodiment, the same reference numerals are given to the same portions as those in the above-described first embodiment, and thus the repeated description is omitted.

As shown in Figs. 13A and 13B and Figs. 14A and 14B, the vehicle body 62is a chassis, and the left and right wheel drive members 14L and 14R are respectively connected to the mounting portions 62L and 62R which are located in the left-right direction, that is, on both sides in the vehicle width direction. Moreover, the left and right wheels 13L and 13R are rotatably supported by the driving members 14L and 14R, respectively. Moreover, one handle supporting member 65is located in the upper middle portion of the vehicle body 62, and the pedal supporting members 65L and 65R are located on both sides of the upper portion. The bearing holes are respectively located on the middle handle support member 65and the pedal support members 65L and 65R on both sides, passing through the front-rear direction of the vehicle traveling.

The handle bearing member 65and the three bearing holes on the pedal supporting members 65L and 65R of the vehicle body 62are at the same height, and the handle bracket 64is rotatably supported by a handle supporting member 65via a rotating support shaft 66, and the pedals are separated left and right. The 61L and 61R are rotatably supported by the pedal supporting members 65L and 65R by the upper rotary support pins 67L and 67R. Each of the pedals 61L and 61R has an arm portion 61a which is convex in a direction perpendicular to the pedal surface on which the foot is placed. In each of the arm portions 61a, bearing holes are respectively provided at the base and the tip end portion, and the upper rotation support pins 67L and 67R are rotatably inserted into the bearing holes of the base.

Further, both ends of the connecting member 68connecting the arms 61a of the left and right divided pedals 61L and 61R are rotatably connected to the bearing holes at the tip end portions of the respective arm portions 61a by the lower rotary support pins 69L and 69R. Moreover, the handle bracket 64is rotatably coupled to the central portion of the axial direction of the connecting member 68by a rotary joint pin 71. Therefore, there are two bearing holes on the handle holder 64, and the distance between them is the same as the distance between the two bearing holes in each arm portion 61a. Therefore, the handle bracket 64, the left and right divided pedals 61L and 61R, and the connecting member 68constitute a parallel connecting structure. The structure other than the above structure is similar to the above-described first embodiment.

Thus, when the rider tilts the handle 15 or separates the pedals 61L and 61R, the left and right divided pedals 61L and 61R or the handle 15 are simultaneously inclined in the same direction. Fig. 14A is a schematic view showing an initial state in which the handle 15 is in the vertical position. Fig. 14B is a schematic view showing a state in which the handle 15 and the left and right divided pedals 61L and 61R are inclined. At this time, the upper surfaces of the left and right divided pedals 61L and 61R are in a state of tilting the handle 15 toward the road surface. Similar effects to the first embodiment described above can also be obtained by the structure of the above-described coaxial two-wheeled vehicle 60.

15A and 15B and Figs. 16A and 16B are schematic views showing a third embodiment of a coaxial two-wheeled vehicle according to the present invention. The coaxial two-wheeled vehicle 80 as the third embodiment includes a body 82 having a chassis, a pedal 81 supported by the vehicle body 82, capable of freely changing the posture, and a handle 15 integrally fixed to the pedal 81. In the third embodiment, the same reference numerals are given to the same portions as those in the above-described first embodiment, and thus the repeated description is omitted.

As shown in Figs. 15A and 15B and Figs. 16A and 16B, the vehicle body 82 is a chassis, and the left and right wheel drive members 14L and 14R are respectively connected to the mounting portions 82L and 82R which are located in the left-right direction, that is, on both sides in the vehicle width direction, and The left and right wheels 13L and 13R are supported by the driving members 14L and 14R in a freely rotatable manner, respectively. A pedal support member 85 is located in the middle of the upper portion of the vehicle body 82. In the pedal supporting member 85, there is a bearing hole that passes through the front-rear direction in which the vehicle travels.

The pedal 81 is a plate that is sized to substantially cover the range from the vehicle body 82 to the left and right wheels 13L and 13R. One of the bracket members 84 is entirely located at an intermediate portion in the left-right direction of the lower surface of the pedal 81. The bracket member 84 is made of two protruding portions spaced apart by a predetermined distance in the front-rear direction. And the pedal supporting member 85 of the vehicle body 82 is installed between the two protruding portions. The front and rear of the bracket member 84 and the pedal support member 85 are rotatably supported by two rotary support shafts 86 at the same shaft center line.

Moreover, four coil springs 87 are provided between the pedal 81 and the vehicle body 82, which is a specific example of the elastic member for keeping the pedal 81 horizontal with respect to the vehicle body 82. The four coil springs 87 are respectively disposed at symmetrical positions in the front, rear, left, and right directions at predetermined intervals. To achieve this, four spring support members 88 for supporting the upper ends of the coil springs 87 are located at four positions on the lower surface of the pedal 81, and four spring support members 89 for supporting the lower ends of the coil springs 87 are located on the vehicle body 82. Four positions on the surface.

Thus, when the rider tilts one of the handle 15 and the pedal 81, the other integrally formed member is also tilted as a whole in the same direction. Fig. 16A is a schematic view showing an initial state in which the handle 15 is in the vertical position. Moreover, Fig. 16B is a schematic view showing a state in which the handle 15 and the pedal 81 are inclined. At this time, the upper surface of the pedal 81 is in a state in which the amount of inclination of the handle 15 is inclined toward the road surface E. Similar effects to the first and second embodiments described above can also be obtained by the structure of the above-described coaxial two-wheeled vehicle 80. It is to be noted that the elastic member is not limited to the coil spring 87 shown in this embodiment, and a leaf spring, a rubber-like elastic body or the like may be used.

Heretofore, according to the embodiment of the present invention, since the steering can be performed by tilting the pedal and the handle in the direction of the rolling axis on the inner side, the rider can stably drive the vehicle and overcome the centrifugal force even if the center of gravity position is high, for example, the standing position. . In this case, by connecting the shaft and the wheel to the pedal member, a camber angle can also be generated on the inner side of the wheel steering, so that the lateral force acting on the tire can be reduced and stabilized. Tire grip.

Moreover, when in the case of the first embodiment of the present invention, when the road surface changes in the direction of the rolling axis (the left and right direction perpendicular to the traveling direction of the vehicle), for example, when traveling on an inclined road surface and one wheel traveling on the step, The separation pedal can be kept horizontal without tilting left and right, so that the road surface change can be absorbed by the height change caused by the ups and downs of the divided pedals, even if the rider who is driving in a standing posture has a high center of gravity, riding The occupant can also stably drive and drive without shaking left and right in the upper part of his body. Moreover, when traveling to a step in an oblique direction, the rider can climb the step with a small driving force by switching the center of gravity on the left and right feet, similar to walking up the stairs with the foot.

Moreover, according to an embodiment of the present invention, a coaxial two-wheeled vehicle may have a raised floor area for accommodating a general adult (having a width of about 400mm or less and a length of about 250mm or less). Therefore, since the width of the vehicle is the same as that occupied by a pedestrian, the vehicle can travel smoothly even in a very crowded area such as a sidewalk without becoming an obstacle to other pedestrians.

The present invention is not limited to the above-described embodiment in which the grip portion of the handle is U-shaped, the grip portion may be linear, elliptical or circular, and other shapes of handles may also be employed. Many variations are possible without departing from the scope and spirit of the invention.

It will be appreciated by those skilled in the art that many variations, combinations, sub-combinations and changes can be made in the scope of the appended claims.

[19] 中华人民共和国国家知识产权局

[51] Int. Cl.

B62K 11/00 (2006.01)

B62K 17/00 (2006.01)

B60L 15/10 (2006.01)

[12] 发 明 专 利 说 明 书

专利号 ZL 200610089876.3

[45] 授权公告日 2008 年 11 月 12 日

[11] 授权公告号 CN 100431906C

[22] 申请日 2006.4.14

[21] 申请号 200610089876.3

[30] 优先权

[32] 2005. 4. 14 [33] JP [31] 117365/05

[32] 2006. 4. 6 [33] JP [31] 105731/06

[73] 专利权人 丰田自动车株式会社

地址 日本爱知县

[72] 发明人 柿沼武一 山野郁男 泽井邦仁

[56] 参考文献

CN1502513A 2004.6.9

JP2005－6435A 2005.1.6

JP2004－276727A 2004.10.7

CN2679014Y 2005.2.16

JP2004－364461A 2004.12.24

JP2004－74814A 2004.3.11

审查员 裴京礼

[74] 专利代理机构 北京金信立方知识产权代理有限公司

代理人 黄 威 徐金伟

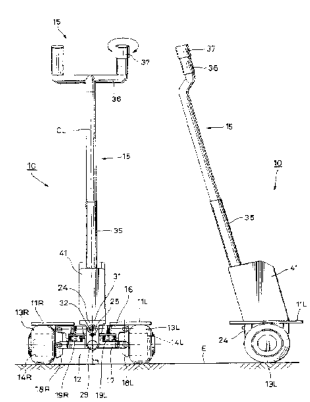
权利要求书 2 页 说明书 15 页 附图 12 页

[54] 发明名称

共轴两轮车辆

[57] 摘要

本发明公开一种共轴两轮车辆，在重心很高的骑乘状态下，骑乘者可稳定行驶，其身体上部不会左右摇晃。 该共轴两轮车辆包括：用于驾驶者骑乘的踏板；车体，当行驶方向被设定为滚动轴线的时候，该车体支撑所述踏板从而能够在围绕作为中心的滚动轴线旋转的滚动方向上改变姿态；一对车轮，该对车轮位于与所述车体行驶方向垂直的方向上同一轴线的两侧并且被所述车体可旋转地支撑；一对单独驱动和旋转所述对车轮的车轮驱动装置；和用于直接改变所述踏板的姿态或通过所述车体间接改变所述姿态的把手。



A B

1、一种共轴两轮车辆，包括：

用于驾驶者骑乘的踏板；

车体，当行驶方向被设定为滚动轴线的时候，该车体支撑所述踏板从而能够在围绕作为中心的滚动轴线旋转的左右滚动方向上改变踏板的姿态；

一对车轮，所述一对车轮位于与所述车体行驶方向垂直的方向上同一轴线的两侧并且被所述车体可旋转地支撑；

一对单独地驱动和旋转所述一对车轮的车轮驱动装置；和

用于直接改变所述踏板的姿态或通过所述车体间接改变所述姿态的把手。

2、如权利要求1所述的共轴两轮车辆，

其中，所述车体包括平行连接机构，该机构具有彼此上下平行设置的车体上部部件和车体下部部件，和一对侧面部件，所述一对侧面部件左右彼此平行设置并以可转动的方式连接于所述车体上部部件和车体下部部件，

所述踏板被分成两个以便提供两个分开的踏板，所述两个踏板单独地固定于所述一对侧面部件，并且所述一对车轮通过所述一对车轮驱动部件被所述一对侧面部件支撑。

3、如权利要求1所述的共轴两轮车辆，

其中，所述踏板被分成两个以便提供两个分开的踏板，所述两个踏板被所述车体以可转动的方式单独地支撑，并且两个分开踏板通过连接件连接起来从而可进行转动，并且所述把手以可转动的方式连接于所述连接件的中部，从而使得所述两个分开踏板可与所述把手的操作同步地进行转动。

4、如权利要求1所述的共轴两轮车辆，

其中，所述把手固定到所述踏板上，并且所述踏板的姿态能够通过所述把手的操作而进行改变。

5、如权利要求2所述的共轴两轮车辆，

其中，弹性部件位于所述车体上部部件和所述车体下部部件之间，该弹性部件用于产生弹性力以将分别由所述车体上部部件和车体下部部件以及所述一对侧面部件形成的角度保持为垂直。

6、如上述权利要求4所述的共轴两轮车辆，

其中，产生弹性力以保持所述踏板与所述车体平行的弹性部件位于所述踏板与所述车体之间。

7、如权利要求1所述的共轴两轮车辆，还包括:

姿态检测装置，用于检测所述踏板或所述把手与重力轴之间的角度，并输出所述检测信号，

其中，所述一对车轮驱动装置的驱动根据所述姿态检测装置的检测信号进行控制，从而提供预定的离心力。

8、如权利要求1所述的共轴两轮车辆，

其中，根据输出至所述一对车轮驱动装置的控制信号，所述踏板的姿态发生变化从而抵消施加到所述骑乘者上的离心力。

共轴两轮车辆

技术领域

本发明涉及一种共轴两轮车辆，其包括两个位于同一轴中心线上的轮子，本发明尤其涉及一种共轴两轮车辆，其可以带着骑乘在上面的人员自由行驶。

背景技术

现有技术中的一种这样的共轴两轮车辆已经在例如专利文献 1 中公开。在专利文献 1 中，介绍了一种共轴两轮车辆，包括位于同一根轴两端的轮子。在专利文献 1 中公开的共轴两轮车辆是"一种共轴两轮车辆，其构造成带有一对轮子；在该对轮子之间设置有一根轮轴；一个能够倾斜支撑在上述轮轴上方的底座；一对安装在底座上的驱动马达，以便驱动每个轮子；和一个控制器，可向该对驱动马达发出操作指令，其中，在底座上设置有一个加速度检测器用来检测在垂直方向上的加速度，并且当在行驶过程中加速度检测器检测到的加速度的绝对值达到或超过一个阈值的时候，控制器发出操作指令以使得该对驱动马达中的每一个都减速。"

根据专利文献 1 中的具有上述结构的共轴两轮车辆，希望达到的效果是"当例如行驶到台阶上时，因为具有能检测在垂直方向加速度的加速度检测器且当在行驶过程中加速度检测器检测到的加速度绝对值达到或超过一个预定阈值的时候，要减速的操作指令已经发送给该对驱动马达中的每一个，因此在遇到台阶等情况时可以安全行驶。"

此外，作为在现有技术中的另一种共轴两轮车辆在例如专利文献 2 中公开。在专利文献 2 中，介绍了一种能控制共轴两轮车辆姿态的方法。在专利文献 2 中的共轴两轮车辆中该姿态控制方法是"在一种带有一对轮子的共轴两轮车辆中；在该对轮子之间设置有一根轮轴；一个车体以可转动的方式支撑在上述轮轴上方；一个车轮驱动马达安装在车体上；一个控制计算机，可以向该驱动马达发出操作指令；还有一个角度检测器来检测车体的倾斜角度，角度检测器所检测的车体倾斜角度以很短时间间隔被取样，通过将取样

值代入提前输入并设定在控制计算机中的控制输入计算方程中来进行计算，其中车体的取样倾斜角度用作状态变量，而将反馈增益作为一个系数，根据计算方程来计算用于车轮驱动马达的控制扭矩；控制计算机向车轮驱动马达发送一个指令来执行与计算控制扭矩相同的操作。”

根据在专利文献 2 的具有上述结构的共轴两轮车辆中的姿态控制方法，期望达到的效果是“在车辆倾斜的情况下，车轮立即在车体倾斜方向上移动，并且成功地复位车体的姿态，因为通过将取样值代入提前输入并设定在控制计算机中的控制输入计算方程中来进行计算，其中车体的取样倾斜角和反馈增益被用作系数；根据计算方程来计算用于车轮驱动马达的控制扭矩；且根据该计算结果执行对车轮驱动马达的反馈控制。”

[专利文献 1]日本公开专利申请 No.2005-6436

[专利文献 2]日本公开专利申请 No.S63-305082

但是，在上述专利文献 1 和 2 所述的共轴两轮车辆中，一个把手固定在用于人骑乘的踏板（骑乘部件）上，一个支撑车轮的支撑部件以可自由旋转地方式固定在踏板上，且踏板的上表面（骑乘表面）与行驶表面（路面）平行。因此，当重心处于比较高的位置，例如骑乘者处于站立状态的站立姿态的时候，骑乘者上部身体就变得不稳定，当行驶在路面与行驶方向垂直倾斜的倾斜路面上的时候由于重力作用、或当转向的时候由于离心力的作用，骑乘者会左右摇动而变得不稳定，并且当离心力过大的时候车体就很可能在侧向上发生翻转。

下面通过附图 1 到 3 来详细介绍这方面的详细内容。图 1A 到 1C 是说明性示意图，分别表示从车辆的前侧观察现有技术中的共轴两轮车辆。在图 1A 到 1C 中，附图标记 1 表示共轴两轮车辆的整体，其中设置有一个作为踏板的车体 2。在与车体 2 行驶方向垂直的方向两侧设置有可旋转的左右车轮 3L 和 3R。此外，附图标记 4 表示一个骑乘在车体 2 上的骑乘者（例如是一个男人），附图标记 G 表示骑乘者 4 的重心，附图标记 W 表示骑乘者 4 的重量（载荷）。

图 1A 表示在没有侧向力和离心力影响的情况下，共轴两轮车辆 1 在平坦路面上直线行驶的状态。在这种情况下，骑乘者 4 的重心 G 基本上位于共轴两轮车辆 1 中心的上方，载荷 W 垂直作用在车体 2 的大致中心。因此，大致相同的载荷作用在左右车轮 3L 和 3R，在车轮 3L 和 3R 与路面 E 相接

触的地面接触点 TL 和 TR 处的反作用力大致相同。

图 1B 表示共轴两轮车辆 1 在平坦路面 E 上转向的状态。在这种情况下，离心力（侧向力）F 从右侧车轮 3R 侧作用在骑乘者 4 上，由于离心力 F 的作用，载荷 W 的重力矢量 W 偏离一个角度θ。当重力矢量 W 的延长线与路面 E 相交所形成的地面接触点 R 位于左侧车轮 3L 的地面接触点 TL 的内侧时，共轴两轮车辆 1 可以稳定地转向。但是，当地面接触点 R 如图 1B 所示处于地面接触点 TL 外侧时，就会损害行驶稳定性，因为左右车轮 3L 和 3R 不能承受离心力 F，当离心力 F 变得过大的时候，车辆就会如图 1C 所示那样发生翻转（在侧向倒下）。

导致共轴两轮车辆 1 翻转的困难程度大部分取决于骑乘者 4 的重心 G 的高度。图 2 是解释该现象的示意图。当骑乘者 4 的重心 G 较低的时候，重心 G 的重力矢量 W 的允许倾斜角度是如图 2 所示的角θ。但是，当骑乘者 4 的重心 G 很高并且变换到重心 G1 的时候，重心 G1 的倾斜角度变为小于角θ的角θ1（θ1<θ），因为从车体 2 的中心到左右车轮 3L 和 3R 的地面接触点 TL 和 TR 的距离保持不变。

从上可知，可以理解的是导致共轴两轮车辆 1 翻转的困难程度是通过重心 G 的高度和离心力 F 的乘积来表示的。具体地说，假设当离心力 F 作用在重心 G 上时，重力矢量 W 的地面接触点 R 与左侧车轮 3L 的地面接触点 TL 对应，就得到 F×H=S（公式 1）。类似的，假设当离心力 F 作用在重心 G1 上时，重力矢量 W1 的地面接触点 R 与左侧车轮 3L 的地面接触点 TL 对应，就得到 F1×H1=S（公式 2）。因此，F×H=F1×H1。这里，因为 H<H1，所以 F>F1。因此，当重心位置更高时，即使离心力小了那么多，共轴两轮车辆 1 也可能发生翻转。

共轴两轮车辆 1 的这种翻转可以通过图 3 所示的结构来避免。图 3 表示的是当离心力 F 作用时，车体 2 朝向右侧车轮 3R 上的路面 E 倾斜的示意图。当车体 2 因此倾斜到离心力 F 作用的一侧的时候，就可以防止共轴两轮车辆 1 的翻转并可能进行稳定转向，因为重力矢量 W1 的地面接触点 R 变到左侧车轮 3L 的地面接触点 TL 的内侧。

发明内容

在现有技术的共轴两轮车辆中，踏板的上表面（骑乘表面）是连续的、

与行驶表面（路面）平行，当行驶在倾斜路面的时候由于重力作用，以及当转向且骑乘者处于站立状态重心位置很高时，由于离心力的作用，骑乘者的身体上部也会左右摇晃而不稳定，而且当这样的力变得过大的时候车辆也会翻转。

一个根据本发明实施例的共轴两轮车辆具有用于驾驶者骑乘的踏板；车体，当行驶方向被设定为滚动轴线的时候，该车体支撑所述踏板从而能够在围绕作为中心的滚动轴线旋转的左右滚动方向上改变姿态；一对车轮，所述一对车轮位于与所述车体行驶方向垂直的方向上两侧的同一轴线并且被所述车体可转动地支撑；一对单独驱动和旋转所述一对车轮的车轮驱动装置；和用于直接改变所述踏板的姿态或通过所述车体间接改变所述姿态的把手。

根据本发明的共轴两轮车辆的实施例，当转向或变换骑乘者的重心的重力矢量与地面接触点或车轮的地面接触点内侧的时候，就可以改变踏板的姿态，以防止共轴两轮车辆的翻转，从而可形成稳定的转向。

附图说明

图 1A 到 1C 是表示共轴两轮车辆和离心力之间关系的示意图，其中图 1A 表示的是离心力没有发生作用的状态，图 1B 表示的是离心力发生作用的状态，图 1C 表示的是车辆由于离心力而翻转的状态；

图 2 是用来解释共轴两轮车辆、离心力和骑乘者重心高度之间关系的示意图；

图 3 是用来抑制作用在共轴两轮车辆上的离心力的措施的示意图；

图 4A 和 4B 是表示根据本发明的共轴两轮车辆的第一实施例的示意图，其中图 4A 是前视图，图 4B 是侧视图；

图 5 是解释性示意图，放大表示了图 4A 中所示的共轴两轮车辆的一个相关部分；

图 6 是解释性示意图，放大表示了图 4B 中所示的共轴两轮车辆的一个相关部分；

图 7 是图 5 所示的共轴两轮车辆中的 D-D 线部分的放大截面图；

图 8 是说明图 4A 中共轴两轮车辆的操作的解释性示意图，表示的是一个轮子在台阶上行驶的状态；

图 9 是说明图 4A 中共轴两轮车辆的操作的解释性示意图，表示的是在

平坦路面上转向的状态；

图 10 是说明图 4A 中共轴两轮车辆的操作的解释性示意图，表示的是在倾斜路面直线行驶的状态；

图 11 是根据本发明的共轴两轮车辆第一实施例的控制器结构的示意性方框图；

图 12A 到 12C 是说明根据本发明的共轴两轮车辆第一实施例行驶状态的解释性示意图，其中图 12A 表示的是在平坦路面上直线行驶；图 12B 是在平坦路面上转向；图 12C 是在倾斜路面上直线行驶；

图 13A 和 13B 是根据本发明的共轴两轮车辆的第二实施例的示意图，其中图 13A 是前视图，图 13B 是侧视图；

图 14A 和 14B 是解释性示意图，放大表示了图 13A 中所示的共轴两轮车辆的一个相关部分，其中图 14A 是直线行驶状态，图 14B 是转向状态；

图 15A 和 15B 是根据本发明的共轴两轮车辆的第三实施例的示意图，其中图 15A 是前视图，图 15B 是侧视图；

图 16A 和 16B 是解释性示意图，放大表示了图 15A 中所示的共轴两轮车辆的一个相关部分，其中图 16A 是直线行驶状态，图 16B 是转向状态。

具体实施方式

一种能够稳定转向且不会导致翻转的共轴两轮车辆可以采用一种简化结构，其中，踏板朝着转向方向的内侧倾斜。

下面，将参照附图介绍本发明的实施例。图 4 到 16 表示的是本发明的实施例。具体地说，附图 4A 到 4B 是表示根据本发明的共轴两轮车辆的第一实施例的前视图和侧视图；图 5 是图 4A 中一个相关部分的放大解释性示意图；图 6 是图 4B 中一个相关部分的放大解释性示意图；图 7 是图 5 中 D-D 线截面图；图 8 是根据第一实施例的共轴两轮车辆的操作的示意图；类似地，图 9 和 10 是一个相关部分的解释性示意图，说明一种操作；图 11 是用于说明根据本发明第一实施例的共轴两轮车辆的控制器的电路的方框图；图 12A 到 12C 是表示骑乘者动作的解释性示意图；图 13A 和 13B 是根据本发明的共轴两轮车辆的第二实施例的前视图和侧视图；图 14A 到 14B 是一个相关部分的解释性示意图，说明根据本发明第二实施例的共轴两轮车辆的一种操作；图 15A 和 15B 是根据本发明的共轴两轮车辆的第三实施例的前视图和

侧视图；图 16A 和 16B 是一个相关部分的解释性示意图，说明根据本发明第三实施例的共轴两轮车辆的一种操作。

如图 4A 和 4B、图 5 和图 6 所示，本发明第一实施例的共轴两轮车辆 10 包括：两个分开踏板 11L 和 11R，示出驾驶者骑乘的踏板的一种特定实施例，一个分别支撑这些分开踏板 11L 和 11R 的车体 12，其能够在滚动方向 X 改变姿态，一对被车体 12 可旋转地支撑的车轮 13L 和 13R，一对车轮驱动部件 14L 和 14R，示出可驱动和旋转该对车轮 13L 和 13R 的车轮驱动装置的特定实施例，一个把手 15，可通过车体 12 等来间接改变两个分开踏板 11L 和 11R 的姿态。

两个分开踏板 11L 和 11R 是驾驶者通过将一只脚放在各踏板上以便于骑乘的踏板，它们是由一对平板制成的，平板的尺寸等于或稍大于人脚。车体 12 具有一个平行连接机构，其中，一个车体上部部件 16 和一个车体下部部件 17 彼此上下平行设置，一对侧面部件 18L 和 18R 左右彼此平行设置并以可转动的方式连接到车体上部部件 16 和车体下部部件 17 上。一对螺旋弹簧 19L 和 19R 位于该平行连接机构的车体上部部件 16 和车体下部部件 17 之间，该螺旋弹簧作为弹性部件的特定实施例，用来产生弹性力，以使车体上部部件 16 和车体下部部件 17 与该对侧面部件 18L 和 18R 保持垂直角度。

如图 7 的一部分所示，车体上部部件 16 和车体下部部件 17 具有大致四边形的底架部件 16a 和 17a、轴承部件 16b 和 17b 和一对弹簧支撑部件 16c、16c 和 17c、17c，底架部件的下部都是敞开的，轴承部件是在每个底架部件 16a 和 17a 的四角沿着纵向突起，每个弹簧支撑部件分别朝向另一个部件的侧面突起。车体上部部件 16 和车体下部部件 17 在左右方向上即车辆的宽度方向上的长度是相同的，当两个部件 16、17 重叠的时候，位于相应角部四个位置的轴承部件 16b 和 17b 也互相重叠。

在车体上部部件 16 中，在纵向即左右方向上的中间和两端的三个位置分别有轴承孔（在前后侧共有六个位置）。同样，在车体下部部件 17 中，在纵向即左右方向上的中间和两端的三个位置分别有轴承孔（在后侧的两端有两个位置，所以共有五个位置）。在车体上部部件 16 两端和车体下部部件 17 两端处的端部轴承孔彼此间隔距离，在端部具有这些轴承孔的左右轴承部分 16b、16b 和 17b、17b 之间设置有一对侧面部件 18L 和 18R。

该对侧面部件 18L 和 18R 是用平板状部件制成的，其宽度可滑动地安装

在位于车体上部部件 16 前后方向上的轴承部件对 16b、16b 之间，以及位于车体上部部件 17 前后方向上的轴承部件对 17b、17b 之间，并且该对侧面部件位于车体上部部件 16 和车体下部部件 17 的左右两侧，其带有向上和向下伸出的平面部分。而且，在每个侧面部件 18L 和 18R 的两侧四个位置处设置有与车体上部部件 16 的轴承孔对和车体下部部件 17 的轴承孔对对应的轴承孔。

在侧面部件对 18L 和 18R 的八个轴承孔中的上部的四个轴承孔中，分别以可转动的方式插入上部旋转支撑销 21L 和 21R，所述销穿过位于车体上部部件 16 四个位置上的轴承部分 16b 的轴承孔。类似地，在侧面部件对 18L 和 18R 的八个轴承孔中的下部的四个轴承孔中，分别以可转动的方式插入下部旋转支撑销 22L 和 22R，所述销穿过位于车体下部部件 17 四个位置上的轴承部分 17b 的轴承孔。因此，车体上部部件 16、车体下部部件 17 和左右侧面部件 18L 和 18R 构成了平行连接机构。

车轮驱动部件 14L 和 14R 分别连接到侧面部件对 18L 和 18R 的每个外表面上。每个车轮驱动部件 14L 和 14R 可包括一个电动机、一个连接到电动机旋转轴上以便传递例如动力等的减速齿轮组。每个车轮驱动部件 14L 和 14R 都带有一个分别固定在侧面部件 18L 和 18R 上的固定部件和一个被该固定部件以可自由旋转的方式支撑的可旋转部件，车轮对 13L 和 13R 分别连接到可旋转部件上。这样，通过车轮驱动部件对 14L 和 14R 被侧面部件对 18L 和 18R 支撑的车轮对 13L 和 13R 具有旋转中心，当行驶在平坦路面上的时候，两个车轮的旋转中心就基本上处于同一轴中心线上。

而且，侧面部件对 18L 和 18R 的上端部分从车体上部部件 16 的上表面大致向上突起，并且上述分开踏板 11L 和 11R 分别连接到其上表面上。该对分开踏板 11L 和 11R 在相同的高度水平延伸，二者之间在左右方向即轮轴方向上具有一个预定的间隙。该对分开踏板 11L 和 11R 之间的距离是当一个男人自然站立的时候，两脚之间的距离。

车体下部部件 17 的弹簧支撑部件对 17c、17c 之间在中心部分的左右方向上带有一个预定的间隙。车体上部部件 16 的弹簧支撑部件对 16c、16c 是位于跟弹簧支撑部件对 17c、17c 对应的位置上。而且，具有适当弹性力的螺旋弹簧 19L 和 19R 在相互对应的弹簧支撑部件 16c 和 17c 之间处于充分压缩状态。在这里，虽然没有在附图中表示，但是优选地每个弹簧支撑部件 16c

和 17c 都带有一个弹簧支撑突起，来支撑螺旋弹簧 19L 和 19R 的每端，这样，就能防止螺旋弹簧 19L 和 19R 脱落。

而且，如图 7 所示，一个把手支架 24 连接在车体上部部件 16 和车体下部部件 17 左右方向的中心部分。把手支架 24 是用鞍形部件制成的，该鞍形部件在前后方向上跨骑在车体上部部件 16 上，在前部有一个延伸向车体下部部件 17 的下部前表面部分 24a，在后部有一个延伸向车体上部部件 16 的下部后表面部分 24b。而且，在把手支架 24 的上表面带有一个安装部分 24c 来固定和支撑一个把手 15。在把手支架 24 的前表面部分 24a 中，与车体上部部件 16 的中心轴承孔和车体下部部件 17 的中心轴承孔对应的位置上有轴承孔。而且，在后表面部分 24b 中，在与车体上部部件 16 的后部中心轴承孔对应的位置上有一个轴承孔。

在把手支架 24 的前表面部分 24a 的上部中心轴承孔中以可转动的方式安装有一个上部前旋转支撑轴 25。而且，在后表面部分 24b 的中心轴承孔中以可转动的方式安装有一个上部后旋转支撑轴 26。上部前旋转支撑轴 25 的轴中心线和上部后旋转支撑轴 26 的轴中心线被设定在相同的轴线上以相互对应。上部前旋转支撑轴 25 的一个轴顶端部分被插入车体上部部件 16 的前表面的孔中，并且通过一个穿过车体上部部件 16 的前表面的固定螺栓 27 进行固定。类似地，上部后旋转支撑轴 26 的一个轴顶端部分被插入车体上部部件 16 的后表面的孔中，并且通过一个穿过车体上部部件 16 的后表面的固定螺栓 28 进行固定。

一个下部前转向支撑轴 29 插入到把手支架 24 的前表面部分 24a 的下部中心轴承孔中。把手支架 24 跟着作为转动中心的下部前转向支撑轴 29 一起沿着滚动方向 X 转动。为了允许该把手支架 24 在预定范围内转动，在车体上部部件 16 和车体下部部件 17 的前表面上有凹腔 16d 和 17d，来避免与把手支架 24 相接触。而且，一个角度检测传感器 31 连接到上部前转向支撑轴 25 上以便通过把手支架 24 在滚动方向 X 上的转动量（转向角）来检测把手 15 的操作量（转动量）。

角度检测传感器 31 包括一个固定在上部前转向支撑轴 25 上的轴部 31a 和一个用来检测轴部 31a 相对旋转角位移量的检测部分 31b。检测部分 31b 固定在固定板 32 的一端，固定板的另一端通过一个固定螺栓 33 固定在把手支架 24 的前表面部分 24a。例如，电位计、具有可变电容器结构的传感器等

都可以作为角度检测传感器31。在这种角度检测传感器31中，通过在轴部31a和检测部31b之间产生的旋转位移量所引起的电阻值的变化就可以检测把手支架24朝着车体上部部件16的倾斜角度。

把手15的下端部固定在把手支架24的安装部分24c上。把手15的结构是具有一个安装并固定在安装部分24c上的把手柱35和一个位于把手柱35的上端部的把手杆36。把手柱35稍微向前倾斜地连接到车体12上，其上端向上延伸。把手杆36是U形的，其两端的凸起部向上朝着把手杆36的上端部，并连接到整体形成的中间部分。

而且，一个能控制车轮驱动部件对14L和14R驱动的转向操作环37连接到把手杆36的一个凸起部的上端。转向操作环37是用来通过手动操作来控制车辆的转向动作，并形成一个用于转向动作的加速器环。当转向操作环37沿着司机想要进行转向的方向转动的时候，一个对应操作量的信号就被输出到下面将要介绍的控制器，该控制器因此控制一对车轮驱动部件14L和14R的驱动力，在左右车轮13L和13R之间就产生转速差，因此就可以以所需的速度进行转向。

如图7所示，在作为把手15的底座部分的把手支架24的上表面上有一个电源存储部件39，该电源存储部件可以容纳作为电源特定实施例的电池38、控制器、其它电子设备和电子装置等，电池用来给车轮驱动部件对14L和14R提供电能。在本实施例中的电源储存部件39具有盒子结构，可以容纳很多电池38。但是，电源并不限于在本实施例中的电池38，还包括便携式蓄电池、燃料电池、和其它类型的电源。电源存储部件39被一个电源盖41所覆盖，这样雨水、灰尘等就不会进入。

在车体上部部件16的底盘部分16a中设置有驱动电路44L和44R，其用来驱动车轮驱动部件14L和14R等部件。而且，在车体下部部件17中带有一个姿态传感器部件45、和一个控制器46，姿态传感器部件45用来检测车体12姿态、把手15的姿态等，并输出检测信号，控制器46输出控制信号来驱动和控制车轮驱动部件对14L和14R等部件。控制器46根据姿态传感器部件45的检测信号、角度传感器31等的检测信号来执行预定的算法程序，必要的控制信号被输出给车轮驱动部件对14L和14R等部件。

如图11所示，控制器46带有一个包括一个微电脑（CPU）的运算电路47、一个存储设备48，存储设备包括一个程序存储器、一个数据存储器、其

它例如RAM或ROM存储器等。电池38和车轮驱动电路对44L和44R连接到控制器46上，还通过一个紧急制动开关49连接。一对车轮驱动电路44L和44R单独控制旋转速度、旋转方向和车轮对13L和13R等，并且车轮驱动部件对14L和14R单独连接在电路上。

角度检测传感器31检测把手15倾斜角度得到的一个检测信号、与转向操作环37的转向操作量对应的一个信号、和姿态传感器部件45的一个检测信号被提供给控制器46。姿态传感器部件45是用来在共轴两轮车辆10行驶的时候检测角速度和加速度，并控制角速度和行驶加速度，其包括例如一个陀螺传感器和一个加速度传感器。

陀螺传感器检测角速度，角速度与俯仰轴线（与车轮对13L和13R的轴对应）51、旋转轴线（穿过车体12的中心并与车辆的行驶方向平行）52、和车体12的偏转轴线（穿过车体12的中心并与车辆行驶的路面垂直）中的至少一个相关。而且，当车体12由上述三个轴线表示的时候，姿态传感器部件45的加速度传感器检测跟上述三个轴线（X轴、Y轴、和Z轴）中的至少一个相关的加速度。

具有上述结构的共轴两轮车辆10可以以例如下面的方式行驶。图4A和4B表示当在平坦路面E上直线行驶的时候车辆的状态，在这种状态中，从前面观察，作为把手15中心的一根轴中心线CL就与行驶路面E垂直。此外，左右分开踏板11L和11R就被水平保持在相同高度。

图8表示的是在平坦路面E上直线行驶的车辆的一个车轮（在本实施例中是左侧车轮13L）行驶到台阶K上。在这种情况下，通过把手15被骑乘者保持垂直，则车辆能以左右分开踏板11L和11R保持水平的状态行驶。因此，即使以站立姿势驾驶的骑乘者的重心很高，路面E的台阶K也可以通过左右分开踏板11L和11R在高度方向上的变化而被吸收掉，因此骑乘者就可以在其身体上部没有左右摇晃的情况下稳定行驶。

图9表示的是在平坦路面E上转向的状态。在这种情况下，骑乘者倾斜把手15，且他/她的身体上部朝着转向中心一侧（内侧）倾斜，以使左右分开踏板11L和11R以及左右车轮13L和13R与把手15平行倾斜，包括骑乘者在内的整个车辆就很容易抵消离心力。

而且，图10表示的是在倾斜路面（倾斜路面M）上的行驶状态，行驶方向与倾斜方向垂直。在这种情况下，与行驶到台阶K上时路面在转动轴线

方向（也就是相对行驶方向的左右方向）上改变的状态类似，骑乘者保持把手 15 垂直，并能以左右分开踏板 11L 和 11R 保持水平的状态行驶。因此，即使以站立姿势驾驶的骑乘者的重心很高，倾斜路面 M 也可以通过左右分开踏板 11L 和 11R 在高度方向上的变化而被吸收掉，因此骑乘者就可以在其身体上部没有左右摇晃的情况下稳定驱动和行驶。

下面，将介绍共轴两轮车辆 10 进行转向的方法。图 12A 表示共轴两轮车辆 10 在平坦路面 E 上直线行驶的状态。图 12B 表示在平坦路面 E 上向左转向的状态。而且，图 12C 表示在倾斜路面 M 上直线行驶（包括在台阶 K 上行驶）的状态。

当共轴两轮车辆 10 进行转向的时候，基本上采用下面的两种办法：一种是仅通过把手 15 的倾斜确定转向量（转向速度、转向半径等）的方法，和一种通过把手 15 的倾斜以及骑乘者旋转转向操作环 37（加快转向速度）来确定转向量的方法。

首先，将介绍仅通过把手 15 的倾斜来确定转向量以进行转向的方法。如图 9 所示，在这种情况下，转向操作量是根据在把手 15 和重力轴 V 之间的把手实际倾斜角 θh 来确定的。根据转向量和车速，在左右车轮 13L 和 13R 之间产生转速差，这样就能获得可产生预定离心力的转向半径以进行转向。在这种情况下，把手实际倾斜角 θh 可以如下来检测。

第一个例子是上述姿态传感器部件 45 是连接到把手 15 上或连接到与把手 15 平行的一对左右分开踏板 11L 和 11R 中的一个上，这样，就能直接检测把手 15 的倾角。

第二个例子是姿态传感器部件 45 连接到如图 7 所示的车体下部部件 17 上。在这种情况下，一个位置传感器用来检测在把手 15 和车体下部部件 17 之间的相对夹角或把手 15 和车体上部部件 16 之间的相对夹角。在图 7 所示的实施例中，在车体上部部件 16 中的角度传感器 31 相当于位置传感器，一个电位计等可以用作例如角度检测传感器 31。角度检测传感器 31 的输出和姿态传感器部件 45 的输出可以用来计算“与重力轴 V 形成的车辆倾斜角 θg”和“把手 15 相对于车体的把手相对倾斜角 θp”之间的差，并检测出把手 15 的把手实际倾斜角 θh（$\theta p - \theta g = \theta h$），“与重力轴 V 形成的车辆倾斜角 θg”是在车体 12 内的姿态传感器部件 45 相对重力轴 V 的输出，“把手 15 相对于车体的把手相对倾斜角 θp”是角度检测传感器 31 的输出。

例如，当作为角度检测传感器 31 的输出的把手相对倾斜角 θp 与作为姿态传感器部件 45 的输出的车辆倾斜角 θg 相符合时，把手 15 是垂直的，并且车辆处于直线行驶状态而不管路面情况（平坦路面、倾斜路面 M、台阶 K 等），如图 12A 以及图 10 和图 12C 所示。另一方面，当共轴两轮车辆 10 如图 9 所示转向的时候，从作为角度检测传感器 31 的输出的把手相对倾斜角 θp 减掉作为姿态传感器部件 45 的输出的车辆倾斜角 θg 所得到的值就是与重力轴 V 所形成的把手实际倾斜角 θh，根据该把手实际倾斜角 θh 来确定转向操作量。

下面，将介绍根据司机旋转转向操作环 37 和把手 15 的倾角来确定转向量的方法。在几乎不产生离心力（例如，离心力为 0.1G 或更小）的情况下，例如低速转向、超枢转制动转向（super-pivotal brake turn）等，骑乘者可以通过使用把手 15 的倾斜和转向操作环从而根据行驶速度来选择操作，因为在这样的情况下通过手动旋转位于把手杆 36 顶端的转向操作环 37 而不是倾斜把手来提高可操作性。在这种情况下，根据转向操作环 37 的转向操作，确定转向量且仅通过把手 15 的倾斜来进行转向的方法就被累加到操作量上，这样，在二者结合并使用的状态下就可以控制转向时的操作量。

首先，当手动旋转把手杆 36 的转向操作环 37 的时候，转向操作环 37 的操作量就通过用电位计等制成的位置检测传感器来检测，检测信号被送到控制器 46。然后，控制器 46 向左右车轮驱动部件 14L 和 14R 输出一个控制信号，这样就可以获得能根据车速产生预定离心力（例如，0.2G）的转向半径，并给左右车轮 13L 和 13R 一个预定的转速差。

这里，当还要进行更急转弯的时候，骑乘者朝着转向中心倾斜把手 15。然后，把手 15 的倾斜量就被如上所述的角度检测传感器 31 检测出来，车辆的姿态被姿态传感器部件 45 检测出来，这样，就计算出与把手 15 的倾斜量对应的车轮控制量。通过把手 15 倾斜量得到的车轮控制量通过转向操作环 37 的转向操作被累加到车轮控制量上。结果，控制器 46 向左右车轮驱动部件 14L 和 14R 输出一个控制信号，这样就改变左右车轮 13L 和 13R 的转速差来获得一个能产生预定离心力（例如，0.4G）的转向半径。因此，即使转向速度很快，也可以执行稳定的转向，而处于站立姿势的骑乘者的身体上部不会左右摇晃。

在第一实施例中，踏板被分成左右两个，因为当使用这样分开两个踏板

11L和11R就可以获得下面的优点，当例如行驶到台阶上时，例如一个车轮首先行驶到如图8所示的台阶K上，但是那侧的车轮就可以依靠很少的驱动力就行驶到台阶 K 上，这时骑乘者就将重心移到下面车轮一侧（非行驶一侧）。随后，重心移到行驶车轮一侧，然后下面车轮（非行驶一侧）就行驶到台阶上，使得骑乘者感觉用脚登台阶一样，因此依靠很少驱动力车辆就可以行驶到台阶K上。

图13A和13B以及图14A和14B是表示根据本发明的共轴双轮车辆的第二实施例的示意图。作为第二实施例的共轴两轮车辆60包括：一个带有底盘的车体62，两个以可自由转向的方式单独被车体62支撑的分开的踏板61L和61R，和一个以可转动的方式将两个分开踏板61L、61R和一个把手支架64连接起来的连接件68。在本第二实施例中，相同的附图标记表示与上述第一实施例中相同的部分，因此就省略了重复的说明。

如图13A和13B以及图14A和14B所示，车体62是作为一个底盘，左右车轮驱动部件14L和14R分别连接到位于左右方向即车体宽度方向两侧的安装部分62L和62R上。而且，左右车轮13L和13R分别被驱动部件14L和14R以可自由旋转的方式支撑。而且，一个把手支撑部件65位于车体62的上部中间，踏板支撑部件65L和65R位于上部的两侧。轴承孔分别位于中间的把手支撑部件65上和两侧的踏板支撑部件65L和65R上，穿过车辆行驶的前后方向。

在把手支撑部件65和车体62的踏板支撑部件65L和65R上的三个轴承孔处于相同高度，把手支架64通过一个转动支撑轴66被一把手支撑部件65以可转动的方式支撑，左右分开踏板61L和61R通过上部旋转支撑销67L和67R以可转动的方式被踏板支撑部件65L和65R支撑。每个踏板61L和61R都带一个臂部61a，沿着与放有脚的踏板表面垂直的方向凸起。在每个臂部61a中，在底座和顶端部分分别设有轴承孔，上述上部旋转支撑销67L和67R可自由转动地插入底座的轴承孔中。

此外，连接左右分开踏板61L和61R的臂部61a的连接件68的两端通过下部旋转支撑销69L和69R以可自由旋转的方式连接到位于各自臂部61a的顶端部分的轴承孔中。而且，把手支架64通过一个旋转连接销71以可自由旋转的方式连接到连接件68轴向的中部。因此，在把手支架64上有两个轴承孔，它们之间的间隔距离与每个臂部61a中的两个轴承孔的间隔距离相

同。因此，把手支架 64、左右分开踏板 61L 和 61R 和连接件 68 构成了一个平行连接结构。除了上述结构之外的结构与上述第一实施例类似。

这样，当骑乘者倾斜把手 15 或分开踏板 61L 和 61R 的时候，左右分开踏板 61L 和 61R 或把手 15 同时在相同方向倾斜。图 14A 是表示把手 15 处于竖直位置的初始状态的示意图。图 14B 表示把手 15 和左右分开踏板 61L 和 61R 倾斜的状态的示意图。这时，左右分开踏板 61L 和 61R 的上表面就处于朝向路面倾斜把手 15 的倾斜量的状态。通过上述共轴两轮车辆 60 的结构也可以获得与上述第一实施例类似的效果。

图 15A 和 15B 以及图 16A 和 16B 是表示根据本发明的共轴两轮车辆的第三实施例的示意图。作为第三实施例的共轴两轮车辆 80 包括：一个带有底盘的车体 82，一个被车体 82 支撑、能使姿态自由变化的踏板 81，和整体固定到踏板 81 上的把手 15。在本第三实施例中，相同的附图标记表示与上述第一实施例中相同的部分，因此就省略了重复的说明。

如图 15A 和 15B 以及图 16A 和 16B 所示，车体 82 是作为一个底盘，左右车轮驱动部件 14L 和 14R 分别连接到位于左右方向即车体宽度方向两侧的安装部分 82L 和 82R 上，而且，左右车轮 13L 和 13R 分别被驱动部件 14L 和 14R 以自由旋转的方式支撑。一个踏板支撑部件 85 位于车体 82 的上部中间。在该踏板支撑部件 85 中，有一个轴承孔穿过车辆行驶的前后方向。

踏板 81 是一块尺寸能基本覆盖从车体 82 到左右车轮 13L 和 13R 范围的板。一个支架部件 84 整体位于踏板 81 下表面左右方向的中间部分。支架部件 84 是用两个在前后方向上间隔预定距离的突起部分制成的。并且车体 82 的踏板支撑部件 85 安装在两个突起部分之间。支架部件 84 和踏板支撑部件 85 的前后被两个处于相同轴中心线的旋转支撑轴 86 可自由旋转地支撑。

而且，四个螺旋弹簧 87 设置在踏板 81 和车体 82 之间，螺旋弹簧是弹性部件的一个特定举例，用来保持踏板 81 相对车体 82 水平。四个螺旋弹簧 87 分别以预定间隔设置在前后左右方向上的对称位置处。为了达到这个目的，四个用于支撑螺旋弹簧 87 上端的弹簧支撑部件 88 位于踏板 81 下表面的四个位置上，并且用于支撑螺旋弹簧 87 下端的四个弹簧支撑部件 89 位于车体 82 上表面的四个位置上。

这样，当骑乘者倾斜把手 15 和踏板 81 之一的时候，另一个整体形成的部件就在相同方向上也整体倾斜。图 16A 是把手 15 处于竖直位置的初始状

态的示意图。而且，图 16B 是把手 15 和踏板 81 倾斜状态的示意图。此时，踏板 81 的上表面处于朝向路面 E 倾斜有把手 15 倾斜量的状态。通过上述共轴两轮车辆 80 的结构也可以获得与上述第一和第二实施例类似的效果。需要注意的是，无须说明，弹性部件不局限于在本实施例中所示的螺旋弹簧 87，也可以采用板簧、橡胶状弹性体等。

至此，根据本发明的实施例，因为可以在转向内侧的滚动轴线方向倾斜踏板和把手来执行转向，所以即使在重心位置很高例如站立位置，骑乘者也可以稳定地驾驶车辆并且克服离心力行驶。在这种情况下，通过将轴和车轮连接到踏板部件上，在车轮转向的内侧也可以产生外倾角（camber angle），这样作用在轮胎上的侧向力就可以减小，并获得稳定的轮胎抓地力。

而且，当处于本发明第一实施例的情况下，当路面沿着滚动轴线方向变化（与车辆行驶方向垂直的左右方向），例如当行驶在倾斜路面和一个轮子行驶在台阶上的时候，该对分开踏板可以不左右倾斜而保持水平，因此这样的路面变化就可以被根据分开踏板的上下起伏变化而引起的高度变化而吸收，即使以诸如站立姿势驾驶的骑乘者的重心很高，骑乘者也可以在其身体上部没有左右摇晃的情况下稳定驱动和行驶。而且，当行驶到处于倾斜方向的台阶上的时候，与用脚登楼梯类似，骑乘者可以通过转换左右脚上的重心来用很少的驱动力登上台阶。

而且，根据本发明的实施例，共轴两轮车辆可以具有一个用于容纳一般成人（宽度为大约 400mm 或更小，长度为大约 250mm 或更小）的突起地板面积。因此，因为车辆的宽度与一个行人的所占用空间相同，因此即使在很拥挤的地区例如人行道上，车辆也可以很顺畅地行驶，而不会成为其它行人的障碍。

本发明并不局限于上述例如把手的持握部分为 U 形的实施例，持握部分可以是直线形、椭圆形或圆形，并且还可以采用其它形状的把手。因此在不背离本发明的范围和原理的情况下，可以做出很多变形。

对于本领域的普通技术人员来说可以理解的是，根据设计需求和其它因素可以做出很多变形、组合、小组合和改变，只要它们都处于所附的权利要求的范围之内。

图 1A

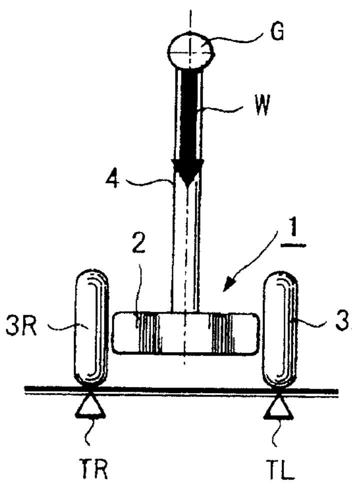


图 1B

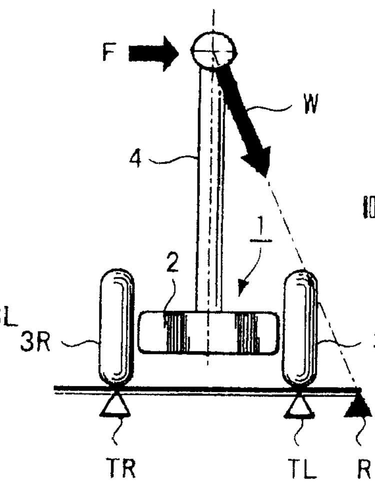


图 1C

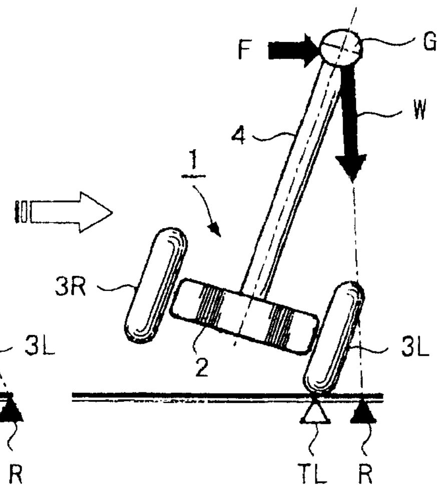


图 2

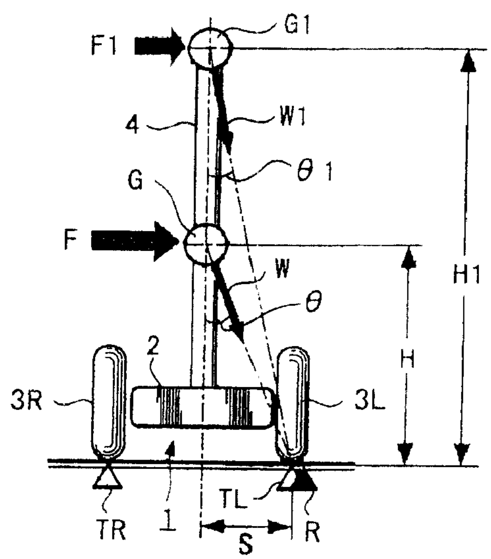
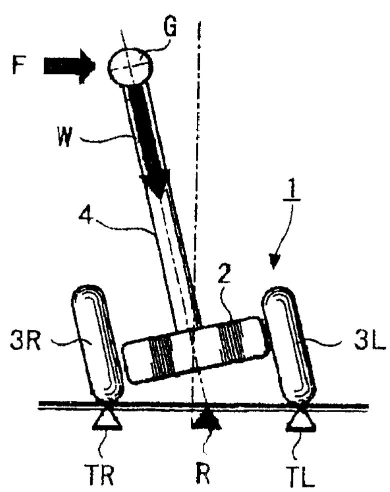


图 3



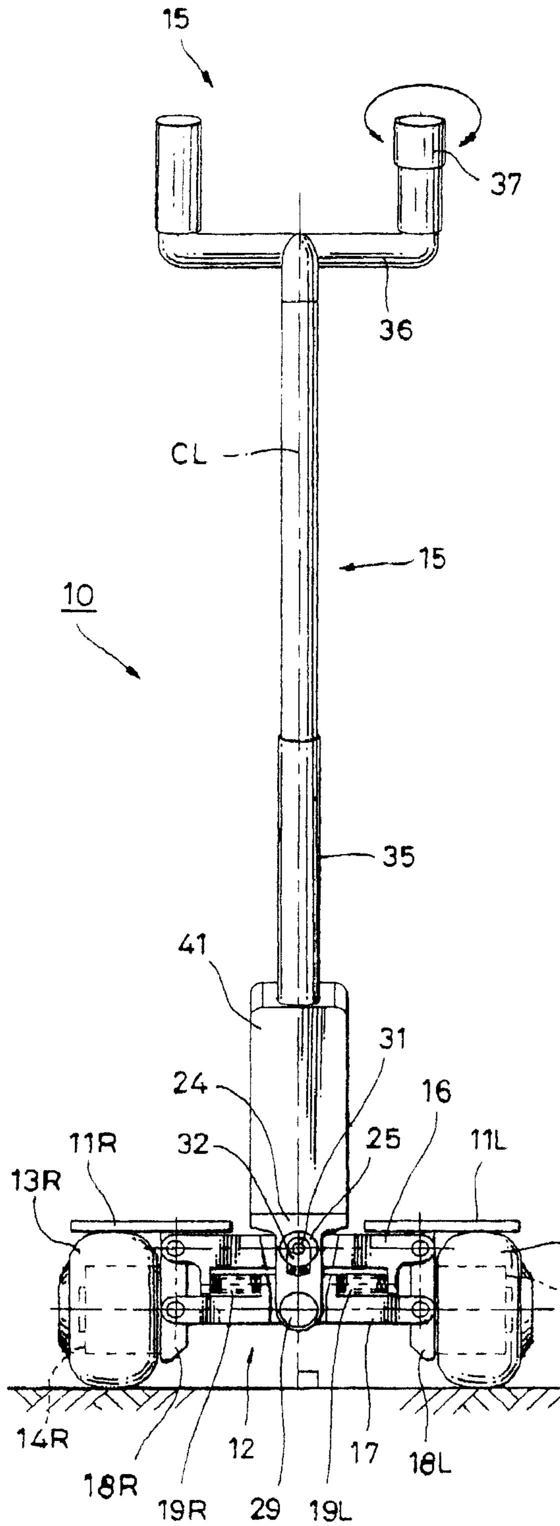

15
37
36
CL
15
10
35
41
31
24
16
32
25
11R
11L
13R
13L
14L
E
14R
12
17
18L
18R
19R
29
19L

图 4A

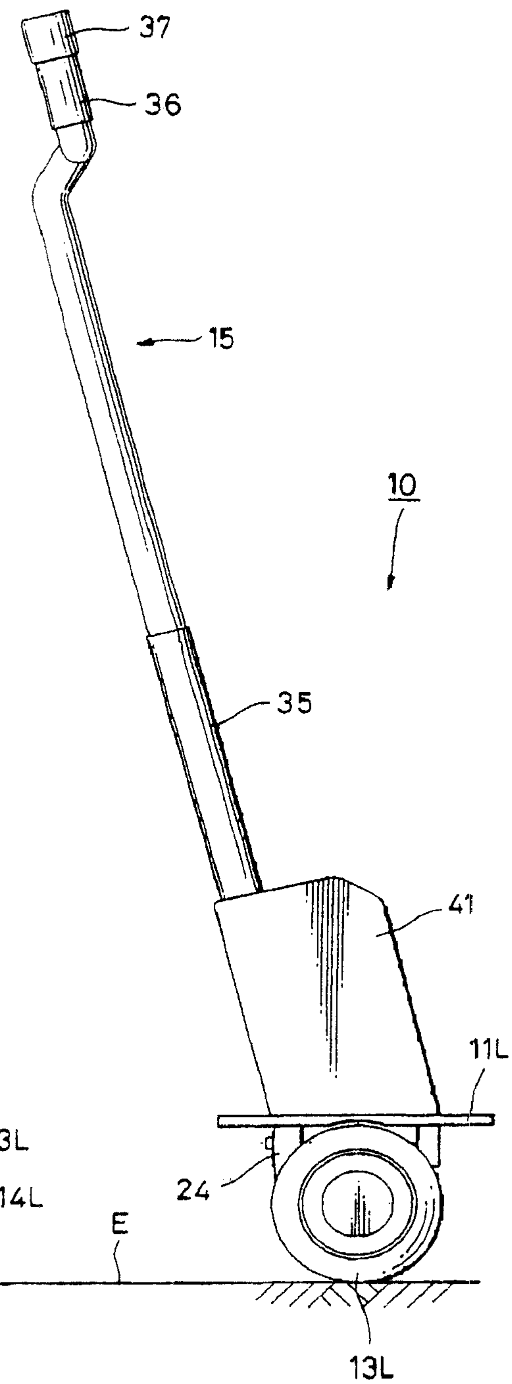

37
36
15
10
35
41
11L
24
13L

图 4B

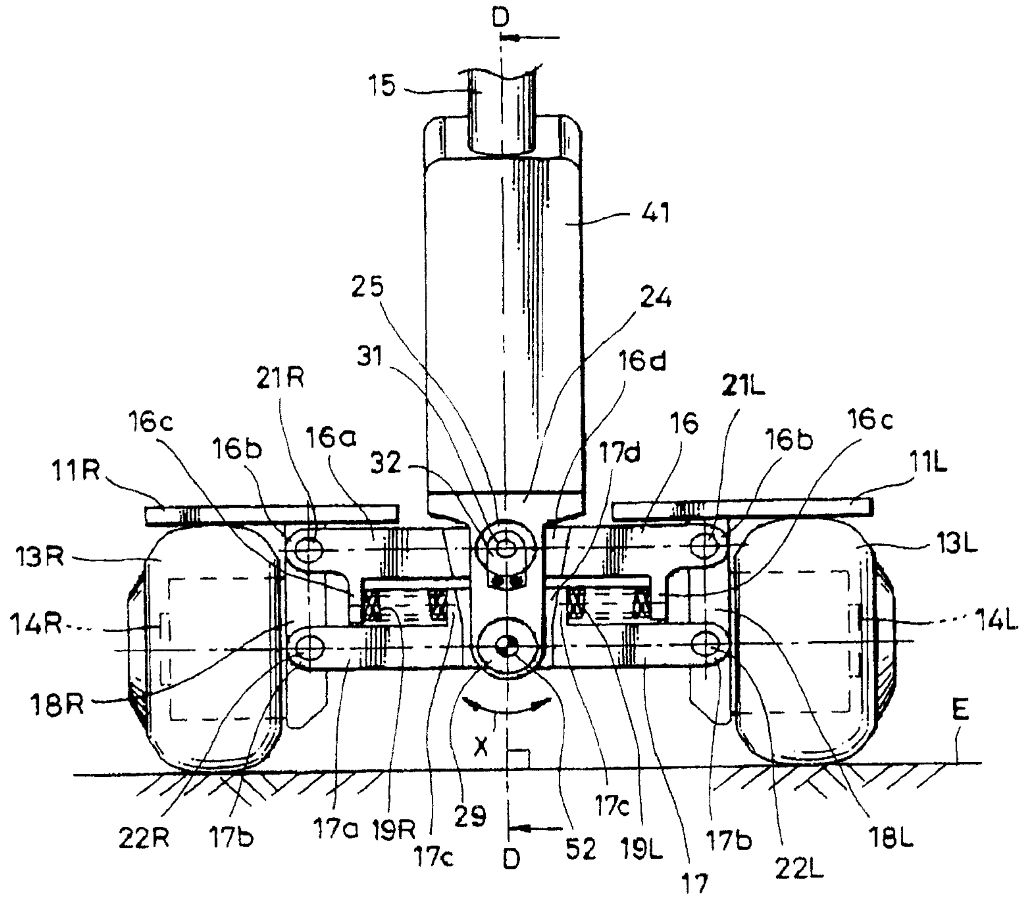

D
15
41
25
24
31
16d
21R
21L
16c
16b
16a
16
16b
16c
11R
32
17d
11L
13R
13L
14R
14L
18R
E
X
22R
17b
17a
19R
17c
29
D
52
17c
19L
17
17b
22L
18L

图 5

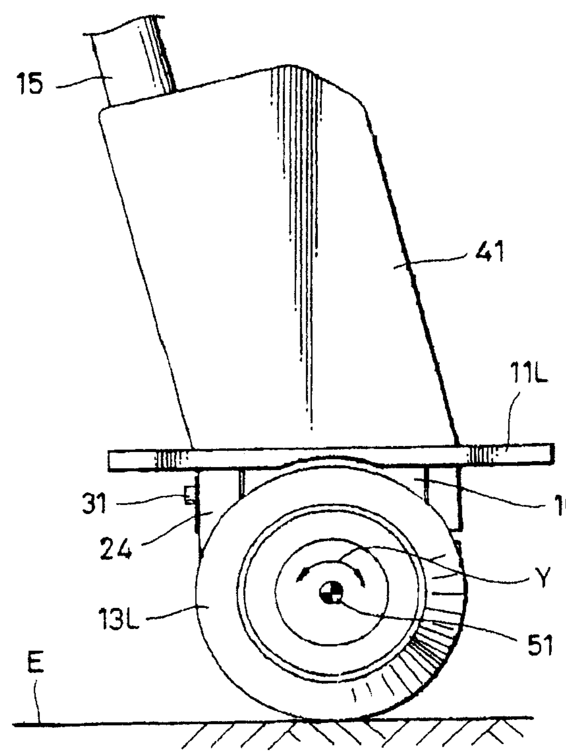

15
41
11L
31
16
24
Y
13L
51
E

图 6

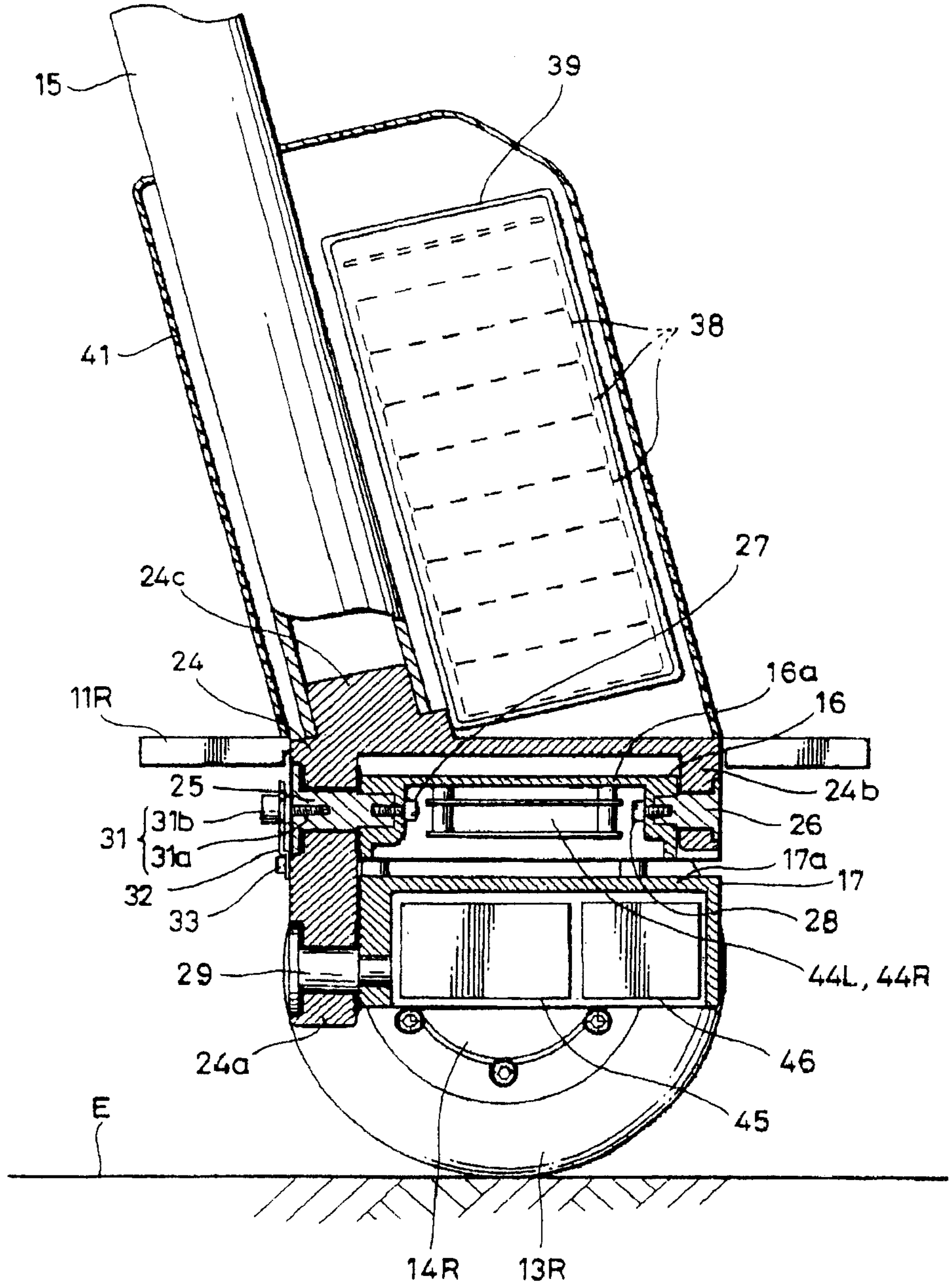

15
39
38
41
27
24c
24
16a
11R
16
25
24b
31
31b
31a
26
17a
32
17
33
28
29
44L, 44R
24a
46
E
45
14R
13R

图 7

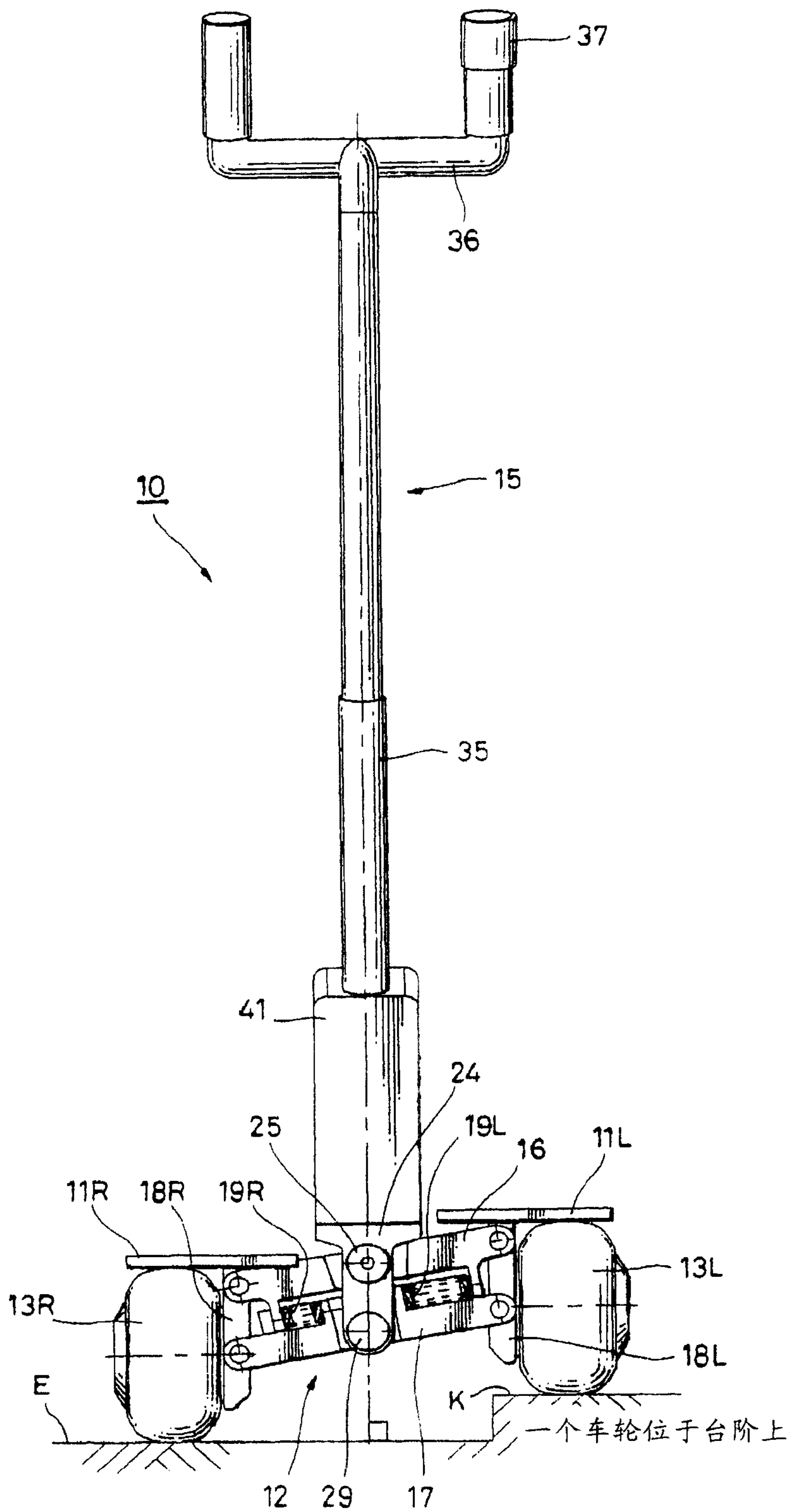

37
36
10
15
35
41
24
25
19L
16
11L
11R
18R
19R
13L
13R
18L
E
K
一个车轮位于台阶上
12
29
17

图 8

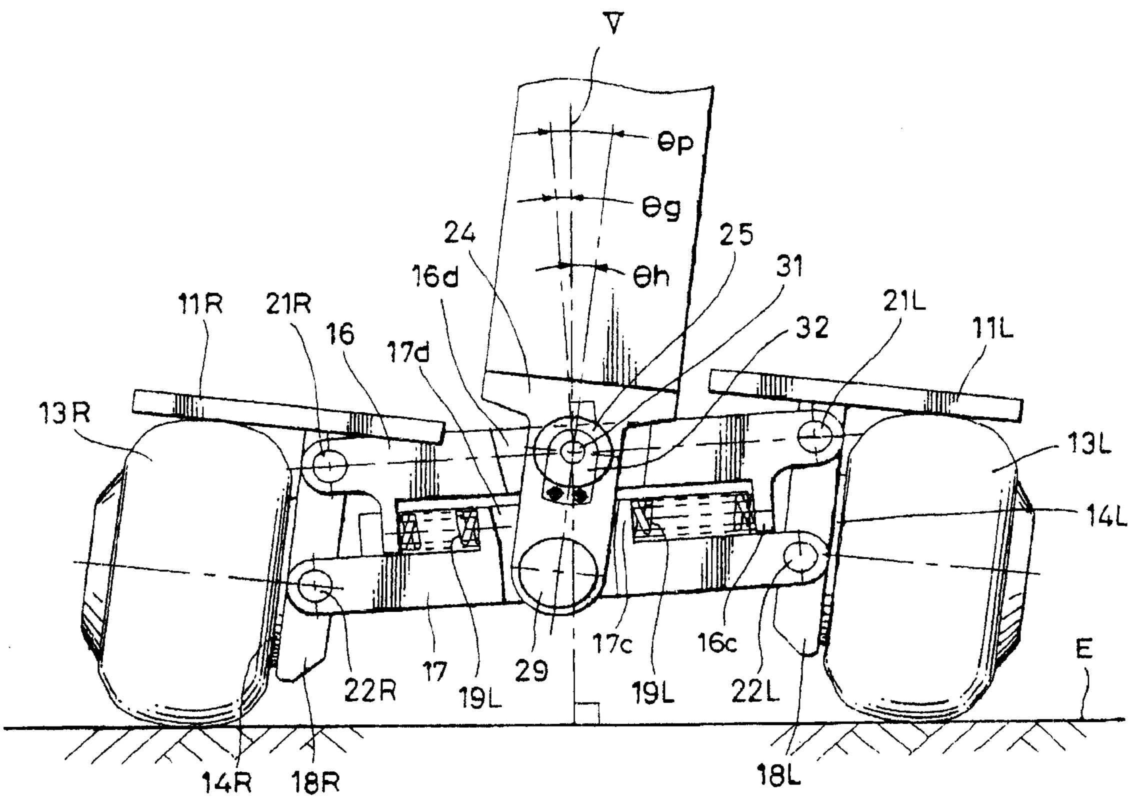

V
θp
θg
θh
24
25
31
32
16d
11R
21R
16
17d
21L
11L
13R
13L
14L
17
29
17c
16c
22R
19L
22L
E
14R
18R
18L

图 9

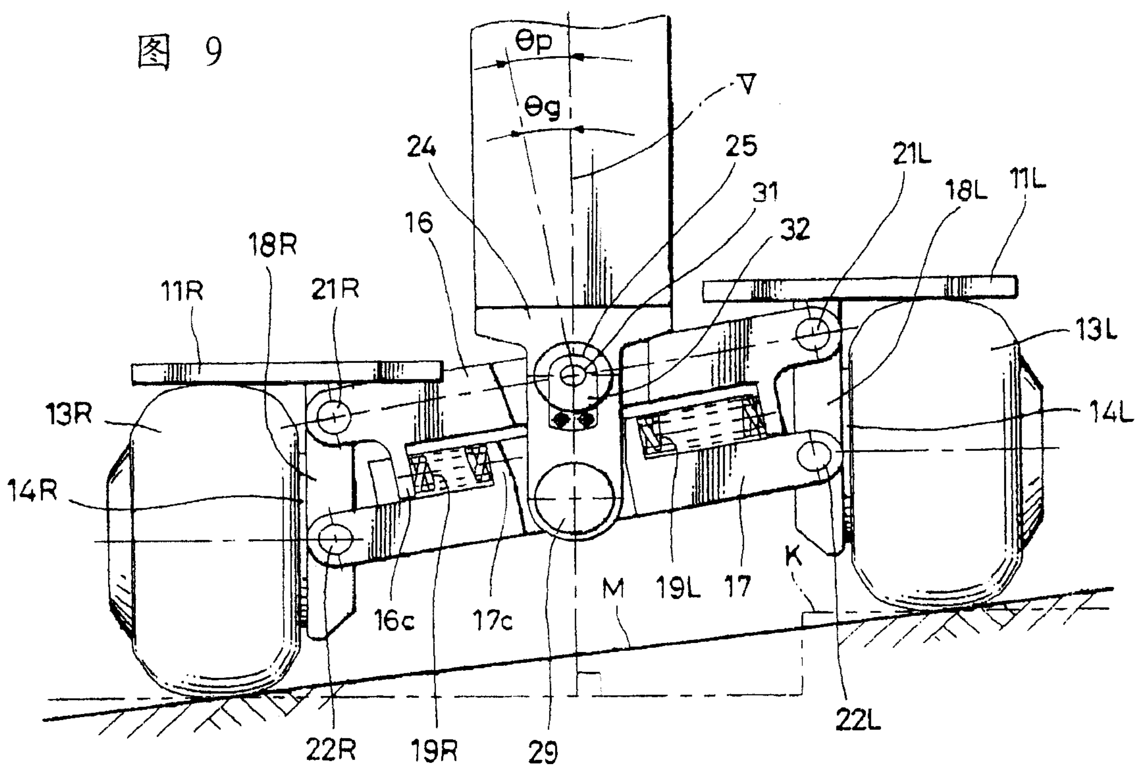

θp
θg
V
24
25
31
32
16
21L
18L
11L
18R
11R
21R
13R
13L
14R
14L
K
M
19L
17
16c
17c
22R
19R
29
22L

图 10

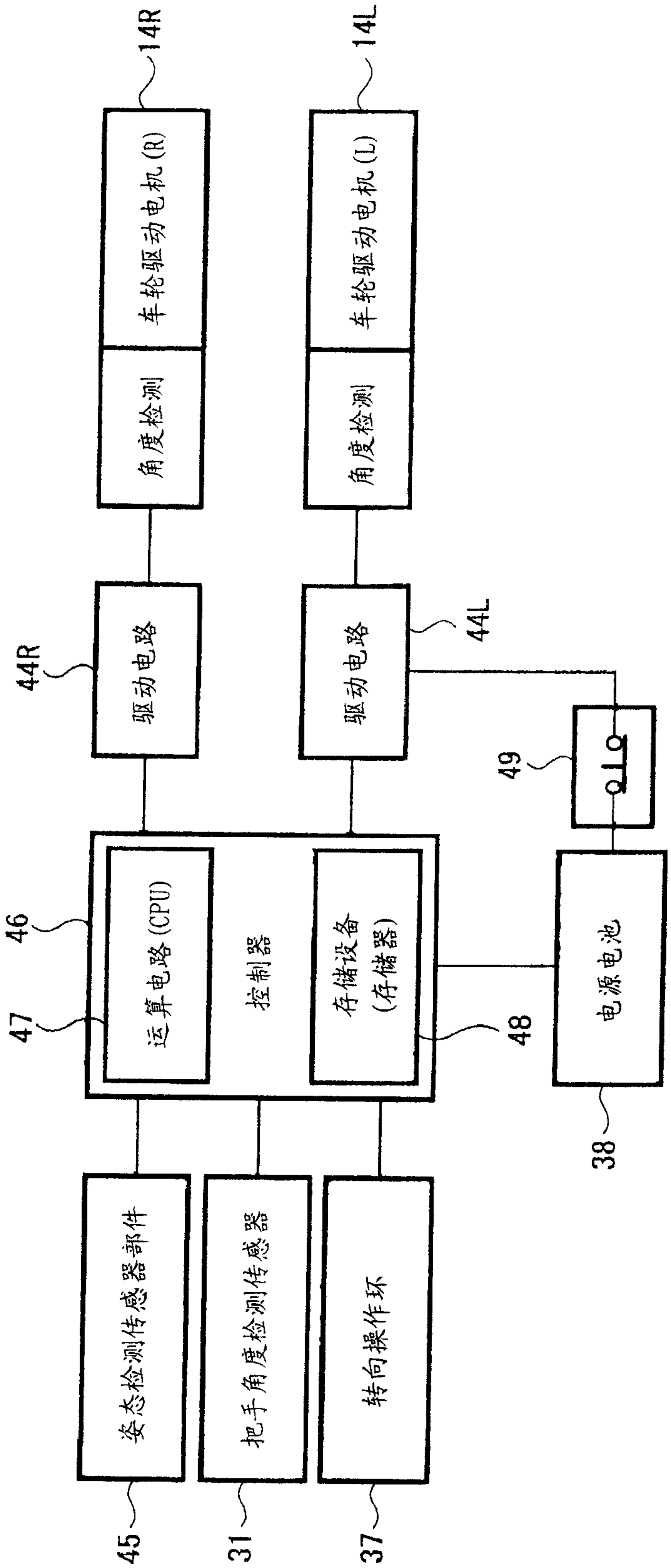

14R
车轮驱动电机(R)
角度检测
14L
车轮驱动电机(L)
角度检测
44R
驱动电路
44L
驱动电路
49
46
47
运算电路(CPU)
控制器
存储设备
(存储器)
48
电源电池
38
姿态检测传感器部件
把手角度检测传感器
转向操作环
45
31
37

图 11

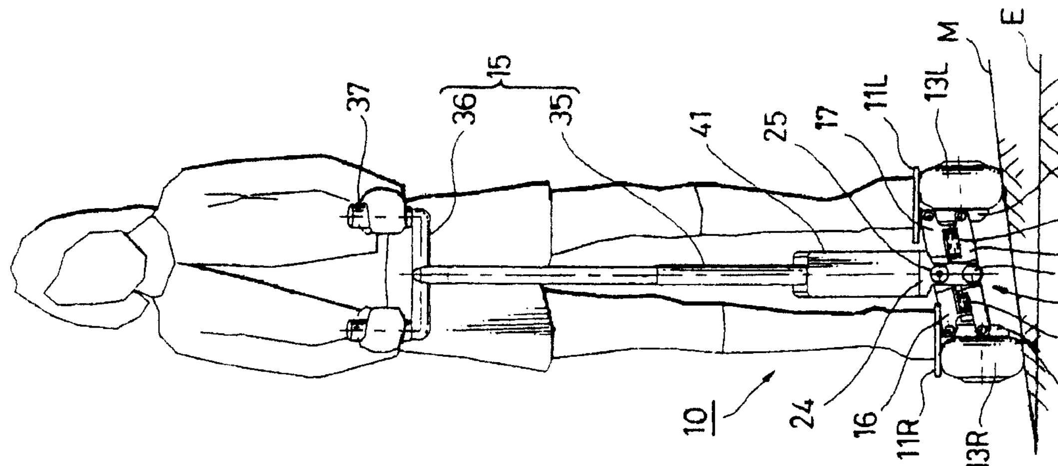


图 12C

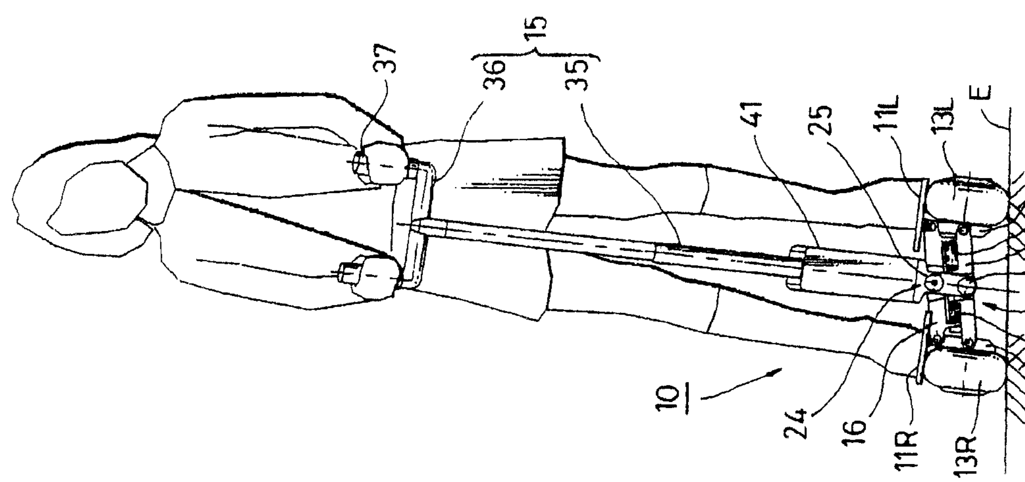


图 12B

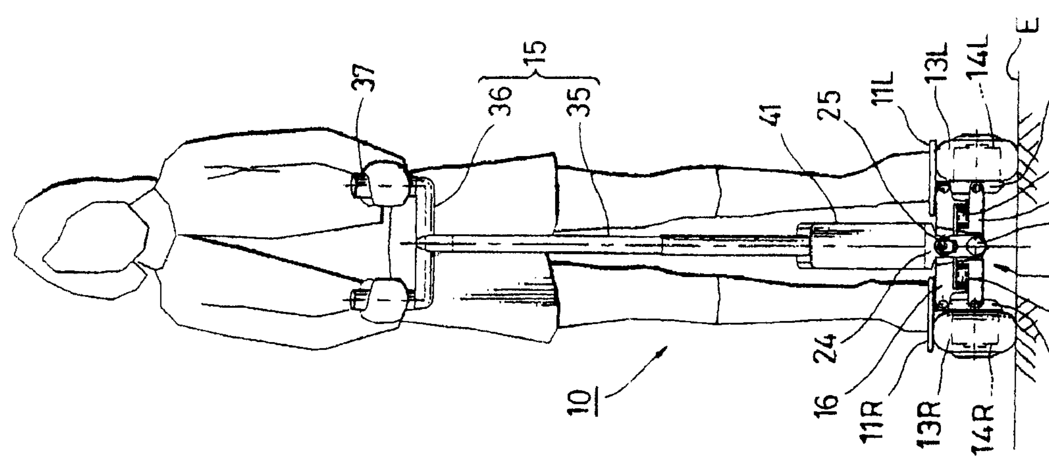


图 12A

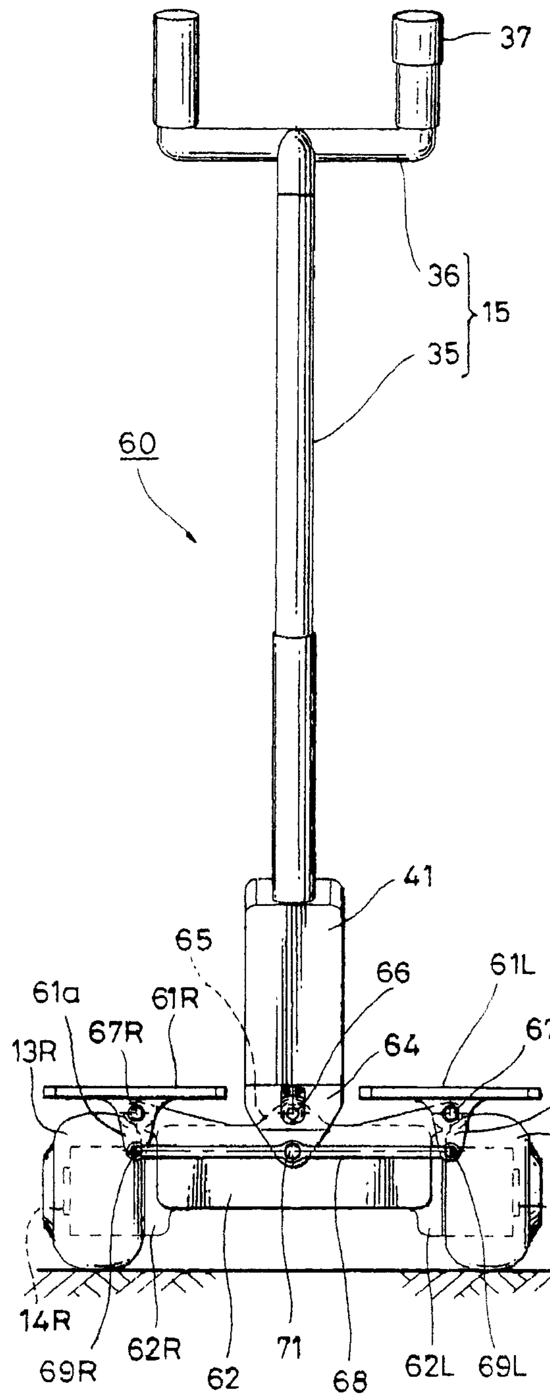

37
36
15
35
60
41
65
66
61L
61a
61R
67R
13R
64
67L
61a
13L
14L
14R
69R
62R
62
71
68
62L
69L

图 13A

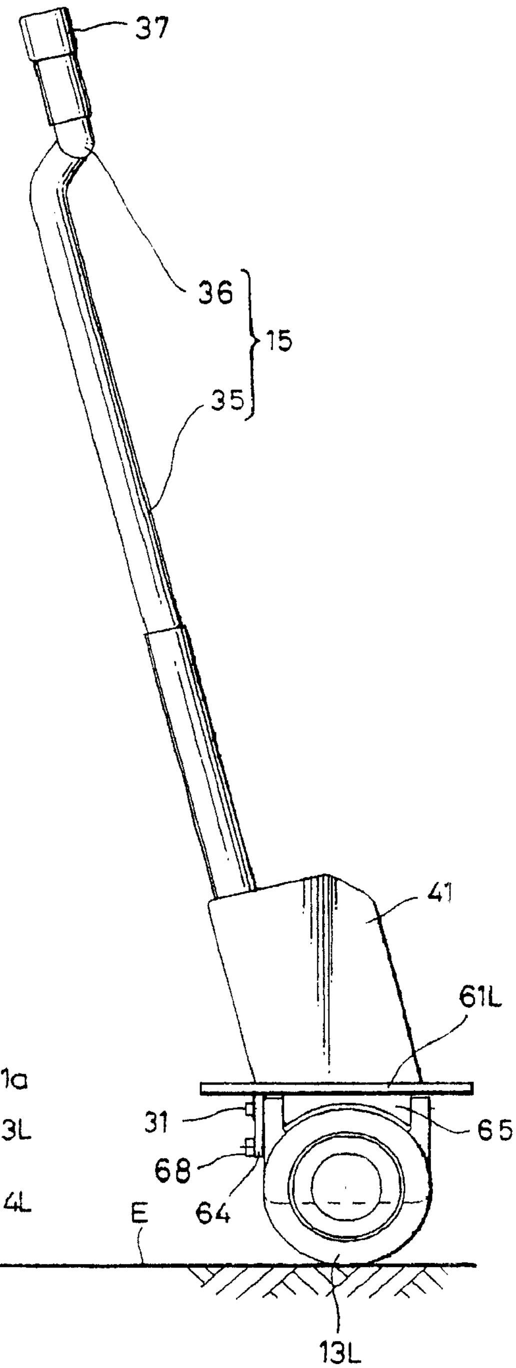

37
36
15
35
41
61L
31
65
68
64
E
13L

图 13B

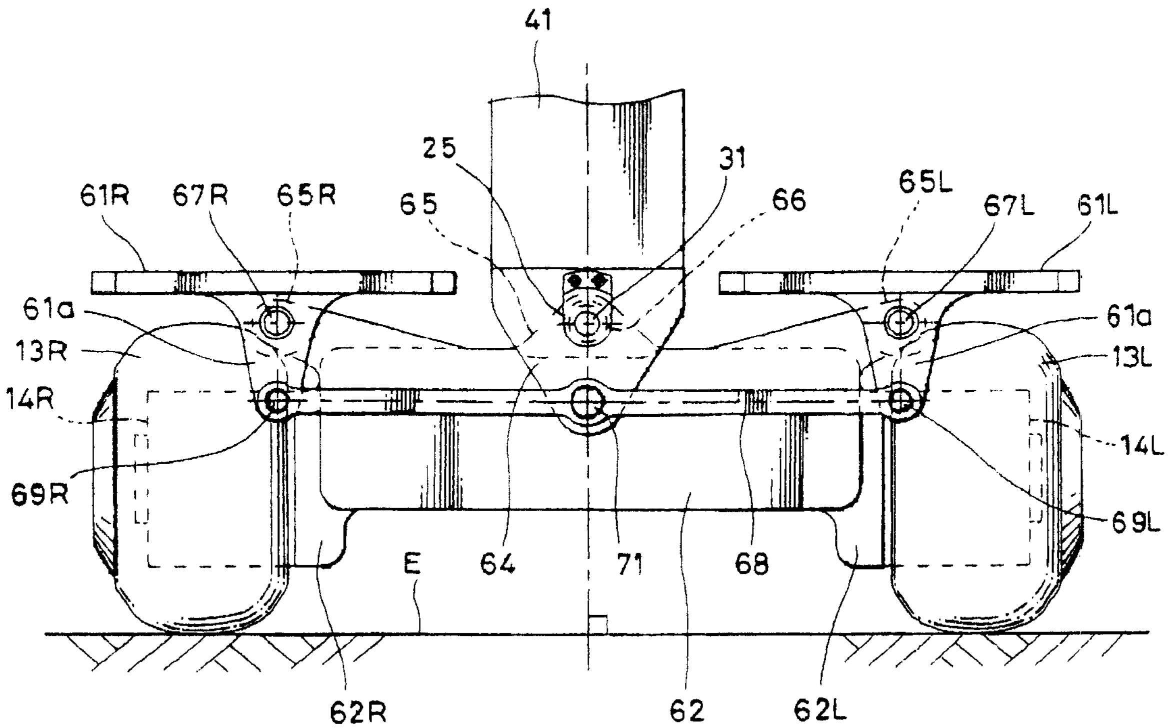

41
25
31
61R
67R
65R
65
66
65L
67L
61L
61a
61a
13R
13L
14R
14L
69R
69L
E
64
71
68
62R
62
62L

图 14A

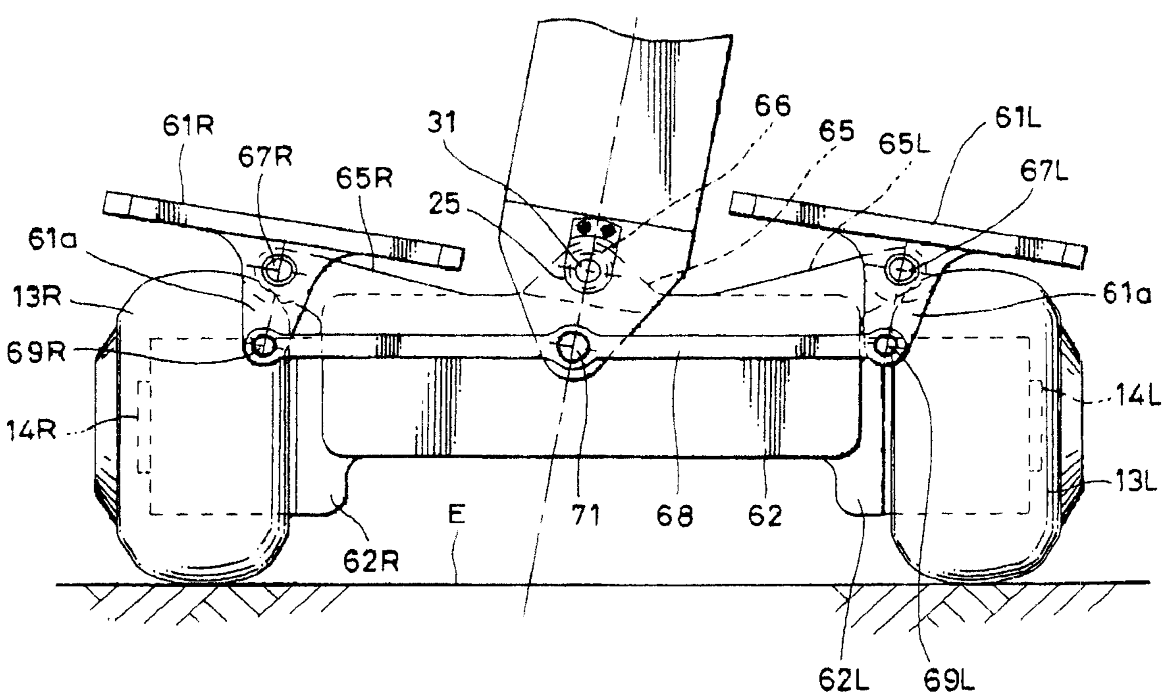
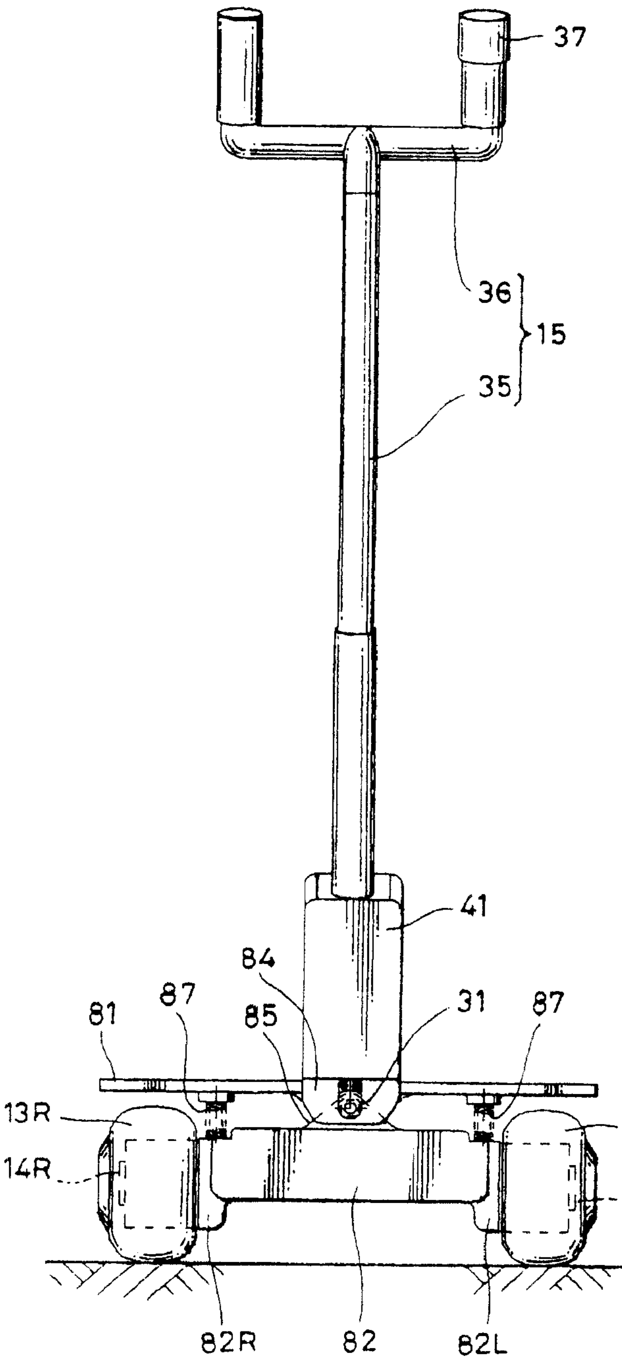
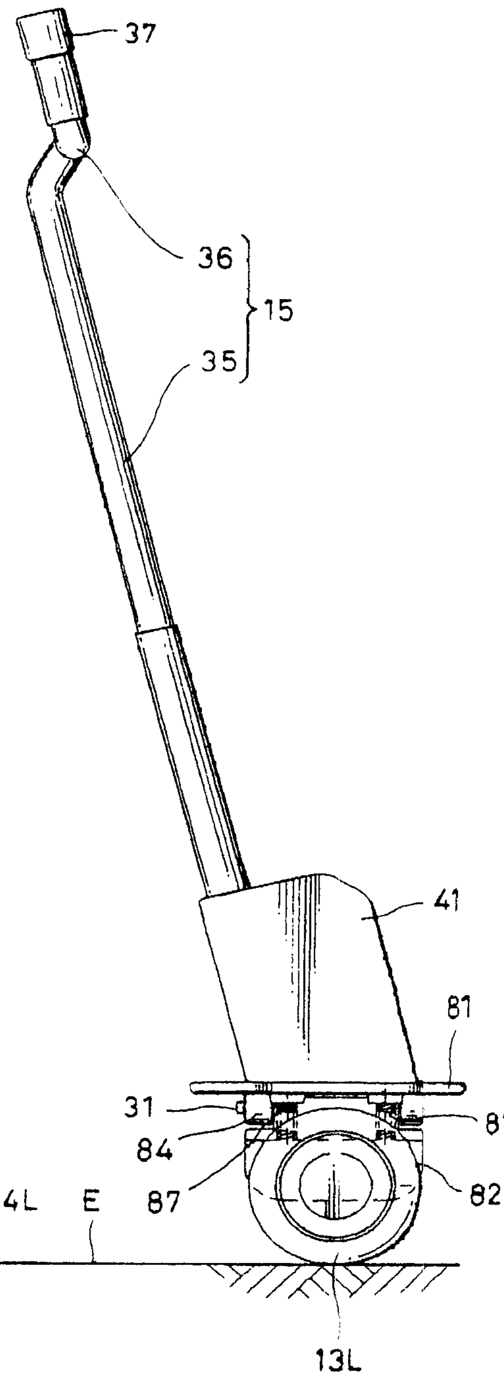

66
61R
31
65
65L
61L
67R
65R
67L
25
61a
61a
13R
69R
14L
14R
13L
E
71
68
62
62R
62L
69L

图 14B



37
36
15
35
41
84
81
87
85
31
87
13R
14R
13L
14L
E
82R
82
82L

图 15A



37
36
15
35
41
81
31
84
87
87
82
87
13L

图 15B

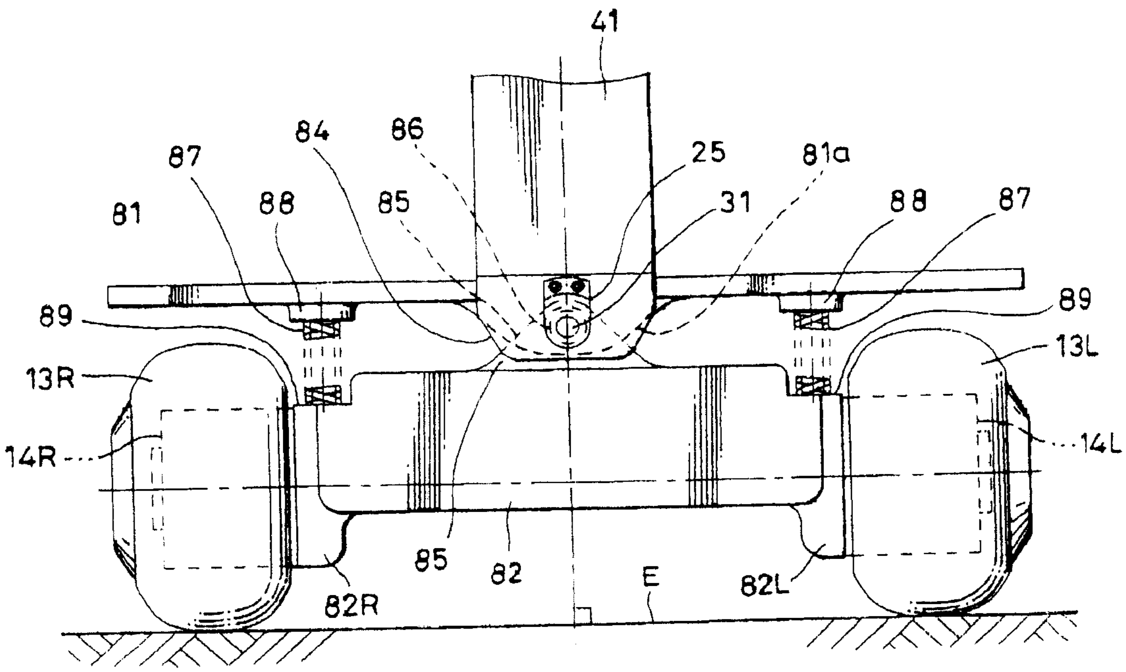

41
84
86
87
25
81a
81
88
85
31
88
87
89
89
13L
13R
14R
14L
85
82
E
82L
82R

图 16A

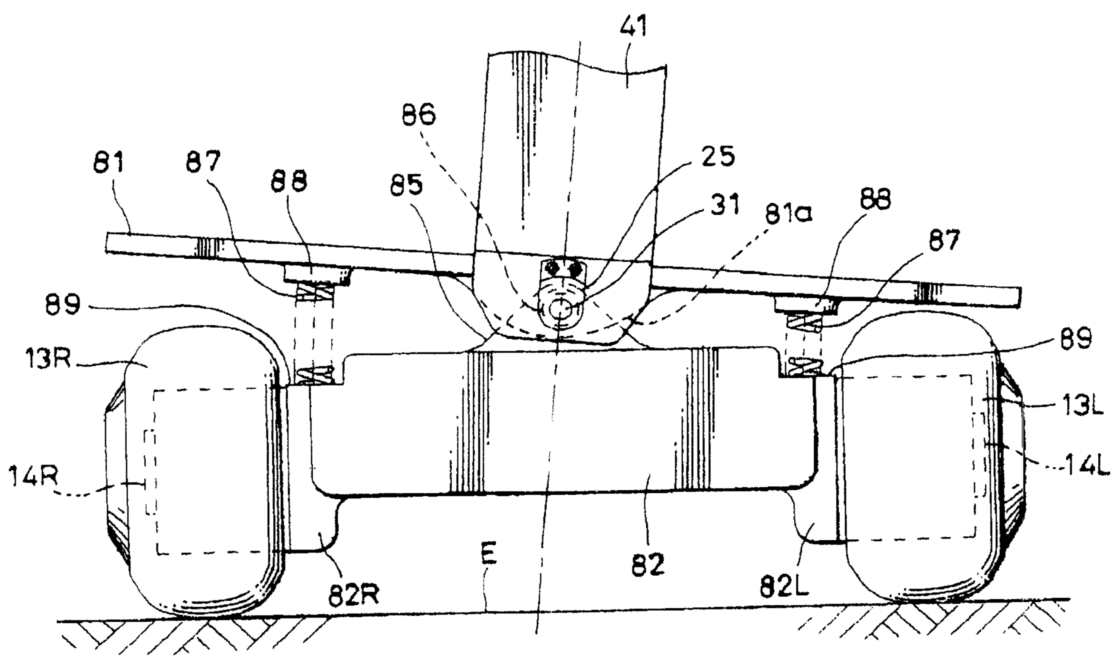

41
86
25
81
87
88
85
31
81a
88
87
89
89
13R
13L
14R
14L
E
82
82L
82R

图 16B

Espacenet

Bibliographic data: CN101920728 (A) — 2010-12-22

Small portable automatic gravity center control vehicle

Inventor(s): YIPENG LI; XUEKAI YAN; GAIHUA GUO; WEI ZHOU; ZHIFA CHEN ± (LI YIPENG, ; YAN XUEKAI, ; GUO GAIHUA, ; ZHOU WEI, ; CHEN ZHIFA)

Applicant(s): WUHAN RUOBITE ROBOT CO LTD ± (WUHAN RUOBITE ROBOT CO., LTD)

Classification: **- international:** ***A63C17/12; B62D51/02; B62D61/00; B62K21/16; B62K3/00***
- cooperative:

Application number: CN200910210535 20091109

Priority number (s): CN200910210535 20091109

Abstract of CN101920728 (A)

The invention discloses a small portable automatic gravity center control vehicle, and relates to a small highly intelligentized portable automatic gravity center control vehicle. The whole vehicle has the characteristics of small volume and light weight; and due to a folded structure, a handle can be folded into a lifting handle, the vehicle can be carried by people and parking space and the possibility that the vehicle is stolen are reduced. The running of the vehicle is controlled by detecting the gravity center shift state of a driver and the vehicle; and the vehicle is flexible to run even in a narrow space. The vehicle has a ladder chassis structure, so driving is more comfortable and safer; and the vehicle is safe, stable and comfortable to run by adopting an intelligent control mode and environmental perception technology.

Notice

CLAIMS CN101920728

1.

The utility model relates to a portable automatic center of gravity control trolley, which is characterized in that it comprises a vehicle body, a wheel, a foldable handle, a steering mechanism, a control system and a safety guarantee system, and the vehicle body is composed of a pedal and a wheel connecting device, and is mainly used for controlling the car by the automatic center of gravity. The bearing part; the wheel is two wheels mounted on the left and right sides of the vehicle body, powered by a motor embedded in the wheel; a foldable handle, a handle that can be retracted and folded according to the height of the user, is the author driving The supporting and operating mechanism includes an operation button, a handle and an indicator panel, and a speaker and a lighting fixture fixed on the handle; the steering mechanism can drive the steering mechanism to rotate by the deflection handle, and change the posture of the pedal and the vehicle body, and Transmitting a vehicle body attitude change signal to a control system; a control system, an embedded computer hardware system and a software system for controlling the movement and monitoring of the automatic center of gravity, including a dynamic balance sensor composed of an acceleration sensor, a gyroscope, and an encoder System, drive circuit, central control system; security system for security Use safe wearer monitoring, feedback and control system by sensing the surrounding environment information, automatically determines the center of gravity of the car in which the operating control environment is safe.

2.

A portable automatic center of gravity control trolley according to claim 1, comprising a retractable handle, a folding mechanism, a steering mechanism, a trapezoidal structure, a motor, a tire, a control box, a control system, and a connecting rod (6-1-5), (6-1-6) and support (6-1-7), (6-1-8), and pin (6-1-1), (6-1-2), (6-1-3), (6-1-4) form a trapezoidal structure, support (6-1-7), (6-1-8), with the pedal, the hub fixed edge, under normal conditions, the trapezoidal structure Keeping the isosceles trapezoid, the pedals remain horizontal, while the wheels remain in the toe state, the handle length is adjustable, and the driver controls the car by hand control of the handles. The height of the handles can be used according to each driver. Habits and body height are adjusted to give the driver the most comfortable and flexible driving state.

3.

A portable automatic center of gravity control trolley according to claim 1, characterized in that it relates to two chassis structures: a six-bar linkage mechanism and a trapezoidal four-bar linkage mechanism; left and right wheels (6-1-9) and (6-1) -17) Through the connection of the chassis, the six-bar linkage mechanism and the trapezoidal four-bar linkage mechanism all have a degree of freedom of left and right deflection. When the driver controls the joystick for control, the joystick drives the six-bar linkage mechanism and the trapezoidal four-bar linkage mechanism. Deflection occurs, causing the vehicle to deflect and reach the goal of controlling the posture of the vehicle body.

4.

A portable automatic center of gravity control trolley according to claim 1, wherein the link mechanism is connected by a pin (7-6), (7-18), (7-16), (7-11) Rod (7-5), (7-21), pedal right support (7-8) and pedal right support (7-19) and lower link (7-12), to achieve the same function as the ladder structure, under The connecting rod (7-12) is connected to the left and right pedal supports through the pin shaft, and is connected to the through-pin shaft and the handle link (7-23), and the pedal support is coupled with the pedal (7-20) and the wheel (7-9). Connected, and as the wheel is in the state of up and down, the lower link is always parallel to the road surface, the upper link (7-5) and the pedal support (7-8) and the handle link (7-23) pass the pin The shaft connection, the upper link (7-21) and the pedal support (7-19) and the handle link (7-23) are connected by the pin shaft, then the handle is turned left and right to drive the upper link to move left and right; (7-14) for the recovery mechanism, fixed to the lower link by the fixed block (7-13), when the handle is deflected to the left, the handle link (7-23) drives the upper link (7-21) to rotate, the link (7-21) The pin (7-18) rotates, the lower end squeezes the return mechanism, and the return mechanism compresses on the left side. The restoring force, the magnitude of the restoring force is proportional to the angle of deflection of the handle, and the greater the angle of deflection of the handle, the greater the restoring force.

5.

A portable automatic center of gravity control trolley according to claim 1, wherein when the handle is deflected, the left and right upper links press the return mechanism ejector pin (8-32) to deform the spring (8-29). Resilience, when the transition is over or there is no need to deflect the handle, the handle automatically returns to the zero-deflection position. When the deflection angle becomes larger, the spring-shaped variable also becomes larger, so the resulting restoring force also becomes larger; (8-13) is the recovery mechanism The fixing block is fixed to the lower link; the spring sleeve (28) is used to prevent the spring from being bent radially, and is fixedly connected with the guiding end sleeve (8-27) and the grid (8-30).

6.
A portable automatic center of gravity control trolley according to claim 1, characterized by a wheel side plate (9-24), a motor (9-38), a motor rear end cover (9-10), and an encoder (9- 41), the hub (9-35), (9-36) and the tire (9-9), the wheel part is connected to the pedal through the (9-24) wheel side plate, and the motor shaft passes through the coupling (9- 40) Connected to the encoder code wheel (9-41) to feed the motor speed back into the control system; the motor (9-38) is fixed to the motor rear end cover (9-10), and the motor rear end cover (9-10) Connected to the wheel side plates (9-24), the motor output is the outer rotor output, which is fixed to the inner hub (9-36); the inner hub (9-36) and the outer hub (9-36) are both wedge-shaped By clamping the tire inside and outside, the degree of clamping is adjusted by adjusting the tightening of the screw to prevent relative sliding between the hub and the tire.

7.
A portable automatic center of gravity control trolley according to claim 1, wherein in the normal state, when the vehicle is on the horizontal ground, the posture of the body link mechanism, the upper link, the lower link and the pedal support constitute an isosceles. Trapezoidal, at this time, the length of the spring c = d, the angle a = b, the kick plate is in a horizontal position; when driving on an inclined road, in order to ensure that the driver is in a comfortable posture, the upper link, the lower link and the pedal support The shape of the structure is deformed; since the shape formed is not a parallelogram, that is, the spring c is in a compressed state, d is in a relaxed state, d>c, and the larger the inclination angle, the larger the spring length difference dc, and the more the restoring force Large, at this time, the angle a<b, and assuming that the angle before the deflection is a1=b1, then a1-a>b-b1, that is, the degree of inclination of the pedal is different at this time, and the pedal is at a horizontal position at a higher position. The pedal with a lower position is slightly inclined to the inside of the vehicle; the driver is more comfortable to drive, and the lower horizontal position of the wheel is inclined toward the inside of the vehicle body, so that the vehicle body is not easily turned over, and the rollover is reduced. Possible.

8.
A portable automatic center of gravity control trolley according to claim 1, wherein the handles can be adjusted to different lengths according to the driver's height or folding requirements; the front poles (13-1-118) and the rear poles (13- 1-119) Can be fixed or slid by the movable pin (13-1-120), the rear bar (13-1-19) has a fixing hole, and the movable pin (13-1-120) is convex when sliding to the fixing hole Out, the front rod and the rear rod are fixedly connected. When the movable pin is pressed hard, the front rod and the rear rod are disconnected from each other, and the front rod and the rear rod can be relatively slid to realize the expansion and contraction; the folding mechanism passes through the U-shaped block (13-2- 43) connected to the ladder structure vertical rod (13-2-23), the T-shaped block (13-2-48) is fixedly connected to the handle (13-2-44), and the rotating shaft (13-2-50) is passed through the U-shaped block. (13-2-43) and the holes in the T-shaped block (13-2-48) make the U-shaped block (13-2-43and the T-shaped block (13-2-48form a hinge relationship, and the other end rotates the shaft) The outer casing spring (13-2-46) is screwed to the nut (13-2-45); (13-2-49) is the pin fixed on the large circular surface of the pin (13-2-50), normal state Next, the nut is pressed by the spring force, so that the large round face of the pin is close to the U-shaped block (13-2-43), and the pin (13-2-49)

passes through the U-shaped block (13-2-43) at the same time. T shape The fixing hole, the handle is fixed, when the nut is pressed hard (13-2-45, the spring (13-2-46) is compressed, the pin (13-2-50) drives the pin (13-2-49) to the U The block (13-2-43) moves outside. When the pin is separated from the fixing hole of the T-shaped block, the U-shaped block and the T-shaped block are hinged, and can be switched between the folded state and the upright state.

9.

A portable automatic center of gravity control trolley according to claim 1, wherein the suspension system is mainly composed of a swinging side arm (14-51), a strong spring (14-52), a rotating shaft (14-53), a rotating shaft and a pedal. Connected, the swinging side arm (14-51) is rotatable about the rotating shaft (14-53), the end of the swinging side arm is connected with the spring 14-52), and the spring compression and extension can drive the swinging side arm to swing, swinging the side arm (14-51) Connected to the wheel part, that is, when the pressure of the wheel part is abrupt, causing the wheel to move up and down, the swing arm is swung and the spring is compressed.

10.

A portable automatic center of gravity control trolley according to claim 1, characterized in that the modular design is adopted, and the system is divided into four parts, namely a motor drive control part (16-54), a sensor signal conditioning and control algorithm part (16). -55), system interface and power supply part (16-57), wireless controller part (16-56); motor drive control part (16-54) is connected with sensor signal conditioning and control algorithm part (16-55), sensor The signal conditioning and control algorithm portion (16-55) is coupled to the wireless controller portion (16-56), and the sensor signal conditioning and control algorithm portion (16-55) is coupled to the system interface and power supply portion (16-57).

Notice

DESCRIPTION CN101920728

A portable automatic center of gravity control car, which relates to a highly intelligent portable automatic center of gravity control car, which has the characteristics of small size and light weight, and adopts a folding structure, so that the handle can be folded to become a handle, so that it can be carried around. , reduce the space of parking cars and the possibility of being stolen. It controls the operation of the vehicle by detecting the shifting state of the driver and the center of gravity of the vehicle. It is flexible and easy to operate even in a small space. The trapezoidal chassis structure makes driving more comfortable and safer. The intelligent control mode and environment-aware technology make the car run safely, stably and comfortably.

Portable automatic center of gravity control trolley

Technical field:

BACKGROUND OF THE INVENTION 1. Field of the Invention This invention relates to a personal assisted vehicle, and more particularly to a vehicle that is driven by a control system to detect a person's weight deviation from the center of gravity of the vehicle and to control its operation. The two wheels are driven by the motor and arranged horizontally and horizontally.

Background technique:

The two-wheel self-balancing device and technology originated from the inverted pendulum theory. The first two-wheel balancing device was invented by Japanese Yamato Kazuo. From 2002 to 2003, it was used by the US company for the ibot wheelchair technology and the segway two-wheel balance car. Used in shopping malls, golf courses, airports, etc., is considered to be an epoch-making means of transportation. 2008In the year, Toyota of Japan began to develop similar products.

One such vehicle of the prior art has been disclosed, for example, in Patent Document 1. The vehicle disclosed in Patent Document 1 is that "in a riding state where the center of gravity is high, the rider can stably travel, and the upper part of the body does not wobble from side to side. The vehicle includes: a pedal for driver riding; a vehicle body; when the traveling direction is set to a rolling axis, the vehicle body supports the pedal so as to be able to change in a rolling direction about a rolling axis as a center Gesture; a pair of wheels. The pair of wheels are located on both sides of the same axis in a direction perpendicular to the traveling direction of the vehicle body and are rotatably supported by the vehicle body; a pair of wheel driving devices that individually drive and rotate the pair of wheels; and Changing the posture of the pedal or indirectly changing the handle of the posture through the vehicle body. "

According to the vehicle having the appeal structure in Patent Document 1, it is desirable to achieve the effect that "the rider is due to gravity when traveling on an inclined road surface inclined obliquely to the exercise direction, or when the steering is due to the centrifugal force, the rider Will be more stable."

According to Patent Document 2, the vehicle described therein is an "electric vehicle distributed around two wheels. Including the body, the wheel and the electric drive system, the wheels with the motor are mounted on both sides of the vehicle body, and the power supply, the control circuit, the drive circuit, the sensor and the control switch are mounted on the vehicle body, and the shaft is rotated between the wheel and the vehicle body. The connection, speed sensor and angle sensor transmit the rotation angle and inclination information of the wheel and the vehicle body to the control circuit, and use the software to calculate the control amount, thereby controlling the movement and balance state of the wheel and the vehicle body. In the patent document 2, when the coaxial vehicle is riding, steering control is performed by a steering switch on the handle, and the pedal is parallel to the ground during riding.

[Patent Document 1] Published Patent Application No. 200610089876.3

[Patent Document 2] discloses Patent Application No. 02138386652.8 and Patent Application No. 200620105334.6

[Patent Document 3] U.S. Patent 6,581,714 B1

However, in the vehicle described in Patent Document 1, the vehicle body is a parallel connection mechanism, and when the steering radius is small, the angle at which the rider leans is large, and at this time, the rider easily turns over.

In the vehicle described in the above Patent Document 2, the upper surface of the pedal is continuous, and the vehicle body cannot change the posture in the course of turning, and when the centrifugal force becomes large, the vehicle body is liable to roll over. Further, in the patent document 2, when the self-balancing vehicle rides on an inclined road surface, the vehicle body and the pedal are both inclined, which makes the rider uncomfortable and has a risk of rollover.

The existing vehicles are complex in structure and costly, and the market promotion is rather slow. Improving technology, improving performance, reducing costs, and promoting popularization are issues that need to be addressed.

Summary of the invention:

The object of the present invention is to provide a portable automatic center of gravity control car which adopts a dual backup motor control strategy, and two sets of motor drive and control systems adopt mutual backup mode to ensure stable operation and operational safety in the event of a failure. Using smarter and safer and more reliable software system, not only real-time error correction from hardware, but also guarantee the reliability of operation, and real-time detection and error correction from software layer by layer, not only establish feedback detection between modules, emergency alarm mechanism, Moreover, a real-time feedback and error response mechanism is established inside each module to ensure the safety, reliability and stability of the automatic center of gravity control car during operation. It solves the problem that the user's standing force is uncomfortable due to the tilting of the left and right pedals during cornering, keeping the center of gravity of the person and the vehicle at the same time shifting. When turning, the possibility of rollover is reduced, and the safety and stability are enhanced.

In order to solve the problems of the background art, the present invention adopts the following technical solutions: it comprises a vehicle body, a wheel, a foldable handle, a steering mechanism, a control system, a safety guarantee system, and the vehicle body is composed of a pedal and a wheel connecting device, The automatic center of gravity controls the main load-bearing part of the trolley; the wheels are two wheels mounted on the left and right sides of the vehicle body, powered by a motor embedded in the wheel; a foldable handle, a telescopic foldable and foldable according to the user's height The handle is a mechanism for the author to drive and operate. The handle includes an operation button, a handle and an indicator panel, and a speaker and a lighting fixture fixed on the handle; the steering mechanism can drive the steering mechanism to rotate through the deflection handle, and change the pedal and a posture of the vehicle body and transmitting a vehicle body attitude change signal to the control system; a control system for the embedded computer hardware system and software system for controlling the movement and monitoring of the automatic center of gravity, including an acceleration sensor, a gyroscope , dynamic balance sensor system composed of encoder, drive circuit, central control system; Full protection system for the protection of the user using the security monitoring, feedback and control system by sensing the surrounding environment information, automatically determines the center of gravity of the car in which the operating control environment is safe.

The automatic center of gravity control trolley pedal of the present invention is non-continuous, and the trapezoidal steering mechanism allows the body posture and center of gravity to be adjusted as the rider rides on a sloping road, during operation, the control system and The monitoring system controls the operation of the cart based on the degree of center shift and the angle of the handle offset. When the vehicle is turning, if the car body is not tilted, it can be seen from the force diagram that the centrifugal force F and the gravity G force F are in a state of unbalanced force, when the turning speed V and the turning radius R: V2/g>a/2h When the car body will roll over, it is very unsafe, and when turning, the car body tilt will make the centrifugal force F and the gravity G force F convenient in the direction of the car body, the force is in equilibrium, and the car body car The bending radius R and the inclination angle θ of the vehicle body are related to the speed v of the vehicle body at this time, that is, R=v<2>/(g.tan θ), which ensures that the tilting of the vehicle body at this time causes the centrifugal force F to be separated from the gravity G. Conveniently in the direction of the car body, the force is in balance, which improves driving safety and comfort.

In the normal state, when the car is on the level ground, the secondary state of the car body linkage mechanism is as shown in the figure. The upper link, the lower link and the pedal support constitute an isosceles trapezoid. At this time, the spring length c=d, the angle a=b, the kick plate is in a horizontal position. When driving on an inclined road surface, in order to ensure that the driver is in a comfortable posture, the shape formed by the upper link, the lower link and the pedal support is deformed, since the formed shape is not a parallelogram, that is, at this time, the spring c is at In the compressed state, d is in a relaxed state, d>c, and the larger the tilt angle, the larger the spring length difference dc, the greater the restoring force, at this time, the angle a<b, and assuming the angle before the deflection is a1=b1, then a1-a>b-b1, that is, $\alpha > \beta$. At this time, the inclination of the pedal is different. At this time, the pedal is at a horizontal position, and the pedal with a lower position is slightly tilted toward the vehicle body. The driver is more comfortable to drive, and the lower horizontal position of the wheel is inclined toward the inside of the vehicle body, so that the vehicle body is not easily turned over, reducing the possibility of rollover.

The invention makes it easier to control the deviation of the center of gravity by controlling the trolley with the legs, and truly controls the operation of the vehicle with the posture of the body and the position of the center of gravity. The control of the armrest easily leads to inconsistency between the car body and the driver's center of gravity, and the safety and stability are easily out of control. The leg in the human body is the key to the control of the center of gravity. The automatic center of gravity control car without the handle leg control of the present invention solves this problem, keeping the center of gravity of the person and the vehicle at the same time offset, and the possibility of rollover occurs during the turning. Reduced, increased security and stability.

The present invention solves the problem of bumping and vibration amplification on uneven road surfaces. For a vehicle without a suspension system, during the uneven road driving, the vibration amplitude of the vehicle's center of gravity position will reach A= θ *Л*h/180, that is, if the ground has a bump of angle θ, then the person's weight is at the center of gravity. The amplitude of the vibration is θ *Л*h/180 (h is the height of the human heart). The automatic center of gravity control car of the present invention controls the trapezoidal structure of the chassis of the car, and the two wheels are not coaxial, and the pedals are not continuous, so the unevenness of the ground is not transmitted or enlarged.

In the present invention, the automatic center of gravity control trolley control lever and the armrest are retractable and foldable, and portable. The telescopic and leg control levers are telescopic and foldable. After folding, the trolley is small in size, and the armrests and levers become handles, allowing the trolley to be carried at hand.

The invention adopts a dual backup motor control strategy, and the two sets of motor drive and control systems adopt mutual backup mode to ensure stable operation and safe operation in the event of a fault. Using smarter and safer and more reliable software system, not only real-time error correction from hardware, but also guarantee the reliability of operation, and real-time detection and error correction from software layer by layer, not only establish feedback detection between modules, emergency alarm mechanism, Moreover, a real-time feedback and error response mechanism is established inside each module to ensure the safety, reliability and stability of the automatic center of gravity control car during operation.

BRIEF DESCRIPTION OF THE DRAWINGS:

1-1 is a schematic structural view of the automatic center of gravity control of the handrail type car driving on a horizontal road surface according to the present invention;

1-2 is a schematic structural view of the automatic center of gravity control of the armrestless clip type car driving on a horizontal road surface according to the present invention;

2-1 is a schematic structural view of the automatic center of gravity control of the handrail type car driving on an inclined road surface according to the present invention;

2-2 is a schematic structural view of the automatic center of gravity control of the armrestless clip type car driving on a horizontal road surface according to the present invention;

3-1 is a schematic structural view showing a state in which an automatic center of gravity control of a handrail type vehicle is turned when the automatic center of gravity is turned;

3-2 is a schematic structural view showing a state in which the automatic center of gravity control of the armrestless clip type car is turned when the automatic center of gravity is turned;

Figure 4-1-4-2 is a schematic structural view of the automatic center of gravity control of the handrail type car turning on a horizontal road surface according to the present invention;

Figure 5-1-5-2 is a top view of the automatic control trolley of the present invention;

6-1 is a schematic structural view of a hand-controlled two-wheel self-balancing vehicle according to the present invention;

6-2 is a schematic structural view of a two-wheel self-balancing vehicle with a leg clamp control type according to the present invention;

Figure 7 is a schematic view showing the trapezoidal structure of the chassis of the automatic center of gravity control car according to the present invention;

Figure 8 is a schematic view showing the structure of the automatic center of gravity control trolley handle recovery according to the present invention;

Figure 9 is a schematic structural view of the automatic center of gravity control trolley wheel according to the present invention;

10-1-10-2 is a schematic structural diagram of a structure of a trapezoidal body of an automatic center of gravity control car according to the present invention;

11-1 is a schematic structural view showing the motion state of the automatic control trolley being a four-link structure according to the present invention;

11-2 is a schematic structural view showing the motion state of automatically controlling the tilting of the car body according to the present invention;

12-1 is a schematic structural view of the automatic control trolley when the vehicle is in an inclined road surface or a turning state according to the present invention;

12-2 is a schematic structural view of the automatic control car body when the vehicle body is tilted according to the present invention;

13-1 is a schematic view showing the telescopic structure of the handle of the automatic center of gravity control trolley of the present invention;

13-2 is a schematic view showing the folding mechanism of the automatic center of gravity control trolley handle of the present invention;

13-3 is a schematic enlarged view of a portion A of FIG. 13-2;

14-1 is a schematic structural view of an embodiment of a leg-controlled automatic center of gravity control car according to the present invention;

14-2 is a schematic structural view of an embodiment of a thigh inner control trolley according to the present invention;

14-3-14-4 is a schematic structural view of an embodiment of a leg-controlled automatic center of gravity control trolley according to the present invention;

14-5-14-6are schematic structural views of an embodiment of a suspension chassis according to the present invention;

Figure 15is a hardware block diagram of the automatic center of gravity control trolley control system;

Figure 16is a block diagram showing the modularization of the automatic center of gravity control trolley software system of the present invention;

17-1 is a functional diagram of the internal software of the sensor signal conditioning and control algorithm module 55in the automatic center of gravity control trolley software system of the present invention;

17-2is a software flow diagram of a sensor signal conditioning and control algorithm module 55in the automatic center of gravity control trolley software system of the present invention;

18-1 is a software functional diagram of the motor control module 54in the automatic center of gravity control trolley software system of the present invention;

18-2is a software flow diagram of the motor control module 54of the present invention;

19-1 is a software functional diagram of a system interface and power control module 57in the automatic center of gravity control trolley software system of the present invention;

19-2is a software flow diagram of the system interface and power management module 57in the automatic center of gravity control trolley software system of the present invention;

20-1 is a software functional diagram of the wireless control module 56of the automatic center of gravity control trolley software system of the present invention;

20-2 is a flowchart of software functions of the wireless control module 56of the present invention.

detailed description:

The specific embodiment adopts the following technical solutions: it comprises a vehicle body, a wheel, a foldable handle, a steering mechanism, a control system, a safety guarantee system, and the vehicle body is composed of a pedal and a wheel connecting device, and is a main load-bearing part of the automatic center of gravity control trolley. The wheels are two wheels mounted on the left and right sides of the vehicle body, powered by a motor embedded in the wheel; a foldable handle, a handle that can be retracted and folded according to the height of the user, is a user's driving support and The operating mechanism includes an operating button, a handle and an indicator panel, and a horn and a lighting fixture fixed on the handle; the steering mechanism can drive the steering mechanism to rotate by the deflection handle, change the posture of the pedal and the vehicle body, and change the posture of the pedal and the vehicle body. The body posture change signal is transmitted to the control system; the control system is used for the embedded computer hardware system and the software system for controlling the movement and monitoring of the automatic center of gravity, and comprises a dynamic balance sensor system composed of an acceleration sensor, a gyroscope and an encoder, Drive circuit, central control system; safety guarantee system, used to ensure To use security monitoring, feedback and control system by sensing the surrounding environment information, automatically determines the center of gravity of the car in which the operating control environment is safe.

Referring to Figure 1-1-1-2, during the exercise, the armrest type vehicle controls the movement of the vehicle through the armrests, while the armrestless grip type vehicle controls the forward and backward movement of the vehicle through the leg levers on the left and right sides of the knee. And turning.

Referring to Figure 1-1-2-1, when the driver is driving on a sloping road surface, the trapezoidal structure will rotate similarly to the turning and cause the pedal surface to tilt. When the vehicle body is at a high position, the pedal tilt angle and the slope angle When the time is the same, the pedal surface is still horizontal, and the trapezoidal structure is used. At this time, the pedal with the higher inclination angle of the pedal is larger, and the center of gravity is biased toward the higher pedal direction, which is in a more comfortable driving state. . At this time, the center of gravity of the driver and the vehicle body is located on the two-wheel symmetry plane, which reduces the possibility of rollover of the vehicle body.

Referring to Figure 3-1-3-2, when the car body turns, the car body is tilted. At this time, the turning radius R of the car and the inclination angle θ of the car body are related to the speed v of the car body at this time, that is, R=v< 2>/(g.tan θ).

See Figure 4-1-4-2for a diagram of the force of the vehicle body tilting and not tilting. If the car body is not tilted, it can be seen from the force diagram that the centrifugal force F and the gravity G force F are in an unbalanced state, when the turning speed V and the turning radius R: V2/g>a/2h (where a is The distance between the two wheels, h is the height of the driver's center of gravity), the car body will roll over, it is very unsafe, and when turning, the car body tilt will make the centrifugal force F and gravity G together force F to facilitate along the car In the body direction, the force is in equilibrium.

Referring to Figure 5-1-5-2, the body of the car is small in size, occupying a small space, and is easy to carry and store after folding.

See Figure 6-1, including the retractable handle, folding mechanism, steering mechanism, trapezoidal structure, motor, tire, control box, control system. Connecting rods 6-1-5, 6-1-6and supports 6-1-7, 6-1-8, and pins 6-1-1, 6-1-2, 6-1-3, 6- 1-4constitutes a trapezoidal structure, supporting 6-1-7, 6-1-8, and the pedal and the hub are fixed. Under normal conditions, the trapezoidal structure maintains a positive isosceles trapezoid, then the pedal is kept horizontal, and the wheel Keeping the toe state, the handle length is adjustable, the driver controls the car by hand control of the handle, the handle height can be adjusted according to each driver's usage habits and body height, so that the driver is most comfortable and most In the state of ease of driving. Referring to Figure 6-2, the driver grips the leg-controlled joystick through the two legs and adjusts the target of the automatic center of gravity control by the posture adjustment.

Referring to Figure 6-1-6-2, it relates to two chassis configurations: a six-bar linkage and a trapezoidal four-bar linkage. The left and right wheels 6-1-9and 6-1-17are connected through the chassis, and the six-bar linkage and the trapezoidal four-bar linkage have a degree of freedom of left and right deflection. When the driver controls the joystick to control, the joystick drives The six-bar linkage mechanism and the trapezoidal four-bar linkage mechanism are deflected, thereby deflecting the entire vehicle and achieving the goal of controlling the posture of the vehicle body.

Referring to Figure 7, the linkage mechanism consists of pins 7-6, 7-18, 7-16, 7-11, upper links 7-5, 7-21, pedal right supports 7-8and pedal right supports 7-19And the lower link 7-12is composed to realize the same function as the trapezoidal structure, the lower link 7-12is connected with the left and right pedal supports through the pin shaft, and is connected with the through pin shaft and the handle link 7-23, and the pedal support Connected to the pedal 7-20and the wheels 7-9, and the upper and lower links are always parallel with the road surface as the wheel is in the state of being in the upper and lower links, the upper link 7-5and the pedal support 7-8and the handle link 7-23is connected by a pin, the upper link 7-21 is connected with the pedal support 7-19and the handle link 7-23through the pin shaft, then the handle is turned left and right to drive the upper link to move left and right. 7-14is a recovery mechanism, which is fixed to the lower link by the fixing block 7-13. When the handle is deflected to the left, the handle link 7-23 drives the upper link 7-21 to rotate, and the connecting rod 7-21 is wound around the pin. When the 7-18 rotates, the lower end squeezes the return mechanism, and the left side of the recovery mechanism compresses to form a restoring force. The magnitude of the restoring force is proportional to the deflection angle of the handle. The larger the deflection angle of the handle, the greater the restoring force.

Referring to Figure 8, the handle return mechanism, 8-24 and 8-33 are adjusting nuts, adjusting the length of the jack, and adjusting the length of the jack to ensure the contact of the return mechanism with the upper link, to ensure the return position of the handle, and Adjust the amount of restoring force.

When the handle is deflected, the left and right upper links press the return mechanism ejector 8-32 to deform the spring 8-29 to generate a restoring force. When the transition ends or the deflection handle is not required, the handle automatically returns to the zero deflection position when the deflection When the angle becomes larger, the spring-shaped variable also becomes larger, so the restoring force formed also becomes larger. 8-13 is the return mechanism fixing block, which is fixed with the lower link. The spring sleeve 28 is used to prevent the spring from being bent radially and is fixed to the guide end sleeves 8-27 and 8-30.

Referring to Figure 9, the wheel portion is composed of a wheel side plate 9-24, a motor 9-38, a motor rear end cover 9-10, an encoder 9-41, a hub 9-35, a 9-36, and a tire 9-9. The wheel part is connected to the pedal through the 9-24 wheel side plate, and the motor shaft is connected to the encoder code wheel 9-41 through the coupling 9-40, and the motor speed is fed back to the control system. The motor 9-38 is fixed to the motor rear end cover 9-10, the motor rear end cover 9-10 is connected to the wheel side plate 9-24, and the motor output is the outer rotor output, which is fixed to the inner hub 9-36. The inner hub 9-36 and the outer hub 9-36 are both wedge-shaped, and the tire is clamped internally and externally, and the degree of clamping is adjusted by adjusting the tightening of the screw to prevent relative sliding between the hub and the tire.

See 10-1. Under normal conditions, when the car is on the level ground, the secondary state of the car body linkage mechanism is as shown in the figure. The upper link, the lower link and the pedal support form an isosceles trapezoid. At this time, the length of the spring c =d, angle a = b, the kick plate is in a horizontal position. When driving on an inclined road surface, in order to ensure that the driver is in a comfortable posture, the shape formed by the upper link, the lower link and the pedal support is deformed; referring to Fig. 10-2, since the formed shape is not a parallelogram, At this time, the spring c is in a compressed state, d is in a relaxed state, d>c, and the inclination angle is larger, the spring length difference dc is larger, the restoring force is larger, at this time, the angle a<b, and the angle before the deflection is assumed to be A1=b1, then a1-a>b-b1, that is, the inclination of the pedal is different at this time. At this time, the pedal is at a horizontal position, and the pedal with a lower position is slightly treated to the vehicle body. tilt. The driver is more comfortable to drive, and the lower horizontal position of the wheel is inclined toward the inside of the vehicle body, so that the vehicle body is not easily turned over, reducing the possibility of rollover.

Refer to Figure 11-1 for the 4-link trapezoidal mechanism. Under normal conditions, the trapezoidal structure is in an isosceles trapezoidal state. When the trolley is on an inclined road or in a turning state, the trapezoidal structure of the body 4 link changes, see Figure 11-2-. At this time, the car body is tilted, and the trapezoidal structure causes the inclination angles of the two pedals to be different, that is, $\alpha 1 > \beta 1$ as shown in the figure, and the inner tilt angle is small, which is in accordance with the shift of the center of gravity when the center of gravity shifts.

Referring to Figure 12-1, when the trolley is on an inclined road or turning state, the trapezoidal structure of the six-link of the car body changes, as shown in Figure 12-2-. At this time, the car body is tilted, and the characteristics of the structure lead to the inclination angle of the two pedals. Different, that is, as shown in the figure, $\alpha 2 > \beta 2$, the inner inclination angle is small, which corresponds to the deviation of the center of gravity when the center of gravity shifts.

In the present invention, the trapezoidal structure features different inclination angles of the left and right pedals, and the inclination angle of the pedals in the direction of the center of gravity is small, and the inclination angle is large, that is, $\alpha > \beta$, which is indicated by the posture of the human body and the attitude of the center of gravity offset, and the center of gravity is offset. The direction inclination angle is smaller than the pair of inclination angles, which is the most comfortable state for human driving, and is optimized to obtain an optimal solution for the length of each link in the trapezoidal structure.

Referring to Figure 13-1, the handles can be adjusted to different lengths depending on the driver's height or folding requirements. The front rod 13-1-118and the rear rod 13-1-119can be fixed or slid by the movable pin 13-1-120, the rear rod 13-1-19has a fixing hole, and the movable pin 13-1-120is sliding. When protruding to the fixing hole, the front rod and the rear rod are fixedly connected. When the movable pin is pressed hard, the front rod and the rear rod are disconnected from each other, and the front rod and the rear rod can be relatively slid to realize the expansion and contraction. Referring to Fig. 13-2, the folding mechanism is connected to the ladder structure vertical rod 13-2-23through the U-shaped block 13-2-43, and the T-shaped block 13-2-48is fixedly connected to the handle 13-2-44, and the rotating shaft 13- 2-50forms a hinged relationship between the U-shaped block 13-2-43and the T-shaped block 13-2-48through the holes in the U-shaped block 13-2-43and the T-shaped block 13-2-48, at the other end The shaft casing spring 13-2-46is screwed to the nut 13-2-45. 13-2-49 is a pin fixed on the large circular surface of the pin 13-2-50. Under normal conditions, the nut is pressed by the spring force, so that the large round face of the pin is tightly attached to the U-shaped block 13-2-43, the pin 13-2-49passes through the fixing holes of the U-shaped block 13-2-43and the T-shaped block at the same time, and the handle is fixed. When the nut 13-2-45is pressed hard, the spring 13-2-46is compressed, and the pin 13-The 2-50driving pin 13-2-49moves to the outside of the U-shaped block 13-2-43. When the pin is separated from the fixing hole of the T-shaped block, the U-shaped block and the T-shaped block are hinged, and can be folded and erected. Switch between states.

Referring to Figures 14-1-14-2-, in accordance with an embodiment of the present invention, two different height leg control levers are employed. Figure 14-1 adopts the method of knee control. This control mode is characterized by short control rods, and the legs are used to control the running of the car body and the posture of the car body, and the control is flexible. Figure 14-2uses the inner thigh control. This method is characterized by the length of the control rod. The driver controls the movement of the car body and the posture of the car body through the inner side of the thigh. The experience is stronger and the coordination between the car and the human body is more. Strong, the driver's driving experience is better. Referring to Figures 14-3and 14-4, the four-link ladder structure and the six-link structure have the same effect in the present invention, and different embodiments can be obtained by changing the structure of the vertical rod and the form of the handle in the link. Referring to Figures 14-5and 14-6, the suspension system is mainly composed of a swinging side arm 14-51, a strong spring 14-52, and a rotating shaft 14-53. The rotating shaft is connected with the pedal, and the swinging side arm 14-51 can be wound around the rotating shaft 14- 53rotation, the end of the swinging side arm is connected with the spring 14-52, the spring compression and extension can drive the swinging side arm to swing, and the swinging side arm 14-51 is connected with the wheel part, that is, when the pressure of the wheel part is abruptly caused to move up and down the wheel, the pendulum is driven The arm swings and compresses the spring.

When it is necessary to turn or drive on a sloping road surface, the center of gravity shift causes pressure changes on both sides, and a pressure difference is formed. The spring-shaped variables are different, resulting in different heights of the pedals on the two sides. At this time, the swing angle of the swing arm is different, and the shaft is rotated. An angle sensor is installed at the position, and the state of the vehicle body is detected by the angle of detection and a corresponding reaction is made.

Referring to FIG. 15, the control circuit is divided into a wireless controller 108, a coordination control module 109, an angle sensing module 110, and two motor driving modules 111, 112, and a total of five parts, and the last four vehicle modules communicate through the CAN bus. The power system is powered by the battery to the coordinated control board, and then the power of other modules is controlled by the unit. The individual modules are described below.

The control module 108can adopt two methods: wired control and wireless control. The wireless control module adopts a portable and low power consumption design, and can be manually controlled or mounted on the handlebar for wirelessly monitoring the state information of the vehicle body and displaying the operation. Status, driving speed, battery level and other information. In the self-balancing and self-guided state, the vehicle body can also be controlled by short-range wireless within 10meters.

The coordination control module 109 is responsible for controlling the interface circuit module of the circuit and other peripheral functions such as the external function button 113 and the battery 114, uniformly monitoring and protecting the voltage and current of the power supply battery, and collecting the battery 114 power information in various working modes. Manages power to other circuit modules and maintains standby performance in low power states. The external function key information except the steering sensor is also collected by the module and sent to the angle sensing module for unified control. The module is also responsible for transmitting the communication status information to the PC through the wireless transmitting interface, which is convenient for monitoring the running state of the vehicle body control circuit, and reserves the function of the wireless remote control, which can ensure that when the vehicle body is running in the automatic balancing mode. It can be flexibly controlled by the user's handheld wireless controller. The module has an interface for sensing guidance information. In the automatic guidance mode, when the orientation information sent by the wireless controller is sensed, the vehicle body is controlled to turn in the correct direction and control the distance from the wireless controller to realize convenient automatic guidance. Features. The module is designed with an external SD card slot to store important information such as angle and speed for real-time acquisition to the SD card. A large amount of recorded data helps to analyze the fault of the vehicle body in a targeted manner.

The angle sensing module 110 is responsible for collecting the current body posture information, including the absolute angle with respect to the horizontal plane, the roll angle, etc., and integrating the measured values of the acceleration sensor and the MEMS gyroscope to calculate the current accurate angle information, and Send to the chassis motor drive module for vehicle body balance control. The signal from the steering sensor is also fed into the angle sensor board, which is responsible for the command to send the steering of the chassis.

The left and right motors of the chassis adopt the same motor drive modules 111 and 112. The module consists of the power supply circuit, control core, external interface, optocoupler isolation circuit, power amplifier circuit and protection circuit. It is responsible for the precise servo control of the DC brushless motor. It is the high performance low speed four quadrant control performance required.

The control system uses a high-performance processor that precisely controls the balance of the car at a rate of at least 100 adjustments per second. The battery uses a high-energy-density battery to provide sufficient power and endurance for the motor while reducing the car. Body weight.

Referring to Figure 16, with a modular design, the system is divided into four sections, namely motor drive control section 16-54, sensor signal conditioning and control algorithm section 16-55, system interface and power section 16-57, and wireless controller section 16 -56; motor drive control portion 16-54 is coupled to sensor signal conditioning and control algorithm portion 16-55, sensor signal conditioning and control algorithm portion 16-55 is coupled to wireless controller portion 16-56, sensor signal conditioning and control algorithm portion The 16-55 is connected to the system interface and the power supply section 16-57.

Referring to Figure 17-1, the signal conditioning and motion control algorithms for each inertial sensor are mainly completed. The sensor signal conditioning program master 17-59 is responsible for filtering and merging the sensor signals to provide higher precision angular and angular velocity information for the motion control program 17-61. The motion control program 17-61 is primarily responsible for calculating the appropriate control output using the attitude and motion information of the current vehicle body generated by the sensor signal conditioning program 17-59. The communication control program 17-60 is responsible for receiving the external control signal and simultaneously transmitting the control output to the motor control module. The error handler 17-58 is responsible for monitoring the working status of each software and hardware inside the module, and giving corresponding alarm information when an error occurs.

Referring to 18-1, the motor control module mainly completes the control command of receiving the upper computer and realizes the control of the motor. The communication control program 18-69 mainly completes the command of receiving the host computer and calls different function modules according to the command. The PID adjustment control program 18-72 mainly performs closed-loop control of the motor, including speed closed loop, current closed loop, and the like. The motor control program 18-73 is primarily responsible for the underlying control of the motor. The hardware monitor 18-71 is responsible for monitoring the operating status of the main sensitive parts of the drive circuit. The error handlers 18-70 are primarily responsible for error handling and external alarms for each function.

Referring to Figure 19-1, the module is mainly responsible for the external interface of the entire system, such as wireless communication port and serial port. And complete the power management of other modules in the system to achieve low power consumption. The power management program 19-81 is mainly responsible for controlling the power of each module in the system, and turning on different devices according to different states. The extended interface manager 19-84 is primarily responsible for controlling the extended interfaces and other accessories in the system. The wireless hypervisor 19-83 is primarily responsible for communicating with the wireless module. The CAN communication management program 19-82 is mainly responsible for monitoring the CAN bus. The error handling program 19-85 is mainly responsible for error handling and external alarm for each function.

See 20-1, this module is mainly used for system expansion control, through the wireless communication interface, control and status monitoring of the automatic center of gravity control car, such as battery power, running speed, running mileage and other states. The LCD control program 20-94 is primarily responsible for controlling and displaying the on-board liquid crystal. The wireless communication management program 20-95 is mainly responsible for wireless access. The menu system 20-96 is responsible for the interactive logic portion of the human machine interface of the LCD display portion. Error handlers 20-97 are primarily responsible for error handling and alarms.

The specific embodiment adopts a dual backup motor control strategy, and the two sets of motor drive and control systems adopt mutual backup mode to ensure stable operation and safe operation in the event of a fault. Using smarter and safer and more reliable software system, not only real-time error correction from hardware, but also guarantee the reliability of operation, and real-time detection and error correction from software layer by layer, not only establish feedback detection between modules, emergency alarm mechanism, Moreover, a real-time feedback and error response mechanism is established inside each module to ensure the safety, reliability and stability of the automatic center of gravity control car during operation.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 101920728 A
(43)申请公布日 2010.12.22

(21)申请号 200910210535.0

(22)申请日 2009.11.09

(71)申请人 武汉若比特机器人有限公司
地址 430000 湖北省武汉市东湖开发区珞瑜路243号科技大厦12层

(72)发明人 李一鹏　闫学凯　郭盖华　周伟　陈志发

(51)Int.Cl.
B62D 51/02(2006.01)
B62D 61/00(2006.01)
B62K 3/00(2006.01)
B62K 21/16(2006.01)
A63C 17/12(2006.01)

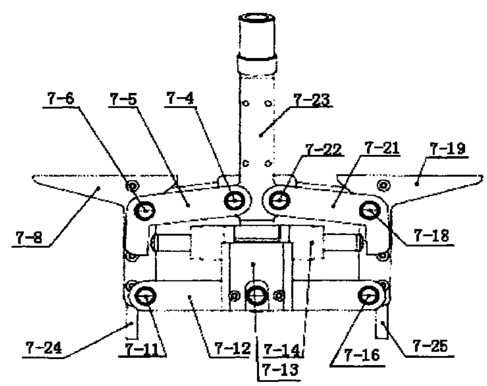
权利要求书 2 页　说明书 8 页　附图 27 页

(54)发明名称

一种便携自动重心控制小车

(57)摘要

一种便携自动重心控制小车，它涉及高智能化的便携自动重心控制小车，整车具有体积小，重量轻的特点，而且采用折叠结构，使把手能够折叠起来成为提手，使其能够随身携带，减小停放车的空间和被盗的可能。采用检测驾驶者与车辆重心偏移状态来控制车辆的运行，运行灵活，即使在狭小空间运行也十分灵活。采用梯形底盘结构使驾驶更舒适，更安全。采用智能的控制方式和环境感知技术，使车运行安全和稳定，舒适。



CN 101920728 A

1. 一种便携自动重心控制小车，其特征在于它包含车体、车轮、可折叠把手、转向机构、控制系统、安全保障系统，车体是由踏板和车轮连接装置组成，是自动重心控制小车的主要承载部分；车轮是两个车轮安装于车体的左右两侧，由内嵌于车轮内的电机提供动力；可折叠把手，一种可按使用者身高伸缩并可折叠的把手，是使作者驾驶扶持和操作的机构，把手上包含有操作按扭，手柄和指示面板以及固定在把手上的喇叭与照明灯具；转向机构，通过偏转把手可带动转向机构转动，改变踏板及车体的姿态，并将车体姿态改变信号传递给控制系统；控制系统，用于所述自动重心控制小车运动和监控的嵌入式计算机硬件系统和软件系统，包括由加速度传感器，陀螺仪，编码器组成的动态平衡传感器系统，驱动电路，中央控制系统；安全保障系统，用于保障使用者使用安全的监控，反馈和控制系统，通过感知周围环境信息，判断所述自动重心控制小车所处的运行环境是否安全。

2. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于它包括可伸缩的把手，折叠机构，转向机构，梯形结构，电机，轮胎，控制箱体，控制系统；连杆 (6-1-5)、(6-1-6) 和支撑 (6-1-7)、(6-1-8)，以及销轴 (6-1-1)、(6-1-2)、(6-1-3)、(6-1-4) 构成梯形结构，支撑 (6-1-7)、(6-1-8)，与踏板、轮毂固边，在正常状态下，该梯形结构保持正等腰梯形，那么踏板即保持水平状态，而轮子保持前束状态，把手长度为可调，驾驶者通过手对把手的控制来对车的控制，把手高度可根据每个驾驶者的使用习惯和身体高度进行调节，使驾驶者处于最舒适和最灵便的驾驶状态中。

3. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于它涉及两种底盘结构：六连杆机构和梯形四连杆机构；左右车轮 (6-1-9) 和 (6-1-17) 通过底盘相连接，六连杆机构和梯形四连杆机构都具有一个左右偏转的自由度，当驾驶者控制操纵杆进行控制时，操纵杆带动六连杆机构和梯形四连杆机构发生偏转，从而使整车发生偏转，达到控制车体姿态的目标。

4. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于连杆机构由销轴 (7-6)、(7-18)、(7-16)、(7-11)，上连杆 (7-5)、(7-21)，踏板右支撑 (7-8) 和踏板右支撑 (7-19) 以及下连杆 (7-12) 组成，实现与梯形结构相同的功能，下连杆 (7-12) 与左右踏板支撑通过销轴相连接，并且与通过销轴与把手连杆 (7-23) 连接，踏板支撑与踏板 (7-20) 和轮子 (7-9) 相连接，并且随着轮子所处状态发生上下错动，下连杆始终保持与路面平行，上连杆 (7-5) 与踏板支撑 (7-8) 及把手连杆 (7-23) 通过销轴连接，上连杆 (7-21) 与踏板支撑 (7-19) 及把手连杆 (7-23) 通过销轴连接，那么，把手左右转，带动上连杆左右运动；(7-14) 为回复机构，通过固定块 (7-13) 与下连杆固连，当把手向左偏转时，把手连杆 (7-23) 带动上连杆 (7-21) 发生转动，连杆 (7-21) 绕销轴 (7-18) 发生转动，其下端挤压回复机构，回复机构左侧发生压缩，形成回复力，回复力大小和把手偏转角度成正比，把手偏转角度越大，回复力越大。

5. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于当把手发生偏转时，左右上连杆压迫回复机构顶杆 (8-32)，使弹簧 (8-29) 发生形变，产生回复力，当转变结束或无需偏转把手时，把手自动回复至零偏转位置，当偏转角度变大时，弹簧形变量也变大，所以形成的回复力也变大；(8-13) 为回复机构固定块，与下连杆固定；弹簧套 (28) 用于防止弹簧发生径向弯曲，与导向端套 (8-27) 及格 (8-30) 固连。

6. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于由车轮侧板

(9-24)、电机 (9-38)，电机后端盖 (9-10)，编码器 (9-41)，轮毂 (9-35)、(9-36) 以及轮胎 (9-9) 组成，车轮部分通过 (9-24) 车轮侧板与踏板相边接，电机轴通过连轴器 (9-40) 与编码器码盘 (9-41) 相连接，将电机转速反馈到控制系统中；电机 (9-38) 与电机后端盖 (9-10) 固连，电机后端盖 (9-10) 与车轮侧板 (9-24) 连接，电机输出为外转子输出，是与内轮毂 (9-36) 固连；内轮毂 (9-36) 和外轮毂 (9-36) 都是楔形的，通过内外夹紧轮胎，通过调节螺钉的松紧调节夹紧程度，防止轮毂与轮胎之间发生相对滑动。

7. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于正常状态下，车在水平地面时，车体连杆机构所处姿态，上连杆，下连杆以及踏板支撑构成等腰梯形，此时，弹簧长度 $c = d$，角度 $a = b$，踢板处于水平位置；当行驶在倾斜路面时，为保证驾驶者处于一个舒适的姿态，上连杆，下连杆以及踏板支撑所构成的形状发生变形；由于所构成的形状不是平行四边形，即此时，弹簧 c 处于压缩状态，d 处于放松状态，$d > c$，而且倾斜角度越大，弹簧长度差 $d-c$ 越大，回复力越大，此时，角度 $a < b$，而且假设偏转前角度为 $a_1 = b_1$，那么 $a_1-a > b-b_1$，即此时，踏板倾斜程度不一样，此时所处位置较高踏板处于水平位置，而所处位置较低的踏板则是向车体内疔稍微倾斜；使驾驶者驾驶时更加舒适，而且，水平位置较低车轮向车体内侧倾斜，使车体不易翻转，减小翻车的可能。

8. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于根据驾驶者身高不同或折叠要求，可将把手调整不同的长度；前杆 (13-1-118) 与后杆 (13-1-119) 可通过活动销 (13-1-120) 进行固定或滑动，后杆 (13-1-19) 上有固定孔，活动销 (13-1-120) 在滑动至固定孔时凸出，使前杆和后杆固定连接，当用力按下活动销，使前杆和后杆脱离连接，前杆和后杆可发生相对滑动实现伸缩；折叠机构通过 U 形块 (13-2-43) 与梯形结构竖杆 (13-2-23) 连接，T 形块 (13-2-48) 与把手 (13-2-44) 固连，转轴 (13-2-50) 通过 U 形块 (13-2-43) 和 T 形块 (13-2-48) 中的孔使 U 形块 (13-2-43 和 T 形块 (13-2-48 形成铰结关系，在另一端转轴外套弹簧 (13-2-46)，与螺母 (13-2-45) 进行螺纹连接；(13-2-49) 为固定在销轴 (13-2-50) 大圆面上的销，正常状态下，由于弹簧的弹力压紧螺母，使销轴大圆面贴紧 U 形块 (13-2-43)，销 (13-2-49) 同时穿过 U 形块 (13-2-43) 和 T 形块的固定孔，把手被固定，当用力压螺母 (13-2-45 时，弹簧 (13-2-46) 压缩，销轴 (13-2-50) 带动销 (13-2-49) 向 U 形块 (13-2-43) 外面运动，当销脱离 T 形块的固定孔时，U 形块与 T 形块间为铰接关系，可以折叠状态和直立状态间进行切换。

9. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于悬挂系统主要由摆动侧臂 (14-51)，强力弹簧 (14-52)，转轴 (14-53) 构成，转轴与踏板连接，摆动侧臂 (14-51) 可绕转轴 (14-53) 转动，摆动侧臂末端与弹簧 14-52) 连接，弹簧压缩伸展可带动摆动侧臂摆动，摆动侧臂 (14-51) 与轮子部分相连接，即轮子部分压力发生突变导致轮子上下运动时，带动摆臂摆动，并压缩弹簧。

10. 根据权利要求 1 所述的一种便携自动重心控制小车，其特征在于采用模块化设计，系统分为 4 个部分，即电机驱动控制部分 (16-54)，传感器信号调理与控制算法部分 (16-55)，系统接口与电源部分 (16-57)，无线控制器部分 (16-56)；电机驱动控制部分 (16-54) 与传感器信号调理与控制算法部分 (16-55) 连接，传感器信号调理与控制算法部分 (16-55) 与无线控制器部分 (16-56) 连接，传感器信号调理与控制算法部分 (16-55) 与系统接口与电源部分 (16-57) 连接。

一种便携自动重心控制小车

技术领域：

[0001] 本发明涉及一种个人辅助交通工具，尤其涉及一种有人驾驶通过控制系统通过检测人与车体重心偏移角度并控制其运行的车辆，其两个车轮由电机带动且为水平横向布置。

背景技术：

[0002] 两轮自平衡装置和技术起源于倒立摆理论，最早由日本山藤一雄发明了类似的两轮平衡装置，2002 年至 2003 年相续被美国公司用于 ibot 轮椅技术和 segway 两轮平衡车上。用于商场，高尔夫球场，机场等，被认为是划时代的交通工具。2008 年日本丰田公司开始开发类似产品。

[0003] 现有技术中的一种这样的车辆已经在例如专利文献 1 中公开。在专利文献 1 中公开的车辆是“在重心很高的骑乘状态下，骑乘者可稳定行驶，其身体上部不会左右摇晃。该车辆包括 ：用于驾驶者骑乘的踏板 ；车体 ；当行驶方向被设定为滚动轴线的时候，该车体支撑所述踏板从而能够在围绕作为中心的滚动轴线旋转的滚动方向上改变姿态 ；一对车轮。该对车轮位于与所述车体行驶方向垂直的方向上同一轴线的两侧并且被所述车体看旋转地支撑 ；一对单独驱动和旋转所述对车轮的车轮驱动装置 ；和用于直接改变所述踏板的姿态或通过所述车体间接改变所述姿态的把手。”

[0004] 根据专利文献 1 中的具有上诉结构的车辆，希望达到的效果是“当行驶在路面与行使方向垂直倾斜的倾斜路面上的时候由于重力作用，或当转向的时候由于离心力的作用，骑乘者会比较稳定”。

[0005] 根据专利文献 2 中，其所描述的车辆为“两轮左右分布的电动车。包括车体、车轮和电驱动系统等，带有电机的车轮安装在车体两侧，电源、控制电路、驱动电路以及传感器和控制开关等安装在车体上，车轮与车体之间为转轴连接，速度传感器和角度传感器将车轮与车体的转角及倾角信息传输到控制电路中，利用其中的软件计算控制量，从而控制车轮与车体的运动及平衡状态。”专利文献 2 中同轴车辆在骑乘时，通过手柄上的转向开关进行转向控制，踏板在骑乘过程中与地面平行。

[0006] [专利文献 1] 公开专利申请 No 200610089876.3

[0007] [专利文献 2] 公开专利申请 No 0213838652.8 和专利申请 200620105334.6

[0008] [专利文献 3] 美国专利 6581714B1

[0009] 但在上述专利文献 1 所述的车辆中，车体为平行连接机构，当转向半径较小时，骑乘者倾斜的角度较大，此时，骑乘者容易翻到。

[0010] 在上述专利文献 2 中所述车辆中，其踏板的上表面是连续的，车体在转弯过程中不能随之改变姿态，离心力变大时，车体容易发生侧翻。而且专利文献 2 中所述自衡车在倾斜路面骑乘时，车体和踏板都处于倾斜状态，使骑乘者不舒适，而且有发生侧翻的危险。

[0011] 现有的车辆结构复杂、成本高昂，市场推广相当缓慢。改进技术、 提高性能、降低成本、推进普及是需要解决的问题。

发明内容：

[0012] 本发明的目的是提供一种便携自动重心控制小车，它采用双备份电机控制策略，两套电机驱动和控制系统采用互相备份的方式，保障在发生故障时的运行稳定和运行安全。采用更智能和更安全可靠的软件系统，不仅从硬件上实时纠错，保证运行的可靠性，而且从软件上逐层实时检测和纠错，不仅在模块之间建立反馈检测，应急报警机制，而且在各个模块内部建立实时反馈和出错应对机制，保证了自动重心控制小车在运行过程中的安全可靠性及稳定性。解决转弯时左右踏板同时倾斜造成的使用者站力不舒适的情况，保持人与车的重心同时发生偏移，在转弯的时候，发生侧翻的可能性降低，安全性和稳定性增强。

[0013] 为了解决背景技术所存在的问题，本发明是采用以下技术方案：它包含车体、车轮、可折叠把手、转向机构、控制系统、安全保障系统，车体是由踏板和车轮连接装置组成，是自动重心控制小车的主要承载部分；车轮是两个车轮安装于车体的左右两侧，由内嵌于车轮内的电机提供动力；可折叠把手，一种可按使用者身高伸缩并可折叠的把手，是使作者驾驶扶持和操作的机构，把手上包含有操作按扭，手柄和指示面板以及固定在把手上的喇叭与照明灯具；转向机构，通过偏转把手可带动转向机构转动，改变踏板及车体的姿态，并将车体姿态改变信号传递给控制系统；控制系统，用于所述自动重心控制小车运动和监控的嵌入式计算机硬件系统和软件系统，包括由加速度传感 器，陀螺仪，编码器组成的动态平衡传感器系统，驱动电路，中央控制系统；安全保障系统，用于保障使用者使用安全的监控，反馈和控制系统，通过感知周围环境信息，判断所述自动重心控制小车所处的运行环境是否安全。

[0014] 本发明设计的自动重心控制小车踏板是非连续的，而且梯形转向机构使其在骑乘者在转弯和在倾斜路面上骑乘时身体姿态和重心随之进行调整，在运行过程中，控制系统和监测系统根据重心偏移程度和把手偏移角度来控制小车的运行。车辆在转弯时，若车体不倾斜，由受力示意图可知，离心力 $F_{离}$和重力 G 合力 F 车体处于受力不平衡状态，当拐弯速度 V 与拐弯半径 R：V2/g ＞ a/2h 时，车体将会发生翻车，是很不安全的，而在拐弯时，车体倾斜则会使离心力 $F_{离}$和重力 G 合力 F 方便沿车体方向，受力处于平衡状态，而且车体车弯半径 R 与车体的倾角 θ 与此时车体的速度 v 相关，即 $R = v^2/(g.\tan\theta)$，保证此时车体倾斜则会使离心力 $F_{离}$和重力 G 合力 F 方便沿车体方向，受力处于平衡状态，使驾驶安全性和舒适性提高。

[0015] 在正常状态下，车在水平地面时，车体连杆机构所处次态如图所示，上连杆，下连杆以及踏板支撑构成等腰梯形，此时，弹簧长度 c ＝ d，角度 a ＝ b，踢板处于水平位置。当行驶在倾斜路面时，为保证驾驶者处于一个舒适的姿态，上连杆，下连杆以及踏板支撑所构成的形状发生变形，由于所构成的形状不是平行四边形，即此时，弹簧 c 处于压缩状态，d 处于放松状态，d ＞ c，而且倾斜角度越大，弹簧长度差 d-c 越大，回复力越大，此时，角度 a ＜ b，而且假设偏转前角度 为 $a_1 = b_1$，那么 $a_1 - a > b - b_1$，即 α ＞ β，此时，踏板倾斜程度不一样，此时所处位置较高踏板处于水平位置，而所处位置较低的踏板则是向车体内疗稍微倾斜。使驾驶者驾驶时更加舒适，而且，水平位置较低车轮向车体内侧倾斜，使车体不易翻转，减小翻车的可能。

[0016] 本发明通过用腿控制小车的方式更容易控制重心的偏离，真正达到用身体姿态和

重心位置来控制车的运行。用扶手控制易导致车体与驾驶者重心偏移得不一致，安全性和稳定性易于失控。人体中腿是重心控制的关键，本发明所涉及的无把手腿控制自动重心控制小车解决了这一问题，保持人与车的重心同时发生偏移，在转弯的时候，发生侧翻的可能性降低，安全性和稳定性增强。

[0017] 本发明解决了在不平路面上，颠簸和振动放大的问题。对于没有悬挂系统的车辆，在不平路面行驶过程中，在车的人体重心位置的振动幅度将达到 A ＝ θ*JI*h/180，即若地面发生角度为 θ 的颠簸，那么人体重心处的振动幅度为 θ*JI*h/180(h 为人体重心的高度)。本发明中所涉及的自动重心控制小车底盘采用的梯形结构，并且两轮不共轴，踏板也不连续，那么地面的不平不会传导，也不会放大。

[0018] 本发明中自动重心控制小车控制杆和扶手是可伸缩和可折叠的，便携。可伸缩扶手和腿控制杆的伸缩和折叠方式，折叠之后小车体积很小，而且扶手和控制杆变为提手，使小车可随手携带。

[0019] 本发明采用双备份电机控制策略，两套电机驱动和控制系统采用互相备份的方式，保障在发生故障时的运行稳定和运行安全。采用更智能和更安全可靠的软件系统，不仅从硬件上实时纠错，保证运行的 可靠性，而且从软件上逐层实时检测和纠错，不仅在模块之间建立反馈检测，应急报警机制，而且在各个模块内部建立实时反馈和出错应对机制，保证了自动重心控制小车在运行过程中的安全可靠性及稳定性。

附图说明：

[0020] 图 1-1 为本发明自动重心控制有扶手型小车在水平路面驾驶的结构示意图；

[0021] 图 1-2 为本发明自动重心控制无扶手腿夹式小车在水平路面驾驶的结构示意图；

[0022] 图 2-1 为本发明自动重心控制有扶手型小车在倾斜路面驾驶的结构示意图；

[0023] 图 2-2 为本发明自动重心控制无扶手腿夹式小车在水平路面驾驶的结构示意图；

[0024] 图 3-1 为本发明自动重心控制有扶手型小车转弯时所处状态的结构示意图；

[0025] 图 3-2 为本发明自动重心控制无扶手腿夹式小车转弯时所处状态的结构示意图；

[0026] 图 4-1-4-2 为本发明自动重心控制有扶手型小车在水平路面拐弯时的结构示意图；

[0027] 图 5-1-5-2 为本发明自动控制小车的俯视图；

[0028] 图 6-1 为本发明手持控制式两轮自平衡车的结构示意图；

[0029] 图 6-2 为本发明腿夹控制式两轮自平衡车的结构示意图；

[0030] 图 7 为本发明所述自动重心控制小车底盘梯形结构示意图；

[0031] 图 8 为本发明所述自动重心控制小车把手恢复结构示意图；

[0032] 图 9 为本发明所述自动重心控制小车车轮的结构示意图；

[0033] 图 10-1-10-2 为本发明自动重心控制小车车体梯形的结构示意构图；

[0034] 图 11-1 为本发明自动控制小车为四连杆结构的运动状态结构示意图；

[0035] 图 11-2 为本发明自动控制小车车体发生倾斜的运动状态结构示意图；

[0036] 图 12-1 为本发明自动控制小车处于倾斜路面或转弯状态时的结构示意图；

[0037] 图 12-2 为本发明自动控制小车车体发生倾斜时的结构示意图；

[0038] 图 13-1 为本发明自动重心控制小车把手的伸缩结构示意图；

[0039] 图 13-2 为本发明自动重心控制小车把手折叠机构的示意图；

[0040] 图 13-3 为图 13-2 的 A 部放大结构示意图；

[0041] 图 14-1 为本发明中腿控制式自动重心控制小车实施例的结构示意图；

[0042] 图 14-2 为本发明采用大腿内侧控制小车实施例的结构示意图；

[0043] 图 14-3-14-4 为本发明中腿控制式自动重心控制小车的实施例的结构示意图；

[0044] 图 14-5-14-6 为本发明采用悬挂式的底盘的实施例的结构示意图；

[0045] 图 15 为本自动重心控制小车控制系统的硬件框图；

[0046] 图 16 为本发明自动重心控制小车软件系统模块化框图；

[0047] 图 17-1 为本发明自动重心控制小车软件系统中传感器信号调理与控制算法模块 55 内部软件的功能图；

[0048] 图 17-2 为本发明自动重心控制小车软件系统中传感器信号调理与控制算法模块 55 软件流程图；

[0049] 图 18-1 为本发明自动重心控制小车软件系统中电机控制模块 54 软件功能图；

[0050] 图 18-2 为本发明电机控制模块 54 的软件流程图；

[0051] 图 19-1 为本发明自动重心控制小车软件系统中系统接口与电源控制模块 57 软件功能图；

[0052] 图 19-2 为本发明自动重心控制小车软件系统中系统接口与电源管理模块 57 的软件流程图；

[0053] 图 20-1 为本发明自动重心控制小车软件系统无线控制模块 56 软件功能图；

[0054] 图 20-2 为本发明无线控制模块 56 的软件功能流程图。

具体实施方式：

[0055] 本具体实施方式采用以下技术方案：它包含车体、车轮、可折叠把手、转向机构、控制系统、安全保障系统，车体是由踏板和车轮连接装置组成，是自动重心控制小车的主要承载部分；车轮是两个车轮安装于车体的左右两侧，由内嵌于车轮内的电机提供动力；可折叠把手，一种可按使用者身高伸缩并可折叠的把手，是使用者驾驶扶持和 操作的机构，把手上包含有操作按扭，手柄和指示面板以及固定在把手上的喇叭与照明灯具；转向机构，通过偏转把手可带动转向机构转动，改变踏板及车体的姿态，并将车体姿态改变信号传递给控制系统；控制系统，用于所述自动重心控制小车运动和监控的嵌入式计算机硬件系统和软件系统，包括由加速度传感器，陀螺仪，编码器组成的动态平衡传感器系统，驱动电路，中央控制系统；安全保障系统，用于保障使用者使用安全的监控，反馈和控制系统，通过感知周围环境信息，判断所述自动重心控制小车所处的运行环境是否安全。

[0056] 参看图 1-1-1-2，在行使过程中，有扶手型车辆通过扶手来控制车辆的运动，而无扶手腿夹持式车辆则通过膝盖左右高度的腿控杆来控制车辆的前进后退以及拐弯。

[0057] 参看图 1-1-2-1，当驾驶者行驶在倾斜路面时，梯形结构将发生类似于转弯时的转动，并引起踏板面的倾斜，当车体处于高处的踏板倾斜角度与斜面角度一致时，此时踏板面仍处于水平，则于梯形结构的原因，此时处于低处的踏板倾角较高处的踏板大，此时人重心偏向高度较高踏板方向，处于较舒适的驾驶状态。而且此时车驾驶者和车体的重心位于两轮对称面上，减小车体发生侧翻的可能。

[0058] 参看图 3-1-3-2，当车体转弯时，车体处于倾斜状态，此时车的转弯半径 R 与车体的倾角 θ 与此时车体的速度 v 相关，即 $R = v^2/(g.\tan\theta)$。

[0059] 参看图 4-1-4-2，当车体倾斜与不倾斜受力示意图。若车体不倾斜，由受力示意图可知，离心力 $F_{离}$和重力 G 合力 F 车体处于受力 不平衡状态，当拐弯速度 V 与拐弯半径 R：V2/g ＞ a/2h 时（其中 a 为两轮间距，h 为驾驶者与人重心的高度），车体将会发生翻车，是很不安全的，而在拐弯时，车体倾斜则会使离心力 $F_{离}$和重力 G 合力 F 方便沿车体方向，受力处于平衡状态。

[0060] 参看图 5-1-5-2，车体的体积小，所占空间很小，折叠后易于携带和存放。

[0061] 参看图 6-1，包括可伸缩的把手，折叠机构，转向机构，梯形结构，电机，轮胎，控制箱体，控制系统。连杆 6-1-5、6-1-6 和支撑 6-1-7、6-1-8，以及销轴 6-1-1、6-1-2、6-1-3、6-1-4 构成梯形结构，支撑 6-1-7、6-1-8，与踏板、轮毂固边，在正常状态下，该梯形结构保持正等腰梯形，那么踏板即保持水平状态，而轮子保持前束状态，把手长度为可调，驾驶者通过手对把手的控制来对车的控制，把手高度可根据每个驾驶者的使用习惯和身体高度进行调节，使驾驶者处于最舒适和最灵便的驾驶状态中。参看图 6-2，驾驶者通过两腿夹持腿控制式操纵杆，并通过姿势调整达到控制自动重心控制小车的目标。

[0062] 参看图 6-1-6-2，它涉及两种底盘结构：六连杆机构和梯形四连杆机构。左右车轮 6-1-9 和 6-1-17 通过底盘相连接，六连杆机构和梯形四连杆机构都具有一个左右偏转的自由度，当驾驶者控制操纵杆进行控制时，操纵杆带动六连杆机构和梯形四连杆机构发生偏转，从而使整车发生偏转，达到控制车体姿态的目标。

[0063] 参看图 7，连杆机构由销轴 7-6、7-18、7-16、7-11，上连杆 7-5、7-21，踏板右支撑 7-8 和踏板右支撑 7-19 以及下连杆 7-12 组成，实 现与梯形结构相同的功能，下连杆 7-12 与左右踏板支撑通过销轴相连接，并且与通过销轴与把手连杆 7-23 连接，踏板支撑与踏板 7-20 和轮子 7-9 相连接，并且随着轮子所处状态发生上下错动，下连杆始终保持与路面平行，上连杆 7-5 与踏板支撑 7-8 及把手连杆 7-23 通过销轴连接，上连杆 7-21 与踏板支撑 7-19 及把手连杆 7-23 通过销轴连接，那么，把手左右转，带动上连杆左右运动。7-14 为回复机构，通过固定块 7-13 与下连杆固连，当把手向左偏转时，把手连杆 7-23 带动上连杆 7-21 发生转动，连杆 7-21 绕销轴 7-18 发生转动，其下端挤压回复机构，回复机构左侧发生压缩，形成回复力，回复力大小和把手偏转角度成正比，把手偏转角度越大，回复力越大。

[0064] 参看图 8，为把手回复机构，8-24 和 8-33 为调节螺母，调节顶杆的长度，通过调节顶杆的长度来保证回复机构与上连杆的接触，保证把手的回复位置，并调节回复力的大小。

[0065] 当把手发生偏转时，左右上连杆压迫回复机构顶杆 8-32，使弹簧 8-29 发生形变，产生回复力，当转变结束或无需偏转把手时，把手自动回复至零偏转位置，当偏转角度变大时，弹簧形变量也变大，所以形成的回复力也变大。8-13 为回复机构固定块，与下连杆固定。弹簧套 28 用于防止弹簧发生径向弯曲，与导向端套 8-27 及格 8-30 固连。

[0066] 参看图 9，为车轮部分，由车轮侧板 9-24、电机 9-38，电机后端盖 9-10，编码器 9-41，轮毂 9-35、9-36 以及轮胎 9-9 组成，车轮部分通过 9-24 车轮侧板与踏板相边接，电机轴通过连轴器 9-40 与编码器码盘 9-41 相连接，将电机转速反馈到控制系统中。电机 9-38 与电机 后端盖 9-10 固连，电机后端盖 9-10 与车轮侧板 9-24 连接，电机输出为外转子输出，是与内轮毂 9-36 固连。内轮毂 9-36 和外轮毂 9-36 都是楔形的，通过内外夹紧轮胎，通

过调节螺钉的松紧调节夹紧程度，防止轮毂与轮胎之间发生相对滑动。

[0067] 参看 10-1，正常状态下，车在水平地面时，车体连杆机构所处次态如图所示，上连杆，下连杆以及踏板支撑构成等腰梯形，此时，弹簧长度 $c = d$，角度 $a = b$，踢板处于水平位置。当行驶在倾斜路面时，为保证驾驶者处于一个舒适的姿态，上连杆，下连杆以及踏板支撑所构成的形状发生变形；参看图 10-2，由于所构成的形状不是平行四边形，即此时，弹簧 c 处于压缩状态，d 处于放松状态，$d > c$，而且倾斜角度越大，弹簧长度差 d-c 越大，回复力越大，此时，角度 $a < b$，而且假设偏转前角度为 $a_1 = b_1$，那么 $a_1\text{-}a > b\text{-}b_1$，即此时，踏板倾斜程度不一样，此时所处位置较高踏板处于水平位置，而所处位置较低的踏板则是向车体内疗稍微倾斜。使驾驶者驾驶时更加舒适，而且，水平位置较低车轮向车体内侧倾斜，使车体不易翻转，减小翻车的可能。

[0068] 参看图 11-1 为 4 连杆梯形机构，正常状态下梯形结构呈等腰梯形状态，当小车处于倾斜路面或转弯状态时，车体 4 连杆梯形结构发生变化，参看图 11-2-，此时车体发生倾斜，梯形结构的特点导致两边踏板倾斜角度不一样，即如图所示 $\alpha_1 > \beta_1$，内侧倾斜角度小，符合人体重心偏移时，重心偏移方向。

[0069] 参看图 12-1，当小车处于倾斜路面或转弯状态时，车体六连杆梯形结构发生变化，如图 12-2-，此时车体发生倾斜，本结构的特点导 致两边踏板倾斜角度不一样，即如图所示 $\alpha_2 > \beta_2$，内侧倾斜角度小，符合人体重心偏移时，重心偏移方向。

[0070] 本发明中，梯形结构特点使左右两边踏板倾角不同，而且重心偏移方向踏板倾角小，对侧倾角大，即 $\alpha > \beta$，由人体站立姿态示意和重心偏移时姿态示意可知，重心偏移方向倾角小于对侧倾角是人驾驶最舒适的状态，且经过优化得到梯形结构中各连杆长度的最优解。

[0071] 参看图 13-1，根据驾驶者身高不同或折叠要求，可将把手调整不同的长度。前杆 13-1-118 与后杆 13-1-119 可通过活动销 13-1-120 进行固定或滑动，后杆 13-1-19 上有固定孔，活动销 13-1-120 在滑动至固定孔时凸出，使前杆和后杆固定连接，当用力按下活动销，使前杆和后杆脱离连接，前杆和后杆可发生相对滑动实现伸缩。参看图 13-2，折叠机构通过 U 形块 13-2-43 与梯形结构竖杆 13-2-23 连接，T 形块 13-2-48 与把手 13-2-44 固连，转轴 13-2-50 通过 U 形块 13-2-43 和 T 形块 13-2-48 中的孔使 U 形块 13-2-43 和 T 形块 13-2-48 形成铰结关系，在另一端转轴外套弹簧 13-2-46，与螺母 13-2-45 进行螺纹连接。13-2-49 为固定在销轴 13-2-50 大圆面上的销，正常状态下，由于弹簧的弹力压紧螺母，使销轴大圆面贴紧 U 形块 13-2-43，销 13-2-49 同时穿过 U 形块 13-2-43 和 T 形块的固定孔，把手被固定，当用力压螺母 13-2-45 时，弹簧 13-2-46 压缩，销轴 13-2-50 带动销 13-2-49 向 U 形块 13-2-43 外面运动，当销脱离 T 形块的固定孔时，U 形块与 T 形块间为铰接关系，可以折叠状态和直立状态间进行切换。

[0072] 参看图 14-1-14-2- 所示，为本发明的实施例图，采用了两种不 同高度的腿控制杆。图 14-1 采膝盖控制的方式，这种控制方式的特点为控制杆短，驾驶都用腿来控制车体的运行和车体的姿态，控制灵活。图 14-2 采用大腿内侧控制的方式，这种方式的特点为控制杆长，驾驶者通过大腿内侧来控制车体的运行和车体的姿态，体验性更强，车与人体的协调性更强，驾驶者的驾驶感受更好。参看图 14-3 和图 14-4 四连杆梯形结构和六连杆结构在本发明中具有相同的效果，通过改变连杆中竖杆的结构和把手的形式可得到不同的实施方

式。参看图 14-5 和图 14-6，悬挂系统主要由摆动侧臂 14-51，强力弹簧 14-52，转轴 14-53 构成，转轴与踏板连接，摆动侧臂 14-51 可绕转轴 14-53 转动，摆动侧臂末端与弹簧 14-52 连接，弹簧压缩伸展可带动摆动侧臂摆动，摆动侧臂 14-51 与轮子部分相连接，即轮子部分压力发生突变导致轮子上下运动时，带动摆臂摆动，并压缩弹簧。

[0073] 当需要转弯或行驶在倾斜路面时，重心偏移导致两侧压力变化，并形成压力差，弹簧形变量不同，导致两边踏板离地高度也不一样，此时，摆臂摆动角度不一样，转轴处安装有角度传感器，通过检测角度可知车体所处状态并作出相应的反应。

[0074] 参看图 15，控制电路分为无线控制器 108，协调控制模块 109，角度传感模块 110 和两个电机驱动模块 111、112，共五大部分，后四个车载模块之间通过 CAN 总线进行通讯，电源系统由电池先给协调控制板供电，再由其统一控制其他模块的电源。下面分别对各个模块进行说明。

[0075] 控制模块 108 可采用有线控制和无线控制两种方式，无线控制模 块采用便携、低功耗的设计方式，可以手持控制或安装在车把上，用于无线监控车体的状态信息，显示运行状态，行驶速度，电池电量等信息。在自平衡和自引导状态下还可以对车体进行 10 米以内的短距离无线控制。

[0076] 协调控制模块 109 负责控制电路与其他外部功能按键 113 和电池 114 等外设的接口电路模块，统一对供电电池的电压、电流进行监测和保护，采集电池 114 电量信息，在各种工作模式下，管理对其他电路模块的供电，维持低功耗状态下的待机性能。除了转向传感器之外的外部的功能按键信息也统一由该模块采集，并送交角度传感模块进行统一的控制。该模块还负责将通讯状态的信息通过无线发射的接口发送至 PC 端，方便监控车体控制电路的运行状态，并预留了无线遥控的功能，可以保证当车体运行在自动平衡模式下时可以灵活地受到使用者的手持无线控制器的控制。该模块有感知引导信息的接口，自动引导模式下，当无线控制器发出的方位信息被感知到时，控制车体转向正确的方向，并控制距离无线控制器的距离，以实现方便的自动引导功能。该模块设计有外扩 SD 卡插槽，将角度，速度等实时采集的重要信息存储至 SD 卡，大量记录的数据帮助对车体的故障进行有针对性的分析。

[0077] 角度传感模块 110 负责采集当前的车体姿态信息，包括相对于水平面的绝对角度、侧倾角度等，通过加速度传感器和微机电陀螺仪的测量值进行融合，计算得到当前的准确角度信息，并发送至底盘电机驱动模块进行车体平衡控制。转向传感器的信号也送进角度传感器 板，统一负责发送底盘转向的命令。

[0078] 底盘左右电机采用完全一样的电机驱动模块 111、112，该模块由供电电路，控制核心，对外接口，光耦隔离电路，功率放大电路以及保护电路组成，负责直流无刷电机的精确伺服控制，特别是要求达到的高性能低速四象限控制性能。

[0079] 控制系统采用的控制核心均为高性能处理器，以每秒至少 100 次的调节速度精确控制车体的平衡，电池采用高能量密度电池，为电机提供充沛的动力及续航能力，同时减轻了车体重量。

[0080] 参看图 16，采用模块化设计，系统分为 4 个部分，即电机驱动控制部分 16-54，传感器信号调理与控制算法部分 16-55，系统接口与电源部分 16-57，无线控制器部分 16-56 ；电机驱动控制部分 16-54 与传感器信号调理与控制算法部分 16-55 连接，传感器信号调理与

控制算法部分 16-55 与无线控制器部分 16-56 连接，传感器信号调理与控制算法部分 16-55 与系统接口与电源部分 16-57 连接。

[0081] 参看图 17-1，主要是完成对各惯性传感器的信号调理与运动控制算法。传感器信号调理程序主 17-59 要负责对各传感器信号进行滤波与融合，为运动控制程序 17-61 提供较高精度的角度和角速度信息。运动控制程序 17-61 主要负责利用传感器信号调理程序 17-59 产生的当前车体的姿态和动作信息计算出合适的控制输出。通讯控制程序 17-60 负责接收外部控制信号，同时将控制输出发送到电机控制模块上去。出错处理程序 17-58 负责监控模块内部各软件与硬件的工作状态，并在出错时给出相应的报警信息。

[0082] 参看 18-1，电机控制模块主要是完成接收上位机的控制命令并实现对电机的控制工作。通讯控制程序 18-69 主要完成接收上位机的命令并根据命令调用不同的功能模块。PID 调节控制程序 18-72 主要完成对电机的闭环控制，包括速度闭环，电流闭环等。电机控制程序 18-73 主要负责对电机进行底层控制。硬件监控程序 18-71 负责监控驱动电路各主要敏感部分的工作状态。出错处理程序 18-70 主要负责对各功能的错误处理与对外报警。

[0083] 参看图 19-1，该模块主要负责整个系统对外的接口，如无线通讯口，串口等。并完成对系统中其他各模块电源管理，以达到低功耗的目的。电源管理程序 19-81 主要负责对系统中各模块的电源进行控制，根据不同的状态，开启不同的设备。扩展接口管理程序 19-84 主要负责对系统中的扩展接口和其他附件进行控制。无线管理程序 19-83 主要负责与无线模块进行通信。CAN 通讯管理程序 19-82 主要负责对 CAN 总线进行监控，出错处理程序 19-85 主要负责对各功能的错误处理与对外报警。

[0084] 参看 20-1，该模块主要用于系统扩展控制，通过无线通讯接口，对自动重心控制小车进行控制与状态监控，如电池电量，运行速度，运行里程等状态。LCD 控制程序 20-94 主要负责对板载的液晶进行控制与显示。无线通讯管理程序 20-95 主要负责无线接入。菜单系统 20-96 负责 LCD 显示部分的人机接口的交互逻辑部分。错误处理程序 20-97 主要负责错误处理和报警。

[0085] 本具体实施方式采用双备份电机控制策略，两套电机驱动和控制 系统采用互相备份的方式，保障在发生故障时的运行稳定和运行安全。采用更智能和更安全可靠的软件系统，不仅从硬件上实时纠错，保证运行的可靠性，而且从软件上逐层实时检测和纠错，不仅在模块之间建立反馈检测，应急报警机制，而且在各个模块内部建立实时反馈和出错应对机制，保证了自动重心控制小车在运行过程中的安全可靠性及稳定性。

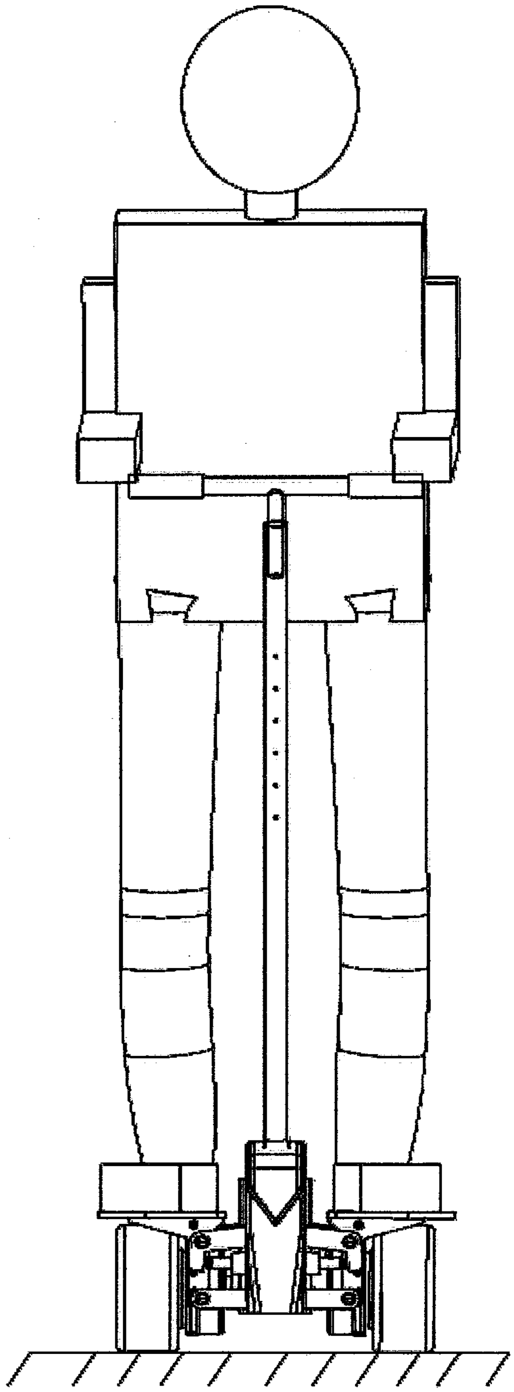


图 1-1

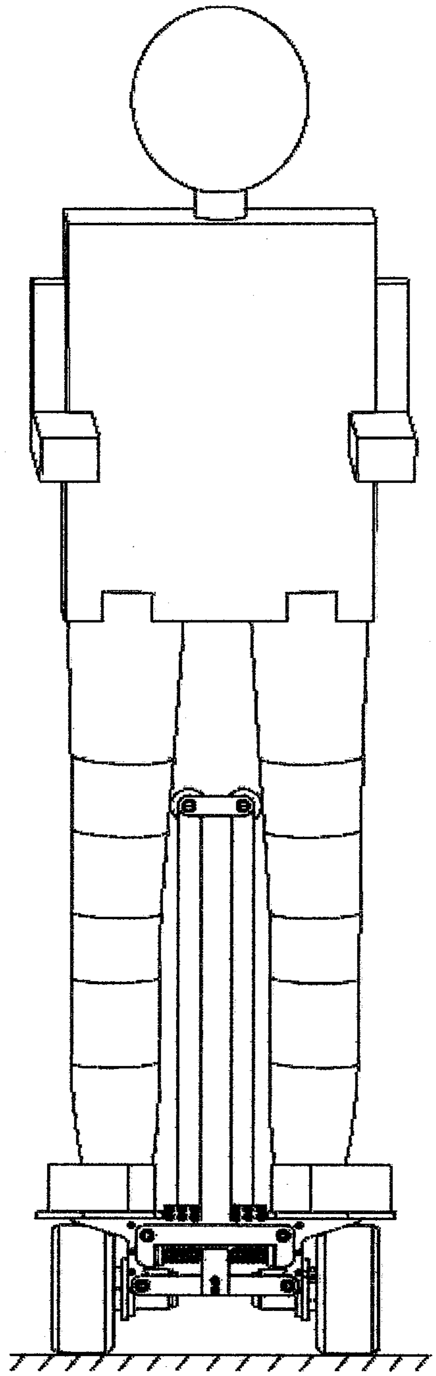


图 1-2

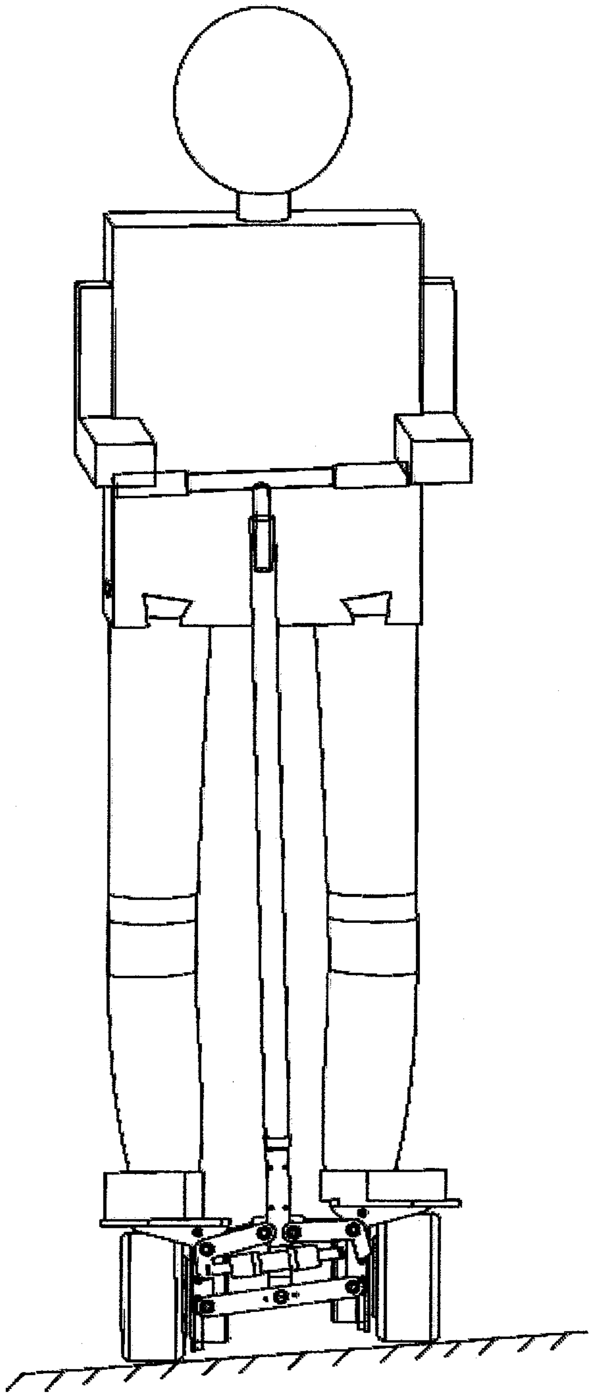


图 2-1

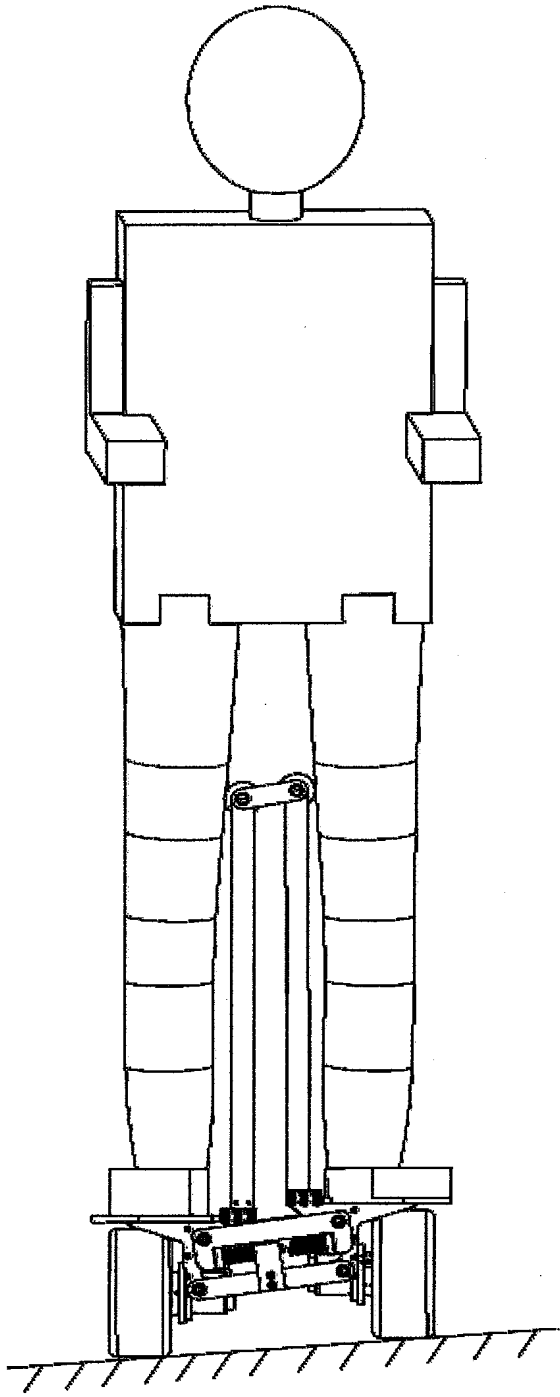


图 2-2

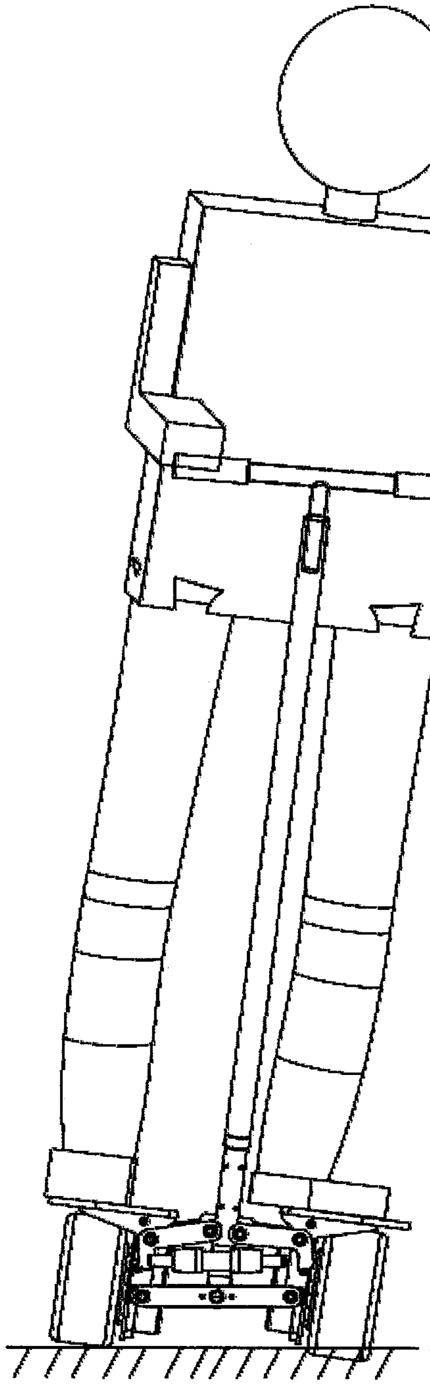


图 3-1

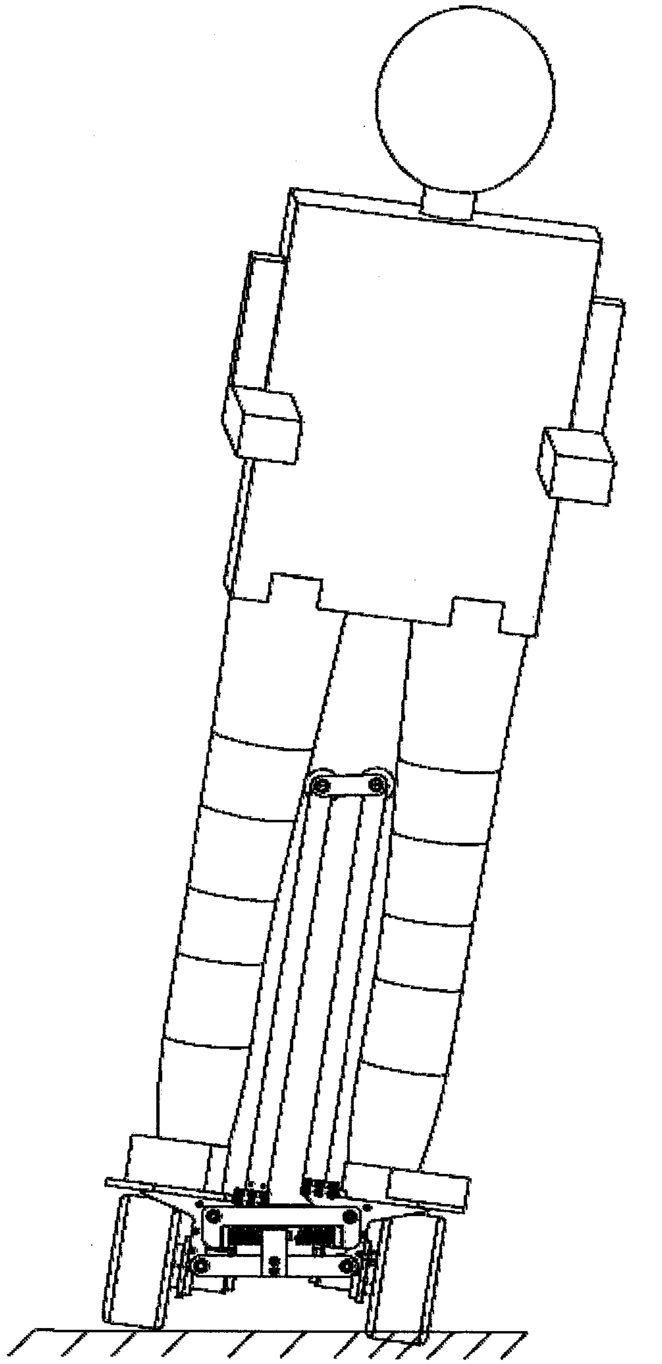


图 3-2

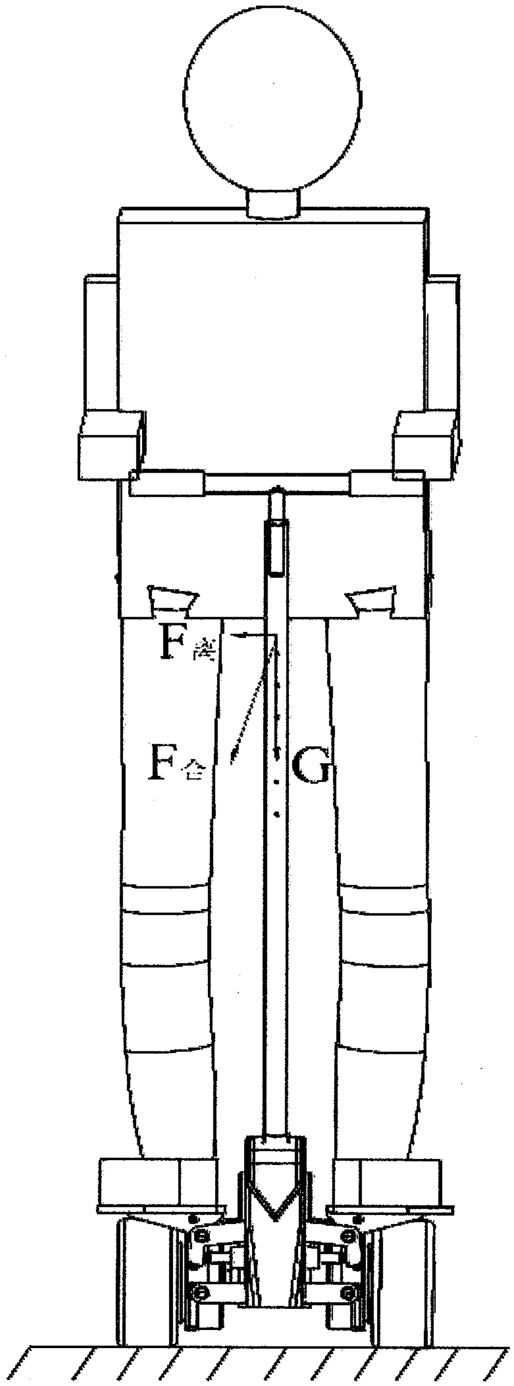


图 4-1

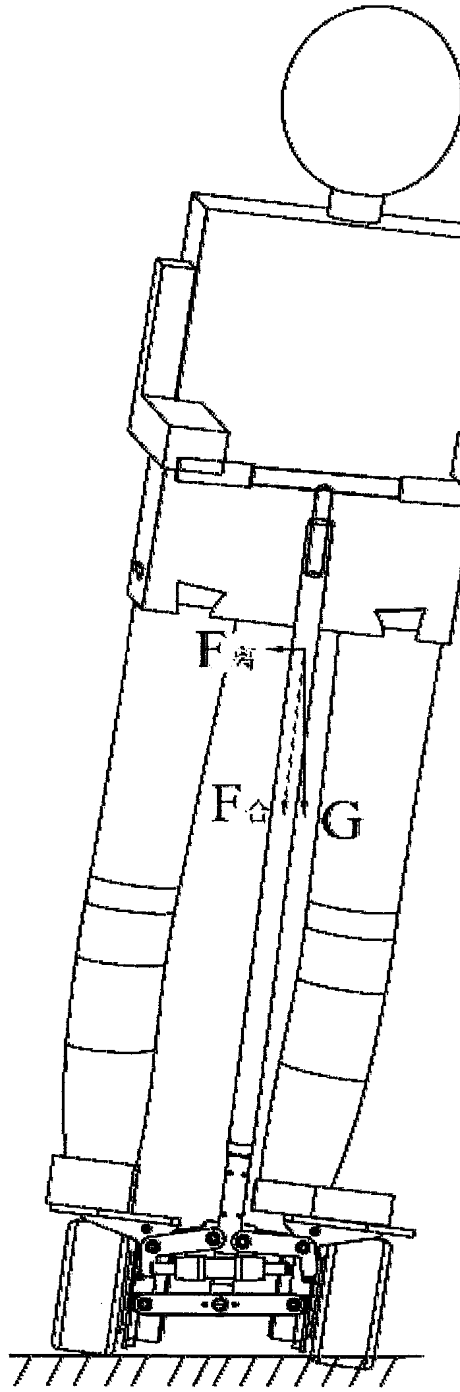


图 4-2

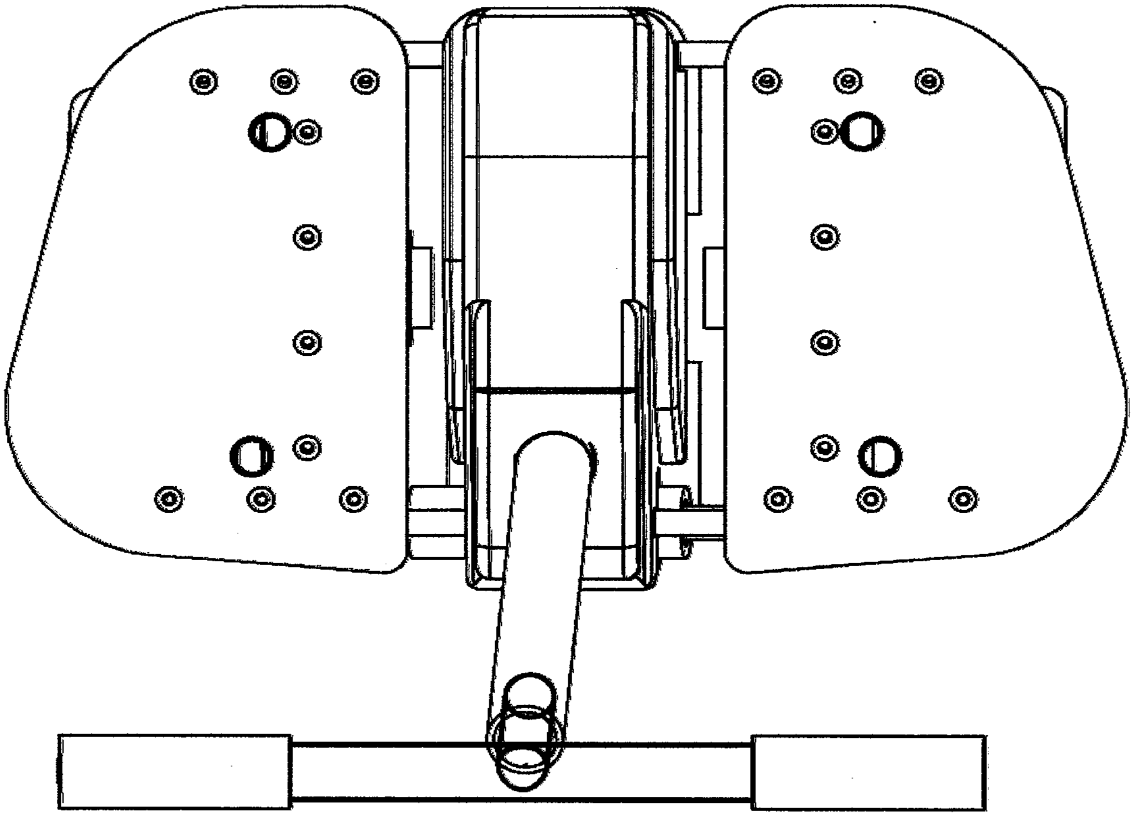


图 5-1

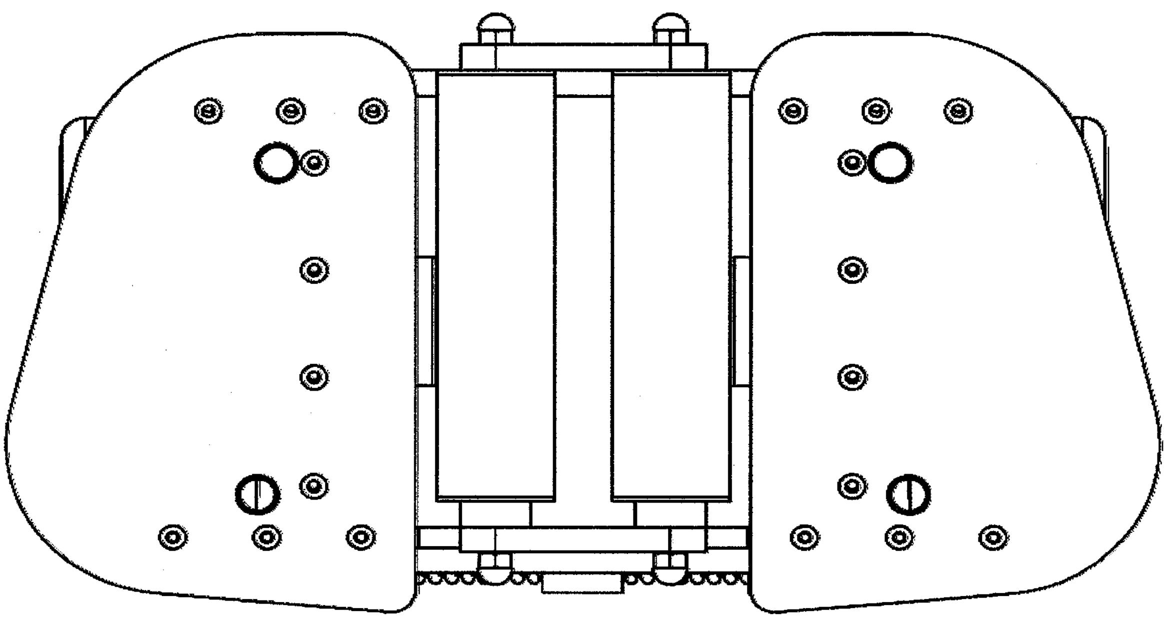


图 5-2

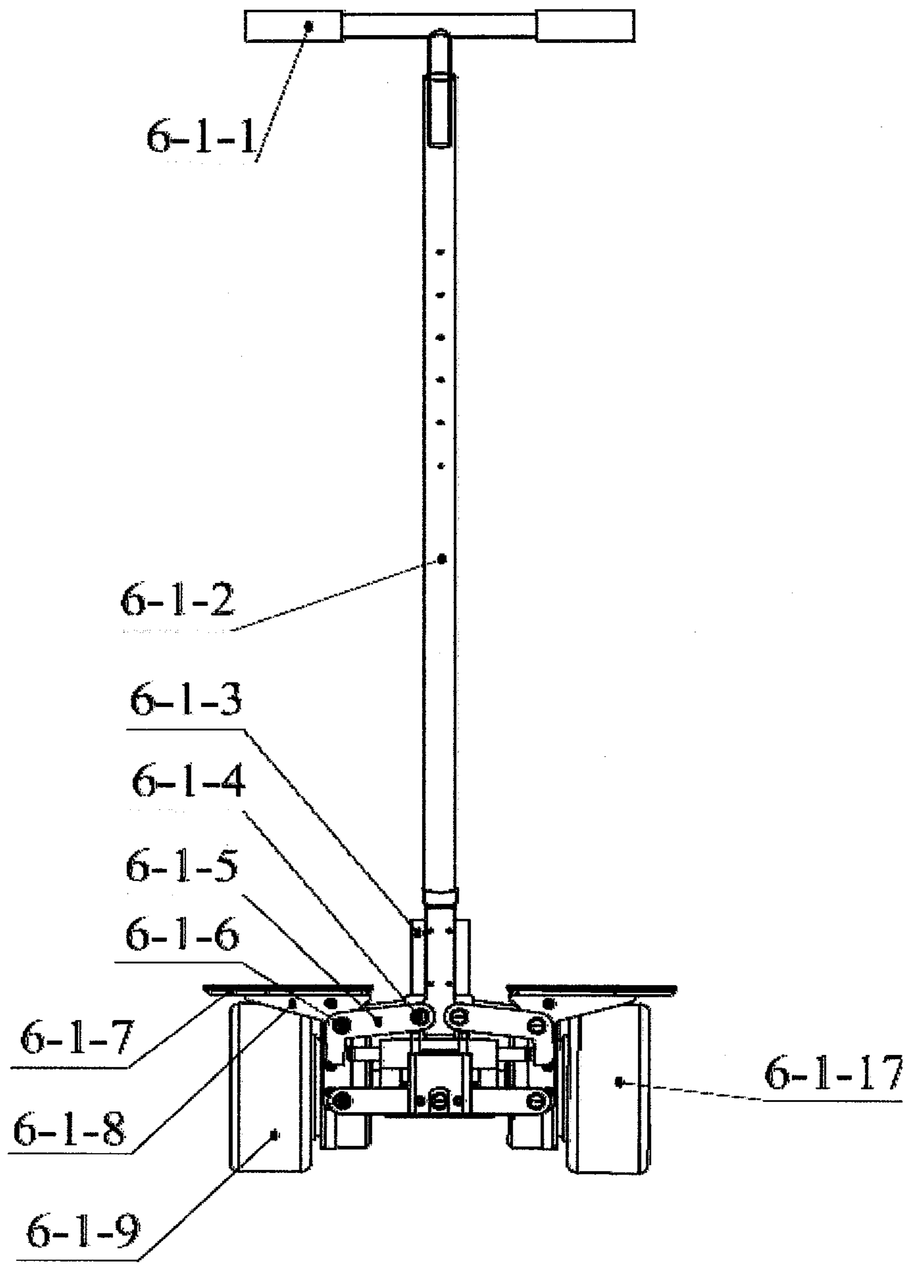


图 6-1

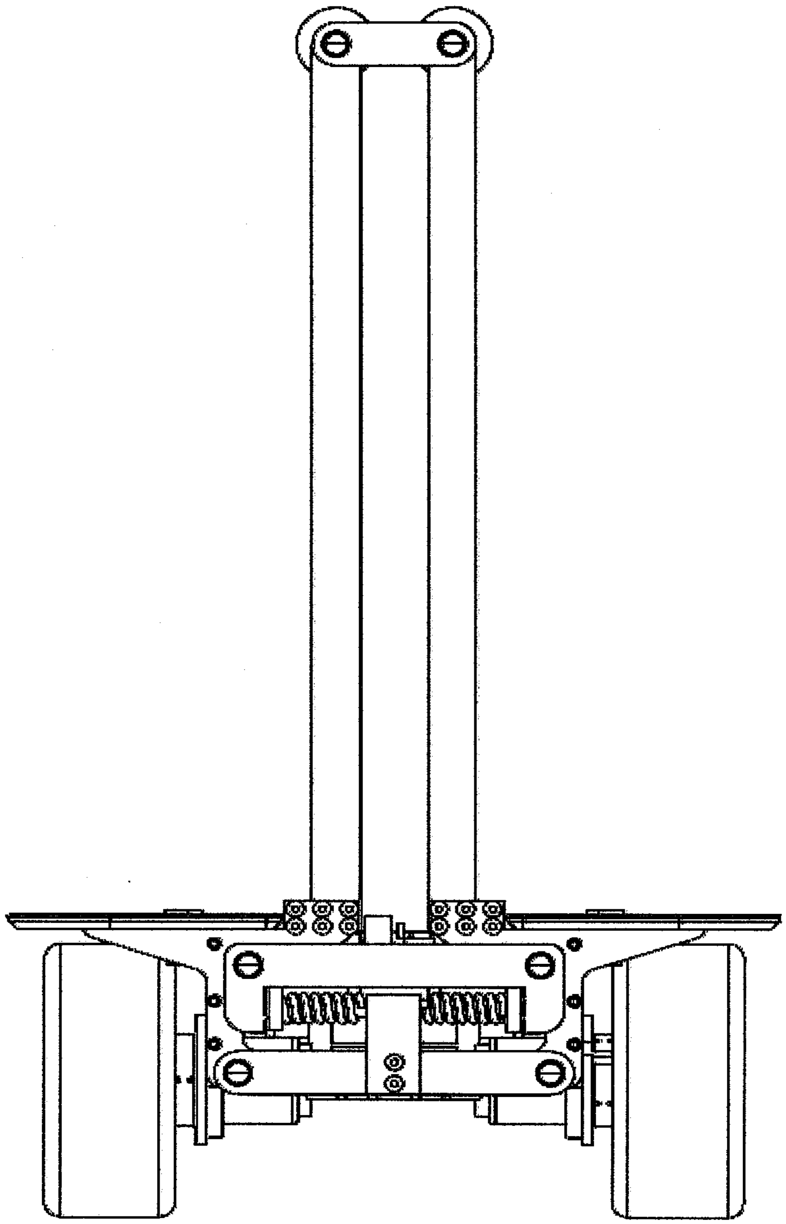


图 6-2

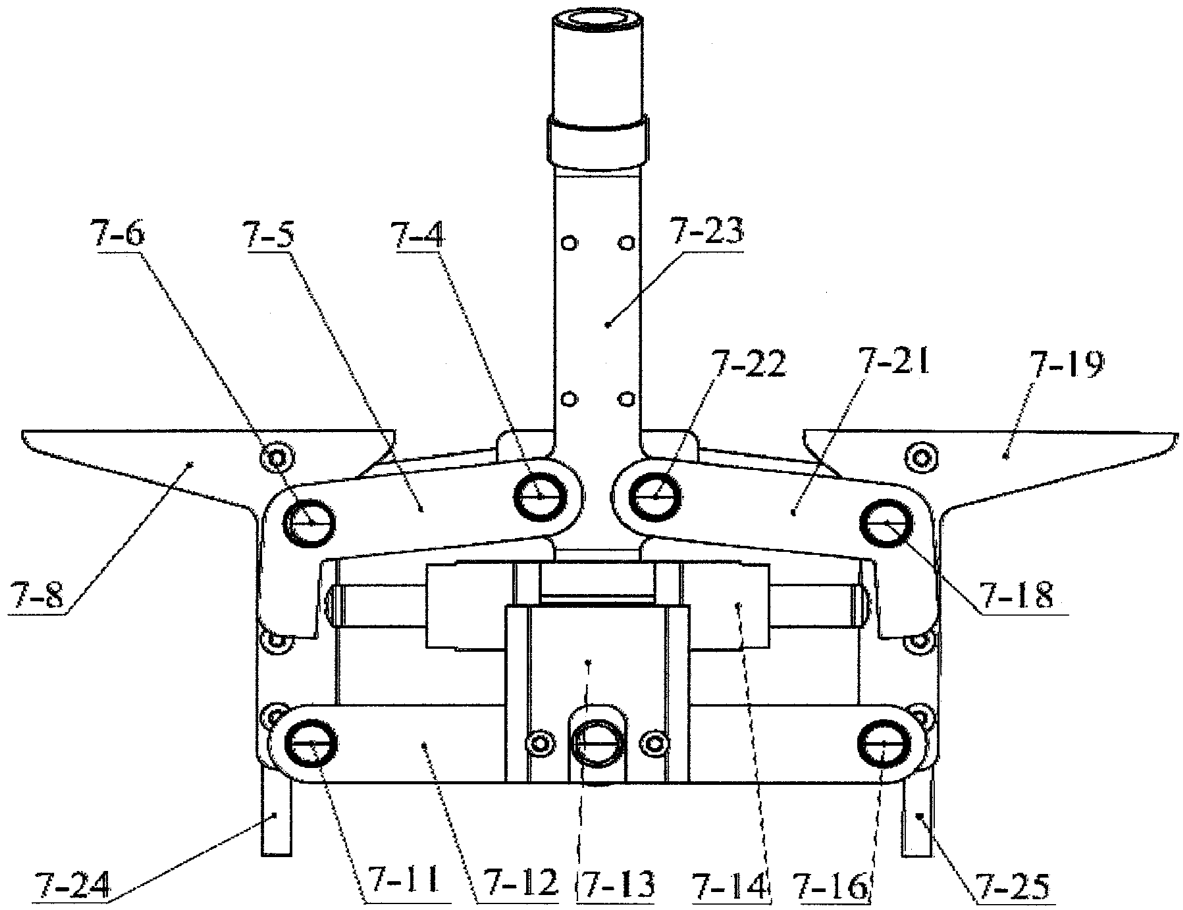


图 7

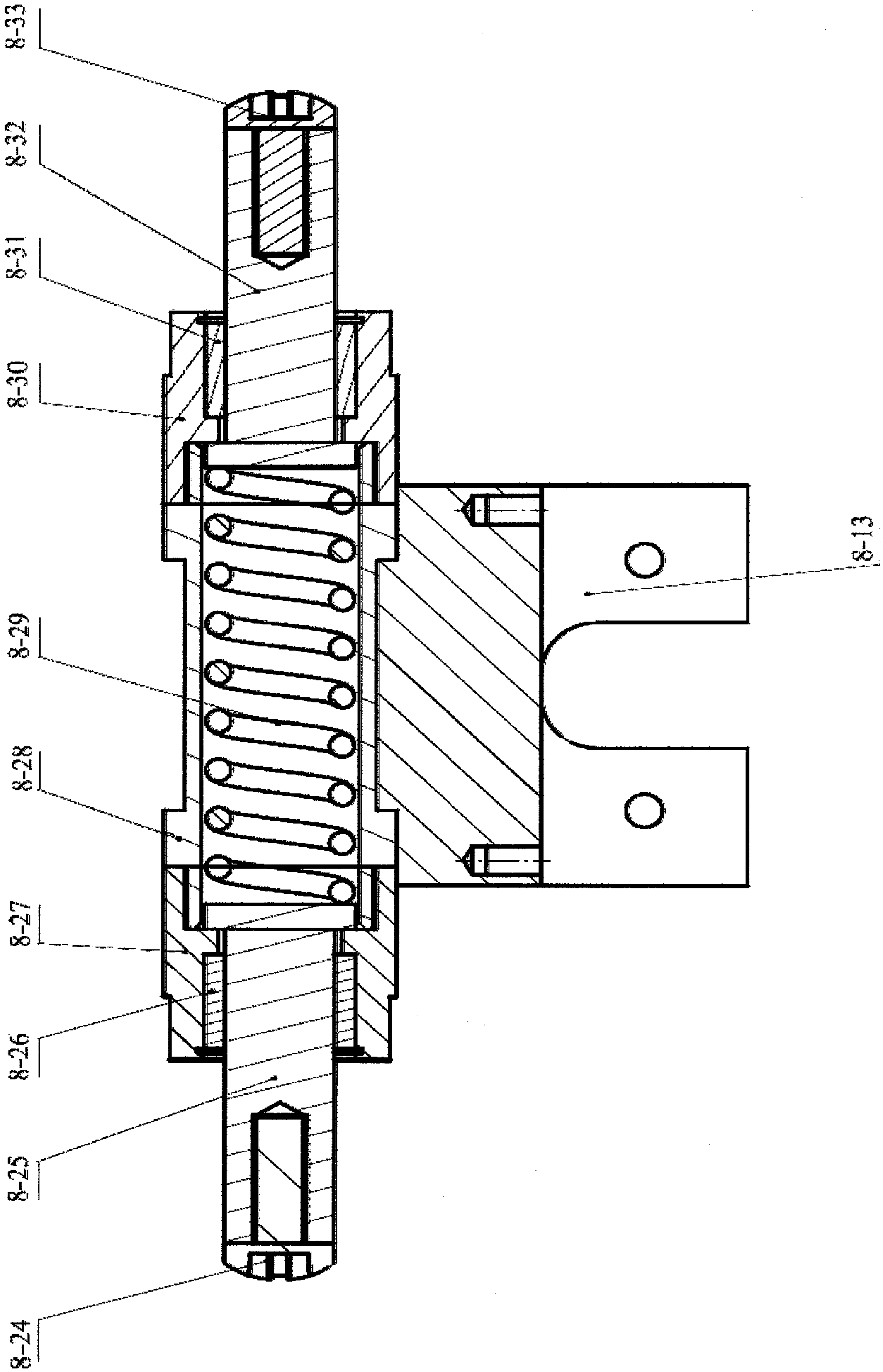


图 8

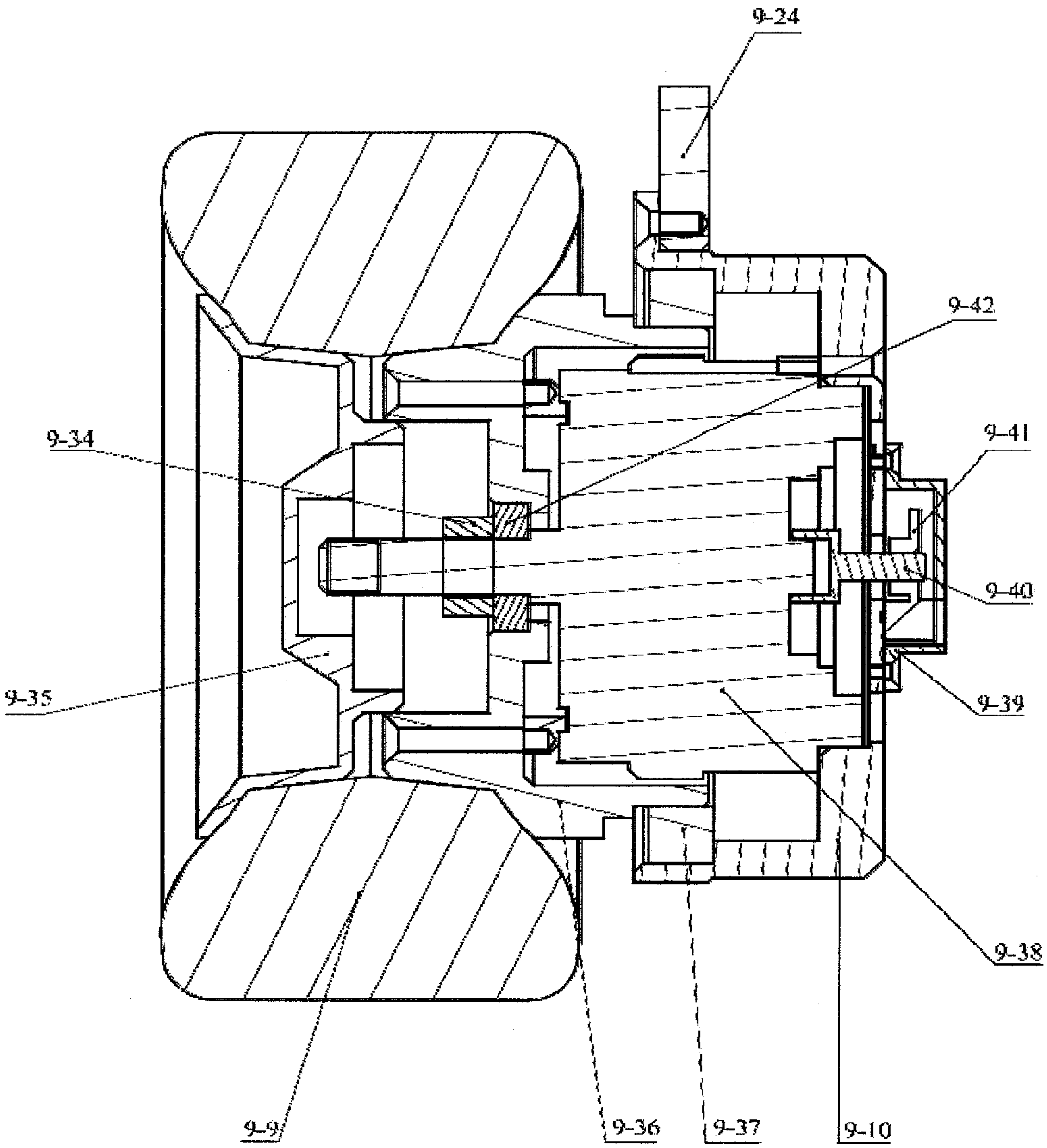


图 9

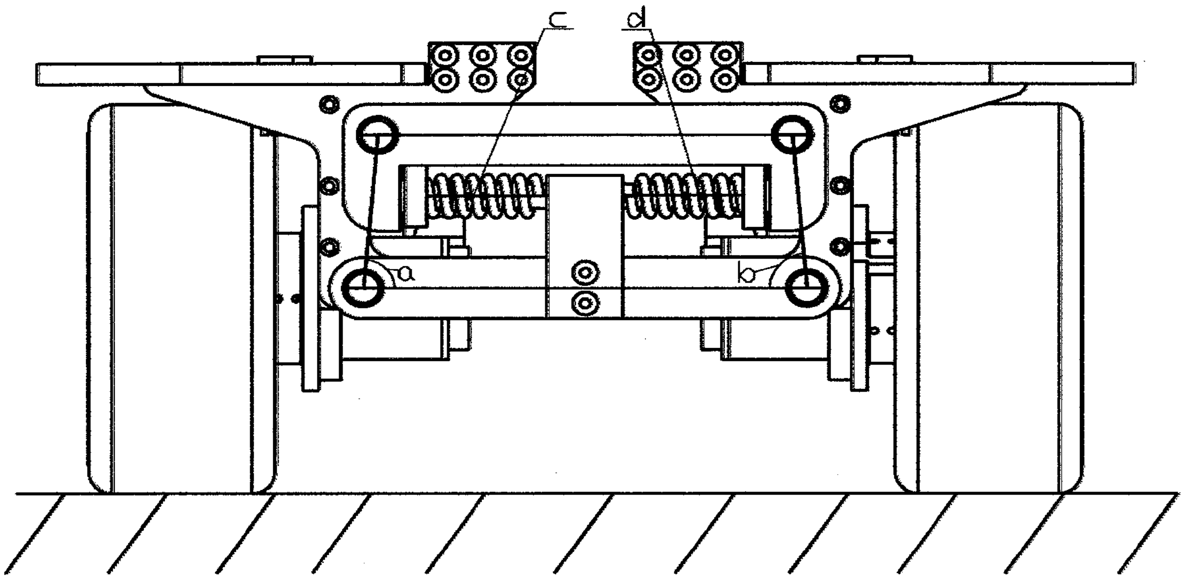


图 10-1

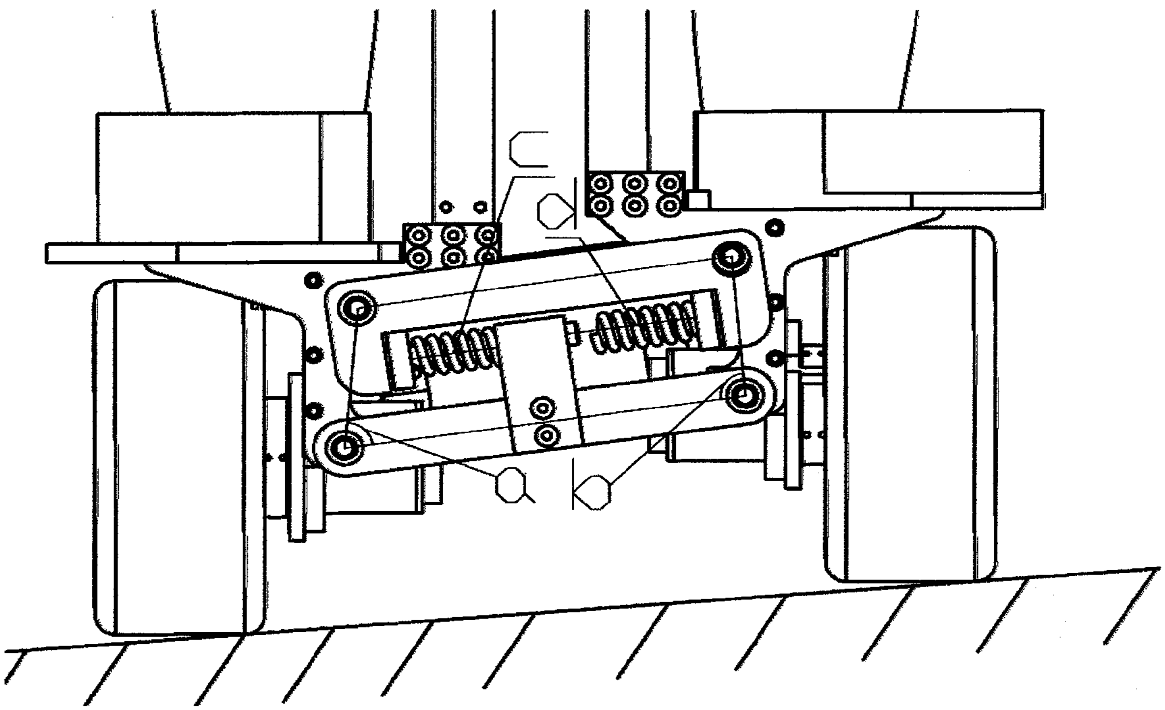


图 10-2

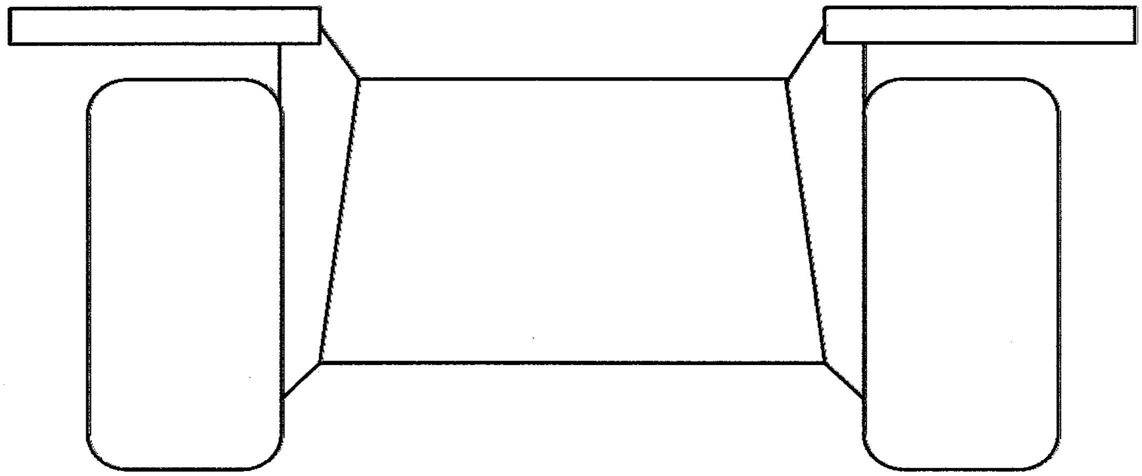


图 11-1

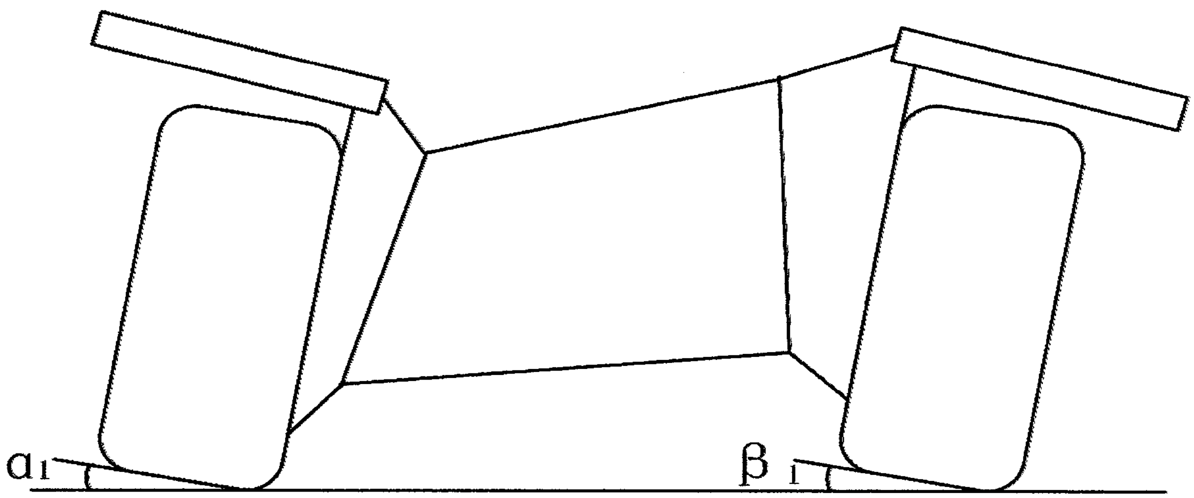


图 11-2

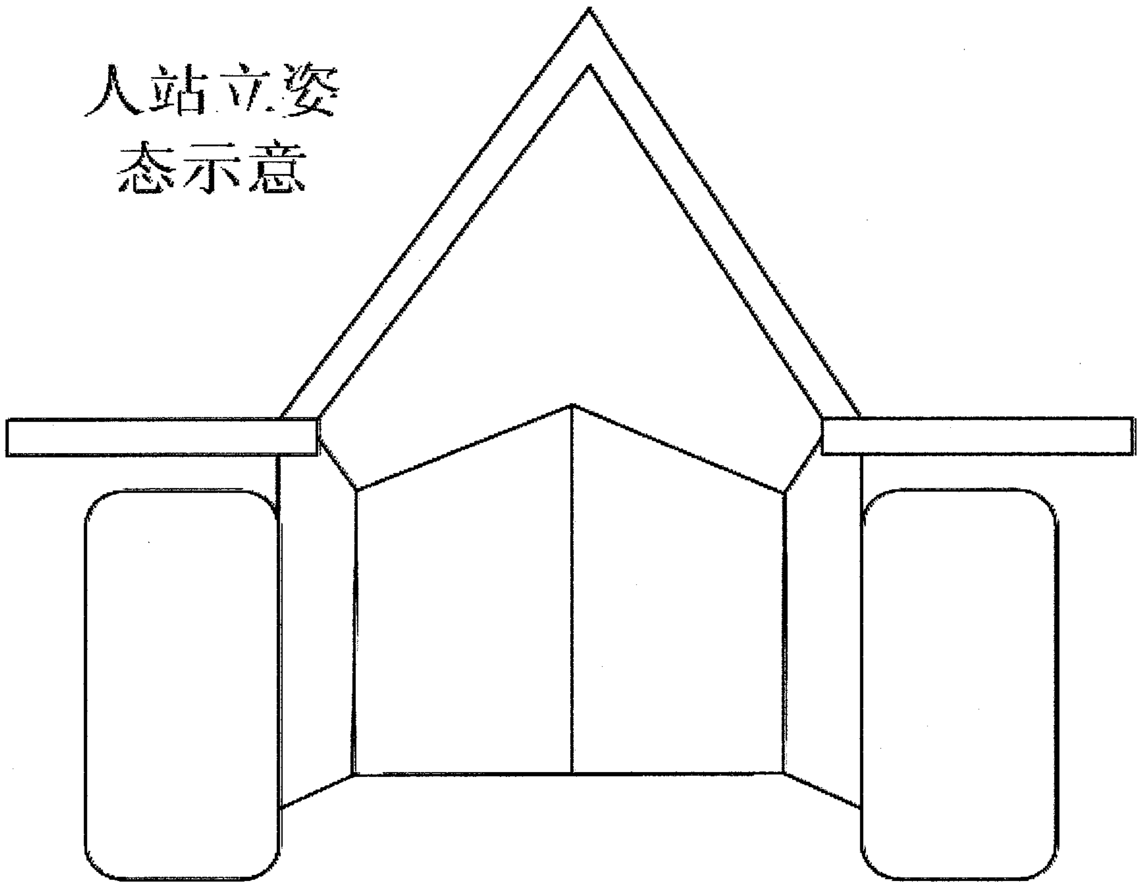


图 12-1

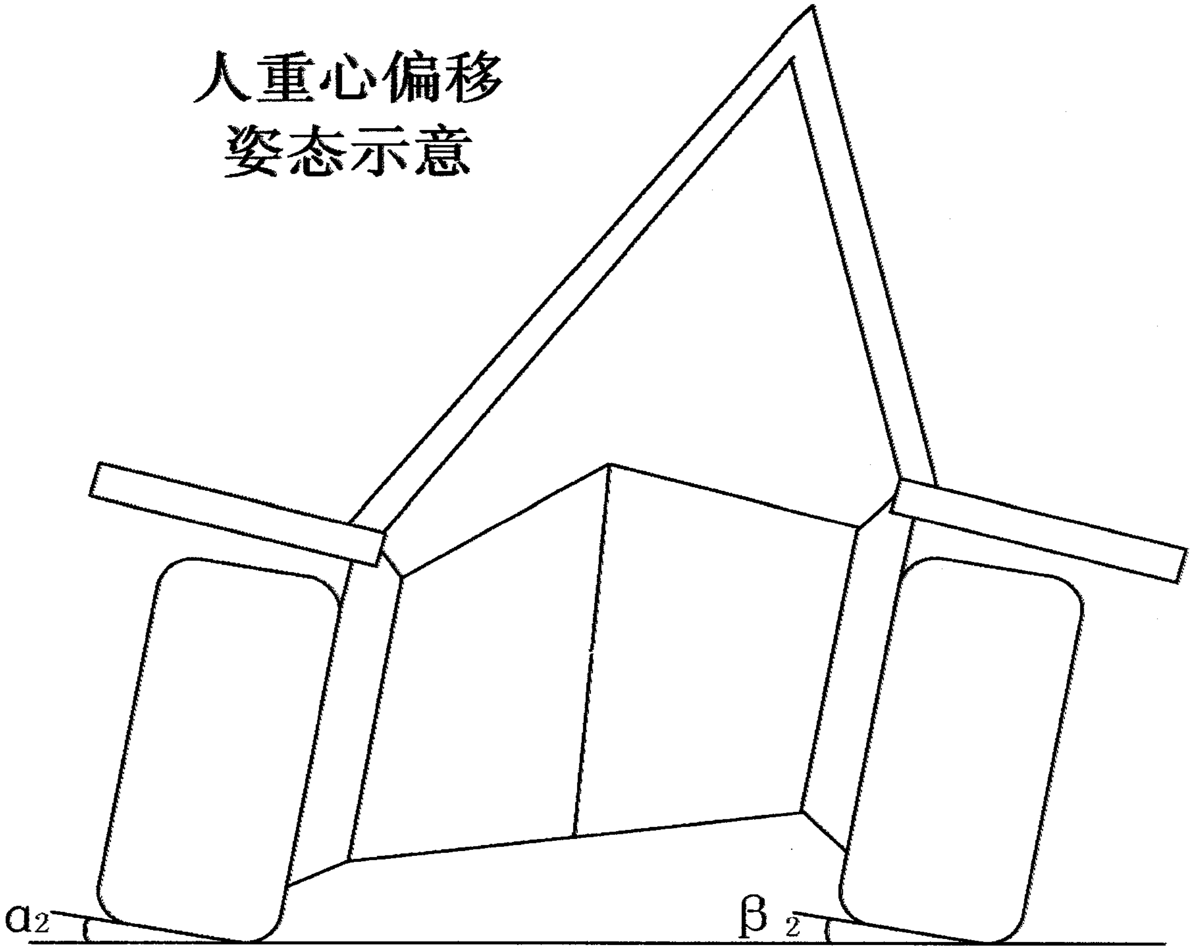


图 12-2

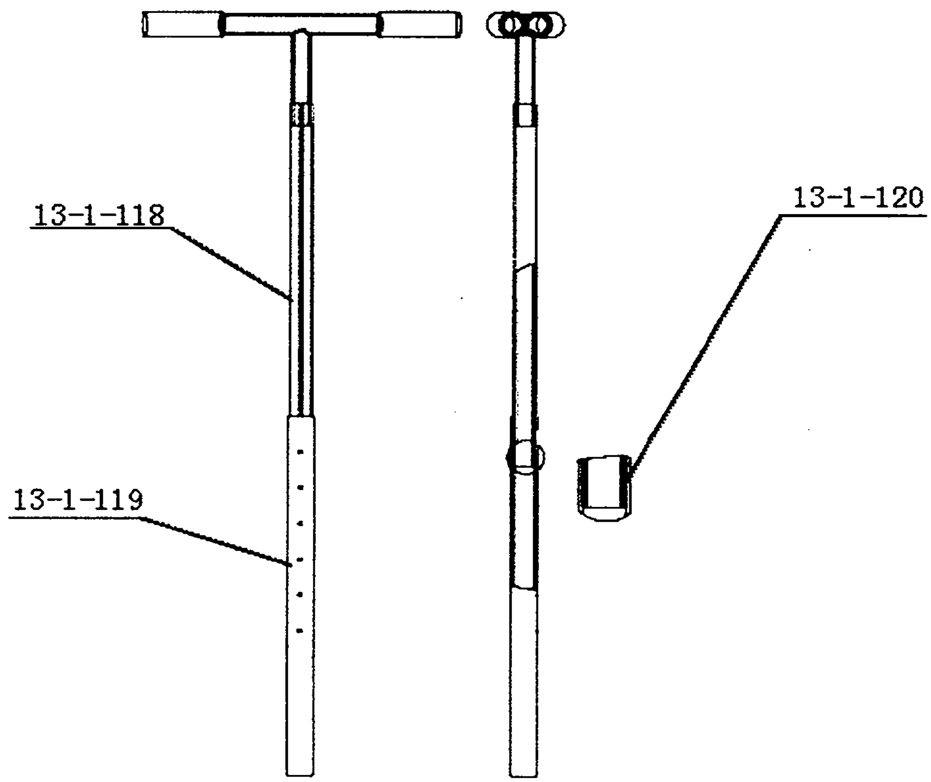


图 13-1

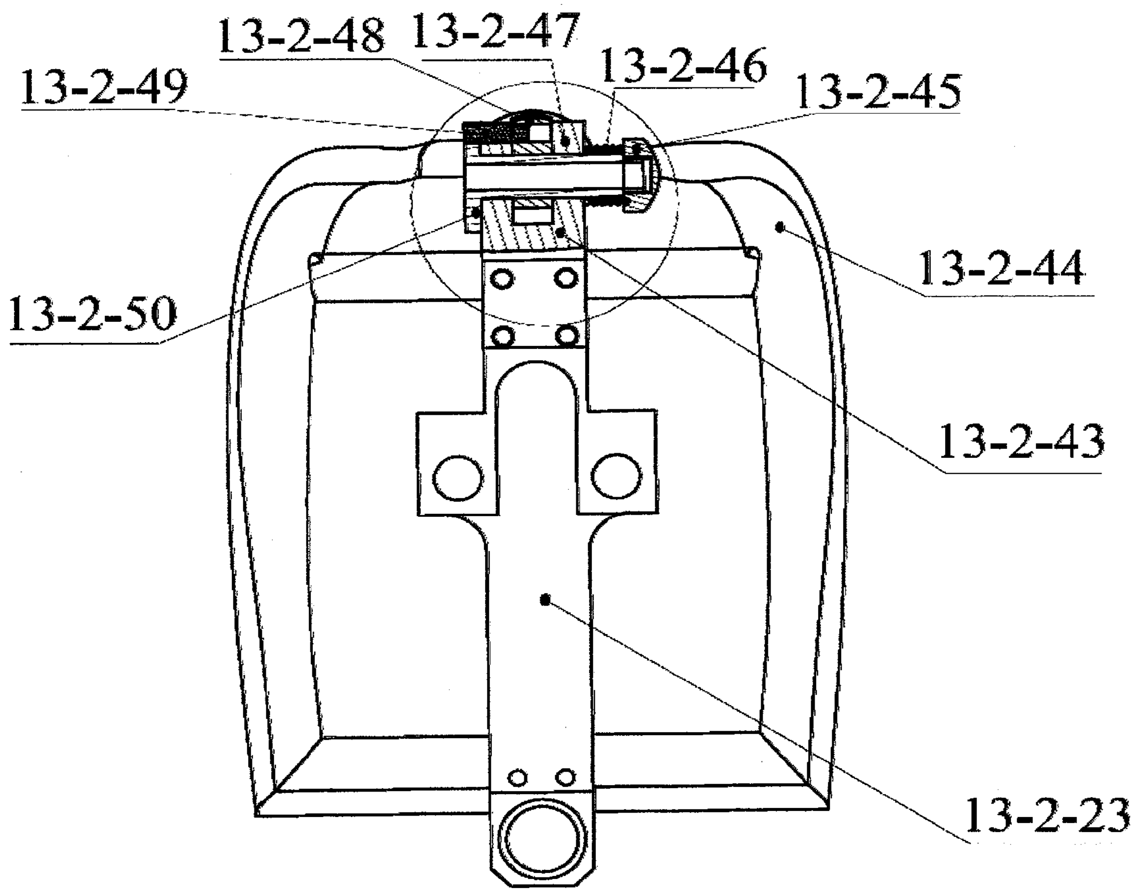


图 13-2

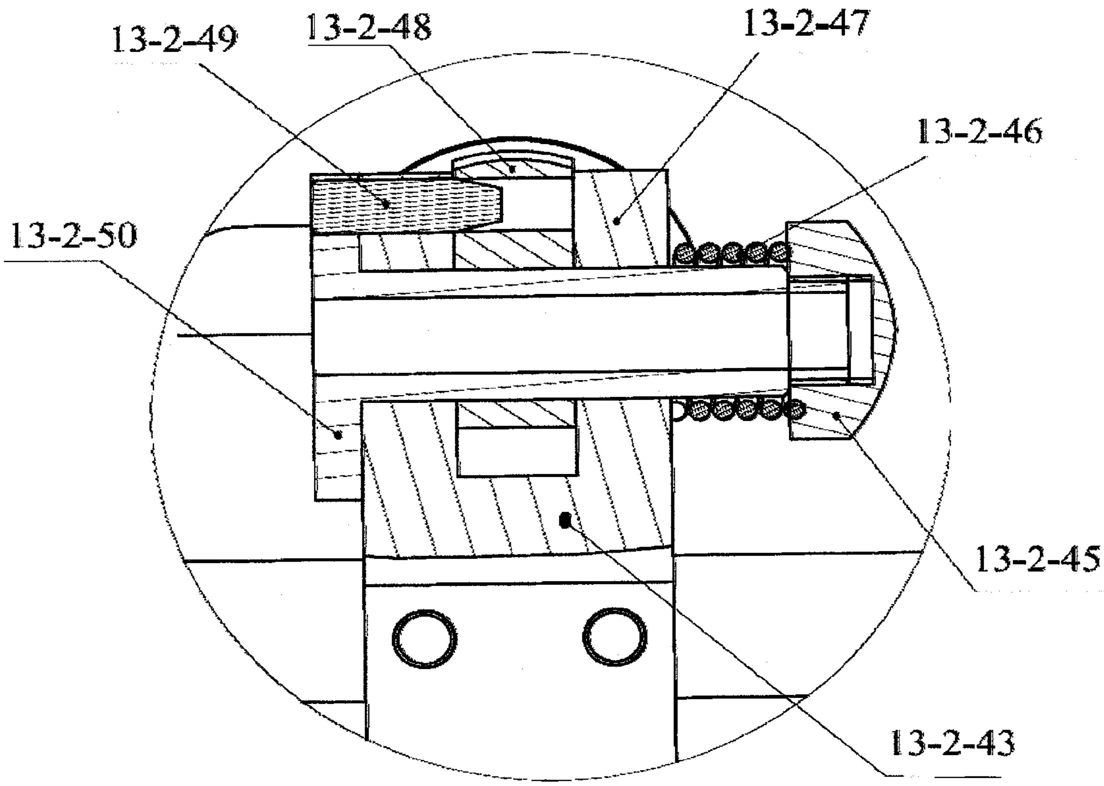


图 13-3

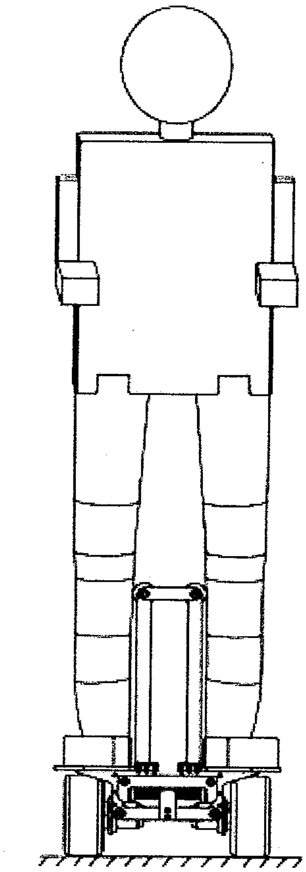


图 14-1

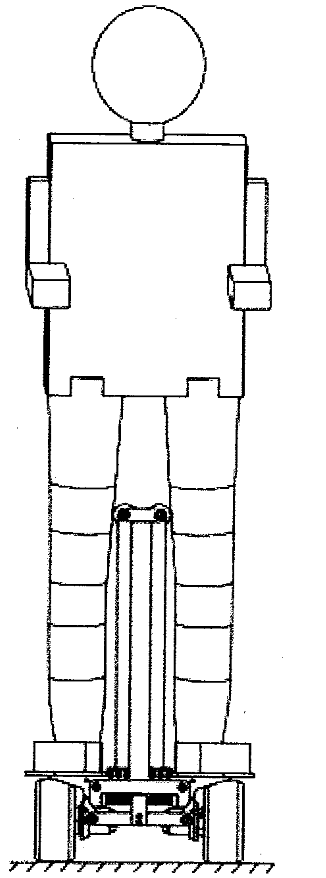


图 14-2

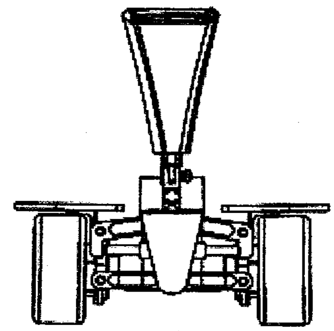


图 14-3

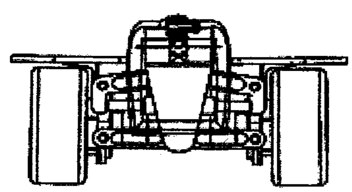


图 14-4

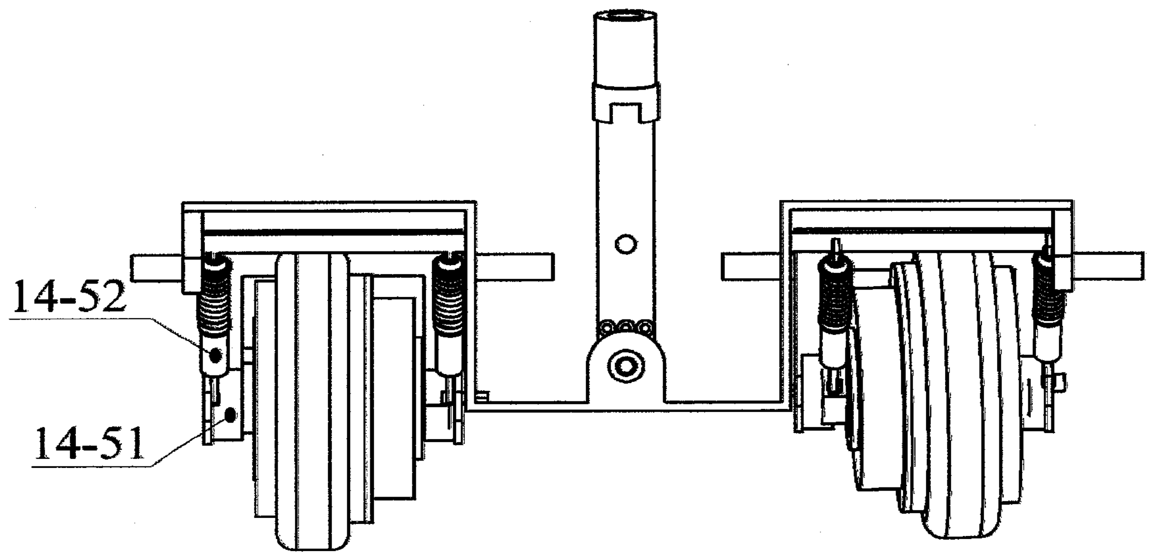


图 14-5

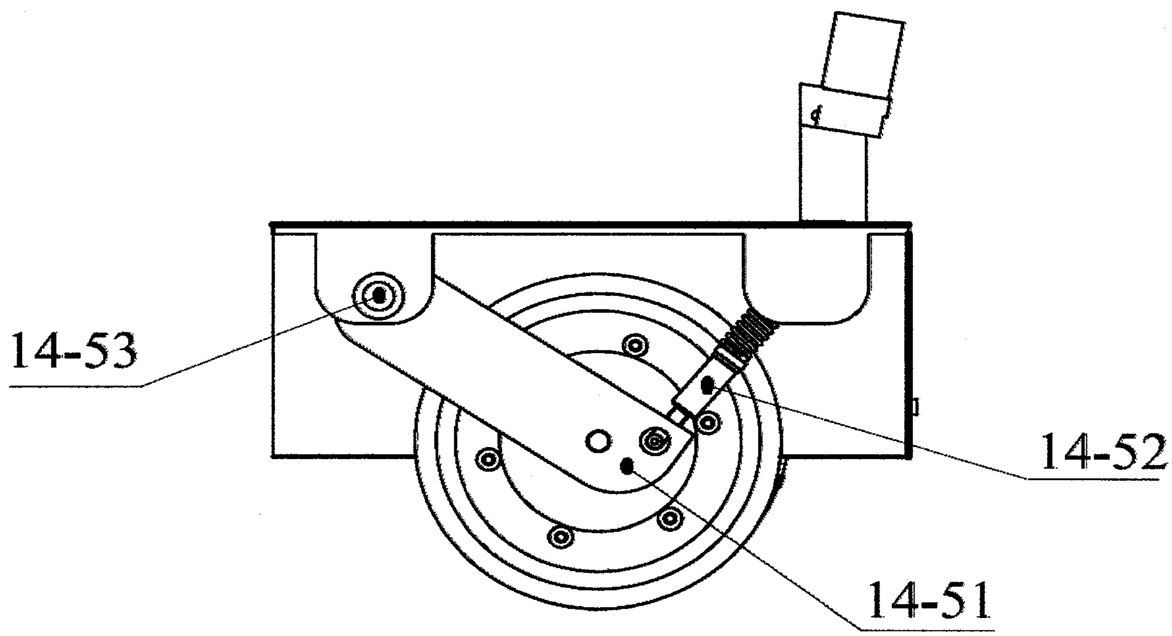


图 14-6

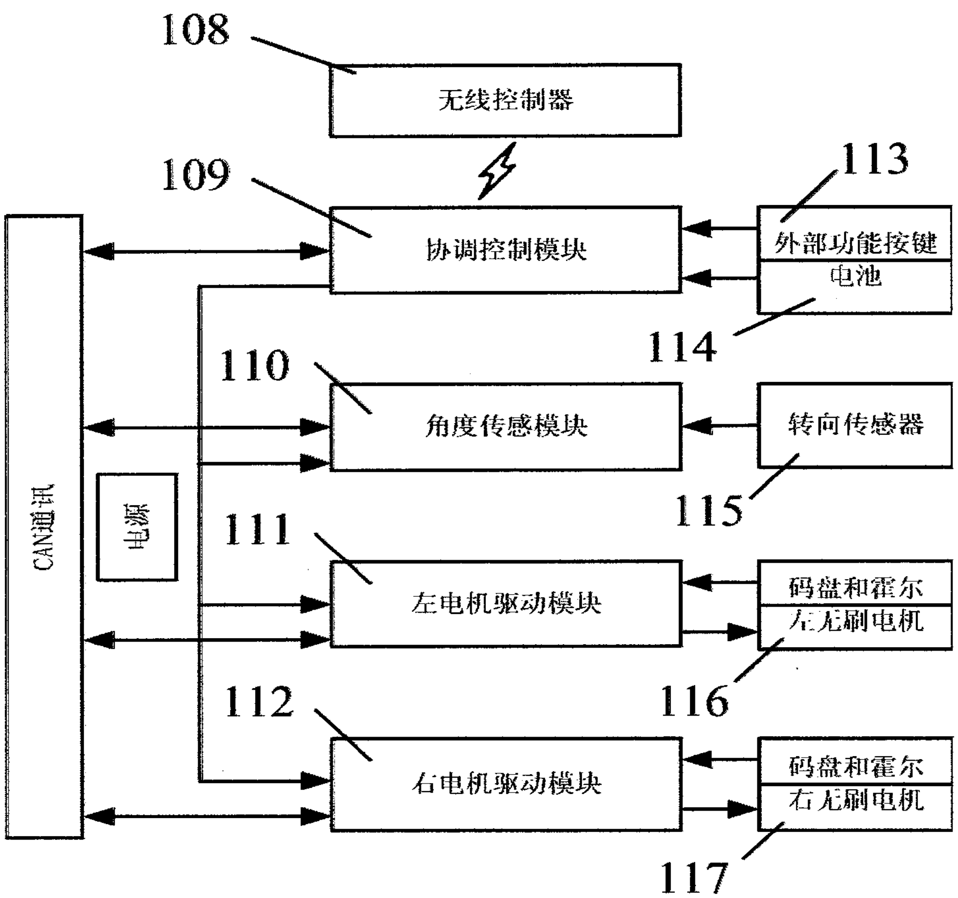

108
无线控制器
109
协调控制模块
113
外部功能按键
电池
114
110
角度传感模块
转向传感器
115
CAN通讯
电源
111
左电机驱动模块
码盘和霍尔
左无刷电机
116
112
右电机驱动模块
码盘和霍尔
右无刷电机
117

图 15

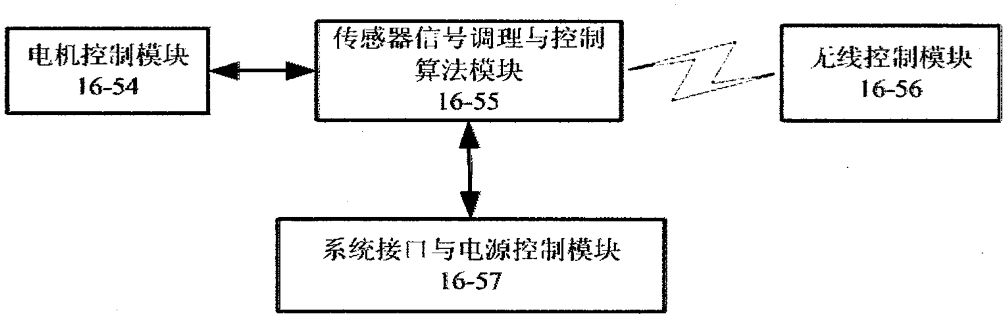

电机控制模块
16-54
传感器信号调理与控制
算法模块
16-55
无线控制模块
16-56
系统接口与电源控制模块
16-57

图 16

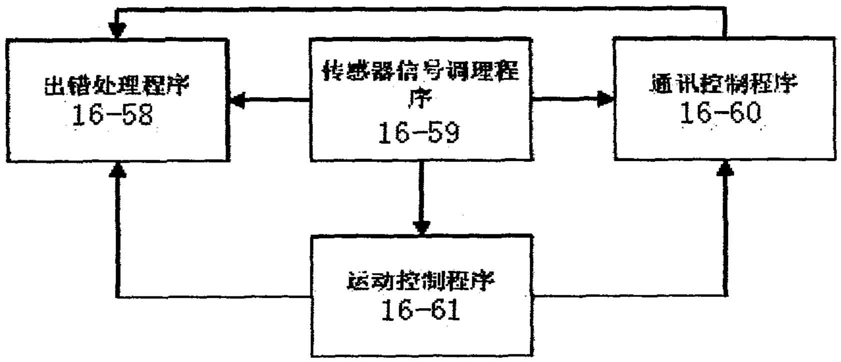

出错处理程序
16-58
传感器信号调理程序
16-59
通讯控制程序
16-60
运动控制程序
16-61

图 17-1

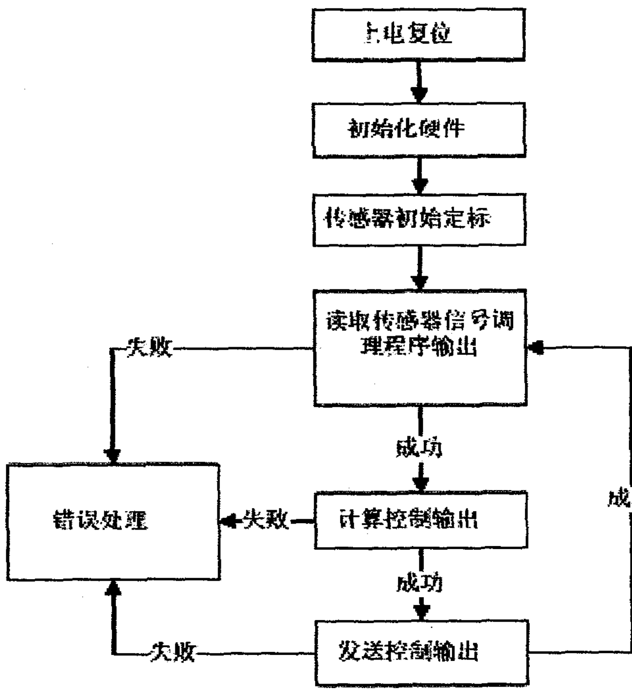

上电复位
初始化硬件
传感器初始定标
读取传感器信号调理程序输出
失败
成功
错误处理
失败
计算控制输出
成功
成功
失败
发送控制输出

图 17-2

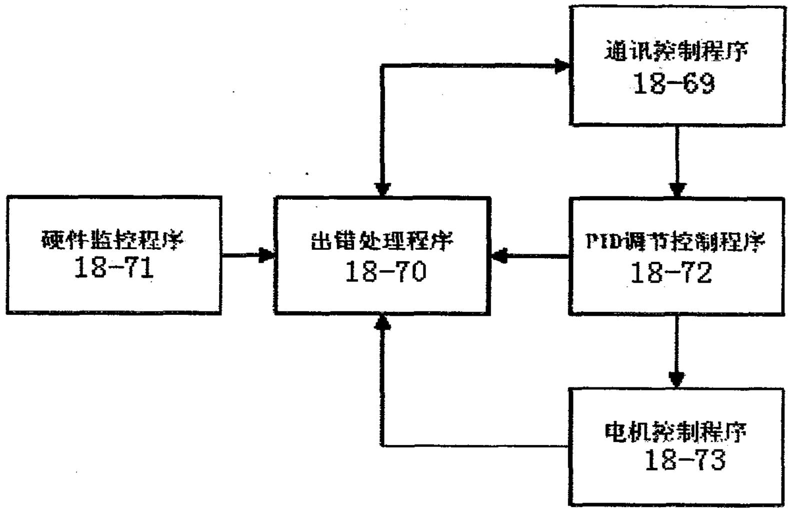

通讯控制程序
18-69
硬件监控程序
18-71
出错处理程序
18-70
PID调节控制程序
18-72
电机控制程序
18-73

图 18-1

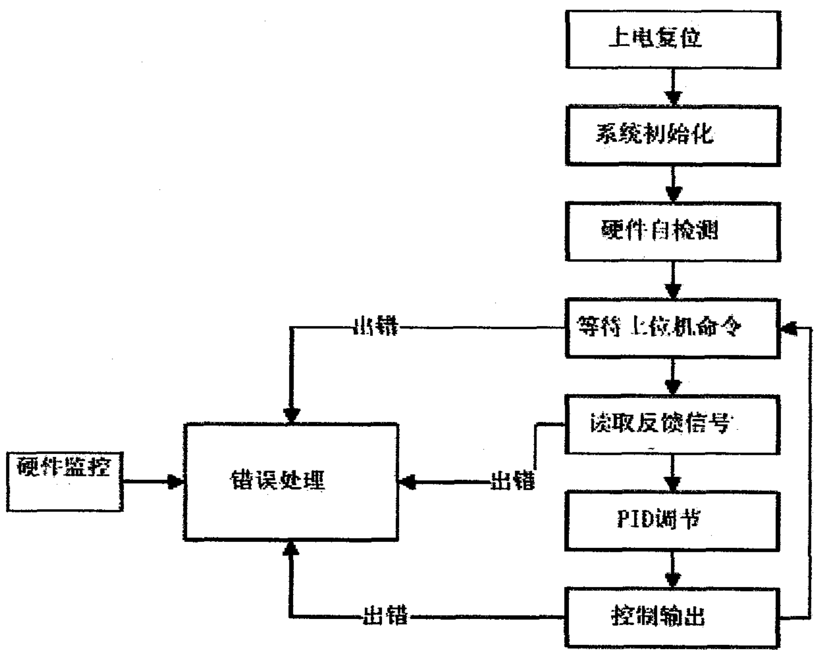

上电复位
系统初始化
硬件自检测
等待上位机命令
读取反馈信号
PID调节
控制输出
硬件监控
错误处理
出错
出错
出错

图 18-2

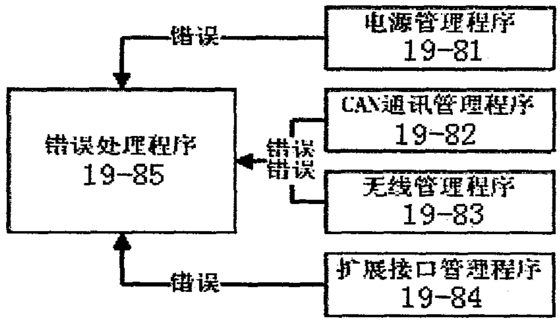


图 19-1

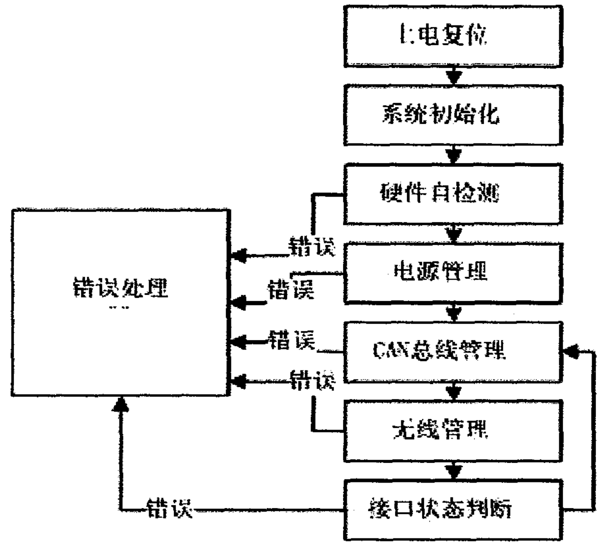


图 19-2

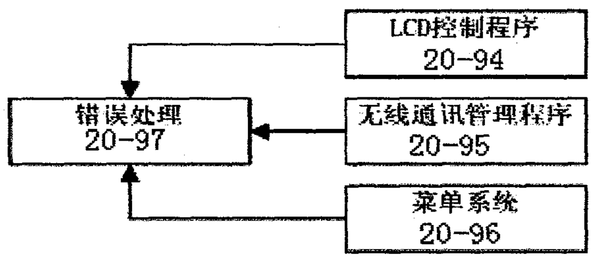


图 20-1

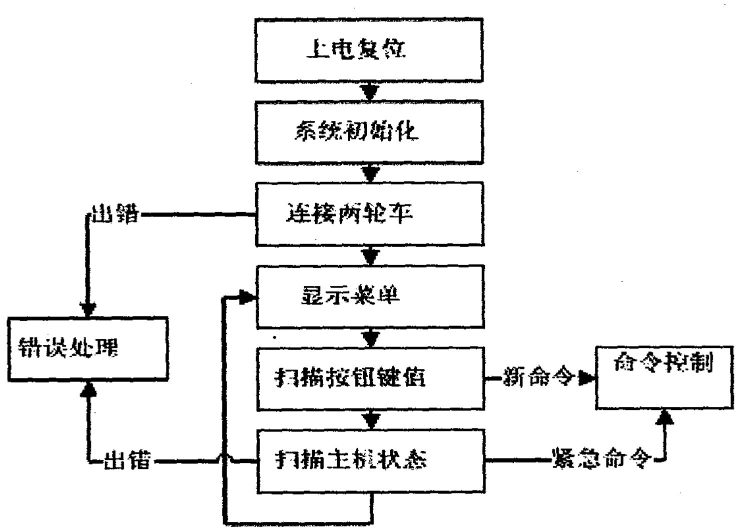


图 20-2

Espacenet

Bibliographic data: CN102514662 (A) — 2012-06-27

Two-wheeled self-balancing electrombile

Inventor(s): HE CHEN + (CHEN HE)

Applicant(s): HE CHEN + (CHEN HE)

Classification:
- international: *B62K11/00; B62K15/00; B62M7/12*
- cooperative:

Application number: CN201110430348 20111212 Global Dossier

Priority number(s): CN201110236406 20110818 ; CN201110430348 20111212

Also published as: CN102514662 (B)

Abstract of CN102514662 (A)

The invention discloses a novel two-wheeled self-balancing electrombile, which is characterized by being provided with two side-by-side wheels capable of rotating independently. The two wheels are connected through a connection mechanism and can tilt leftwards or rightwards conformably through the connection mechanism. Tilting of the two wheels enables the electrombile to swerve, and when the two wheels tilt, the connection mechanism can still enable pedals to maintain level. Each wheel is driven by a motor and further provided with an electronic control system which enables the pedals of the electrombile to maintain horizontal balance in the front direction and the back direction. When the gravity center of an electrombile rider tilts forwards, backwards or towards two sides, the electrombile can be directly led to advance towards the tilting direction. In addition, some designs capable of improving electrombile stability and portability are further provided.

Notice

CLAIMS CN102514662

1.
A two-wheeled self-balancing electric vehicle consisting of the following components:

a first wheel and a second wheel, which are arranged in parallel with each other in mirror symmetry; they have no common axle, and can be independently rotated and uniformly tilted left and right;

a first wheel frame and a second wheel frame, the first wheel frame is connected to the first wheel, and the second wheel frame is connected to the second wheel;

a connecting mechanism connecting the first wheel frame and the second wheel frame;

a first motor and a second motor, the first motor drives the first wheel, and the second motor drives the second wheel;

At least one electronic control system controls the first electric motor and the second electric motor to maintain a horizontal balance of the front and rear direction of the two-wheel self-balancing electric vehicle.

2
The two-wheeled self-balancing electric vehicle according to claim 1, wherein the two-wheeled vehicle is

switchable between a folded configuration and a non-folded configuration.

3
A two-wheeled self-balancing electric vehicle according to claim 1, wherein said connecting mechanism is formed by at least two connecting rods at different heights, each of which is connected to said first round. The frame and the second wheel frame as described.

4
The two-wheeled self-balancing electric vehicle according to claim 3 wherein said connecting mechanism is further provided with a handle for carrying a two-wheel self-balancing electric vehicle in a folded configuration.

5
A two-wheeled self-balancing electric vehicle according to claim 1, wherein said first wheel and said second wheel have a negative inclination.

6
The two-wheeled self-balancing electric vehicle according to claim 1, wherein each of the first wheel frame and the second wheel frame is further provided with a pair of leg plates, which are located on the inner side of the respective wheel frames and have a slight Concave curved surface.

7.
A two-wheeled self-balancing electric vehicle according to claim 1, wherein said connecting mechanism is further provided with a biasing elastic member for causing the tilting first wheel and the second wheel to have a tendency to reset. A position that is substantially mirror-symmetrical to each other when restored to the untilted side.

8
A two-wheeled self-balancing electric vehicle according to claim 1, wherein said step board is disposed between the first wheel frame and the second wheel frame.

9
A two-wheeled self-balancing electric vehicle according to claim 1, wherein said foot plates are disposed outside said first wheel frame and said second wheel frame, respectively.

10

A two-wheeled self-balancing electric vehicle according to claim 1, wherein said first electric motor and said second electric motor are friction transmission mechanisms each driving the first wheel and the second wheel, respectively.

Notice

DESCRIPTION CN102514662

The invention proposes a novel two-wheel self-balancing electric vehicle, which is characterized in that two wheels are arranged side by side and can rotate independently. There is a connecting mechanism that connects the two wheels, which allows the two wheels to tilt sideways to the left or to the right. The tilting of the two wheels allows the car to turn. When the two wheels are tilted, the connecting mechanism still enables the footboard to maintain a horizontal position. Each wheel has an electric motor drive and an electronic control system that allows the car's footrest to maintain a horizontal balance in the fore and aft direction. The rider tilts the center of gravity forward, backward, or both sides to directly advance the car toward the tilting side. In addition, the present invention further provides some designs that improve the stability and portability of the vehicle.

Two-wheel self-balancing electric vehicle

Technical field

The present invention proposes an electric two-wheeled vehicle in which two wheels are arranged opposite each other, and the rider can stand between two wheels for operation. Specifically, it is a standing electric two-wheeled vehicle with front and rear self-balancing functions. In particular, it is pointed out that the two wheels of the car rotate without enjoying the common axle.

Background technique

A technical example of one of the most well-known self-balancing electric vehicles in the world is disclosed by Kamen et al. (Personal Mobility Vehicles and Methods, U.S. Patent No. 6, 302, 230B1, Oct. 16, 2001). Kamen's patent summarizes the background of current self-balancing two-wheeled electric vehicles and reveals their related technologies for power-driven and electronic control balancing. The self-balancing two-wheeled electric vehicle disclosed in the Kamen patent has two wheels arranged in parallel, with a platform between the two wheels (or above) for the rider (operator) to stand; it is also provided A handlebar for maneuvering is used to improve the stability of the rider's standing and to control the direction in which the car travels. This self-balancing two-wheeled electric vehicle was produced and put on the market in 2002. The product of the two-wheeler is called Segway. This two-wheeled vehicle has been applied in many countries and in many aspects, and it is an effective medium and short distance transportation vehicle.

However, some users prefer to use a self-balancing two-wheeled electric vehicle that does not have a handlebar. Because the two-wheel electric vehicle without the handlebar has a large portability, it is convenient to disassemble and assemble. In particular, if the handlebar is not provided, the rider can free his hands to do other things while the car is moving. These advantages become especially important in many environments.

In Kamen's patent, the implementation of the handlebar is successful. However, the embodiment disclosed in this patent that does not have a handlebar is not as practical as it is, so it is not implemented as a self-balancing two-wheeled vehicle with a handlebar.

If the rider is standing on a two-wheeler, if the two wheels of the car are configured similarly to the two wheels of the Segway, and there is no handlebar on the car, then the rider is in contact with the car. In addition to the supporting contact points of the rider's feet, there are no other points of contact. Therefore, it is difficult for the rider to maintain the stability of his ankle and knee joint as the car travels. Although the car itself is capable of automatically maintaining front-to-back dynamic balance on a longitudinal plane, the rider's body cannot be relaxed due to the lack of support points. The rider's legs and feet, in addition to controlling the direction of travel of the car, in order to maintain the balance of the car, must also adjust the relative position of the legs, so the rider's standing position usually can not be maintained in a comfortable position, while It is also difficult for the car to travel steadily.

Therefore, the market requires the car to support the rider in a stable manner in a new way, and also requires the car to control the direction of travel in a new way. In addition, this new method is required to better improve the portability, stability, and control intuition of the car. These requirements are also general expectations for products in the field and related fields.

Summary of the invention

The vehicle of the present invention has two independently rotating wheels that are side by side. Each wheel has a drive motor and the ability to maintain front and rear self-balancing in a longitudinal plane. The rider can stand between the two wheels of the car, and the rider will control the forward and reverse direction of the car by shifting the center of gravity in the longitudinal plane and tilting to the left and right. A connecting mechanism is arranged between the two wheel frames, so that the two wheels can be tilted side by side in the same direction during the turning process. The function is achieved by using a plurality of parallel parallel multi-connecting rods, each connecting rod is rotatably matched with two wheel carriers, and at least two of the connecting rods are arranged at different heights (relative to In terms of the road surface of the ride). The tilting function of the wheels improves the stability of the car and the comfort of the legs and feet during steering.

The car can be turned into a folded form. When folding, use the hinges in the connecting rod to close the two wheels together for easy carrying or storage. The folded-shaped car can be carried by a handle that is attached to the connecting structure. When the car is fully folded, the handle is placed so that it does not come into contact with the wheel or the wheel carrier.

The structure of the car when working, so that the two feet of the rider stand between the two wheels for the footboard for the standing foot, and each leg of the rider can be firmly with the inner side of the corresponding wheel frame. contact. This structural form increases the number of contact points between the rider's body and the car, and disperses the contact points, thus making the two-wheeled vehicle without the handlebars more dramatic in terms of stability and comfort during use. Improvement. In order to stably maintain frictional contact between the rider's legs and the corresponding wheel frame, a leg plate for leg contact is specifically provided on the wheel frame. The surface that is in contact with the leg on the leg plate should have a greater friction than the wheel frame; the surface shape should be slightly curved to fit the usual contour of the rider's lower leg.

Those skilled in the art will be able to further understand the technical features of the present invention and other related advantages after reviewing the detailed description below in conjunction with the drawings.

DRAWINGS

1 is a side perspective view of an embodiment of a two-wheeled self-balancing electric vehicle in accordance with the present invention.

Figure 2is a side perspective view of the two-wheeled self-balancing electric vehicle of Figure 1 described above with its two wheels tilted toward one side during the turning process.

Figure 3is a top perspective view of the two-wheeled self-balancing electric vehicle of Figure 1 with its attachment mechanism partially folded.

Figure 4is a side elevational view of the two-wheeled self-balancing electric vehicle of Figure 1 with its attachment mechanism fully folded. You can see the handles configured on the connection mechanism.

Figure 5is a side perspective view of another embodiment of a two-wheeled self-balancing electric vehicle in accordance with the present invention. It shows the situation where its two wheels are tilted to one side at the same time during the turn.

Figure 6is a further embodiment of a two-wheeled self-balancing electric vehicle in accordance with the present invention, which is a side perspective view of a partial detail around the handlebar. These details illustrate a bias reset block for the handlebar and its locking mechanism as proposed by the present invention.

Figure 7is a still further embodiment of a two-wheeled self-balancing electric vehicle in accordance with the present invention, illustrating the foot pedal disposed on the outside of the wheel.

These examples will be detailed below.

detailed description

Referring to Figure 1, this is a side perspective view of a two-wheeled self-balancing electric vehicle embodiment of the present invention. The two-wheel self-balancing electric vehicle 100is composed of two wheels, a first wheel 110and a second wheel 111, two wheel frames, a first wheel frame 120and a second wheel frame 121, one for each wheel and one for each wheel. The wheel frame is connected; a connecting mechanism 130having one end connected to the first wheel frame 120and the other end connected to the second wheel frame 121; two foot plates 140located between the two wheels 110and 111, The bicycle is used for standing on both feet; and a handle 133is attached to the connecting mechanism 130for carrying the electric vehicle 100. 132on the drawing is a hinge, and 150is a leg plate, which will be described later.

The wheels 110and 111 are arranged side by side, mirror symmetrical, substantially parallel, they have no common axle, so they are independently rotatable and each can be rotated at a different speed and/or in a different direction. (Simply, the center axis of the wheel means a central axis that is perpendicular to the plane of rotation of the wheel. The axle of the wheel refers to the physical central axis of the plane of rotation of the vertical wheel. The range of wheel sizes is wide. The wheel shown in Figure 1 is larger and its diameter is similar to the length of an adult calf. The two wheels 110and 111 are respectively matched with the wheel frames 120and 121. The first wheel frame 120and the second wheel frame 121 have the same structure, and they can adopt various possible shapes as long as the wheels 110and 111 are not hindered. The connection between the connection mechanisms 130 In the present embodiment, the wheel frames 120and 121 are in the shape of a casing, and the wheels 110and 111 are covered and partially sealed. The basic function of the wheel carrier is to connect the wheels 110, 111 to the connection mechanism 130 In addition, the wheel frames 120and 121 have other functions such as support and guidance of the wheels 110, 111, rain and dust prevention of the wheels 110, 111, and prevention of contact of the wheels 110, 111 with the human body or clothes.

As can be seen from Figure 1, the present invention designs the two wheels to have a slight negative angle of inclination. As you know, looking at the wheel from the front of the car, the angle between the wheel and the plumb line is called the camber. If the upper end of the wheel is inclined inward, it is in the shape of [eight], called Negative Camber. This will help the rider overcome the centrifugal force during cornering and the rider's firm contact with the calf and the leg plate.

The attachment mechanism 130is generally horizontally disposed with one end mated with the wheel carrier 120 and the other end mated with the wheel carrier 121. The connecting mechanism 130is composed of three elongated connecting rods 131, two of which are located on the same horizontal plane, and the third root is located lower than the above-mentioned horizontal plane. (In fact, the number and configuration of the connecting rods can be additionally designed, as long as there are at least two connecting rods, which are at different heights relative to the road surface on which the bicycle is riding. The three connecting rods 131 are parallel to each other, and each of them is rotatably coupled to the wheel frames 120, 121. With respect to the attachment mechanism 130, this rotatable connection allows the wheels 110and 111 to be tilted side by side without severely disrupting the horizontal configuration of the linkage 130 Among the plurality of connecting rods, at least two connecting rods 131 at different heights are used to connect the wheels 110and 111 to each other, and the two wheels 110and 111 must be caused to simultaneously tilt in the same direction, and usually Tilt to a similar angle. (If the two wheels are parallel to each other, then their respective angular values are always equal. If the two wheels are arched to each other, then their respective varying angular magnitude values are substantially unequal, but are usually similar. These characteristics of the coupling mechanism 130are important so that the wheels 110and 111 have the ability to tilt or tilt toward the turning direction, thereby providing greater stability to the turning process and reducing the likelihood of rollover.

FIG. 2illustrates the case of the two-wheeled self-balancing electric vehicle 100of FIG. 1 described above, when turning left. In order to make the car turn to the left in the forward direction of the car, the rider initially tilts to the left, forcing the wheels 110and 111 to tilt to the left in unison. The term "wheel tilting" as used herein means that the center axis of the wheel is at an angle to the horizontal line, and the center axis of the wheel is not maintained horizontally. The tilting to the left or right is relative to the direction of travel of the car. (The tilting action of the wheel activates the tilt detection unit in the electronic control system. The angle change that occurs during the tilting of each wheel is in a vertical plane perpendicular to the direction of travel. Rotating the three connecting rods 131 attached to the two wheel frames 120and 121, the horizontal angle is substantially unchanged, that is, the position is still substantially maintained, but those connecting rods 131 at different levels are opposite to each other. The level of the level has changed. As shown in Figure 2, the two upper connecting rods are moved more to the left than the lower connecting rod. The connecting mechanism 130can still maintain the usual horizontal position when the wheels 110and 111 are tilted in the turning direction. The two foot plates 140rigidly mated to the upper two connecting rods 131 are also maintained in a normal horizontal position. For cyclists, these features add safety and comfort. In addition, the translational motion of the three connecting rods 131 only slightly shifts the horizontal and vertical positions of the two footboards 140, so that the rider can move his center of gravity laterally more smoothly and comfortably.

It should be noted that the footboard should have at least one load surface. The tread plates illustrated in these figures are a specific example of a person or a load that can usually be carried, usually with two load-bearing surfaces. Obviously, the footboards can be designed in a variety of shapes and sizes, either mated to the attachment mechanism or mated to the wheel carrier.

It should also be noted that the connection mechanism proposed by the present invention allows the footrest to maintain a substantially horizontal state regardless of whether the wheel is tilted or not.

FIG. 3illustrates the case of the two-wheeled self-balancing electric vehicle 100of FIG. 1 described above, when partially folded. In order to facilitate carrying and storage, the present invention proposes a manner in which the two wheels of the two-wheeled electric vehicle 100are brought together to be converted into a folded configuration from the use form compression. The folded form refers to the distance between two wheels, which is much smaller than the unfolded form (used state). In this example, the folding function is achieved by the folding attachment mechanism 130. Specifically, each of the connecting rods 131 has a hinge 132. In this example, each hinge 132is located in the middle of the respective connecting rod 131, but in general, the hinge 132is mounted so that the entire connecting mechanism 130can be folded.

There is also a handle 133which can be coupled to one or more of the rods 131. In the illustrated example, the handle 133is located in the middle of the attachment mechanism 130and is generally in the same vertical plane as the hinge 132. When the handle 133is pulled up, it is pulled to the hinge 132, and the hinge 132is connected to the two wheels 110and 111 having a considerable weight, so that the connecting mechanism 130is folded up, as shown in FIG. 3, the two wheels 110and 111 Finally, they can be brought together. Then, the handle 133can be used to carry the folded car.

In order to facilitate carrying by hand, the handle 133can be further designed to be elongated and extended. As shown in FIG. 4, when the connecting mechanism 130is completely folded, the handle 133drawn on the drawing is elongated. , extended to a point slightly larger than the outer diameter of the wheel. This function of the handle 133is realized by a slide bar 151, one end of which is rigidly coupled to the handle 133, and the other end is coupled to the connecting rod 131, so the slide bar 151 is disposed such that the handle 133The vertical movement can be made with respect to the connection point of the connection mechanism 130to move to a position away from the connection mechanism 130. When the handle 133is pulled upward, the handle 133is first slid to the fully extendable position, and the force pulled further upwards causes the link mechanism 130to be in the folded configuration described above. The configuration of the handle 133and the slider 151 should be properly arranged. When the link mechanism 130is fully folded, the handle 133is to extend beyond the edges of the wheels 110, 111 and/or the wheel frames 120, 121, so that the electric vehicle 100is carried by hand. When not touching the wheel and the wheel carrier. This function not only provides people with greater comfort, but also makes the two folding wheels closer together.

It should be noted that there are many ways to get the hand out of the wheel and the edge of the wheel carrier, and other than the specific sliding mechanism described above, other possible ways can be used.

For optimum stability, it is preferable for the rider to firmly rest his calf against the wheel frames 120, 121 when standing. The design of the multi-point contact between the rider and the vehicle proposed by the present invention makes it easy for the rider to keep his feet and calves in place. Therefore, two leg plates 150are further disposed on the car 100, and are disposed on the wheel frames 120and 121, respectively. The leg plate 150is attached to the inner side of the wheel frames 120and 121, and its position and height are set. When each foot of the rider stands on the respective footboard, the outer sides of the two calves are each capable of The respective leg plates 150are in contact. The leg plate 150can be made of a soft, bendable material, such as a woven material or other suitable material, and the leg plate 150should provide a certain amount of friction to help the rider to stably pull his calf. On the wheel frames 120and 121. The leg plate 150can be further designed with a slightly concave curved surface whose longitudinal axis is substantially perpendicular to the footboard 140and which is shaped to substantially conform to the rider's calf shape.

Figure 5is a side perspective view of another embodiment of the present invention, illustrating a stepping board having a different shape than the footing plate previously described. As can be seen from the figure, the two-wheel self-balancing electric vehicle 200is composed of: wheels 210and 211, wheel frames 220and 221, a connecting mechanism 230with a connecting rod 231, and a leg plate 250. They have substantially the same functions as the corresponding components of the aforementioned electric vehicle 100. However, in the present example, no handle is provided, and the folding method of the attachment mechanism 230is not included. The present embodiment is characterized in that two of the tread plates 240on the vehicle 200are rigidly mated to the inner side of the wheel frames 220 and 221. These foot plates 240 may be separate components that are rigidly mated to the wheel frames 220 and 221, or may be non-independent components that are integrally molded on the respective wheel carrier 220 or 221 with the same material as the wheel carrier.

Figure 6 depicts a partial perspective view of the handlebar 333 around the two-wheeled self-balancing electric vehicle 300. As can be seen from the figure, only a part of the components such as the wheel 311, the wheel carrier 321, the connecting mechanism 330, and the footrest 340 of the vehicle 300 are shown. In addition to having the same function as the two-wheeled vehicle 100, the two-wheeled vehicle 300 further includes a bias reset block 354 and a locking mechanism 350 for the handlebar 333. The handle 333 is rigidly coupled to the slide bar 351, and the slide bar 351 is slidable in a direction substantially perpendicular to the link mechanism 330, so that the handle 333 can handle the handle 333 in the same manner as the electric vehicle 100 described above. The slider 351 is slidably pulled out to raise the handle 333. The bias reset block 354 is made of an elastic material such as rubber, which is firmly attached to the handle 333, or the attachment mechanism 330, so that the bias reset block 354 is pressed against the handle 333. The portion is between a portion on the connection mechanism 330. In the present example, as shown, the bias reset block 354 has a rectangular block shape and is firmly attached to the bottom of one end of the handlebar 333. When the vehicle 300 in the folded configuration (as shown in Figures 3 and 4) is conventionally erected on the road surface, pushing down on the handlebar 333 forces the vehicle 300 to change from the folded configuration to the unfolded unfolded configuration. . Initially, the handlebar 333 is in the fully extended position, and when the handlebar 333 is pressed down forcefully, the handlebar 333 firstly slides down along with the slider 351, and then pushes down further. The link mechanism 330, which was originally in the folded configuration, is unfolded until all of the link bars 331 are substantially straightened, and the bias reset block 354 is simultaneously pressed by both the handlebar 333 and a link bar 331. After the vehicle 300 is fully deployed into the operational configuration, the locking mechanism 350 locks the components described above to various positions that cause the vehicle 300 to fully deploy.

The locking mechanism 350 of the present example has a lock head 352 that engages the bolt 353 to prevent the deployed attachment mechanism 330 from returning to the folded configuration when engaged. (If there is no locking mechanism 350, the attachment mechanism 330 may tend to fold due to the elasticity of the bias reset block 354 or other reasons. When the wheel is tilted during the turning, as described above, the plurality of connecting rods 331 are horizontally moved relative to each other. At this time, with respect to the upper two connecting rods 331, the handle 333 is kept in the same position, the locking tongue 353 is disposed on the lower one of the connecting rods 331, and the locking head 352 is also kept with the locking tongue 353. Engaged state. The final resultant force is generated on the slider 351, so that the bias reset block 354 is compressed, deformed, and tends to return to its original shape due to its elasticity, and thus tends to restore the entire connecting mechanism to the intermediate, non-turning state. The location. The position is that the two wheels of the car are basically neither left nor right, and are substantially mirror-symmetrical to each other. The function of the bias reset block 354 is that when the vehicle 300 is not subjected to an external force in the left and right directions, the two wheels are not tilted.

The lock head 352 is engaged with the lock tongue 353, and there are many loosening methods after the lock, which are well known in the art. One of the simple methods is to set the locking tongue 353 into a resilient component, and press the locking tongue 353 by hand to disengage the locking 352, and then pull the handle 333 to change the working state of the car. The state of being folded.

Fig. 7 presents another example in which two self-balancing electric vehicles 400 are provided, except that two foot pedals 440 are disposed outside the two wheels 410 and 411, and the remaining components are similar to the above examples, and 420 and 421 are wheels. The frame 431 is a connecting rod in the connecting mechanism 430, and the connecting mechanism 430 also allows the two vehicles to switch between a folded configuration and a non-folded configuration.

The two-wheeled vehicle proposed by the present invention is provided with two electric motors, each of which is driven by an electric motor, the first electric motor drives the first electric wheel, and the second electric motor drives the second electric wheel. In the example proposed by the present invention, these motors are housed in respective wheel carriers without being exposed. The motor is controlled by an electronic control system that allows the car to automatically balance back and forth in the longitudinal plane. An electronic control system can control the motors on the two wheels, or each wheel can have its own independent electronic control system to control the respective motors. An electronic control system (using a gyro sensor, accelerometer, or other means known in the art) can detect the forward or backward tilt of the car. Based on the detected signal, the motor responds with an appropriate acceleration or deceleration to make the car The footrest maintains a balanced front and rear position. Thus, the electronic control system allows the rider standing on the footboard between the two wheels to command the forward and backward of the car by moving its center of gravity. He moves his center of gravity forward or backward, allowing the car to accelerate in the direction of moving the center of gravity. If the center of gravity moves in the opposite direction of the car, the car will slow down.

As mentioned above, if the rider wants to make the car turn, he can move the center of gravity laterally in the direction of turning, so that the wheel has a tilting change, and the rider's leg rests on the leg plate and keeps with the car. In contact, a change in position relative to each other in the horizontal direction occurs between the connecting rods. The electronic control system includes the ability to detect one or more of the above changes. For example, electronic control systems (via gyroscopes, accelerometers, etc.) can detect changes in one or two wheels that are tilted laterally. The electronic control system then adjusts the speed and/or direction of each of the two wheels, and the difference in speed produced by the two wheels causes the car to turn in the direction of the rider's center of gravity. The steering control of the car plus the front and rear balance control of the car, in combination, provides a simple and intuitive manipulation method for the rider to use the two-wheeled vehicle proposed by the present invention.

The electric motor drives the wheels through a transmission mechanism. There are various types of transmission mechanisms, and the gear transmission is more common. In the example of the present invention, a friction transmission mechanism that is generally less used is employed. For example, each motor drives a rotating, cylindrical member that is smaller in diameter than the wheel diameter, in contact with the inner edge of the wheel, the motor drives the cylindrical member, and the cylindrical member re-drives the wheel Turn. The surface of the rotating, cylindrical component and the inner edge of the wheel must be pressed to transmit the rotational torque of the motor to the wheel. The friction drive mechanism can be connected to the wheel without the hub. This arrangement is much lighter than the weight of the central hub wheel, thus enhancing the portability of the car.

In summary, the present invention proposes a novel two-wheeled self-balancing electric vehicle characterized by two wheels that are mutually rotatable alongside each other. There is a connecting mechanism that connects the two wheels, which enables the two wheels to tilt sideways to the left or to the right. The tilting of the two wheels allows the car to turn. When the two wheels are tilted, the attachment mechanism still maintains the footrest in a horizontal position. Each wheel has an electric motor drive and an electronic control system that allows the car's footrest to maintain horizontal balance in the fore and aft direction. The rider tilts the center of gravity forward, backward, or both sides to directly advance the car toward the tilting side. Further, the present invention further provides some designs for improving the stability and portability of the vehicle.

The various embodiments described above are intended to be illustrative of the specific embodiments and are not intended to be limited Therefore, the scope of the embodiments should be determined by the appended claims and their corresponding documents, and not by the examples given above. In addition, it should be understood that further modifications can be made to the invention. The patent is intended to cover various modifications, uses, or improvements in accordance with the principles of the present invention. It is also intended to be deviated from the known embodiments or embodiments disclosed herein. The scope of the principle.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 102514662 A
(43)申请公布日 2012.06.27

(21)申请号 201110430348.0
(22)申请日 2011.12.12
(66)本国优先权数据
201110236406.6 2011.08.18 CN
(71)申请人 陈和
地址 400700 重庆市北碚区朝阳路58号4单元3-4室
(72)发明人 陈和
(51)Int.Cl.
B62K 11/00(2006.01)
B62K 15/00(2006.01)
B62M 7/12(2006.01)

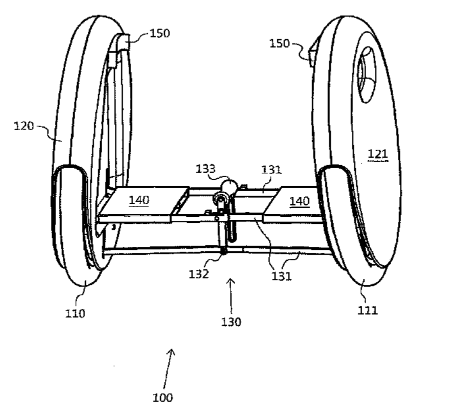
权利要求书 1 页 说明书 7 页 附图 7 页

(54)发明名称

两轮自平衡电动车

(57)摘要

本发明提出了一种新型的两轮自平衡电动车,其特点是设有两个彼此并排的、能独立转动的轮子。有一个连接机构使两个轮子相连,该连接机构能使两个轮子一致地朝左或朝右倾侧。两个轮子的倾侧,能使车子转弯。当两个轮子倾侧时,该连接机构仍能使踏脚板,保持水平位置。每个轮子各自有一个电动机驱动,还设有具有电子控制系统,该控制系统使得车子的踏脚板,能保持前后方向的水平平衡。骑车人将其重心向前、后、或两侧倾斜,就可直接使车子朝倾侧的方向前进。此外,本发明还进一步提供了一些提高车子稳定性与便携性的设计。



CN 102514662 A

1. 一种两轮自平衡电动车，它是由如下部件所构成：

第一车轮与第二车轮，它们是彼此镜面对称地平行设置的，它们没有共同的车轴，既能独立转动，又能一致地左右倾斜；

第一轮架与第二轮架，第一轮架连接所述的第一车轮，第二轮架连接所述的第二车轮；

一个连接机构，连接所述的第一轮架以及所述的第二轮架；

第一电动机与第二电动机，第一电动机驱动所述的第一车轮，第二电动机驱动所述的第二车轮；

至少一个电子控制系统，控制所述的第一电动机与所述的第二电动机，使所述的两轮自平衡电动车的踏脚板能保持前后方向的水平平衡。

2. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，该两轮车可以在折叠形态与非折叠形态之间转换。

3. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的连接机构至少是有两根位于不同高度的连接杆所构成，每一根都是连接到所述的第一轮架以及所述的第二轮架。

4. 根据权利要求 3 所述的两轮自平衡电动车，其特征在于，所述的连接机构上，还进一步配接有一个手把，用来携拎折叠形态的两轮自平衡电动车。

5. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的第一车轮与第二车轮都有一个负倾角。

6. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的第一轮架与第二轮架都进一步各设置一个靠腿板，它们位于各自轮架的内侧，并具有稍凹的弯曲表面。

7. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的连接机构上，还设置有一个偏压弹性部件，使已经倾侧的第一车轮与第二车轮具有复位的趋向，复原到未倾侧时的，彼此基本镜面对称的位置。

8. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的踏脚板，设置在第一轮架与第二轮架之间。

9. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的踏脚板，分别设置在第一轮架与第二轮架的外侧。

10. 根据权利要求 1 所述的两轮自平衡电动车，其特征在于，所述的第一电动机与第二电动机，是用摩擦传动机构，各自分别驱动第一车轮与第二车轮。

两轮自平衡电动车

技术领域

[0001] 本发明提出了一种电动两轮车，两个轮子是彼此相对地排列的，骑车人可以站立在两个轮子之间操作。确切地说，是一种站立式的、具有前后自平衡功能的电动两轮车。特别要指出的是，该车两个轮子的转动，不享用共同的车轴。

背景技术

[0002] 当前世界上最有名的一种自平衡电动车的技术实例，是由 Kamen 等人的专利(Personal Mobility Vehicles and Methods，U. S. Patent No. 6，302，230B1，Oct. 16，2001)所揭示的。Kamen 的专利总结了目前自平衡两轮电动车的背景技术，揭示了它们动力驱动与电子控制平衡的相关技术。Kamen 专利所揭示的自平衡两轮电动车，它有相对平行排列的两个轮子，两个轮子之间（或之上）设有一个供骑车人（操作者）站立的平台；它还设置了一个操纵用的手把杆，用来改善骑车人站立的稳定性，以及控制车子行进的方向。这种自平衡两轮电动车，于 2002 年开始生产并投入市场，该两轮车的商品，名叫“赛格威”(Segway)。这种两轮车在多个国家、多个方面都已得到了应用，不啻为一种有效的中、短距离的运输工具。

[0003] 然而，某些用户希望使用不设手把杆的自平衡两轮电动车。因为不设手把杆的两轮电动车，具有较大的可携带性，拆装也比较方便。特别是，如果不设手把杆的话，当车子行进时，骑车人可以空出双手来做其他的事情。在许多环境下，以上这些优点会变得格外的重要。

[0004] Kamen 的专利中，有手把杆的实施方案是成功的。但是，该专利中所揭示的、没有设置手把杆的实施方案，因为很难付之实用，所以没有像有手把杆的自平衡两轮车那样得到实现。

[0005] 假如骑车人站在一辆两轮车上，如果该车的两个轮子的配置与 Segway 的两个轮子配置相似，车子上又不设置手把杆的话，那末骑车人与车子相接触的地方，除了车子脚踏板支撑骑车人脚的支撑接触点外，再也没有其它接触点了。因此，当车子行进时，骑车人要保持其踝关节与膝关节的稳定是很困难的。虽然车子本身是能够在纵向平面上，自动地保持前后的动态平衡，但是由于缺少支撑点，使得骑车人的身体不能放松。骑车人的腿与脚，除了要控制车子的行进方向外，为了保持人车的平衡，还必须要调节腿脚的相对位置，所以骑车人的站立姿势通常不能保持在一个舒适的位置，同时车子也很难稳定地行进。

[0006] 因此，市场要求车子以新的方式来支持骑车人稳定地骑行，还要求车子以新的方式来控制行进的方向。此外，也要求该种新方式能较好地改善车子的便携性、稳定性、控制的直觉性，这些要求也是本领域以及有关领域对产品的普遍期望。

发明内容

[0007] 本发明的车子是有两个彼此并排的、独立转动的轮子。每个轮子有一个驱动马达，还有在纵向平面上保持前后自平衡的能力。车子的两个轮子之间能供骑车人站立，骑车人

将重心在纵向平面上前后变动的方式，以及朝左右倾侧的方式来控制车子的前进与转向。两个轮架之间设有一个连接机构，使得两个轮子在转向过程中，能够一致地并排倾侧。该功能是采用了一组复式平行的多元连接杆来达到的，每根连接杆都是可转动地与两个轮架相配接，连接杆中至少有两根是配置在不同的高度（相对于骑行的路面而言）。轮子倾侧的功能，改善了车子的稳定性以及转向过程中腿脚的舒适性。

[0008]　车子能够转为折叠形态。折叠时，利用连接杆中的铰链使两个轮子合拢在一起，以便于携带或储藏。折叠形态的车子，可用配接在连接结构上的一个把手来携拎。当车子完全折叠后，设置的该把手是丝毫不会与车轮、轮架相接触的。

[0009]　车子工作时的结构形态，使得骑车人的两脚站在两个轮子之间供站脚用的踏脚板上，并且使得骑车人的每一条腿都能与相应轮架的内侧稳固地相接触。这种结构形态增加了骑车人身体与车子之间的接触点的数量，并且分散了接触点，因而使得不设手把杆的两轮车，使用时的稳定性与舒适性都获得了戏剧性的改善。为了使骑车人的腿与相应的轮架之间，稳定地保持摩擦接触，在轮架上专门设置了供腿接触的靠腿板。靠腿板上与腿接触的表面，与轮架相比，应具有较大的摩擦力；其表面形状还要稍有弯曲，以适配骑车人小腿通常的轮廓。

[0010]　业内有经验人士在结合图纸审阅下文的详细叙述后，可以进一步了解本发明的技术特点以及其它有关的优点了。

附图说明

[0011]　图 1 是根据本发明所提出的两轮自平衡电动车，一种实施方案的侧向透视图。

[0012]　图 2 是上述图 1 的两轮自平衡电动车，在转弯过程中，它的两个轮子同时朝一侧倾斜时的侧向透视图。

[0013]　图 3 是上述图 1 的两轮自平衡电动车，它的连接机构在部分折叠时的俯向透视图。

[0014]　图 4 是上述图 1 的两轮自平衡电动车，它的连接机构在完全折叠时的侧视图。可以看到在连接机构上配置的把手。

[0015]　图 5 是根据本发明所提出的两轮自平衡电动车，另一种实施方案的侧向透视图。图示了在转弯过程中，它的两个轮子同时朝一侧倾斜的情景。

[0016]　图 6 是根据本发明所提出的两轮自平衡电动车的又一种实施方案，是手把周围的局部细节的侧向透视图。这些细节图示了本发明所提出的一种有关手把的偏压复位块以及它的锁紧机构。

[0017]　图 7 是根据本发明所提出的两轮自平衡电动车的又一种实施方案，图示了脚踏板设置在车轮的外侧。

[0018]　这些实例，将在下文中详述。

具体实施方式

[0019]　参阅图 1，这是本发明所提出的一种两轮自平衡电动车实施方案的侧向透视图。图中两轮自平衡电动车 100 的组成有：两个车轮，第一车轮 110 与第二车轮 111；两个轮架，第一轮架 120 与第二轮架 121，每个车轮各自与一个轮架相连接；一个连接机构 130，它的一端与第一轮架 120 相连，另一端与第二轮架 121 相连；两个踏脚板 140，它们位在两个轮子 110

与 111 之间，它们供骑车人的双脚站立使用；以及一个手把 133，它配接在连接机构 130 上，用来提携电动车 100 的。图上的 132 是铰链，150 是靠腿板，将在下文中加以说明。

[0020] 车轮 110 与 111 是彼此并列地、镜面对称地设置的，基本是平行的，它们没有共同的车轴，因此它们是可以独立转动的，而且各自能够以不同的速度与 / 或以不同的方向旋转。（顺便指出，车轮的中心轴线是指，垂直于车轮转动平面的中心轴线。车轮的车轴是指，垂直车轮转动平面的实体中心轴。）轮子大小尺寸的可取范围很宽，图 1 所示的轮子较大，它的直径与成人小腿长度差不多。两个车轮 110 与 111，各自分别同轮架 120、121 相配接，第一轮架 120 与第二轮架 121 的结构相同，它们可以采用各种可能的形状，只要不妨碍车轮 110 与 111 与连接机构 130 之间的连接。本实施方案中，轮架 120 与 121 是呈罩壳状的形状，将车轮 110 与 111 罩起，部分地封住。轮架的基本功能是使车轮 110、111 与连接机构 130 相连接。除此以外，轮架 120 与 121 还有其他如像：车轮 110、111 的支撑与导向，车轮 110、111 的防雨与防尘，防止车轮 110、111 与人体或衣服的接触等的用途。

[0021] 从图 1 上可见，本发明将两个轮子设计得具有一点负倾角。大家知道，从车头望向车轮，车轮与铅垂线的夹角称为外倾角 (Camber)，若轮子上端向内倾斜，呈 [八] 字形，称作负倾角 (Negative Camber)。这会有助于骑车人克服转弯时的离心力，以及骑车人将小腿与靠腿板的稳固接触。

[0022] 连接机构 130 通常是水平配置的，该机构的一端与轮架 120 相配接，另一端与轮架 121 相配接。连接机构 130 是由三根细长的连接杆 131 组成，其中两根是位于同一个水平面上，第三根的位置低于上述的水平面。（实际上，可以另外设计连接杆的数量与配置，只要其中至少有两根连接杆，相对于骑行的路面而言，处于不同的高度就行。）三根连接杆 131 是互相平行的，每一根都是与轮架 120、121 可转动地配接的。相对于连接机构 130 而言，该种可转动的连接，使得车轮 110 与 111 能够并排地倾斜，而不会严重打乱连接机构 130 的水平配置。多根连接杆中，至少要有位于不同高度的两根连接杆 131，被用来将车轮 110 与 111，彼此相连，必须使得两个车轮 110 与 111，同时发生相同方向的倾侧，并且通常是倾侧相近的角度。（假如两个轮子彼此是平行的话，则它们各自变化的角度大小数值，始终基本上是相等的。假如两个轮子彼此成拱形的话，则它们各自变化的角度大小数值，基本上是不相等的，但是通常是相近似的。）连接机构 130 的这些特性是十分重要的，使得车轮 110 与 111 具有朝转弯方向倾侧或倾斜的能力，因而对转弯过程，提供较大的稳定性，减少了翻车的可能性。

[0023] 图 2 图示了上述图 1 的两轮自平衡电动车 100，在左转弯时的情况。为了使车子朝车子前进方向的左侧转弯，起初是骑车人先朝左倾斜，迫使车轮 110 与 111 一致地朝左倾侧。这里所说的车轮倾侧是指，车轮的中心轴线与水平线产生有一个夹角，车轮的中心轴线不保持水平了，本文称为车轮发生了倾侧。倾侧的朝左或右，是相对于车子行进方向而言的。（车轮的倾侧动作可激活电子控制系统中的倾斜探测单元。）每个车轮在倾侧过程中，发生的角度变化是位在垂直于行进方向的垂直平面上。可转动配接到两个轮架 120 与 121 上的三根连接杆 131，水平的角度基本上没有变化，即基本上依然保持水平的位置，但是位于不同水平高度的那些连接杆 131，它们彼此相对的水平高度是发生了变化。正如图 2 所示，上方的两根连接杆，相对于较低的那根连接杆，只是更加向左平移移动了一些。使得当车轮 110 与 111 向转弯方向倾侧时，连接机构 130 仍能保持通常的水平位置。刚性地配接在

上部两根连接杆 131 上的两个踏脚板 140，同样是保持着通常的水平位置。对骑车人来说，这些特点增加了安全性与舒适性。此外，三根连接杆 131 的平移动作，只是导致两个踏脚板 140 的水平与垂直位置稍微平移了一点，使得骑车人能够较平稳、较舒适地侧向移动他的重心。

[0024]　应该指出，踏脚板至少应有一个载重的表面。这些图上图示的踏脚板，是通常能载人或载物的一种具体实例，通常有两个载重的表面。显然，踏脚板可以设计成各种形状与尺寸，可以与连接机构相配接，也可以与轮架相配接。

[0025]　还要指出的是，无论车轮是否倾侧，本发明提出的连接机构，都使得踏脚板始终能保持基本水平的状态。

[0026]　图 3 图示了上述图 1 的两轮自平衡电动车 100，在部分折叠时的情况。为了方便携带与储藏，本发明提出了一种方式，将两轮电动车 100 的两个车轮靠拢在一起，从使用形态压缩转换成的折叠形态。折叠形态是指两个车轮之间的距离，比非折叠形态（使用状态）时要小得多。在这个例子中，该折叠功能是靠折叠连接机构 130 来实现的。具体来说，每一根连接杆 131 都有一个铰链 132。本例中，每个铰链 132 是位于各自相应连接杆 131 的中部，但是一般来说，只要将铰链 132 安装得能将整个连接机构 130 折叠起来就行了。

[0027]　还设有一个手把 133，它可连接杆 131 中的一根或多根相配接。在所示的实例中，手把 133 是位于连接机构 130 的中部，大致是与铰链 132 位于同一个垂直平面上。当手把 133 向上拉时，拉传到铰链 132，铰链 132 是连到有相当重量的两个车轮 110 与 111，所以使得连接机构 130 折叠起来，如图 3 所示，两个车轮 110 与 111 最后可合拢到了一起。然后，手把 133 可用来携拎已折叠好的车子了。

[0028]　为了方便用手携拎，进一步可将手把 133 设计成可拉长延伸的式样，如图 4 所示，当连接机构 130 完全折叠时，图上所画出的手把 133 是伸长了的，伸长到了略大于车轮外径的地方。手把 133 的该功能是靠一条滑杆 151 来实现的，滑杆 151 的一端刚性地配接到手把 133，另一端配接到连接杆 131 上，所以滑杆 151 的设置，使得手把 133 可相对于连接机构 130 的连接点做垂直的移动，移动到离开连接机构 130 的某一位置处。当向上拉扯手把 133 时，手把 133 首先是滑到满程可伸长的位置，进一步向上拉扯的力，可使连接机构 130 成为上述折叠的形态。手把 133 与滑杆 151 的组态应该恰当安排，当连接机构 130 完全折叠时，手把 133 要超出车轮 110、111 与 / 或轮架 120、121 的边缘，使得用手携拎电动车 100 时，而不会碰到车轮与轮架。这个功能既为人们的携拎提供了更大的舒适性，也使得折叠后的两个车轮可以更加的靠拢。

[0029]　应该指出，使手超出车轮与轮架边缘的方法很多，除了使用上述特定的滑动机构以外，还可采用其他可能的方式来实现。

[0030]　为了达到最佳的稳定性，骑车人站立时，最好是将其小腿稳固地触靠在轮架 120、121 上。本发明提出的骑车人与车子之间多点接触的设计，使得骑车人很容易地将他的脚与小腿保持在适当的位置。因此，在车子 100 上进一步设置了两块靠腿板 150，分别配置在轮架 120 与 121 上。靠腿板 150 是附设在轮架 120 与 121 的内侧，它的位置与高度要设置得，当骑车人的每只脚站立在各自的踏脚板上时，两条小腿的外侧正好各自能够与各自的靠腿板 150 相触靠。靠腿板 150 可以用柔软的、可弯曲的材料制成，如编织材料或其他合适的材料，靠腿板 150 应提供一定的摩擦力，有助于骑车人将他的小腿稳定地触靠在轮架 120 与

121 上。靠腿板 150 还可进一步设计成，略有一点凹形的曲面，该曲面的纵轴大致与踏脚板 140 相垂直，曲面的形状还要与骑车人的小腿外形大致拟合。

[0031] 图 5 是根据本发明所提出的另一种实施方案的侧向透视图，图示了一种踏脚板，它的形态不同于前文所述的踏脚板。从图上可见，两轮自平衡电动车 200 是由 :车轮 210 与 211、轮架 220 与 221、带有连接杆 231 的连接机构 230、以及靠腿板 250 等组成。它们与前述实例电动车 100 中相对应的部件有着基本相同的功能。不过，本实例中，未设手把，不包括连接机构 230 的折叠方法。本实例的特点是，车子 200 上的两个踏脚板 240，每一个都是刚性地配接在轮架 220 与 221 内侧的表面上。这些踏脚板 240 可以是刚性地配接在轮架 220 与 221 上的独立部件，也可以是在各自的轮架 220 或 221 上，用与轮架相同的材料一体化模压出来的非独立部件。

[0032] 图 6 画出了两轮自平衡电动车 300 上，手把 333 周围的局部透视图。从图上可见，只画出了车子 300 上车轮 311、轮架 321、连接机构 330、脚踏板 340 等部件的一部分。两轮车 300 除了具有两轮车 100 同样的功能外，还进一步包含有一个偏压复位块 354，以及一个关于手把 333 的锁紧机构 350。手把 333 是刚性地与滑杆 351 相配接的，滑杆 351 能够在大致垂直于连接机构 330 的方向上滑动，因此手把 333 能够以与前述电动车 100 相同的方式，将手把 333 的滑杆 351 滑动拉出，使手把 333 升高。偏压复位块 354 是用橡胶一类的弹性材料制成的，它是牢固地附着在手把 333 上，或者连接机构 330 上，使偏压复位块 354 被压住在手把 333 上的某部位与连接机构 330 上的某部位之间。在本实例中，如图所示，偏压复位块 354 呈矩形的块状，牢固地附着在手把 333 一端的底部。当处于折叠形态（如图 3 与图 4 所示）的车子 300 常规地竖立在路面上时，在手把 333 上用力向下推压，可使车子 300 从折叠形态转变为展开的非折叠形态。开始时，手把 333 是处于全部伸出的位置，在手把 333 上用力向下推压时，手把 333 首先是随着滑杆 351 一同向下滑动，然后进一步向下推压的力，使得原先处于折叠形态的连接机构 330 得以展开，直到所有的连接杆 331 基本上全部伸直，并且偏压复位块 354 被手把 333 与一根连接杆 331 两者同时压住。车子 300 完全展开成工作形态后，锁紧机构 350 会使上述这些部件锁住在使车子 300 完全展开的各个位置。

[0033] 本实例的锁紧机构 350 有一个锁头 352，它可与锁舌 353 相啮合，当它啮合时，能阻止已展开的连接机构 330 返回到折叠形态。（如果没有锁紧机构 350 的话，则由于偏压复位块 354 的弹性或其他原因，连接机构 330 可能会趋向于折叠。）当车轮在转弯过程中倾侧时，如前文所述，几根连接杆 331 会彼此相对发生水平移动。此时，相对于上面两根连接杆 331 来说，手把 333 是保持停留在同样的位置，锁舌 353 是设置在较低的一根连接杆 331 上，锁头 352 也是与锁舌 353 保持啮合状态的。在滑杆 351 上产生最终的合力，使得偏压复位块 354 压缩、发生变形，由于它具有弹性，趋向于要恢复其原状，因而趋向于要使整个连接机构复原到中间的、非转弯时所处的位置。该位置即是，车子的两个轮子基本上既不偏左，也不偏右，彼此基本上是镜面对称的。偏压复位块 354 的作用，就是当车子 300 在没有受到左右方向的外力时，两个轮子是不会倾侧的。

[0034] 锁头 352 与锁舌 353 相啮合，锁紧后的松开方法很多，已为业内人士所熟知。其中简便的一种方法是，将锁舌 353 设置成有弹性的部件，用手加压锁舌 353，就可使锁头 352 脱开，再一拉手把 333，即可使工作状态的车子转变为折叠的状态。

[0035] 图 7 提出了另一个实例，图上两轮自平衡电动车 400，除了两个脚踏板 440 设置在

两个车轮 410 与 411 的外侧以外，其余部件都与上述实例相似，420 与 421 是轮架，431 是连接机构 430 中的连接杆，连接机构 430 也是使该两辆车可以在折叠形态与非折叠形态之间转换。

[0036] 本发明所提出的两轮车设置有两个电动机，每一个车轮各自被一只电动机驱动，第一电动机驱动第一车轮，第二电动机驱动第二车轮。本发明提出的实例中，这些电动机都被罩在各自的轮架内，而没有暴露在外。电动机是被一个电子控制系统所控制的，它使车子实现纵向平面上前后的自动平衡。一个电子控制系统可以控制两个轮子上的电动机，也可以每个轮子有各自独立的电子控制系统来控制各自的电动机。电子控制系统（用陀螺传感器，加速度计，或业内已知的其他手段）能够探测到车子向前或向后的倾侧，根据探测到的讯号，电动机做出适当的加速或减速的响应，使车子的踏脚板保持前后平衡的位置。因此，该电子控制系统使得站在两个轮子之间踏脚板上的骑车人，能够通过移动其重心，来指挥车子的向前与向后。他朝前或朝后移动其重心，可使车子朝移动重心的方向加速，朝车子行进的相反方向移动重心的话，车子就会减速。

[0037] 如上所述，骑车人如要使车子转弯，他可将重心朝要转弯的方向侧向移动，于是车轮发生了倾侧的变化，骑车人的腿靠在靠腿板上，与车子保持着接触，连接杆之间发生了水平方向上彼此相对位置的变化。电子控制系统包含有探测以上一项或多项变化讯息的功能。例如，电子控制系统（通过陀螺仪、加速度计等部件）能探测到一个或两个轮子朝侧向倾斜的变化。然后，电子控制系统来调节一个或两个轮子各自的速度与 / 或方向，两个轮子产生的速度差致使车子朝着骑车人移动重心的方向转弯。车子的转向控制加上车子的前后平衡控制，综合起来，为骑车人使用本发明所提出的两轮车，提供了一种简便的、直觉的操纵方法。

[0038] 电动机是通过一种传动机构来驱动车轮的，有多种形式的传动机构，较常用的是齿轮传动。本发明的实例中，采用的是一种通常较少使用的摩擦传动机构。例如，每个电动机驱动一个旋转的、圆柱形的部件，它的直径比车轮直径要小，将它与车轮的内缘相接触，电动机驱动圆柱形部件，利用摩擦力，圆柱形部件再驱动车轮转动。旋转的、圆柱部件的表面与车轮的内缘必须压紧，才能将电动机的转动力矩传给车轮。摩擦传动机构，可以与无轮毂的车轮相连接，这种设置的重量比使用有中心轮毂车轮的重量要轻得多，所以也增强了车子的便携性。

[0039] 综上所述，本发明提出了一种新型的两轮自平衡电动车，其特点是设有两个彼此并排的、能独立转动的轮子。有一个连接机构使两个轮子相连，该连接机构能使两个轮子一致地朝左或朝右倾侧。两个轮子的倾侧，能使车子转弯。当两个轮子倾侧时，该连接机构仍能使踏脚板，保持水平位置。每个轮子各自有一个电动机驱动，还设有具有电子控制系统，该控制系统使得车子的踏脚板，能保持前后方向的水平平衡。骑车人将其重心向前、后、或两侧倾斜，就可直接使车子朝倾侧的方向前进。此外，本发明还进一步提供了一些提高车子稳定性与便携性的设计。

[0040] 虽然以上叙述的各种实施方案包含了许多特定的细节，但是不应构成对实施方案包括范围的限制，而且也不应仅仅限于目前提出的这些特定方案的图示上。因此，这些实施方案的涵盖范围应该由所附的权利要求及其相应的文件所确定的，而不是由上述给出的实例所决定的。此外，还应该理解为本发明还能作进一步的改动。本专利旨在涵盖根据本发

明的原理所进行的各种变化、用途或改良；也涵盖了与本发明所揭示的已知方案或实施方案有所偏离，但仍然从属于本发明技术及其应用原理的范围。

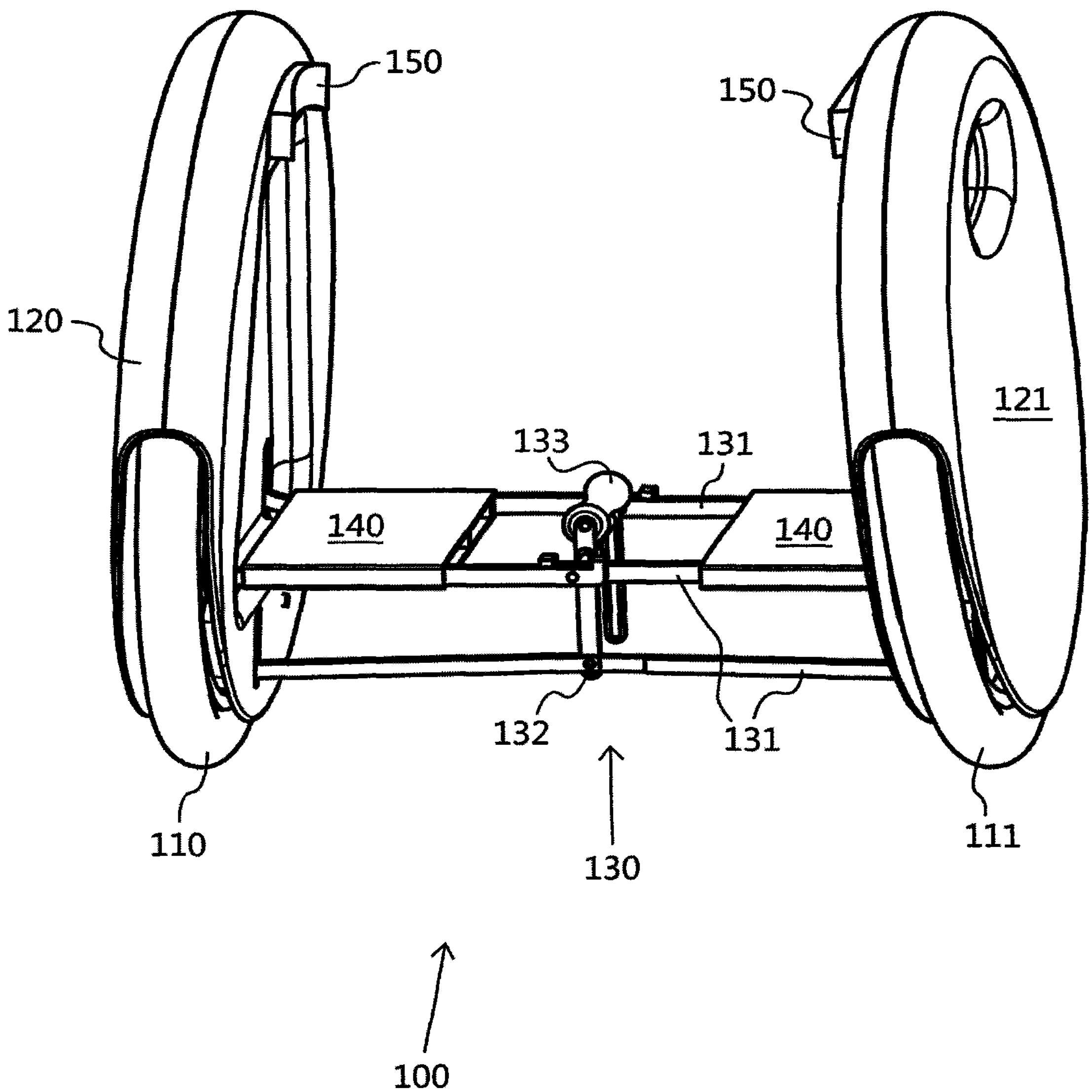


图 1

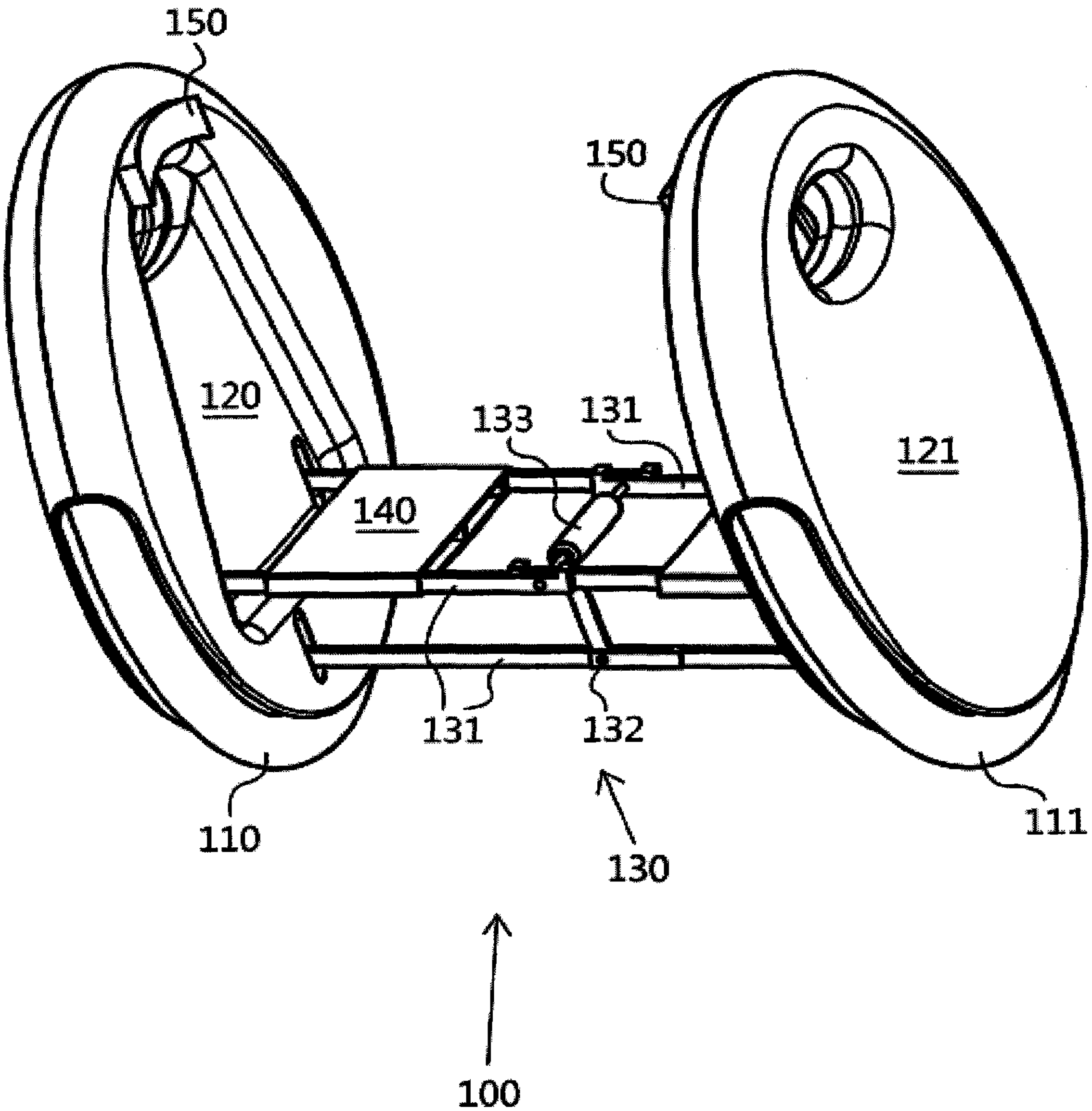


图 2

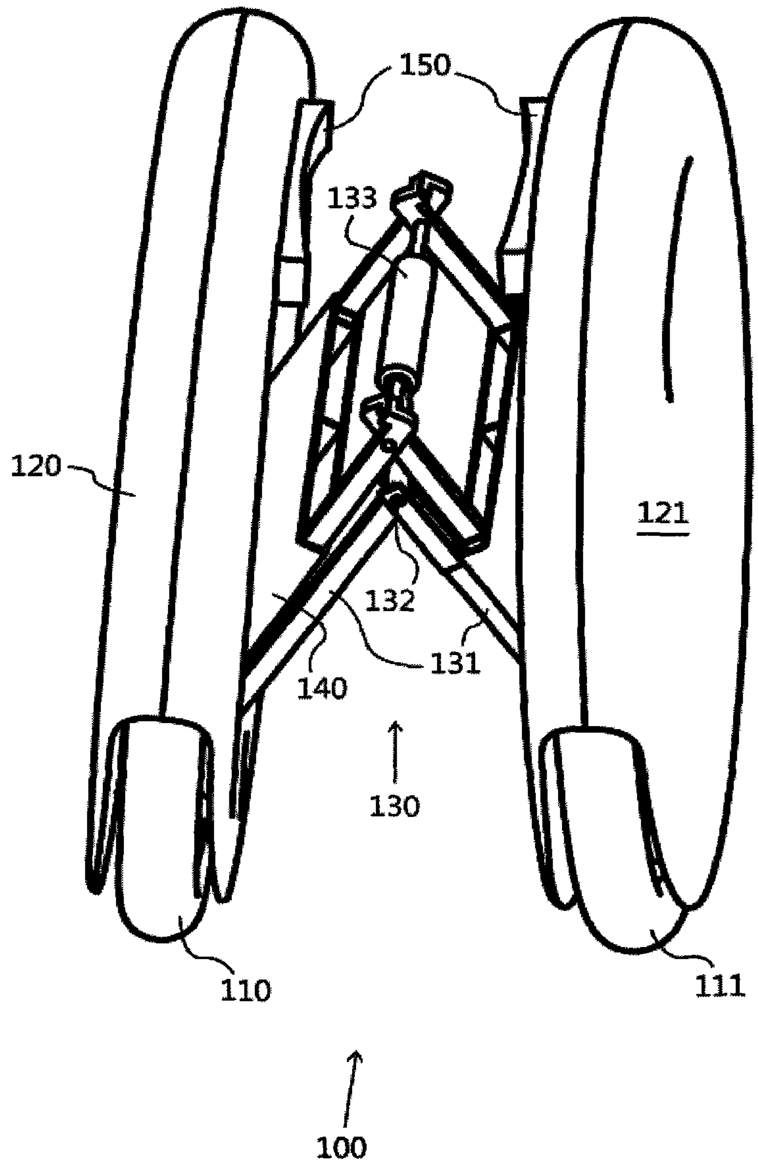


图 3

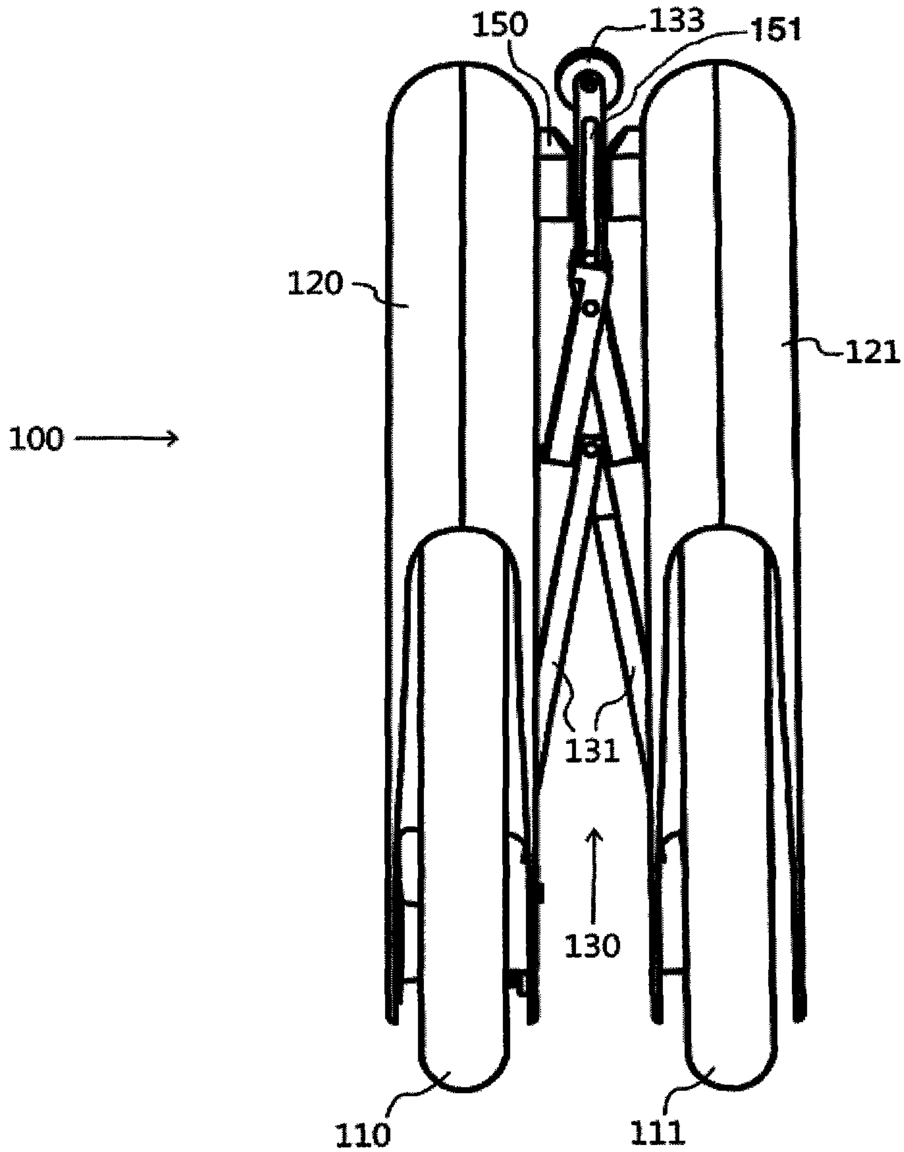


图 4

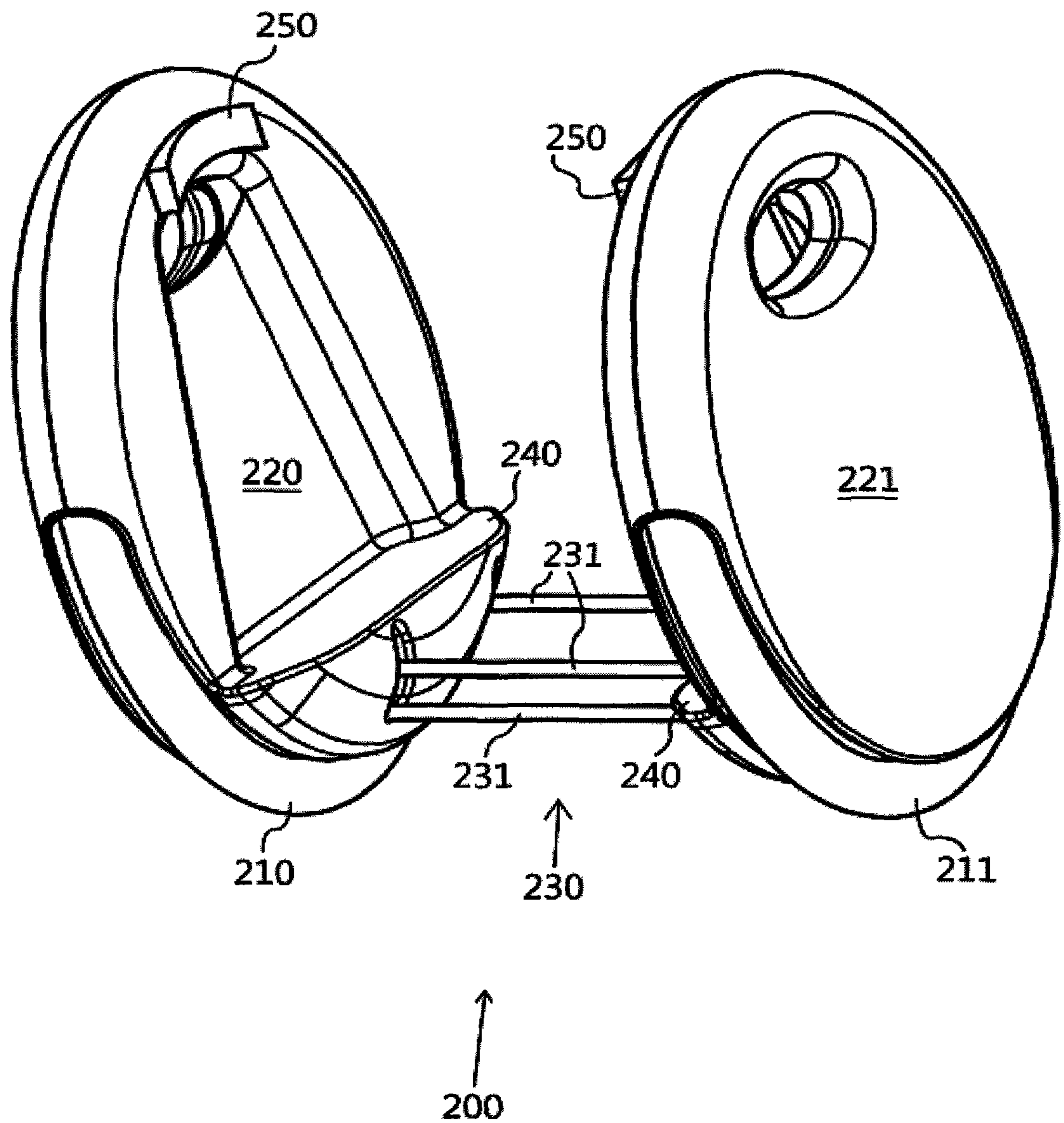


图 5

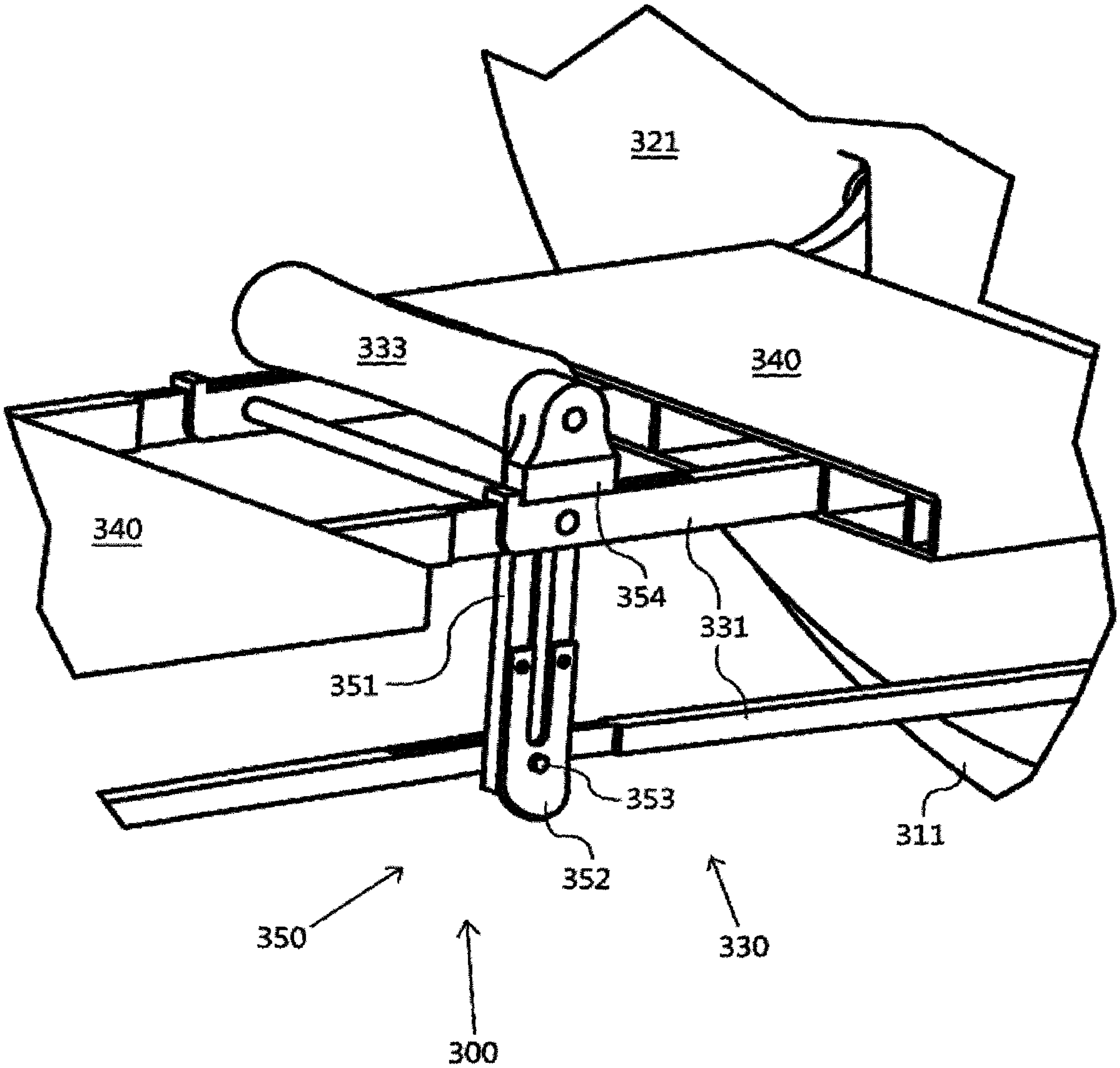


图 6

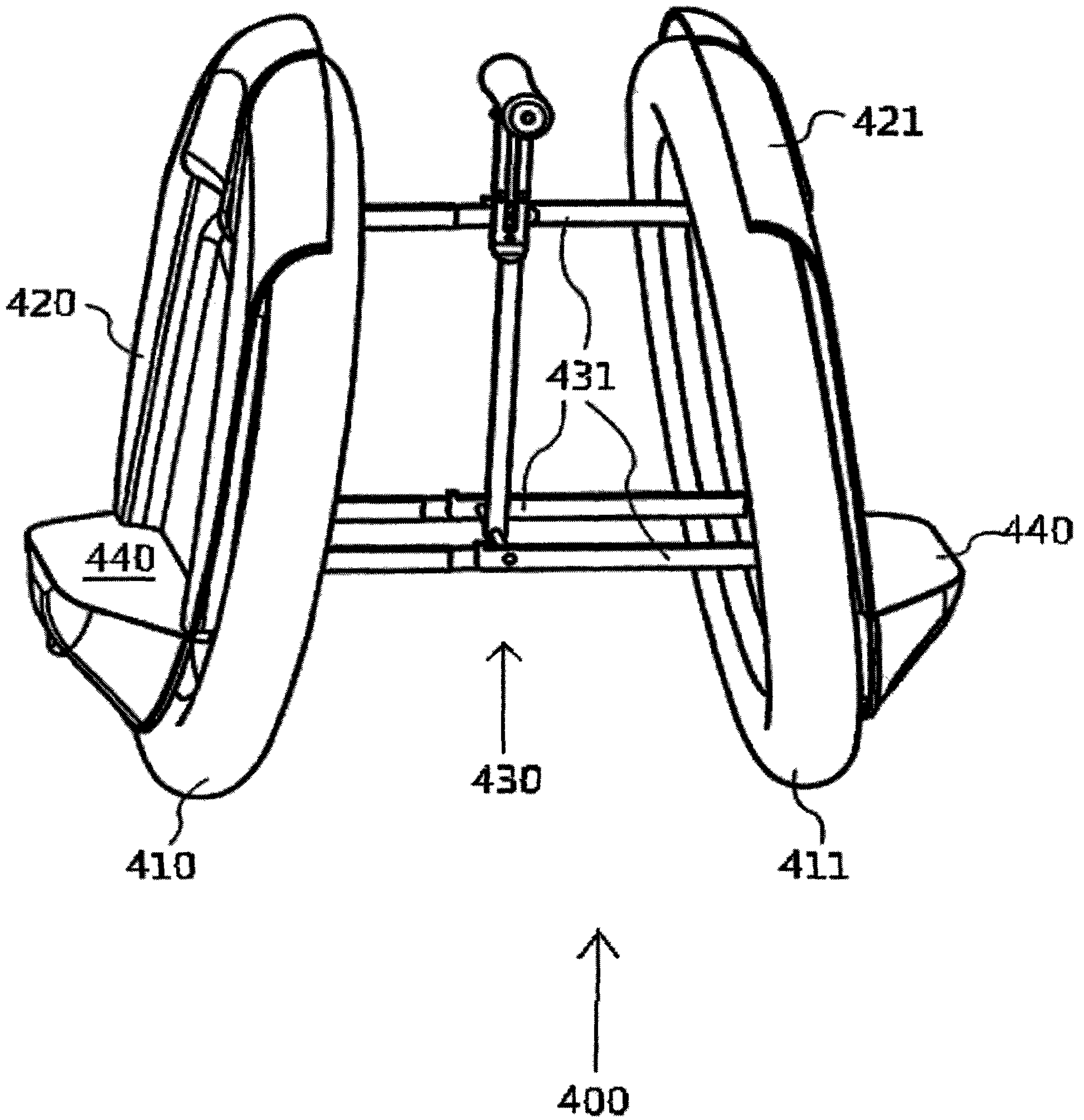


图 7

Espacenet

Bibliographic data: CN102602481 (A) — 2012-07-25

Two-wheeled self-balancing electric vehicle

Inventor(s): HE CHEN ± (CHEN HE)

Applicant(s): HE CHEN ± (CHEN HE)

Classification:
- international: *B62K11/00*
- cooperative: **B62K11/00 (EP)**; **B62K11/007 (EP)**; B60L2200/16 (EP); B60L2220/42 (EP); B60L2220/46 (EP); B60L2260/34 (EP); Y02T10/646 (EP)

Application number: CN201210112847 20120418 Global Dossier

Priority number(s): CN201210112847 20120418

Abstract of CN102602481 (A)

The invention provides a novel self-balancing two-wheeled electric vehicle which is provided with two basically parallel wheels which are arranged in parallel on the left and right and can independently rotate. In order to reduce the volume and weight, the frame is omitted, and a foot pedal also serves as a frame. The foot pedal consists of two parts which can independently tilt forward or backward respectively; two wheels are arranged below the foot pedal; the wheels are lower than the upper surface of the foot pedal; and the two wheels are controlled by an electronic self-balancing control system so that the foot pedal is kept at horizontal balance in the front-back direction. A driver standing on the foot pedal can control the vehicle to go forward or backward or turn simply by changing the center of gravity. Therefore, the two-wheeled electric vehicle is flexible in control and stable in operation; and moreover, the vehicle is very light and convenient and easy to carry, and can be applied to multiple fields.

Notice

CLAIMS CN102602481

1.
A two-wheeled self-balancing electric vehicle, which is composed of the following components:

a first wheel and a second wheel, which are disposed substantially parallel to each other, have no common axle, and can rotate independently;

The first step board and the second step board, the first step board is matched with the first wheel, the second step board is matched with the second wheel, and the first step board and the second step board are rotatably connected to each other Each of them can be tilted forward or backward independently, and the upper surfaces of the first and second tread plates are respectively provided for the left and right legs of the driver, the first wheel is located below the first foot plate, and the second wheel is located Below the second step board;

a first motor and a second motor, the first motor drives the first wheel, the second motor drives the second wheel, the first motor and the second motor are controlled by at least one electronic system, and the electronic control system controls the rotational speed of the wheel so that The footboard maintains a horizontal balance in the front-rear direction for the driver to control the forward, backward and steering of the two-wheeled electric vehicle.

2.
A two-wheeled self-balancing electric vehicle, which is composed of the following components:

a first wheel and a second wheel, which are disposed substantially symmetrically to each other, and which have no common axle and can be rotated independently;

a torsionally deformable stepping board which is matched with the first wheel and the second wheel, and the part of the stepping board which is matched with the first wheel and the upper surface of the part of the stepping board which is matched with the second wheel are respectively provided for the driver Standing on the left and right feet, the two parts of the footboard are torsionally deformable, each of which can independently tilt forward or backward, and the first wheel and the second wheel are located below the footboard;

a first motor and a second motor, the first motor drives the first wheel, the second motor drives the second wheel, the first motor and the second motor are controlled by at least one electronic system, and the electronic control system controls the rotational speed of the wheel so that The footboard maintains a horizontal balance in the front-rear direction for the driver to control the forward, backward and steering of the two-wheeled electric vehicle.

Notice

DESCRIPTION CN102602481

The invention proposes a novel self-balancing two-wheel electric vehicle. There are two substantially parallel, side-by-side, independently rotatable wheels. In order to reduce the size and weight, the frame is eliminated, and the stepping board functions as a frame. The footboard consists of two parts, each of which can be tilted independently forward or backward; two wheels are arranged below the footboard, the height of the wheel is lower than the upper surface of the footboard; the two wheels are controlled by an electronic self-balancing control system Control so that the footboard maintains a horizontal balance in the front and rear direction. A driver standing on a stepping board can change the center of gravity to control the car to move forward, backward or turn. Therefore, the two-wheeled electric vehicle is not only flexible in operation, stable in operation, but also particularly lightweight and easy to carry, and can be applied in various fields.

Two-wheel self-balancing electric vehicle

Technical field

The invention proposes a self-balancing two-wheel electric vehicle. Its two wheels are arranged under the footboard and are arranged substantially parallel on the left and right sides. Each wheel has an independent electronic self-balancing control system and a power drive system. The driver can stand on the footboard to drive the two-wheel electric drive. The car's forward, backward and steering. Specifically, this is a standing, self-balancing electric two-wheeled vehicle that is controlled by a driver.

Background technique

A technical example of one of the most well-known two-wheeled self-balancing electric vehicles in the world is disclosed by Kamen et al. (U.S. Patent No. 6,302,230B1, Oct. 16, 2001). Kamen's patent summarizes the background of the self-balancing two-wheeled electric vehicle at the time, revealing the related technologies of their dynamic drive and electronic control balance. The self-balancing two-wheeled electric vehicle disclosed in the Kamen patent has two wheels arranged in parallel, with a platform between the two wheels (or above) for the rider (operator) to stand; it is a single The shaft double wheel design has a common drive shaft connecting the two wheels; it also provides a handlebar for steering to improve the stability of the rider's standing and to control the direction in which the car travels. This self-balancing two-wheeled electric vehicle was produced and put on the market in 2002. The product of the two-wheeler is called Segway. This two-wheeled vehicle has been applied in many countries and in many aspects, and it is an effective medium- and short-distance transportation vehicle.

The Segway has a weight of about 40kg, which is cumbersome and expensive. These shortcomings hinder its further application. Some users want to use a lighter two-wheeled electric vehicle, which requires easy disassembly and assembly and greater portability. It also requires lowering costs to meet the needs of a wider range of markets.

In addition, we have successfully developed an extremely lightweight self-balancing unicycle electric vehicle and have disclosed its technical features and technical solutions (CN102275621A, 20111214). The unicycle electric car has a maximum speed of about 15km/h and a weight of about 13kg. When riding, the operator's two feet stand on two footboards respectively. The footboards are fixed on the wheel frame and are placed on both sides of the wheel, which are located below the axle. When the reference vertical axis between the operator's center of gravity and the axle is perpendicular to the ground, the speed of the self-balancing unicycle is zero. Because the footboard is fixed on the wheel frame, when the operator standing on the footboard tilts the center of gravity forward or backward, the wheel frame is also tilted forward or backward with the action of the operator. The status signal of the front low or rear tilt (ie, the position state of the car) is transmitted to the micro-processing through the gyroscope, and the micro-processing drive motor advances or retracts the single-wheel electric vehicle. If the operator tilts the center of gravity toward the left and right, the vehicle can be turned. Lightweight, flexible and easy to carry are the outstanding advantages of this self-balancing unicycle. However, the market also calls for the development of a lightweight, stand-up, two-wheeled electric vehicle that is not hand-operated.

Therefore, it is a common expectation in the related field to develop a self-balancing two-wheel electric vehicle that is portable, low in cost, simple in operation and stable in operation, and is used in relevant occasions.

Summary of the invention

The self-balancing two-wheeled electric vehicle proposed by the present invention has two substantially parallel, side-by-side, independently rotatable wheels. In order to reduce the size and weight, the frame is eliminated, and the stepping board functions as a frame. The two wheels are placed below the footboard. Each wheel has an electronic self-balancing control system and a power drive system that drives the wheels to roll forward or backward based on positional changes in the front and rear directions of the footboard, keeping the footrests balanced in the fore and aft direction. This allows the driver standing on the footboard to drive the two-wheeled electric vehicle forward, backward or steering.

In summary, the invention discloses that the two wheels each have independent axles and can rotate independently; the pedals are composed of two parts, each of which can independently tilt forward or backward; two wheel settings Below the footboard, the height of the wheel is lower than the upper surface of the footboard; the two wheels are controlled by an electronic self-balancing control system that maintains the footboard in a horizontal balance in the front-rear direction. A motorist standing on a stepping board can control the car to move forward, backward or turn as long as it changes its center of gravity. Therefore, the two-wheeled electric vehicle is not only flexible in operation, stable in operation, but also particularly lightweight and easy to carry, and can be applied in various fields.

Those skilled in the art will be able to further understand the technical features of the present invention and other related advantages after reviewing the detailed description below in conjunction with the drawings.

DRAWINGS

BRIEF DESCRIPTION OF THE DRAWINGS Figure 1 is a side elevational perspective view of an example in accordance with the present invention. Its footboard is composed of two parts.

2is a top perspective view of a side view in accordance with another example of the present invention. Its footboard is a whole.

Figure 3is a side elevational perspective view of the example of Figure 2.

These examples will be detailed below.

detailed description

Referring to Figure 1, this is an embodiment of a two-wheeled self-balancing electric vehicle for personal use as set forth in the present invention, which is a side elevational view thereof. The two-wheel self-balancing electric vehicle 100has two steps, the left half foot board 110and the right half foot board 111. The tread plates of the two halves are rotatably coupled to each other, and they are each tiltable forward or backward without affecting each other. There are also two wheels that are respectively mated with the footboard, the left wheel 120is mated with the left half footboard 110, and the right wheel 121 is mated with the right half footboard 111. The left wheel 120 and the right wheel 121 are arranged in parallel with each other in parallel, and the two wheels are independently rotatable and are rotatable in different directions with different speeds. The left wheel 120and the right wheel 121 are each driven by an electric motor. The upper surfaces of the left half foot board 110and the right half foot board 111 are respectively provided for the driver's foot and are the driver's foot plane. When the two legs of the driver are standing substantially in parallel on the left half foot plate 110and the right half foot board 111, the front and rear directions of the standing driver are the front and rear directions of the two-wheeled electric vehicle. Relative to the ground, the two halves of the footboard can each be tilted forward or backward; the two wheels can also roll forward or backward on the ground. Each of the motors is individually controlled by an electronic self-balancing control system that maintains the balance of the two-wheeled electric vehicle's footboard in the fore and aft direction. Electronic control systems typically set the balance of the plane of the footboard parallel to the ground, that is, the electronic control system makes the two-wheeled electric vehicle's footboard generally tend to be parallel to the ground. When the electronic self-balancing control system detects that the footboard has an oblique angle with respect to the ground in the front-rear direction, the motor is instructed to drive the wheel to accelerate or decelerate, so that the two-wheeled electric vehicle's footboard is balanced in the front-rear direction. Of course, the electronic control system can also set a certain position of the footboard to a balanced state, which can be used to control the balance of the car. The technology of the electronic self-balancing control system is well known to those skilled in the art and can be implemented, for example, by electronic kits and circuits such as various gyro sensors or electronic accelerometers. The electronic self-balancing control system can be used in two sets or two electronic systems can be used to control two separate subsystems. The electronic self-balancing control system drives the wheel rotation through a drive system that includes an electric motor and a transmission. Both the electronic self-balancing control system and the drive system are placed on the underside of the footboard. For safety reasons, the cover is covered. The electronic system and the transmission system are not shown.

When the electronic self-balancing control system is working, the plane of the footboard is tilted forward, the wheels roll forward; the foot plane is tilted backwards and the wheels roll backwards. As the angle of the tilt increases, the acceleration becomes larger; when the angle of the tilt decreases, the acceleration becomes smaller. Because each wheel has its own independent motor controlled by the electronic self-balancing control system, the driver can change the center of gravity before and after, so that the footboard is tilted to control the forward speed of the two-wheel self-balancing electric vehicle; when the driver's left foot and The footboards on which the right foot is stepped are tilted at different angles so that the speeds of the two wheels are different, and the running direction of the two-wheeled self-balancing electric vehicle can be controlled.

By the way, the functions of the left and right halves of the two-wheeled self-balancing electric vehicle are the same. Only when the driver stands on the top, there is a sense of left and right, so there is no practical point. The above is for the convenience of the description, only the name of the "left" and "right" in front of the parts, such as the use of "first" and "second" instead, will be more precise. Therefore, the name of the specification can be replaced with the names of the first wheel, the second wheel, the first foot plate, the second foot plate, the first motor, the second motor, and the like.

Referring to Figure 2, this is another embodiment of a two-wheeled self-balancing electric vehicle for personal use in accordance with the present invention, which is a perspective view from a side elevation. Figure 3is a side elevational perspective view of the embodiment. The difference between this solution and the solution of Figure 1 is that the footboard is not split into two parts. As can be seen from the figure, the foot plate 230of the two-wheel self-balancing electric vehicle 200in the present embodiment appears to be an integral continuous component, and the left and right two-step tread plates are connected by a twistable connection structure. . The twistable connector is disposed on the bottom surface of the footboard. The middle part of the step board, that is, the left and right part of the foot board can be connected by a twistable flexible material, and the left and right parts of the foot board are connected as a whole. The twistable connecting structure is disposed on the bottom surface of the foot board, and the foot board after the structure connecting member can be twisted, so that the step board becomes a torsionally deformable step board.

The technical features of the connector of the twistable structure are disclosed in another patent (CN 101513569B, 2011.07.06). It is a new, flexible, twistable connection for personal skating sports equipment. The part can be twisted and cannot be bent; it is both a twistable spring and a connecting piece. It is simple to make and install; it is easy to precisely control the uniformity of performance; there is no slack; there is no wear during work. It has high reliability.

The left and right ends of the overall continuous step board 230have considerable strength and can withstand the standing of the driver. The middle part of it can be distorted. As the driver's center of gravity moves forward and backward, on the step board 230, the foot planes of the left and right portions on which the driver's feet are stepped may be twisted toward the front or the back, similar to the scheme shown in FIG. 1, the step board 230 The functions of the left half and the right half correspond to the left half foot plate 110and the right half foot board 111 in the plan of Fig. 1, each of which can be tilted forward or backward.

The two wheels of the two-wheeled electric vehicle 200are respectively mated with the footboard 230and also coupled to the bottom surface of the footboard 230. The left wheel 210is mated to the left half of the foot plate 230, and the right wheel 211 is coupled to the right half of the foot plate 230. The left wheel 210and the right wheel 211 are arranged in parallel with each other in parallel, and the two wheels are independently rotatable and are rotatable in different directions at different speeds. As in the solution of Fig. 1, the left wheel 211 and the right wheel 211 are also each driven by an electric motor. Each of the motors is also individually controlled by an electronic self-balancing system such that the upper surface of the two-wheeled electric vehicle's footboard is generally intended to be parallel to the ground. For safety reasons, the motor and electronic self-balancing control system are also placed in the cavity of the footboard or covered with a cover. The same principle, because each wheel has its own independent motor and electronic self-balancing control system, the driver can use two feet to tilt the foot plane to control the forward speed and running direction of the two-wheel self-balancing electric vehicle.

While the embodiments described above contain many specific details, they should not be construed as limiting the scope of the embodiments. Therefore, the scope of the present invention should be determined by the appended claims and their corresponding documents, and not by the examples given above. In addition, it should be understood that further modifications can be made to the invention. The patent is intended to cover various modifications, uses, or improvements in accordance with the principles of the present invention. It is also intended to be deviated from the known embodiments or embodiments disclosed herein. The scope of the principle.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 102602481 A
(43)申请公布日 2012.07.25

(21)申请号 201210112847.X

(22)申请日 2012.04.18

(71)申请人 陈和
地址 400700 重庆市北碚区朝阳路58号4单元3-4室

(72)发明人 陈和

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

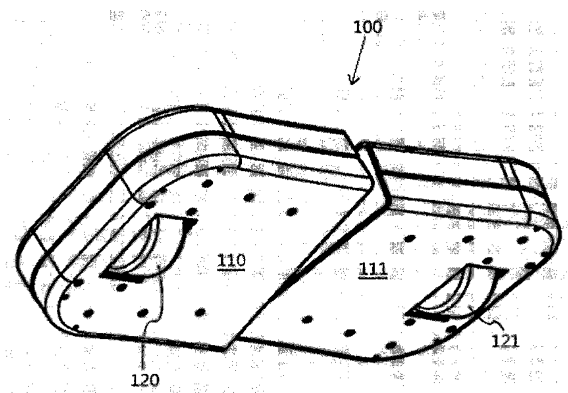
权利要求书 1 页 说明书 4 页 附图 2 页

(54)发明名称

两轮自平衡电动车

(57)摘要

本发明提出了一种新型的自平衡式的两轮电动车。有两个基本平行的、左右并排的、能独立转动的轮子。为了缩小体积与重量，省去了车架，踏脚板兼任车架的功能。踏脚板由两部分组成，它们各自能够独立地朝前或朝后倾斜；两个车轮设置在踏脚板的下方，车轮的高度低于踏脚板的上表面；两个车轮被电子自平衡控制系统所操控，使踏脚板保持前后方向上的水平平衡。站立在踏脚板上的驾车者，只要改变其重心即可操控车子朝前、朝后或转向行进了。因此，该种两轮电动车不仅操纵灵活、运行稳定，而且特别轻便、易于携带，可以在多种领域内得到应用。



CN 102602481 A

1. 一种两轮自平衡电动车，它是有如下部件所构成：

第一车轮与第二车轮，它们是彼此基本平行地左右设置的，没有共同的车轴，能独立地转动；

第一踏脚板与第二踏脚板，第一踏脚板与第一车轮相配接，第二踏脚板与第二车轮相配接，第一踏脚板与第二踏脚板之间是互相可转动地连接着的，它们各自能够独立地朝前或朝后倾斜，第一踏脚板与第二踏脚板的上表面分别供驾车者左右两脚站立，第一车轮位于第一踏脚板的下方，第二车轮位于第二踏脚板的下方；

第一电动机与第二电动机，第一电动机驱动第一车轮，第二电动机驱动第二车轮，第一电动机与第二电动机至少被一套电子系统所控制，电子控制系统控制车轮的转动速度，使踏脚板保持前后方向上的水平平衡，供驾车者用来操控两轮电动车的向前、朝后与转向。

2. 一种两轮自平衡电动车，它是有如下部件所构成：

第一车轮与第二车轮，它们是彼此基本对称地左右设置的，它们没有共同的车轴，能独立地转动；

一个可扭转变形的踏脚板，它与第一车轮、第二车轮相配接，与第一车轮相配接的那部分踏脚板以及与第二车轮相配接的那部分踏脚板的上表面分别供驾车者左右两脚站立，这两部分踏脚板之间是可扭转变形的，它们各自能够独立地朝前或朝后倾斜，第一车轮与第二车轮都位于踏脚板的下方；

第一电动机与第二电动机，第一电动机驱动第一车轮，第二电动机驱动第二车轮，第一电动机与第二电动机至少被一套电子系统所控制，电子控制系统控制车轮的转动速度，使踏脚板保持前后方向上的水平平衡，供驾车者用来操控两轮电动车的向前、朝后与转向。

两轮自平衡电动车

技术领域

[0001] 本发明提出了一种自平衡式的两轮电动车。它的两个轮子设置在踏脚板的下方，基本平行地排列在左右两边，每个轮子都有独立的电子自平衡控制系统与动力驱动系统，驾车者站立在踏脚板上即可驱使两轮电动车的前进、后退与转向。确切地说，这是一种站立式的、由驾车者操控的、自平衡式电动两轮车。

背景技术

[0002] 当前世界上最有名的一种两轮自平衡电动车的技术实例，是由 Kamen 等人的专利(U.S.Patent No.6,302,230 B1,Oct.16,2001)所揭示的。Kamen 的专利总结了当时自平衡两轮电动车的背景技术，揭示了它们动力驱动与电子控制平衡的相关技术。Kamen 专利所揭示的自平衡两轮电动车，它有相对平行排列的两个轮子，两个轮子之间（或之上）设有一个供骑车人（操作者）站立的平台；它是单轴双轮的设计，有一根共同的驱轴将两个轮子相连；它还设置了一个操纵用的手把杆，用来改善骑车人站立的稳定性，以及控制车子行进的方向。这种自平衡两轮电动车，于 2002 年开始生产并投入市场，该两轮车的商品，名叫“赛格威”(Segway)。这种两轮车在多个国家、多个方面都已得到了应用，不啻为一种有效的中、短距离的运输工具。

[0003] 赛格威车的自重约有 40 公斤，比较笨重，价格也比较昂贵。这些缺点妨碍了它的进一步推广应用。某些用户希望使用较轻便的两轮电动车，要求拆装方便，具有较大的可携带性。还要求降低成本，满足更大范围市场的需要。

[0004] 另外，我们成功研制出了一种极其轻便的自平衡独轮电动车，并已公开了它的技术特征与技术方案(CN102275621A,20111214)。该独轮电动车的最大速度约为 15 公里/小时，自重约 13 公斤。骑行时，操作者的两只脚分别站立两只踏脚板上，踏脚板是固定在轮架上的，设置在轮子的两侧，位在轮轴的下方。当操作者的重心与轮轴之间的参考纵轴垂直于地面时，自平衡独轮电动车的速度为零。因为踏脚板是固定在轮架板上的，当站在踏脚板上的操作者将重心前倾或后仰时，致使轮架板也随着操作者的行动一同前倾或后翘，轮架板前低或后翘（即是车子的位置状态）的状态信号通过陀螺仪传给微处理，微处理驱动电机使独轮电动车前进或后退。如操作者将重心朝左右倾侧时，则可使车辆转向。轻巧灵活、便于携带是该自平衡独轮电动车的突出优点。然而，市场还要求发展一种轻便的、站立式的、不用手操控的两轮电动车。

[0005] 因此，研制一台可便携、成本较低、操作简单、运行稳定的自平衡两轮电动车，供有关场合使用，是有关领域的普遍期望。

发明内容

[0006] 本发明提出的自平衡式两轮电动车是有两个基本平行的、左右并排的、能独立转动的轮子。为了缩小体积与重量，省去了车架，踏脚板兼任车架的功能。两个轮子设置在踏脚板的下方。每个轮子各有一个电子自平衡控制系统和一个动力驱动系统，它们是根据踏

脚板的前后方向上的位置变化，来驱动车轮向前或朝后滚动，使踏脚板在前后方向上保持平衡。从而使站立在踏脚板上的驾车者能驾驭两轮电动车前进、后退或转向。

[0007] 总结来说，本发明所揭示的发明内容有：两个车轮各有独立的车轴，能独立地转动；踏脚板由两部分组成，它们各自能够独立地朝前或朝后倾斜；两个车轮设置在踏脚板的下方，车轮的高度低于踏脚板的上表面；两个车轮被电子自平衡控制系统所操控，使踏脚板保持前后方向上的水平平衡。站立在踏脚板上的驾车者，只要改变其重心即可操控车子朝前、朝后或转向行进了。因此，该种两轮电动车不仅操纵灵活、运行稳定，而且特别轻便、易于携带，可以在多种领域内得到应用。

[0008] 业内有经验人士在结合图纸审阅下文的详细叙述后，可以进一步了解本发明的技术特点以及其它有关的优点了。

附图说明

[0009] 图 1 是根据本发明所提出的一个实例的仰视侧向的透视图。它的踏脚板是有两部分所组成的。

[0010] 图 2 是根据本发明所提出的另一个实例的俯视侧向的透视图。它的踏脚板是一个整体。

[0011] 图 3 是图 2 实例的仰视侧向的透视图。

[0012] 这些实例，将在下文中详述。

具体实施方式

[0013] 参阅图 1，这是本发明所提出的个人使用的两轮自平衡电动车的一种实施方案，该图是它的仰视侧向的透视图。图中的两轮自平衡电动车 100 的踏脚板是有两部分组成，左半踏脚板 110 与右半踏脚板 111。这两半部分的踏脚板互相是可转动地连接着的，它们能够互不影响地各自朝前或朝后倾斜。还有两个车轮分别与踏脚板相配接，左车轮 120 与左半踏脚板 110 相配接，右车轮 121 与右半踏脚板 111 相配接。左车轮 120 与右车轮 121 是互相平行地相对排列的，这两个轮子能够独立地转动，彼此可以用不同的速度、朝不同的方向旋转。左车轮 120 与右车轮 121 各自用一个电动机驱动。左半踏脚板 110 与右半踏脚板 111 的上表面，可分别供驾车者的脚站立，是驾车者的踏脚平面。驾车者的两脚基本平行地分别站在左半踏脚板 110 与右半踏脚板 111 上时，站立着的驾车者的前后方向也就是两轮电动车的前后方向。相对于地面而言，两半部分的踏脚板各自都可朝前或朝后倾斜；两个轮子也可朝前或朝后在地面上滚动。每一个电动机各自被一套电子自平衡系统所控制，该电子自平衡控制系统使两轮电动车的踏脚板在前后方向上保持平衡。电子控制系统通常设定，踏脚板的平面与地面相平行时为平衡状态，也就是说：电子控制系统使两轮电动车的踏脚板通常是倾向于要与地面保持平行。当电子自平衡控制系统探测到踏脚板相对于地面在前后方向上有一倾斜角度时，就会指令电动机驱使轮子加速或减速，使得两轮电动车的踏脚板在前后方向上保持平衡。当然，电子控制系统也可将踏脚板的某一位置设定为平衡状态，同理可以用来控制车子的平衡。该电子自平衡控制系统的技术已为业内人士所熟知，例如可用各种陀螺传感器或电子加速度计等电子套件与线路来实现。电子自平衡控制系统可以用两套，也可以用一个电子系统控制两个独立的分系统。电子自平衡控制系统通过包括

电动机与传动机构的驱动系统驱动车轮转动。电子自平衡控制系统与驱动系统都被设置在踏脚板的底面，为了安全起见，用罩子盖住，图上未画出电子系统与传动系统。

[0014] 当电子自平衡控制系统工作时，踏脚板的平面朝前倾斜，轮子就朝前滚动 ；踏脚平面朝后倾斜，轮子就朝后滚动。倾斜的角度增大，则加速度变大 ；倾斜的角度减小，则加速度变小。因为每个轮子有自己独立的被电子自平衡控制系统控制的电动机，驾车者可以前后改变其重心，使踏脚板发生倾斜，来操控两轮自平衡电动车的前进速度 ；当驾车者左脚与右脚所踩的踏脚板，分别倾斜不同的角度，使得两只轮子的速度不同，就可以操控两轮自平衡电动车的运行方向。

[0015] 顺便指出，该两轮自平衡电动车左右两半部分的功能是相同的，只有当驾车者站在上面时才有左右的意义，所以没有实际意义的左右之分。上文是为了叙述上的方便，才在部件前冠以“左”与“右”的名称，如用“第一”与“第二”来代替，会更确切一些。因此，规范的名称可以改用第一车轮、第二车轮，第一踏脚板、第二踏脚板，第一电动机、第二电动机等名称来替代。

[0016] 参阅图 2，这是根据本发明所提出的个人使用的两轮自平衡电动车的另一种实施方案，这是俯视侧向的透视图。图 3 是该实施方案的仰视侧向的透视图。本方案与图 1 方案的不同处是没有将踏脚板分裂成两部分。从图上可见，本方案中的两轮自平衡电动车 200 的踏脚板 230，看起来是一个整体连续的组件，它的左右两部分踏脚板是用一种可扭转的连接结构相连接起来的。该种可扭转的连接件设置在踏脚板的底面。踏脚板上的中间部分，即左右两部分踏脚板之间可用可扭转的柔性材料相连接，将左右两部分踏脚板连接成一个整体。可扭转的连接结构设置在踏脚板的底面，设置可扭转结构连接件后的踏脚板，使踏脚板成为可扭转变形的踏脚板了。

[0017] 该种可扭转结构的连接件的技术特点，本人已在另一个专利 (CN 101513569B，2011.07.06) 中揭示。它是一种崭新的、用于个人滑行运动器材的、可扭转的柔性连接结构。该部件能扭转，不能弯曲 ；既是可扭转的弹簧，又是连接件。它的制作与按装较为简单 ；易于精确控制性能的均一性 ；而且没有松弛现象 ；工作过程中没有磨损。它具有很高的可靠性。

[0018] 整体连续的踏脚板 230 的左右两端是有相当的强度，能承受驾车者的站立。它的中间部分能够扭曲。随着驾车者的重心前后的移动，在踏脚板 230 上，驾车者两脚所踩踏的左右部分的踏脚平面，可以朝前或朝后扭曲，与图 1 所示的方案相似，踏脚板 230 的左半部分与右半部分的功能相当于图 1 方案中的左半踏脚板 110 与右半踏脚板 111，各自可以随意地朝前或朝后倾斜。

[0019] 两轮电动车 200 的两个车轮分别与踏脚板 230 相配接，也配接在踏脚板 230 的底面。左车轮 210 配接在踏脚板 230 的左半部分，右车轮 211 配接在踏脚板 230 的右半部分。左车轮 210 与右车轮 211 是互相平行地相对排列的，这两个轮子能够独立地转动，彼此可以用不同的速度、朝不同的方向旋转。与图 1 的方案相同，左车轮 211 与右车轮 211 也是各自被一个电动机驱动。每一个电动机也各自被一套电子自平衡系统控制，使两轮电动车的踏脚板的上表面通常是倾向于要与地面保持平行。为了安全起见，电动机与电子自平衡控制系统也都被设置在踏脚板的空腔内，或用罩子盖住。同样的原理，因为每个轮子有自己独立的电动机与电子自平衡控制系统，驾车者可以用两脚使踏脚平面发生倾斜，来操控两轮自

平衡电动车的前进速度以及运行方向。

[0020]　虽然以上叙述的实施方案包含了许多特定的细节，但是不应构成对实施方案包括范围的限制，而且也不应仅仅限于目前提出的这些特定方案的图示上。因此，这些实施方案的涵盖范围应该由所附的权利要求及其相应的文件所确定的，而不是由上述给出的实例所决定的。此外，还应该理解为本发明还能作进一步的改动。本专利旨在涵盖根据本发明的原理所进行的各种变化、用途或改良；也涵盖了与本发明所揭示的已知方案或实施方案有所偏离，但仍然从属于本发明技术及其应用原理的范围。

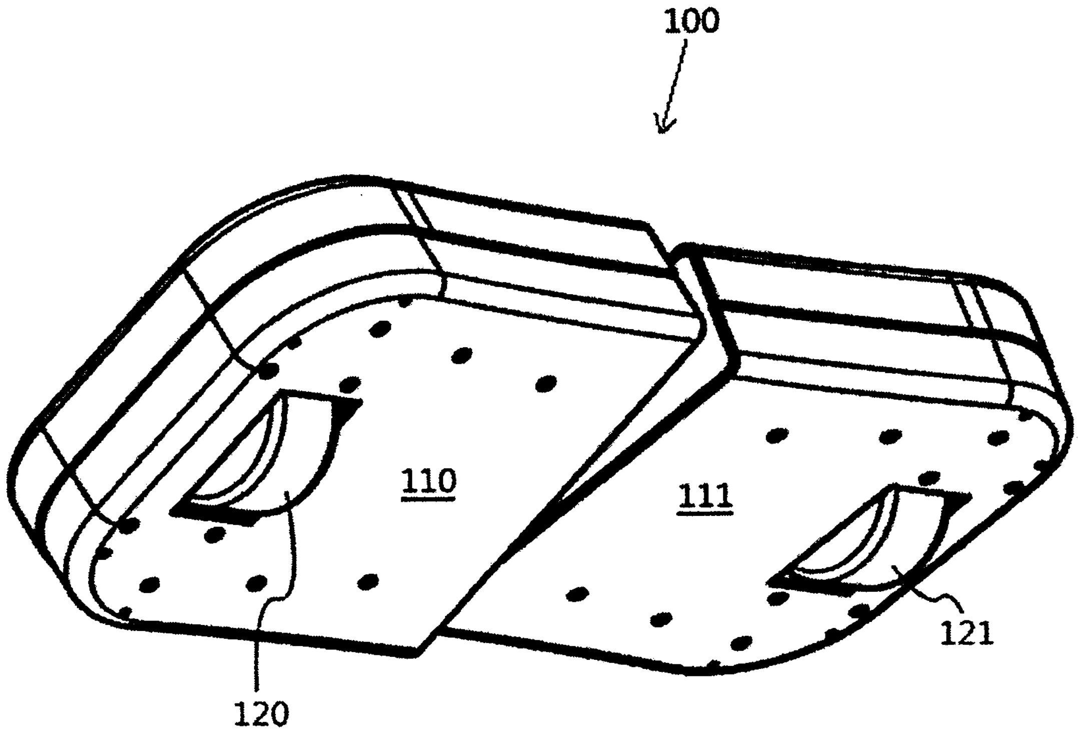


图 1

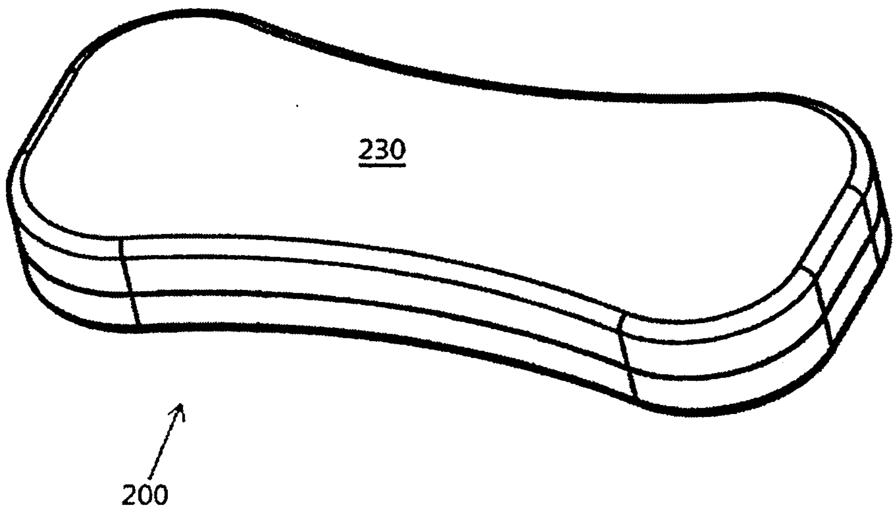


图 2

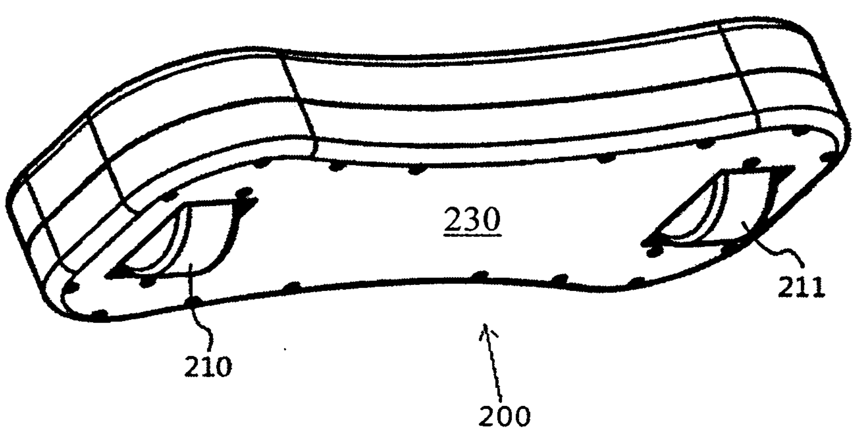


图 3

Espacenet

Bibliographic data: CN103529850 (A) — 2014-01-22

Control method of two-wheeled self-balance vehicle

Inventor(s): JIANG LIBIAO; ZHAI WEILIANG; JIANG SIYU; ZHANG KERAN; ZHAO YUZHOU; LIANG QILIN; LIANG JUN; YANG JIAN + (JIANG LIBIAO, ; ZHAI WEILIANG, ; JIANG SIYU, ; ZHANG KERAN, ; ZHAO YUZHOU, ; LIANG QILIN, ; LIANG JUN, ; YANG JIAN, ; 姜立标, ; 翟伟良, ; 姜思羽, ; 张可然, ; 赵誉洲, ; 梁启麟, ; 梁俊, ; 杨剑)

Applicant(s): GUANGZHOU COLLEGE SOUTH CHINA UNIV TECHNOLOGY + (GUANGZHOU COLLEGE OF SOUTH CHINA UNIVERSITY OF TECHNOLOGY, ; 华南理工大学广州学院)

Classification: - international: *B62K11/00; G05D1/08*
- cooperative:

Application number: CN201310516158 20131028 Global Dossier

Priority number(s): CN201310516158 20131028

Also published as: CN103529850 (B)

Abstract of CN103529850 (A)

A control method of a two-wheeled self-balance vehicle comprises the steps as follows: (1), performing initialization; (2), reading values of a gyroscope, an accelerometer and a rotation angle sensor as well as the pulse number of an encoder respectively; (3), obtaining a vehicle body inclination, a handlebar turning angle, motor speeds and a vehicle speed; (4), then calculating PWM (pulse width modulation) values of vertical control, direction control and speed control respectively through a PID (proportion integration differentiation) control algorithm; (5), superposing the three PWM values together and outputting the three PWM values to left and right motors; (6), then sending data of the gyroscope, the accelerometer, the vehicle body inclination, a battery voltage, motor currents and the vehicle speed to an upper computer so as to monitor the operating status of the whole vehicle; (7), when the battery voltage is monitored to be smaller than a preset value, and the motor currents or the vehicle speed is monitored to be larger than the preset value through monitoring, turning on corresponding LED warning lights; and (8), when the vehicle body inclination is larger than a preset angle through monitoring when the vehicle body inclination is monitored to be larger than a preset angle, determining that the vehicle body falls down, stopping the operation and returning to an initializer. According to the control method, a more accurate operational method is adopted.

Notice

CLAIMS CN108529850

1.

A two-wheel self-balancing vehicle control method, characterized in that the method comprises the following steps

(1) After the two-wheel self-balancing car is powered on, the system first enters each initialization program, including phase-locked loop initialization, AD conversion initialization, timer initialization, PWM initialization, and port initialization

(2)

Then delay 1s to wait for the system to stabilize, then read the initial values of the gyroscope, accelerometer and angle sensor, and then delay the 1s to wait for the parameter change;

(3)

The program sets the 1ms interrupt function, and puts the vertical control, direction control and speed control simultaneously during the period; when the 1ms interrupt is generated, the values of the gyroscope, accelerometer and angle sensor and the pulse of the encoder are read separately. number;

(4)

The gyro and accelerometer data fusion filtering is performed by Kalman filtering to obtain the vehicle body inclination angle; the handlebar rotation angle is calculated by the value of the rotation angle sensor; the motor rotation speed and the vehicle speed are calculated by the number of pulses of the encoder;

（5）
Then, the PID values of the vertical control, the direction control and the speed control are respectively calculated by the PID control algorithm;

（6）
Superimposing three PWM values together to output to the left and right motors;

（7）
Then, the data of the gyroscope, the accelerometer, the vehicle body tilt angle, the battery voltage, the motor current and the vehicle speed are sent to the upper computer to monitor the running state of the whole vehicle;

（8）
When the monitored battery voltage is lower than the preset value, the motor current or the vehicle speed is greater than the preset value, the corresponding LED warning light is turned on; when the vehicle body tilt angle is greater than the preset angle, it is determined that the vehicle body falls and stops. Run and go back to the initialization program.

DESCRIPTION CN103529850

A two-wheel self-balancing vehicle control method comprises the following steps: (1) initializing; (2) reading the values of the gyroscope, the accelerometer and the angle sensor respectively and the number of pulses of the encoder; (3) obtaining the vehicle body Inclination angle, handlebar rotation angle, motor speed and vehicle speed; (4) Then calculate the PWM values of upright control, direction control and speed control by PID control algorithm; (5) superimpose three PWM values together to output to left and right The motor (6) then sends the gyroscope, accelerometer, body tilt angle, battery voltage, motor current and vehicle speed data to the host computer to monitor the operating state of the vehicle; (7) when the monitored battery voltage is lower than the preset When the value, motor current or vehicle speed is greater than the preset value, the corresponding LED warning light is turned on; (8) when the vehicle body tilt angle is greater than the preset angle, it is determined that the vehicle body falls and stops running, and returns to the initialization. In the program. The present invention employs a more precise calculation method.

Two-wheel self-balancing vehicle control method

Technical field

The invention relates to a two-wheel self-balancing vehicle, in particular to a two-wheel self-balancing vehicle control method.

Background technique

The self-balancing electric car automatic balancing operation principle is mainly based on a basic principle called

"Dynamic Stabilization", which is the automatic balancing ability of the vehicle itself. The built-in precision solid state gyro (Solid-State Gyroscopes) is used to determine the posture of the vehicle body. After calculating the appropriate command through a precise and high-speed central microprocessor, the motor is driven to achieve a balanced effect. The current balance car allows the user to shake at will while riding, and the control system on it automatically performs the drive motor processing for balance correction; due to the algorithmic defects of the existing control system, the drive motor processing balance correction time is longer, There is a greater risk of using this type of self-balancing vehicle when in use.

Summary of the invention

In order to solve the above technical problem, the technical solution of the present invention is: a two-wheel self-balancing vehicle control method, comprising the following steps:

(1)
After the two-wheel self-balancing car is powered on, the system first enters each initialization program, including phase-locked loop initialization, AD conversion initialization, timer initialization, PWM initialization, and port initialization.

(2)
Then delay 1s to wait for the system to stabilize, then read the initial values of the gyroscope, accelerometer and angle sensor, and then delay the 1s to wait for the parameter change;

(3)
The program sets the 1ms interrupt function, and puts the vertical control, direction control and speed control simultaneously during the period; when the 1ms interrupt is generated, the values of the gyroscope, accelerometer and angle sensor and the pulse of the encoder are read separately. number;

(4)
The gyro and accelerometer data fusion filtering is performed by Kalman filtering to obtain the vehicle body inclination angle; the handlebar rotation angle is calculated by the value of the rotation angle sensor; the motor rotation speed and the vehicle speed are calculated by the number of pulses of the encoder;

(5)
Then, the PID values of the vertical control, the direction control and the speed control are respectively

calculated by the PID control algorithm;

(6)
Superimposing three PWM values together to output to the left and right motors;

(7)
Then, the data of the gyroscope, the accelerometer, the vehicle body tilt angle, the battery voltage, the motor current and the vehicle speed are sent to the upper computer to monitor the running state of the whole vehicle;

(8)
When the monitored battery voltage is lower than the preset value, the motor current or the vehicle speed is greater than the preset value, the corresponding LED warning light is turned on; when the vehicle body tilt angle is greater than the preset angle, it is determined that the vehicle body falls and stops. Run and go back to the initialization program.

The beneficial effects of the present invention compared to the prior art are:

The invention adopts a more precise calculation method, so that the time for the drive motor to process the balance correction is shorter, and the risk of the self-balancing vehicle in use is reduced.

DRAWINGS

Figure 1 is a control flow chart of the present invention.

detailed description

The invention will now be further described with reference to the drawings of the specification.

As shown in FIG. 1, a two-wheel self-balancing vehicle control method includes the following steps:

(1) After the two-wheel self-balancing car is powered on, the system first enters each initialization program, including phase-locked loop initialization, AD conversion initialization, timer initialization, PWM initialization, and port initialization.

(2) Then delay 1s to wait for the system to stabilize, then read the initial values of the gyroscope, accelerometer and angle sensor, and then delay the 1s to wait for the parameter change;

(3) The program sets the 1ms interrupt function, and puts the vertical control, direction control and speed control simultaneously during the period; when the 1ms interrupt is generated, the values of the gyroscope, accelerometer and angle sensor and the pulse of the encoder are read separately. number;

(4) The gyro and accelerometer data fusion filtering is performed by Kalman filtering to obtain the vehicle body inclination angle; the handlebar rotation angle is calculated by the value of the rotation angle sensor; the motor rotation speed and the vehicle speed are calculated by the number of pulses of the encoder;

(5) Then, the PID values of the vertical control, the direction control and the speed control are respectively calculated by the PID control algorithm;

(6) Superimposing three PWM values together to output to the left and right motors;

(7) Then, the data of the gyroscope, the accelerometer, the vehicle body tilt angle, the battery voltage, the motor current and the vehicle speed are sent to the upper computer to monitor the running state of the whole vehicle;

(8) When the monitored battery voltage is lower than the preset value, the motor current or the vehicle speed is greater than the preset value, the corresponding LED warning light is turned on; when the vehicle body tilt angle is greater than the preset angle, it is determined that the vehicle body falls and stops. Run and go back to the initialization program.

Correlation value calculation aa+=P_enc*enc_anglespeed*dt*0.001+(1-P_enc)*(acc_angle-angle);//tilt calculation;

Aa: the inclination angle obtained by the combination of the gyroscope and the accelerometer;

P_enc: scale factor;

Enc_angkespeed: the AD value of the gyroscope;

Dt: gyroscope integration time;

Acc_angle: angular velocity AD value;

Angle: the angle of inclination.

PWM_angle=(int)(pp*angle+D_angle*enc_anglespeed);//Upright PWM calculation;

PP: proportional coefficient;

D_angle: differential coefficient;

PWM_angle: Upright PWM value.

PWM_turn=(int)(P_turn*turn);//turn to PWM calculation;

P_turn: steering scale factor;

Turn: the AD value of the steering sensor;

PWM_turn; Turns to the PWM value.

1、Parameter design and calculation of each component of two-wheel self-balancing car

The parameter design of the single-axis electric vehicle is mainly to determine the overall structural size, quality parameters, main performance parameters, motor rated parameters, transmission ratio, battery capacity and so on.

1.1、Vehicle structure parameters

(1) Outside dimensions

The scooter pays attention to portability and flexibility. The projected area of the car body on the ground is similar to the shoulder width of a person.

Therefore, the initial overall dimensions are 680mm long, 360mm wide, and 1140mm high, with the pedal height being 250mm.

(2) Track

For a scooter, the change in track is mainly related to the roll stiffness.

Increasing the wheelbase is beneficial to increase the roll stiffness and good lateral stability, but is accompanied by an increase in the length and mass of the vehicle.

Therefore, after comprehensive consideration, the selected wheelbase is 600mm.

(3) Quality parameter

The largest proportion of the quality of the scooter is the lithium battery pack, the motor, the reducer and the wheel. The higher the mass, the more power is consumed, thus reducing the cruising range.

In order to control the quality value, the body part adopts a truss structure, and the pedal and the car shell adopt a carbon fiber structure to ensure the appearance while minimizing the quality of the whole vehicle.

Since the detailed quality of each component is unknown, the quality of the whole vehicle can not be accurately obtained.

However, in order to start from the aspects of energy saving, environmental protection, flexibility and lightness, the whole vehicle preparation quality is initially selected to be 40kg and the load mass is 100kg.

(4) Main performance parameters

According to the survey, the maximum speed of the general scooter is 15-25km/h, the time from acceleration to the maximum speed is 2-5s, and the highest slope that can climb is 15-30° ; therefore, the dynamic parameters of the single-axle electric vehicle are determined. For: the maximum speed is 20km/h, the acceleration time is 3s, and the maximum grade is 20° .

As the scooter is used as a short-distance transport vehicle, the speed should not be too high, otherwise it will easily cause instability and reduce the safety factor; the acceleration time is the time used for continuously accelerating the cement road to the maximum speed under the allowable inclination of the vehicle body, the scooter The reaction is sensitive, and it usually takes a very small time to reach the high-speed running state; the scooter is used more for the flat road, and occasionally encounters the uphill condition, so the maximum climbing attitude is set at 20° to meet the needs of different groups of people.

Since the left and right motors of the scooter can be independently controlled, the steering differential control is realized by the control system, so the minimum turning radius is zero and the maneuver is flexible.

1.2、 Motor parameters

All the movements of the scooter are completed by the motor. It is very important to determine the motor parameters. The appropriate motor must be selected to meet the requirements of the vehicle.

The higher the motor power, the better the power, but it is accompanied by an increase in mass, an increase in volume, and an increase in price. Therefore, the key to motor parameter design is to determine the rated power of the motor.

The scooter in this article is rated for operation at the highest speed, and the required power:

(2-1)

Where η is the transmission efficiency, G is the gravity (N) acting on the car, f is the rolling resistance coefficient, ua is the maximum speed (km/h), CD is the air resistance coefficient, and A is the windward area (m < 2>), then: when the scooter is empty, G=40× 9.8N, f=0.012, CD=0.3, A=1.2m < 2>, ua=20km/h, η =0.95

When the scooter is fully loaded, G=140× 9.8N, f=0.012, C D =0.3, A=2m < 2> , u a =20km/h, η =0.95

But the key to maintaining the balance of the scooter at any time is that the backup power of the motor is large enough. Experience has shown that the rated power of the motor must be more than three times the power required for calculation. Therefore, the main parameters of the DC motor selected in this paper are: rated voltage 24V, rated power 500W, rated speed 4500r/min, rated torque 1.06Nm.

1.3、 Transmission ratio

The gear ratio is determined by the relationship between the maximum vehicle speed and the rated motor speed. The outer diameter of the tire is 14in. The wheel rolling radius r= 180mm can be obtained. The maximum speed v=20km/h=333.3m/min, the wheel circumference C=2π r=2× 3.14× 0.18= 1.13m(2-2)

Then the rated speed of the wheel = [image] (2-3)

Transmission ratio (2-4)

1.4、 Lithium Ion Battery

The key to determining the lithium-ion battery parameters is the battery capacity, which can be calculated by the vehicle cruising range. Due to various factors such as temperature, humidity, battery materials, and usage, the battery may not be full capacity, and it is impossible to discharge completely. When it reaches a certain voltage, it will stop working. Therefore, a battery capacity usable coefficient $\lambda = 0.8$ is set in the calculation.

When the scooter is running at the highest speed, the current [image] (2-5)

The time required for cruising range of 35km [image] (2-6)

Then the battery capacity is (2-7)

Therefore, a 24V 15Ah series assembled lithium battery pack was selected.

2、Dynamic check

2.1、Acceleration time check

The following is the calculation of the time t required for the scooter to accelerate from standstill to the maximum speed at rated voltage. The detailed derivation process is as follows:

Motor speed [image] (2-8)

Motor output torque [image] (2-9)

Wheel drive torque [image] (2-10)

Available vehicle acceleration:

(2-11)

Finished up:

(2-12)

Integrate both sides of the above formula:

(2-13)

which is:

(2-14)

Make

(2-15)

It can be seen that the single-axis electric vehicle designed in this paper accelerates from the static to the maximum speed of 20km/h on the horizontal dry cement road, the acceleration time is 2.4s, less than the preset value of 3s, and the power is good.

2.2、 Maximum grade check

When the scooter is uphill, the main forces are rolling resistance, slope resistance and driving force, where the rolling resistance is $F_f = Gf\cos\alpha$ (2-16)

The slope resistance is $F_i = G\sin\alpha$ (2-17)

Motor rated torque (2-18)

Maximum motor torque $T_{max} = \lambda T_N$ (2-19)

Where λ is the overload factor, generally 1.8-2.2, taking $\lambda = 2$, then;

$T_{max} = \lambda T_N = 2 \times 1.06 = 2.12$Nm

As the maximum climb is sought, the scooter moves at a constant speed, [image] is balanced by force:

$F_t = F_f + F_i$ (2-20)

That is, $G(f\cos\alpha + \sin\alpha) = F_t$ (2-21)

Finished up:

(2-22)

(2-23)

Order:

(2-24)

(2-25)

Solutions have to

Maximum grade gradient $\alpha = \alpha + \beta - \beta = 25.3 - 1.15 = 24.15^{\circ}$ (2-26)

Therefore, the maximum grade is 20° larger than the preset value, which satisfies the requirements.

(19) 中华人民共和国国家知识产权局

(12) 发明专利申请

(10) 申请公布号 CN 103529850 A
(43) 申请公布日 2014.01.22

(21) 申请号 201310516158.X

(22) 申请日 2013.10.28

(71) 申请人 华南理工大学广州学院
地址 510800 广东省广州市花都区学府路 1 号

(72) 发明人 姜立标 翟伟良 姜思羽 张可然 赵誉洲 梁启麟 梁俊 杨剑

(74) 专利代理机构 广州中浚雄杰知识产权代理有限责任公司 44254
代理人 张少君

(51) Int. Cl.
G05D 1/08 (2006.01)
B62K 11/00 (2013.01)

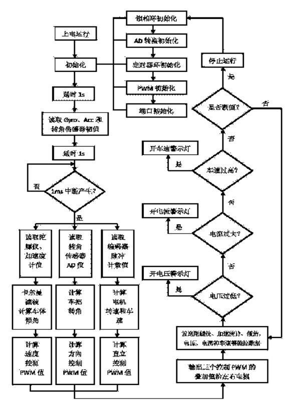
权利要求书1页 说明书6页 附图1页

(54) 发明名称

两轮自平衡车控制方法

(57) 摘要

一种两轮自平衡车控制方法，包括以下步骤：(1) 初始化；(2) 分别读取陀螺仪、加速度计和转角传感器的值以及编码器的脉冲个数；(3) 求取车体倾角、车把转角、电机转速和车速；(4) 然后通过 PID 控制算法分别计算出直立控制、方向控制和速度控制的 PWM 值；(5) 将三个 PWM 值叠加在一起输出给左、右电机；(6) 接着发送陀螺仪、加速度计、车体倾角、电池电压、电机电流和车速的数据给上位机，以监控整车的运行状态；(7) 当监控到电池电压低于预设值、电机电流或者车速大于预设值时，则打开相应的 LED 警示灯；(8) 当监控到车体倾角大于预设角度时，就判定为车体跌倒，并停止运行，重新回到初始化程序当中。本发明采用更精确的运算方法。



CN 103529850 A

1. 一种两轮自平衡车控制方法，其特征在于，包括以下步骤：

（1）两轮自平衡车上电运行后，系统首先进入各初始化程序，包括锁相环初始化、AD 转换初始化、定时器初始化、PWM 初始化与和端口初始化；

（2）然后延时 1s 等待系统稳定后，接着读取陀螺仪、加速度计和转角传感器初值，再延时 1s 等待参数变化；

（3）程序设定了 1ms 中断函数，把直立控制、方向控制和速度控制都放在期间同时进行；当 1ms 中断产生时，则分别读取陀螺仪、加速度计和转角传感器的值以及编码器的脉冲个数；

（4）通过卡尔曼滤波来进行陀螺仪和加速度计数据融合滤波，求取车体倾角；通过转角传感器的值计算车把转角；通过编码器的脉冲个数计算电机转速和车速；

（5）然后通过 PID 控制算法分别计算出直立控制、方向控制和速度控制的 PWM 值；

（6）将三个 PWM 值叠加在一起输出给左、右电机；

（7）接着发送陀螺仪、加速度计、车体倾角、电池电压、电机电流和车速的数据给上位机，以监控整车的运行状态；

（8）当监控到电池电压低于预设值、电机电流或者车速大于预设值时，则打开相应的 LED 警示灯；当监控到车体倾角大于预设角度时，就判定为车体跌倒，并停止运行，重新回到初始化程序当中。

两轮自平衡车控制方法

技术领域

[0001] 本发明涉及两轮自平衡车，尤其是两轮自平衡车控制方法。

背景技术

[0002] 自平衡电动车自动平衡运作原理主要是建立在一种被称为"动态稳定"（Dynamic Stabilization）的基本原理上，也就是车辆本身的自动平衡能力。以内置的精密固态陀螺仪（Solid-State Gyroscopes）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。目前的平衡车允许使用者在骑行时随意摇晃，其上的控制系统会自动进行驱动电机处理进行平衡修正；由于现有的控制系统的算法缺陷，导致驱动电机处理平衡修正的时间较长，使该种类型的自平衡车在使用时存在的风险较大。

发明内容

[0003] 为解决上述技术问题，本发明的技术方案是：一种两轮自平衡车控制方法，包括以下步骤：

[0004] （1）两轮自平衡车上电运行后，系统首先进入各初始化程序，包括锁相环初始化、AD 转换初始化、定时器初始化、PWM 初始化与和端口初始化；

[0005] （2）然后延时 1s 等待系统稳定后，接着读取陀螺仪、加速度计和转角传感器初值，再延时 1s 等待参数变化；

[0006] （3）程序设定了 1ms 中断函数，把直立控制、方向控制和速度控制都放在期间同时进行；当 1ms 中断产生时，则分别读取陀螺仪、加速度计和转角传感器的值以及编码器的脉冲个数；

[0007] （4）通过卡尔曼滤波来进行陀螺仪和加速度计数据融合滤波，求取车体倾角；通过转角传感器的值计算车把转角；通过编码器的脉冲个数计算电机转速和车速；

[0008] （5）然后通过 PID 控制算法分别计算出直立控制、方向控制和速度控制的 PWM 值；

[0009] （6）将三个 PWM 值叠加在一起输出给左、右电机；

[0010] （7）接着发送陀螺仪、加速度计、车体倾角、电池电压、电机电流和车速的数据给上位机，以监控整车的运行状态；

[0011] （8）当监控到电池电压低于预设值、电机电流或者车速大于预设值时，则打开相应的 LED 警示灯；当监控到车体倾角大于预设角度时，就判定为车体跌倒，并停止运行，重新回到初始化程序当中。

[0012] 本发明与现有技术相比所带来的有益效果是：

[0013] 本发明采用更精确的运算方法，使驱动电机处理平衡修正的时间更短，降低自平衡车在使用时存在的风险。

附图说明

[0014] 图 1 为本发明控制流程图。

具体实施方式

[0015] 下面结合说明书附图对本发明作进一步说明。

[0016] 如图 1 所示，一种两轮自平衡车控制方法，包括以下步骤 :

[0017] (1)两轮自平衡车上电运行后，系统首先进入各初始化程序，包括锁相环初始化、AD 转换初始化、定时器初始化、PWM 初始化与和端口初始化 ;

[0018] (2)然后延时 1s 等待系统稳定后，接着读取陀螺仪、加速度计和转角传感器初值，再延时 1s 等待参数变化 ;

[0019] (3)程序设定了 1ms 中断函数，把直立控制、方向控制和速度控制都放在期间同时进行 ;当 1ms 中断产生时，则分别读取陀螺仪、加速度计和转角传感器的值以及编码器的脉冲个数 ;

[0020] (4)通过卡尔曼滤波来进行陀螺仪和加速度计数据融合滤波，求取车体倾角 ;通过转角传感器的值计算车把转角 ;通过编码器的脉冲个数计算电机转速和车速 ;

[0021] (5)然后通过 PID 控制算法分别计算出直立控制、方向控制和速度控制的 PWM 值 ;

[0022] (6)将三个 PWM 值叠加在一起输出给左、右电机 ;

[0023] (7)接着发送陀螺仪、加速度计、车体倾角、电池电压、电机电流和车速的数据给上位机，以监控整车的运行状态 ;

[0024] (8)当监控到电池电压低于预设值、电机电流或者车速大于预设值时，则打开相应的 LED 警示灯 ;当监控到车体倾角大于预设角度时，就判定为车体跌倒，并停止运行，重新回到初始化程序当中。

[0025] 相关值计算 aa+=P_enc*enc_anglespeed*dt*0.001+(1-P_enc)*(acc_angle-angle) ;// 倾角计算 ;

[0026] aa: 陀螺仪与加速度计融合后得出的倾角 ;

[0027] P_enc :比例系数 ;

[0028] enc_angkespeed :陀螺仪的 AD 值 ;

[0029] dt: 陀螺仪积分时间 ;

[0030] acc_angle: 角速度 AD 值 ;

[0031] angle :倾角。

[0032] PWM_angle=(int)(pp*angle+D_angle*enc_anglespeed);// 直立 PWM 计算 ;

[0033] PP: 比例系数 ;

[0034] D_angle: 微分系数 ;

[0035] PWM_angle :直立 PWM 值。

[0036] PWM_turn=(int)(P_turn*turn) ;// 转向 PWM 计算 ;

[0037] P_turn :转向比例系数 ;

[0038] turn: 转向传感器的 AD 值 ;

[0039] PWM_turn; 转向 PWM 值。

[0040] 1、两轮自平衡车各零部件参数设计及计算

[0041] 单轴代步电动车参数设计主要是确定总体结构尺寸、质量参数、主要性能参数、电

机额定参数、传动比大小、电池容量大小等等。

[0042] 1.1、整车结构参数

[0043] （1）外廓尺寸

[0044] 代步车注重的是便携、灵活性，车体在地面投影面积与人的肩宽差不多。因此，初定整体外廓尺寸为长 680mm，宽 360mm，高 1140mm，其中踏板高度为 250mm。

[0045] （2）轮距

[0046] 对于代步车来说，轮距变化主要与影响到侧倾刚度。增大轮距，有利于增加侧倾刚度，横向稳定性好，但伴随的是整车长度和质量的增加。因此，综合考虑后选择轮距为600mm。

[0047] （3）质量参数

[0048] 代步车质量占比最大的是锂电池组、电机、减速器和车轮，质量越大，耗电越多，从而降低巡航里程。为了控制质量值，车体部分采用了桁架式结构，踏板和车外壳采用碳纤维结构，确保美观同时最大限度减轻整车质量。

[0049] 由于各部件的详细质量不知道，整车整备质量无法精确获得。但为了从节能环保、灵活轻便出发，整车整备质量初选为 40kg，载质量为 100kg。（4）主要性能参数

[0050] 根据调查，一般代步车最高车速为 15-25km/h，从静止加速到最高车速所用时间为 2-5s，能爬上的最高坡度为 15-30°；因此确定单轴代步电动车动力性参数为：最高车速 20km/h，加速时间 3s，最大爬坡度 20°。由于代步车作为短程代步交通工具，车速不宜过高，否则容易造成不稳定性，降低安全系数；加速时间是在车体允许的倾角下在平缓水泥路面连续加速到最高车速所用的时间，代步车反应灵敏，一般用很少时间就能达到高速运行状态；代步车为平路使用较多，偶尔会遇到上坡情况，因而设定最大爬坡态度 20°，以满足不同人群的需求。

[0051] 由于代步车左右电机均可独立控制，通过控制系统实现转向差速控制，因此最小转弯半径为零，机动灵活。

[0052] 1.2、电机参数

[0053] 代步车一切动作都是由电机完成，电机参数确定非常关键，必须选择合适的电机来满足整车使用要求。电机功率越大，动力性越好，但也伴随着质量增加、体积增大、价格上升。因此，电机参数设计关键是确定电机的额定功率。

[0054] 本文中的代步车以最高车速运行时为额定工况，所需功率：

[0055] $$P=\frac{1}{\eta}\left(\frac{Gfu_a}{3600}+\frac{C_D A u_a^3}{76140}\right)$$

[0056] （2-1）

[0057] 其中，η 为传动效率，G 为作用在汽车上的重力（N），f 为滚动阻力系数，u_a 为最高车速（km/h），C_D 为空气阻力系数；A 为迎风面积 (m^2)，则：代步车空载时，G=40×9.8N，f=0.012，C_D=0.3，A=1.2m^2，u_a=20km/h，η=0.95

[0058] $$P=\frac{1}{0.95}\left(\frac{40\times9.8\times0.012\times20}{3600}+\frac{0.3\times1.2\times20^3}{76140}\right)=0.094\text{kW}$$

[0059] 代步车满载时，G=140×9.8N，f=0.012，C_D=0.3，A=2m^2，u_a=20km/h，η=0.95

[0060] $P=\frac{1}{0.95}(\frac{140\times9.8\times0.012\times20}{3600}+\frac{0.3\times2\times20^3}{76140})=0.163\text{kW}$

[0061] 但代步车在任何时刻都能够保持平衡的关键在于电机的后备功率足够大，经验证明，电机的额定功率必须是计算所需功率的3倍以上。因此，本文选定的直流电机主要参数是：额定电压24V，额定功率500W，额定转速4500r/min，额定扭矩1.06Nm。

[0062] 1.3、传动比

[0063] 由整车最高车速与电机额定转速之间关系确定传动比。本文轮胎外径为14in，查表可得车轮滚动半径r=180mm，最高车速v=20km/h=333.3m/min，车轮周长C=2πr=2×3.14×0.18=1.13m（2-2）

[0064] 则车轮额定转速 $=\frac{v}{C}=\frac{333.3}{1.13}=294.9\text{r/min}$（2-3）

[0065] 传动比 $i=\frac{4500}{294.9}\approx15$（2-4）

[0066] 1.4、锂离子电池

[0067] 锂离子电池参数确定关键是电池容量大小，可以通过整车巡航里程计算得到。由于受温度、湿度、电池材料、使用情况等各种因素影响，电池不可能满容量，更不可能完全放电，到一定电压就会停止工作。因此，计算时设定了一个电池容量可用系数λ=0.8。

[0068] 代步车在最高车速运行时，电流 $I=\frac{P}{U}=\frac{163}{24}=6.79\text{A}$（2-5）

[0069] 巡航里程为35km所需时间 $t=\frac{S}{v}=\frac{35}{20}=1.75\text{h}$（2-6）

[0070] 则电池容量为 $Q=\frac{It}{\lambda}=\frac{6.79\times1.75}{0.8}=14.85\text{Ah}$（2-7）

[0071] 因此，选择24V15Ah串联组装的锂电池组。

[0072] 2、动力性校核

[0073] 2.1、加速时间校核

[0074] 下面计算在额定电压下，代步车从静止加速到最高车速所需的时间t，详细推导过程如下：

[0075] 电机转速 $n_{电机}=n_{车轮}\cdot i=\frac{60u}{2\pi r}\cdot i$（2-8）

[0076] 电机输出扭矩 $T_{电机}=9550\frac{P_N}{n_{电机}}=\frac{9550P_N 2\pi r}{60ui}=318.3\frac{P_N\pi r}{ui}$（2-9）

[0077] 车轮驱动力矩 $T_t=T_{车轮}=T_{电机}i\eta=318.33\frac{P_N\pi r\eta}{u}$（2-10）

[0078] 可得整车加速度：

[0079] $$a=\frac{du}{dt}=\frac{F}{m}=\frac{T_t/r-Gf}{m}=\frac{318.3\frac{P_N\pi\eta}{u}-mgf}{m}$$（2-11）

[0080] 整理得：

[0081] $$\frac{du}{dt}=\frac{318.3\times3.14\times0.5\times2\times0.95}{140u}-0.012\times9.8=\frac{6.78}{u}-0.12 \quad (2\text{-}12)$$

[0082] 对上式两边同时积分得：

[0083] $$\int dt=\int\frac{u}{6.78-0.12u}du \quad (2\text{-}13)$$

[0084] 即：

[0085] $$t=\int_0^{5.6}\frac{u}{6.78-0.12u}du \quad (2\text{-}14)$$

[0086] 令 $m=\frac{u}{6.78-0.12u}$，得 $u=\frac{6.78-m}{0.12}$，$du=-8.33dm$

[0087] $$\begin{aligned}t&=8.33\int_{6.1}^{6.8}\frac{6.78-m}{0.12m}dm\\&=8.33\times(56.5\ln m-8.33m|_{6.1}^{6.8}) \quad (2\text{-}15)\\&=2.4s\end{aligned}$$

[0088] 由此可见，本文设计的单轴代步电动车，在水平干燥水泥路面，从静止开始加速到最高车速 20km/h，加速时间为 2.4s，小于预设值 3s，动力性良好。

[0089] 2.2、最大爬坡度校核

[0090] 代步车上坡时，主要受力为滚动阻力、坡度阻力和驱动力作用，其中滚动阻力为 $F_f=Gf\cos\alpha$ （2-16）

[0091] 坡度阻力为 $F_i=G\sin\alpha$ （2-17）

[0092] 电机额定扭矩 $T_N=9550\frac{P_N}{n_N}=9550\frac{0.5}{4500}=1.06Nm$ （2-18）

[0093] 电机最大扭矩 $T_{max}=\lambda T_N$ （2-19）

[0094] 其中，λ 为过载系数，一般为 1.8-2.2，取 λ=2，则；

[0095] $T_{max}=\lambda T_N=2\times1.06=2.12Nm$

[0096] 由于求最大爬坡度时，代步车匀速前进，$\frac{du}{dt}=0$，由受力平衡得：

[0097] $F_t=F_f+F_i$ （2-20）

[0098] 即 $G(f\cos\alpha+\sin\alpha)=F_t$ （2-21）

[0099] 整理得：

[0100] $$\cos\alpha+50\sin\alpha=\frac{335.7\times50}{140\times9.8}=12.2 \quad (2\text{-}22)$$

[0101] $$\frac{\cos\alpha}{\sqrt{1+50^2}}+\frac{50\sin\alpha}{\sqrt{1+50^2}}=\frac{12.2}{\sqrt{1+50^2}} \quad (2\text{-}23)$$

[0102] 令 $\sin\beta=\frac{1}{\sqrt{1+50^2}}$，$\cos\beta=\frac{50}{\sqrt{1+50^2}}$，则：

[0103] $\sin\beta\cos\alpha+\cos\beta\sin\alpha=\frac{12.2}{\sqrt{1+50^2}}$ （2-24）

[0104] $\sin(\alpha+\beta)=\frac{12.2}{\sqrt{1+50^2}}$ （2-25）

[0105] 解得 $\alpha+\beta=\arcsin(\frac{12.2}{\sqrt{1+50^2}})=25.3$ 。

[0106] $\beta=\arcsin(\frac{1}{\sqrt{1+50^2}})=1.15$ 。

[0107] 最大爬坡度 α＝α＋β－β＝25.3-1.15=24.15° （2-26）

[0108] 因此，最大爬坡度比预设值 20° 大，满足要求。

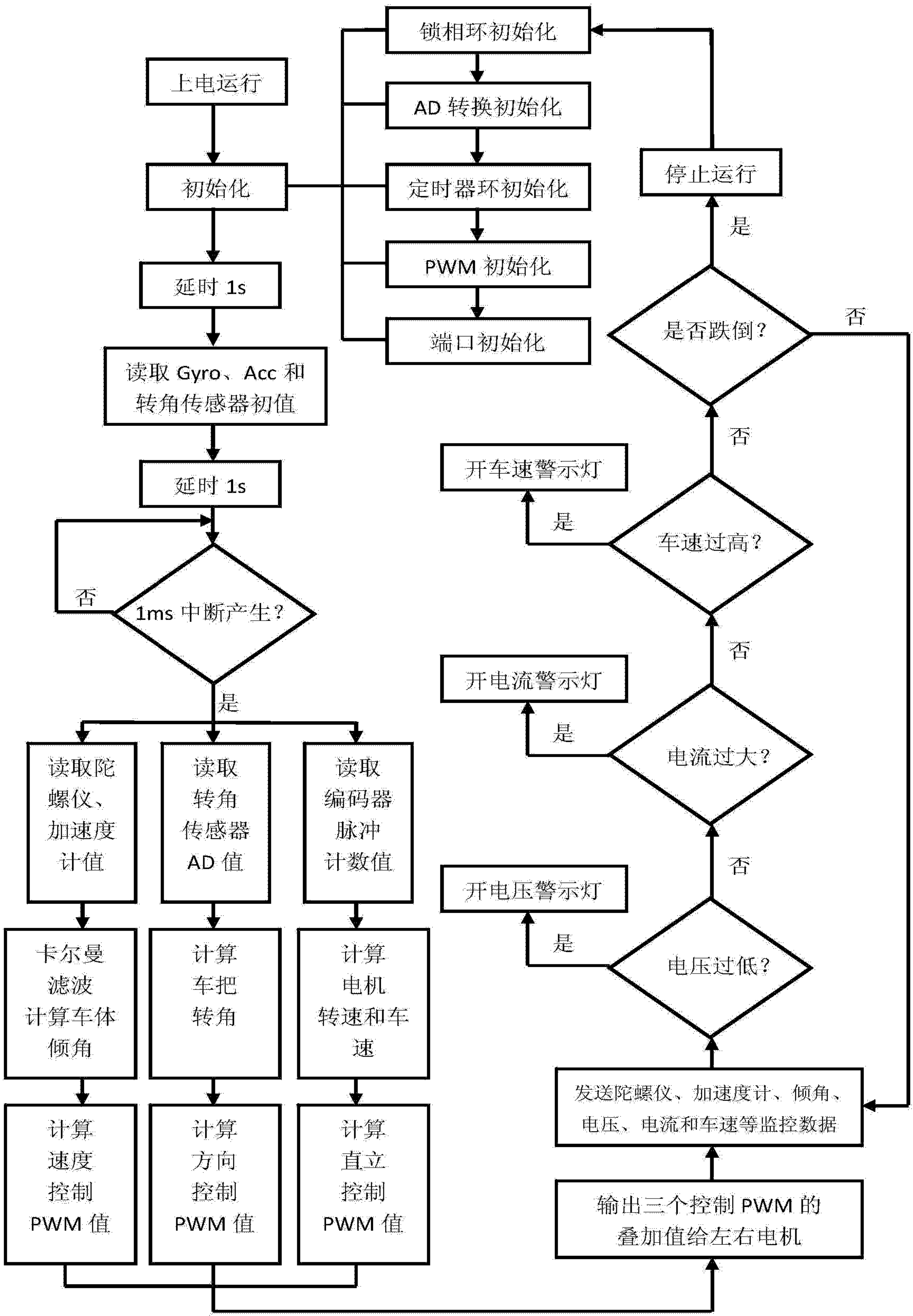

锁相环初始化
AD 转换初始化
定时器环初始化
PWM 初始化
端口初始化
上电运行
初始化
延时 1s
读取 Gyro、Acc 和转角传感器初值
延时 1s
1ms 中断产生？
否
是
读取陀螺仪、加速度计值
读取转角传感器 AD 值
读取编码器脉冲计数值
卡尔曼滤波计算车体倾角
计算车把转角
计算电机转速和车速
计算速度控制 PWM 值
计算方向控制 PWM 值
计算直立控制 PWM 值
输出三个控制 PWM 的叠加值给左右电机
发送陀螺仪、加速度计、倾角、电压、电流和车速等监控数据
电压过低？
是
开电压警示灯
否
电流过大？
是
开电流警示灯
否
车速过高？
是
开车速警示灯
否
是否跌倒？
是
否
停止运行

图 1

Espacenet

Bibliographic data: CN103600796 (A) — 2014-02-26

Two-wheel self-balance vehicle in single shaft driving

Inventor(s): MO JINQIU; DUAN RENQUAN; XU HENG; WU TONG; CHEN GUISHUN ± (MO JINQIU, ; DUAN RENQUAN, ; XU HENG, ; WU TONG, ; CHEN GUISHUN, ; 莫锦秋, ; 段仁全, ; 许恒, ; 吴桐, ; 陈贵顺)

Applicant(s): UNIV SHANGHAI JIAOTONG ± (SHANGHAI JIAO TONG UNIVERSITY, ; 上海交通大学)

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

Application number: CN201310488709 20131017 Global Dossier

Priority number (s): CN201310488709 20131017

Also published as: CN103600796 (B)

Abstract of CN103600796 (A)

The invention discloses a two-wheel self-balance vehicle in single shaft driving. The two-wheel self-balance vehicle comprises a pedal for bearing an operator, a vehicle body, two wheels, a steering lever and a control circuit system, wherein the vehicle body is used for loading a motor and a control circuit; the two wheels are at the coaxial position, and single shaft driving is performed through the single driving motor; parallel steering of the vehicle body is performed through the steering lever; and according to the control circuit system, the dip angle of the vehicle body is measured through a sensor so as to perform running control of the vehicle body. The whole vehicle has the advantages of being light in weight and running stably.

Notice

CLAIMS CN108600796

1.

A two-wheel self-balancing vehicle with single-axis driving, comprising: a vehicle body, a motor fixing frame, a driving motor, a wheel, a motor driving gear, a transmission gear, a transmission shaft, a bearing, a bearing fixing frame, a steering rack, a steering gear, a steering rod, a wheel knuckle, the motor fixing frame and the bearing fixing frame are all disposed on the vehicle body, the motor is disposed on the motor fixing frame, and the motor driving gear is fixedly connected with the motor, the motor The drive gear meshes with a drive gear that is coupled with a drive shaft that is coupled to a steering gear that is hinged to the wheel knuckle.

2.

The two-wheel self-balancing vehicle according to claim 1, wherein the vehicle body is further provided with an upper cover, and a shock absorbing and sound absorbing layer is disposed between the vehicle body and the upper cover.

3.

The two-wheel self-balancing vehicle according to claim 2, wherein the upper surface of the upper cover is a load-bearing pedal, and a shock-absorbing layer is disposed on the load-bearing pedal.

4.

The two-wheel self-balancing vehicle according to claim 2, wherein the shock absorbing sound absorbing layer is a rubber mat.

5

The two-wheel self-balancing vehicle according to claim 1, wherein both the steering rack and the special transmission gear are subjected to heat treatment strengthening.

Notice

DESCRIPTION CN108600796

The invention discloses a two-wheel self-balancing vehicle with single shaft drive. The two-wheel self-balancing vehicle comprises: a pedal for carrying an operator; a vehicle body for loading the motor and the control circuit; two wheels, the two wheels are in a coaxial position, and a single drive motor is used for single-axis driving; The rod is used for parallel steering of the vehicle body through the steering rod; the control circuit system uses the sensor to measure the inclination of the vehicle body to perform the running control of the vehicle body. The whole vehicle has the characteristics of light weight and stable running.

Single-wheel drive two-wheel self-balancing vehicle

Technical field

The present invention relates to a two-wheel self-balancing vehicle, and more particularly to a self-balancing vehicle that drives a two-wheel motor with a single motor, which allows the operator riding on the free ride.

Background technique

At present, the number of private cars in large cities has risen sharply, making traffic congestion increasingly serious. In this context, the two-wheeled balance car, as an electric-driven, self-balancing personal transportation vehicle, has a good development trend due to its environmental protection and economy.

It mainly includes a bearing mechanism, a drive system, a steering system, and a control system. Its main operating principle: the new car body realized by the electronic self-balancing system and the inverted pendulum principle. The main process is to determine the posture state of the car body by the built-in precision electronic gyroscope of the balance car, and calculate the corresponding command by the central microprocessor to control the driving system of the car body to adjust the posture of the car body, thereby realizing the car. Self-balancing and running functions of the body.

The invention patent publication with the authorization number CN101353070A describes a coaxial two-wheeled vehicle. A pedal, a vehicle body, a pair of wheels, a pair of separate drive and rotation of the pair of wheel drive devices and a handle directly for directly changing the attitude of the pedal or indirectly changing the posture through the vehicle body are included. But it is a two-wheel independent drive driven by a pair of motors.

Existing balance car products such as the US Segway Segway self-balancing car, Japan Toyota Winglet and other products. The existing two-wheel balance car products are two-wheel independent drive for a pair of motors, which makes the cost higher. It also makes it difficult for consumers to withstand these products and affects the promotion and use of the products.

Summary of the invention

It is an object of the present invention to provide a two-wheel self-balancing vehicle that is driven using a single motor, which solves the need for a costly manner of driving two or more motor-driven bodies to reduce the number of motors used, thereby maintaining the existing product. Reduce the energy consumption of the product and the cost of the product under the premise of function and safety.

In order to achieve the above object, the technical solution of the present invention is as follows:

A two-wheel self-balancing vehicle with single-axis driving, comprising: a vehicle body, a motor fixing frame, a driving motor, a wheel, a motor driving gear, a transmission gear, a transmission shaft, a bearing, a bearing fixing frame, a steering rack, a steering gear, a steering rod, a wheel knuckle, the motor fixing frame and the bearing fixing frame are all disposed on the vehicle body, the motor is disposed on the motor fixing frame, and the motor driving gear is fixedly connected with the motor, the motor The drive gear meshes with a drive gear that is coupled with a drive shaft that is coupled to a steering gear that is hinged to the wheel knuckle.

Preferably, the vehicle body is further provided with an upper cover, and a shock absorbing and sound absorbing layer is disposed between the vehicle body and the upper cover.

Preferably, the upper surface of the upper cover is a load-bearing pedal, and a shock-absorbing layer is disposed on the load-bearing pedal.

Preferably, the shock absorbing sound absorbing layer is a rubber mat.

Preferably, both the steering rack and the special drive gear require heat treatment strengthening.

The beneficial effects of the invention are mainly embodied in: the design of the patent of the invention can reduce the number of uses of the motor, and at the same time reduce the complexity of the design of the control system to a certain extent, and at the same time reduce the number of assemblies of the motor, and can also alleviate the whole vehicle. Weight, improve the car's endurance.

DRAWINGS

1is a schematic view of a main view of a two-wheel self-balancing vehicle of a single-axis drive according to the present invention;

2is a schematic view of the single-shaft driven two-wheel self-balancing vehicle with the upper cover removed;

3is a schematic view showing the axonometric drawing of a two-wheel self-balancing vehicle wheel of a single-axis drive according to the present invention.

detailed description

The present invention will be further described below in conjunction with the embodiments, but the scope of the present invention is not limited to the embodiments.

As shown in FIG. 1to FIG. 3 a single-axis two-wheel self-balancing vehicle includes a vehicle body 1, a motor mount 2, a drive motor 3, a wheel 4, a motor drive gear 5, a transmission gear 6, and a transmission shaft 7. The bearing 8, the bearing holder 9, the steering rack 10, the steering gear 11, the steering rod 12, the wheel knuckle 13, the wheel coupling flange 14, and the upper cover 15of the vehicle body.

Specifically, as shown in FIG. 1, the vehicle body 1is a main load-bearing device of the vehicle body, and the motor fixing frame 2and the bearing fixing frame 9are fixed to the vehicle body by bolting, and the motor 3is coupled to the motor fixing frame 2by screws. The motor drive gear 5is connected to the output shaft of the motor 3through a key, the gear 5and the transmission gear 6mesh with each other, and the transmission gear 6 is coupled with the wheel drive shaft 7through a key connection. The rotation of the motor is powered by the aforementioned mechanism.

As shown in FIG. 2, the steering rod 12is coupled to the steering gear 11and the steering rack 10is meshed with the steering gear 11, and the steering rack 10is hinged with the wheel knuckle 13. Thus, the operator operates the steering rod 12to drive the movement of the transmission rack 10, and the transmission rack 10is brought to the steering knuckle and the wheel for parallel steering of the vehicle body.

The patented design of the invention can reduce the number of uses of the motor, and at the same time reduce the complexity of the design of the control system to a certain extent, and at the same time, reduce the weight of the whole vehicle and improve the endurance of the vehicle body by reducing the number of assembled motors.

The above is only the preferred embodiment of the present invention, and is not intended to limit the scope of the present invention, and the variations, modifications, and modifications of the shapes, structures, features, and spirits described in the scope of the claims of the present invention. It is intended to be included within the scope of the appended claims.

(19) 中华人民共和国国家知识产权局

(12) 发明专利申请

(10) 申请公布号 CN 103600796 A
(43) 申请公布日 2014.02.26

(21) 申请号 201310488709.6

(22) 申请日 2013.10.17

(71) 申请人 上海交通大学
地址 200240 上海市闵行区东川路 800 号

(72) 发明人 莫锦秋　段仁全　许恒　吴桐
陈贵顺

(74) 专利代理机构 上海汉声知识产权代理有限公司 31236
代理人 郭国中

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

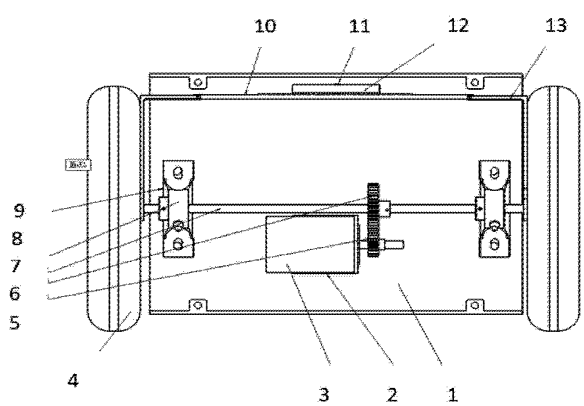
权利要求书1页　说明书2页　附图2页

(54) 发明名称

一种单轴驱动的两轮自平衡车

(57) 摘要

本发明公开了一种单轴驱动的两轮自平衡车。该两轮自平衡车包含：用于承载操作者的踏板；车体，用于电机、控制电路的装载；两个轮子，两轮位置为同轴位置，使用单个驱动电机进行单轴驱动；转向杆，通过转向杆进行车体的平行转向；控制电路系统，运用传感器测量车体倾角进行车体的运行控制。整车具有重量轻，行驶平稳等特点。



CN 103600796 A

1. 一种单轴驱动的两轮自平衡车，其特征在于，包括：车体、电机固定架、驱动电机、车轮、电机驱动齿轮、传动齿轮、传动轴、轴承、轴承固定架、转向齿条、转向传动齿轮、转向杆、车轮转向节，所述电机固定架和轴承固定架均设置在车体上，所述电机设置在电机固定架上，所述电机驱动齿轮与电机固定连接，所述电机驱动齿轮与传动齿轮相啮合，所述传动齿轮与传动轴联接配合，所述转向杆与转向传动齿轮相联接，所述转向齿条与车轮转向节相互铰接。

2. 根据权利要求 1 所述的两轮自平衡车，其特征在于，所述车体上还设有上盖，所述车体与上盖之间设有减震消声层。

3. 根据权利要求 2 所述的两轮自平衡车，其特征在于，所述上盖上表面为承重踏板，所述承重踏板之上应设有减震层。

4. 根据权利要求 2 所述的两轮自平衡车，其特征在于，所述减震消声层为橡胶垫。

5. 根据权利要求 1 所述的两轮自平衡车，其特征在于，所述转向齿条和专项传动齿轮都需要进行热处理强化。

一种单轴驱动的两轮自平衡车

技术领域

[0001]　本发明涉及一种两轮自平衡车，特别涉及一种单个电机驱动两轮的自平衡车，其可以使骑乘在上面的操作者自由行驶。

背景技术

[0002]　当前，大城市中私家车数量急剧上升，使得交通拥堵日益严重。在此背景下，两轮平衡车作为一种由电力驱动、具有自我平衡能力的个人代步类运输工具，因其环保，经济等特点，有着良好的发展趋势。

[0003]　其主要包含有承载机构，驱动系统，转向系统，控制系统。其主要运行原理：采用电子自平衡系统及倒立摆原理而实现的新型车体。主要过程为平衡车内置精密电子陀螺仪对车体所处的姿位状态进行判定，通过中央微处理器运算出相应的指令，对车体的驱动系统进行控制调整车体的姿态，从而实现车体的自平衡与运行功能。

[0004]　授权公告号为 CN101353070A 的发明专利公开描述了一种共轴两轮车辆。包含踏板、车体、一对轮子、一对单独驱动和旋转所述对车轮驱动装置和直接用于直接改变所述踏板的姿态或通过所述车体间接改变所述姿态的把手。但其是采用一对电机驱动的双轮独立驱动。

[0005]　现有平衡车产品如美国 Segway 赛格威自平衡车，日本丰田 Winglet 等产品等。现有的两轮平衡车产品都为一对电机进行的两轮独立驱动，使得成本较高。也使得消费者难以承受这些产品，影响了产品的推广使用。

发明内容

[0006]　本发明的目的就是提供一种使用单个电机进行驱动的两轮自平衡车，解决需要两个或多个电机驱动车体的高代价方式，以减少电机的使用数目，从而实现在保持现有产品的功能和安全性的前提下降低产品的能耗以及产品的成本。

[0007]　为了实现上述目的，本发明的技术方案如下：

[0008]　一种单轴驱动的两轮自平衡车，其特征在于，包括：车体、电机固定架、驱动电机、车轮、电机驱动齿轮、传动齿轮、传动轴、轴承、轴承固定架、转向齿条、转向传动齿轮、转向杆、车轮转向节，所述电机固定架和轴承固定架均设置在车体上，所述电机设置在电机固定架上，所述电机驱动齿轮与电机固定连接，所述电机驱动齿轮与传动齿轮相啮合，所述传动齿轮与传动轴联接配合，所述转向杆与转向传动齿轮相联接，所述转向齿条与车轮转向节相互铰接。

[0009]　作为优选方案，所述车体上还设有上盖，所述车体与上盖之间设有减震消声层。

[0010]　作为优选方案，所述上盖上表面为承重踏板，所述承重踏板之上应设有减震层。

[0011]　作为优选方案，所述减震消声层为橡胶垫。

[0012]　作为优选方案，所述转向齿条和专项传动齿轮都需要进行热处理强化。

[0013]　本发明的有益效果主要体现在：通过本发明专利设计可使电机的使用数量减少，

同时在一定程度上降低控制系统的设计的复杂程度，同时由于减少电机的装配数目，还可以减轻整车的重量，提高车体续航能力。

附图说明

[0014] 图 1 为本发明的单轴驱动的两轮自平衡车主视图示意图；

[0015] 图 2 为本发明的单轴驱动的两轮自平衡车拆掉上盖的示意图；

[0016] 图 3 为本发明的单轴驱动的两轮自平衡车车轮的轴测图示意图。

具体实施方式

[0017] 下面结合实施例对本发明作进一步描述，但本发明的保护范围不仅局限于实施例。

[0018] 如图 1 至图 3 所示，一种单轴驱动的两轮自平衡车，包含车体 1、电机固定架 2、驱动电机 3、车轮 4、电机驱动齿轮 5、传动齿轮 6、传动轴 7、轴承 8、轴承固定架 9、转向齿条 10、转向传动齿轮 11、转向杆 12、车轮转向节 13、车轮联接法兰盘 14、车体上盖 15。

[0019] 具体而言，如图 1 所示，车体 1 是车体的主要承重装置，电机固定架 2、轴承固定架 9 通过螺栓连接固定在车体上，电机 3 通过螺钉联接到电机固定架 2 上，电机驱动齿轮 5 则通过键与电机 3 的输出轴相连接，齿轮 5 与传动齿轮 6 相互啮合，传动齿轮 6 则通过键联接与车轮传动轴 7 进行联接配合。电机的转动通过前述机构进行动力传动。

[0020] 如图 2 所示，转向杆 12 通过与转向传动齿轮 11 向联接，转向齿条 10 与转向传动齿轮 11 啮合联接，转向齿条 10 与车轮转向节 13 进行铰接。从而操作者操作转向杆 12 则带动传动齿条 10 的移动，传动齿条 10 带到转向节及车轮进行车体的平行转向。

[0021] 本发明专利设计可使电机的使用数量减少，同时在一定程度上降低控制系统的设计的复杂程度，同时由于减少电机的装配数目，还可以减轻整车的重量，提高车体续航能力。

[0022] 综上所述，仅为本发明的较佳实施例而已，并非用来限定本发明实施的范围，凡依本发明权利要求范围所述的形状、构造、特征及精神所为的均等变化与修饰，均应包括于本发明的权利要求范围内。

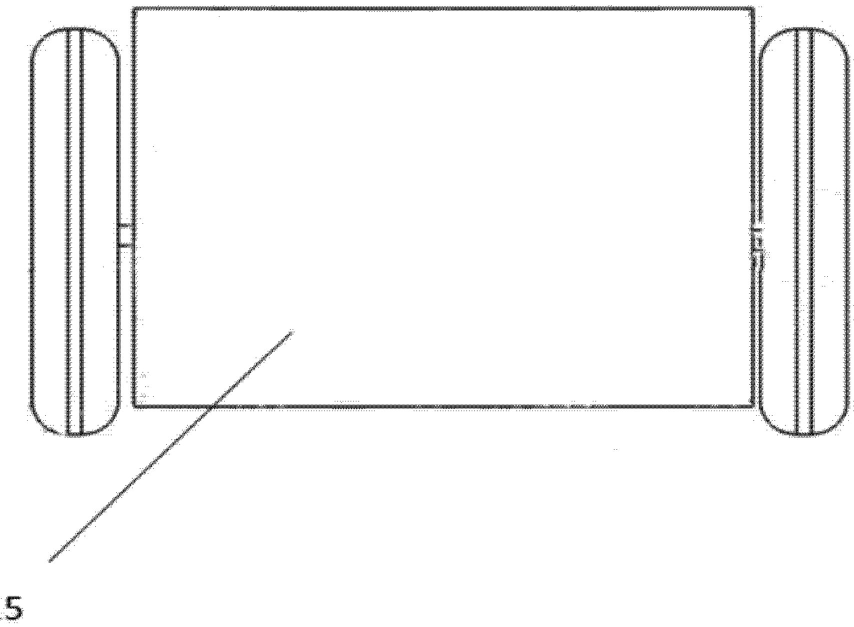


图 1

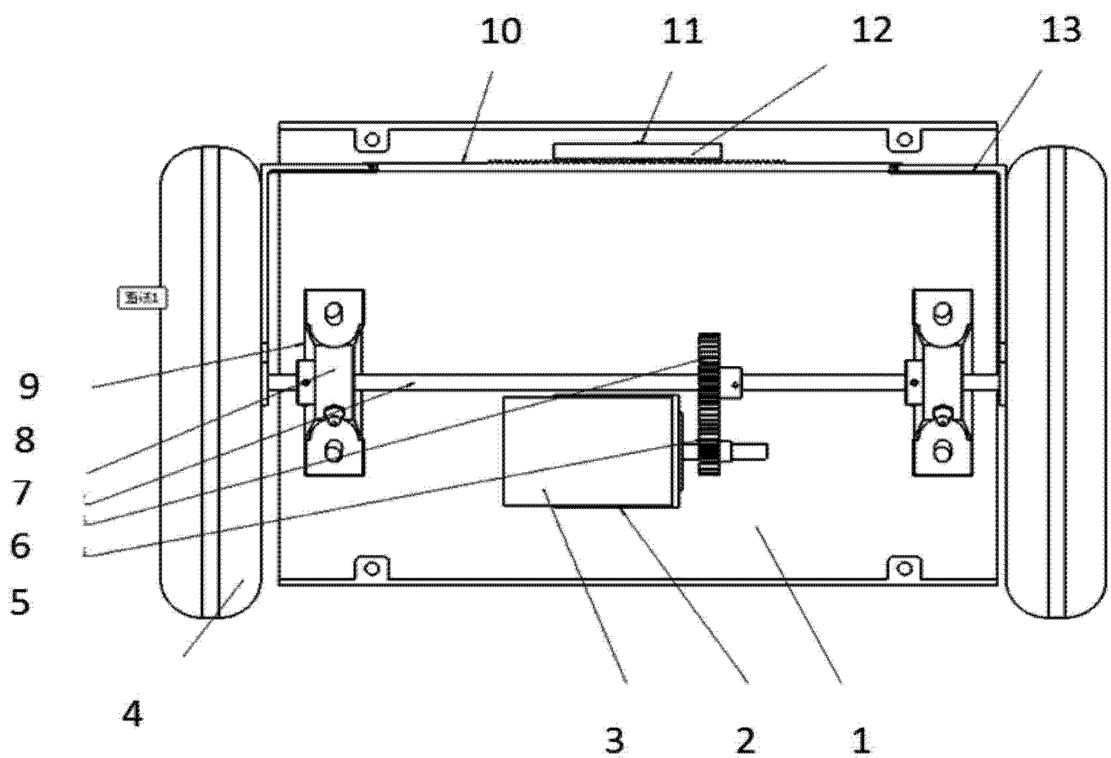


图 2

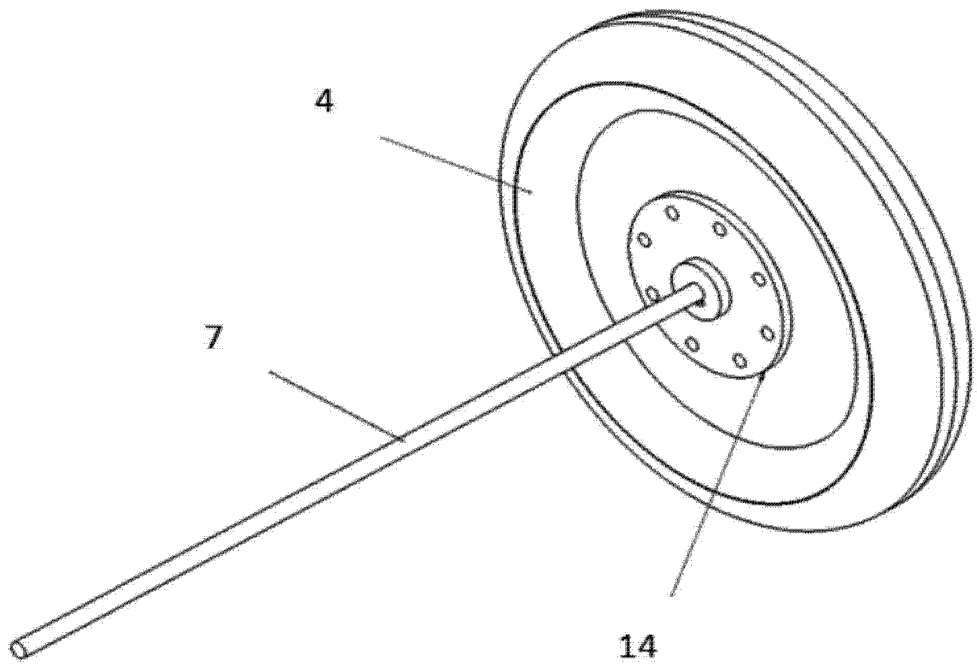


图 3

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 104014123 A
(43)申请公布日 2014.09.03

(21)申请号 201410262353.9

(22)申请日 2014.06.13

(71)申请人 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)

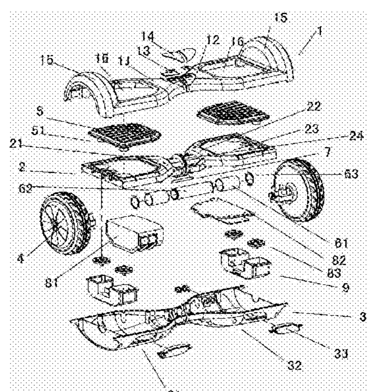
权利要求书1页 说明书3页 附图2页

(54)发明名称

纵向双轮车体

(57)摘要

本发明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。本发明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 104014123 A

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]　本发明涉及一种骑行装备，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。

发明内容

[0003]　本发明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] 本发明的有益效果是：

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。

[0015] 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。

[0016] 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。

[0017] 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

[0018] 图 1 是平衡扭扭车体与电力驱动系统配合的剖视图；

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；

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

[0019] 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。

[0020] 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。

[0021] 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。

[0022]　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。

[0023]　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。

[0024]　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。

[0025]　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。

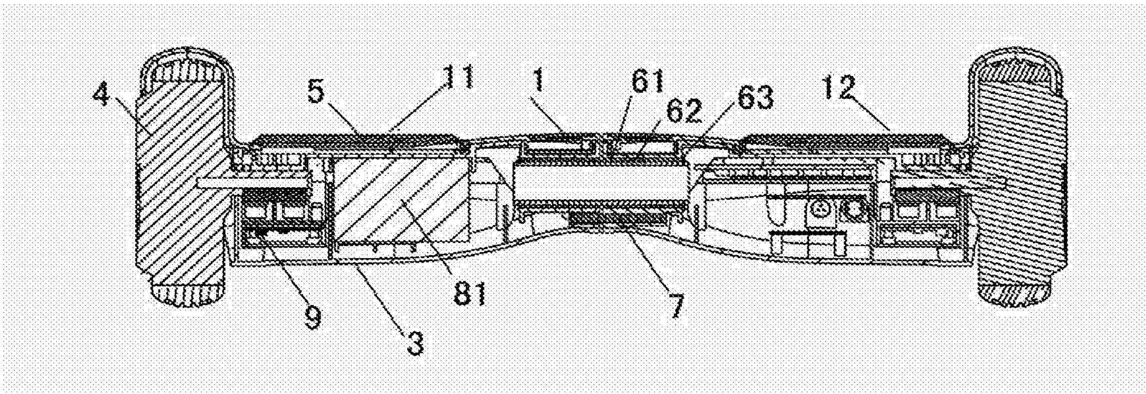


图 1

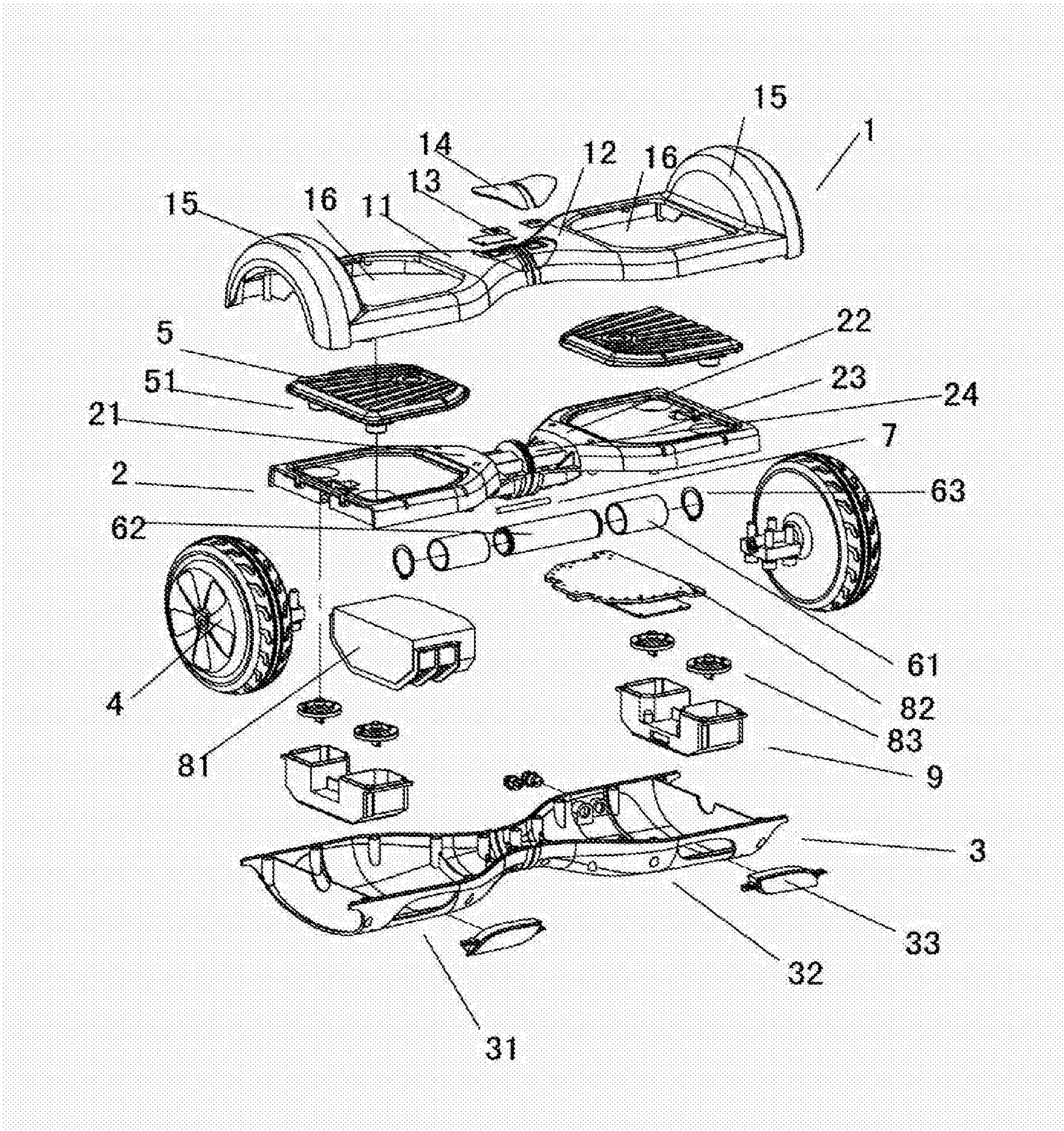

15
1
14
12
16
15
16
11
13
5
22
51
23
24
21
7
2
63
62
4
61
82
83
81
9
3
33
32
31

图 2

Espacenet

Bibliographic data: CN104029769 (A) — 2014-09-10

Electric balance swingcar

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: CN201410262108 20140613 Global Dossier

Priority number (s): CN201410262108 20140613

Also published as: CN104029769 (B) CN105109599 (A) CN105109599 (B) CN105109600 (A) CN105109600 (B) more

Abstract of CN104029769 (A)

The invention discloses an electric balance swingcar. The swingcar comprises a top cover, an inner cover, a bottom cover, hub motors, a rotating mechanism and a balance controlling mechanism, wherein each of the top cover, inner cover and the bottom cover comprises two parts which are symmetrically arranged and can rotate mutually; the inner cover is arranged between the top cover and the bottom cover and is cooperated with the top cover and the bottom cover together; the rotating mechanism is fixed at the middle transverse position of the inner cover; the hub motors which are vertically arranged are fixed at the border positions of the left side and the right side of the inner cover; the balance controlling mechanism is fixed on the bottom cover and is connected with the motors; the rotating mechanism comprises two bearings, an axle sleeve and two circlips, wherein the two bearings are respectively fixed at the inner ends of the two same parts of the inner cover, and the axle sleeve is fixed in the two bearings and is fixed on the inner cover through the circlips. The swingcar disclosed by the invention can solve the technical problem that a user controls the running state of the balance swingcar only by using feet.

Notice

CLAIMS CN104029769

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 control mechanism; the top cover, the inner cover and the bottom cover respectively comprise two 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 is fixed with a rotating mechanism in the middle lateral position; the left and right side edges of the inner cover are fixed with a longitudinally disposed hub motor; balance control The mechanism is fixed on the bottom cover and connected to the motor; 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 at The two bearings are 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 control mechanism, one of which is a display A reminder board for the power capacity, and a reminder board for displaying whether it is working or not, each of which 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 1 or 7, wherein the balance control mechanism comprises a power supply, a controller, a hub motor drive circuit, an acceleration sensor, a gyroscope, an infrared photoelectric sensor; The controller is connected, and the controller is respectively connected with 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 CN104029769

The invention 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 control 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 control mechanism is fixed on the bottom cover and connected to the motor; 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, the sleeve It is fixed in two bearings and fixed to the inner cover by a snap spring. The present invention solves the technical problem of how to allow the user to control the running state of the balance vehicle only by using the foot.

Electric balance twist car

Technical field

The present invention relates to an electric balance two-wheeled vehicle in which two platforms carrying a person can be twisted to drive each other to drive.

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.

Summary of the invention

It is an object of the present invention to provide an electric balance twisting vehicle that 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 control 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 Between the top cover and the bottom cover and 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 control mechanism is fixed at the bottom Covered 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 in the two bearings And fixed to the inner cover by a snap spring.

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 control mechanism, one of which is a prompt board for displaying the power capacity, and the other is a prompt board for displaying whether the work is performed, Each cue board 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 control 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, and 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 invention are:

1、

Since the rotating mechanism, the balance control 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 on one side or both sides, The inner cover and the bottom cover are twisted together, so that the sensor sends a signal to the balance control mechanism, and the balance control mechanism drives the hub motor according to the internal control program, thereby allowing the user to move forward or backward, thus achieving "foot control". It is obviously different from "hand control" and is 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 control mechanism. The cover 1, the inner cover 2and the bottom cover 3cooperate with each other to form a main body structure of the balance vehicle, and the hub motor 4is longitudinally mounted on both sides of the main body structure and drives the main body structure by the rotation mechanism and the balance control mechanism. Retreat or turn.

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 can occur under the action; the inwardly facing portions of the left top cover 11 and the right top cover 12are connected to form an "X" shape, and have two prompting plates 13at the innermost end position, and the above-mentioned prompting plate 13is connected with the balance control mechanism. One of them is a reminder board 13for displaying the power source capacity, and the other is a reminder board 13for displaying whether it is working or not, 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 3is 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 32have 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 32are connected to form an "X" shape and have two transparent decorative lamps 33on the outermost side of the innermost end.

The rotating mechanism comprises two oil bearing 61, a bushing 62and 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 62is fixed in the two bearings 61 and passes through The retaining spring 63is fixed to the inner cover 2such that the left and right inner covers of the inner cover 2are rotatable by the cooperation of the rotating mechanism. In order to mount the above-described rotating mechanism, a cylindrical cylinder 24is designed at the inward end of the left inner cover 21 and the right inner cover 22, and the bearing 61 and the sleeve 62are mounted to the cylindrical body 24from the outside to the inside by the snap spring 63. Inside. In order to prevent the deflection of the rotating mechanism, a limiting shaft 7is 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 7in the right inner cover 22being 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 balance control mechanism is a common component used in the current balance vehicle, and the internal program is also a prior art. For details, reference may be made to the currently disclosed balance vehicle control method and the use of various balance car manufacturers. The balance control mechanism, such as the Chinese patent number 201320050547.3, the patent name is the smart balance vehicle balance control device and the smart balance car, this control device is the balance control mechanism in this embodiment, or as the Chinese patent number 201220367045.9, the patent name is the use of CPLD The circuit control device for controlling the balance car motor is described; 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 3and controls the motor 4. The balance control mechanism mainly comprises a power supply 81, a controller 82, an in-wheel motor drive circuit, an acceleration sensor, a gyroscope 83, and an infrared photoelectric sensor; the power supply 81 and the controller 82are connected to the controller to provide power, the controller 82and the hub motor The driving circuit connection is to drive the corresponding components to work. 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. These are the technologies in the field. The personnel are very aware of the technology, so this is no longer described too much. In order to mount the gyroscope 83, in particular, 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) 发明专利申请

(10) 申请公布号 CN 104029769 A
(43) 申请公布日 2014.09.10

(21) 申请号 201410262108.8

(22) 申请日 2014.06.13

(71) 申请人 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)

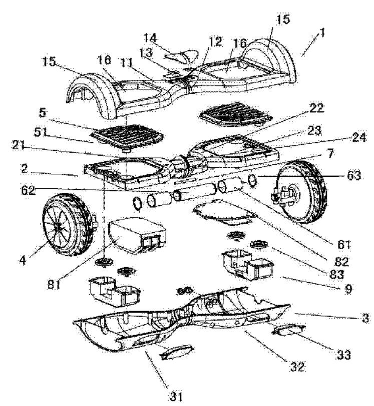
权利要求书1页　说明书3页　附图1页

(54) 发明名称

电动平衡扭扭车

(57) 摘要

本发明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、平衡控制机构；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；平衡控制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。本发明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。



CN 104029769 A

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、平衡控制机构；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；平衡控制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，上述提示板与平衡控制机构连接，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：所述平衡控制机构包括供电电源、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] 本发明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。

发明内容

[0004] 本发明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、平衡控制机构；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；平衡控制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，上述提示板与平衡控制机构连接，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]　所述平衡控制机构包括供电电源、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]　本发明的有益效果是：

1、由于采用转动机构、平衡控制机构及顶盖、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控制机构，平衡控制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。

[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 是平衡扭扭车的剖视图；

图 2 是平衡扭扭车的爆炸示意图；

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

[0020]　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、一个平衡控制机构，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控制机构的作用下驱动该主体结构前进、后退或者转弯。

[0021]　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 与平衡控制机构连接，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。

[0022] 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。

[0023] 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。

[0024] 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。

[0025] 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。

[0026] 平衡控制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控制机构，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控制机构，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。该平衡控制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。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。

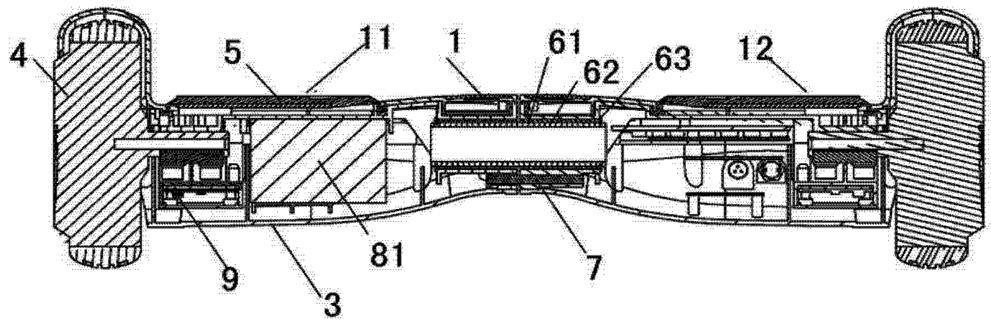

4
5
11
1
61
62
63
12
9
3
81
7

图 1

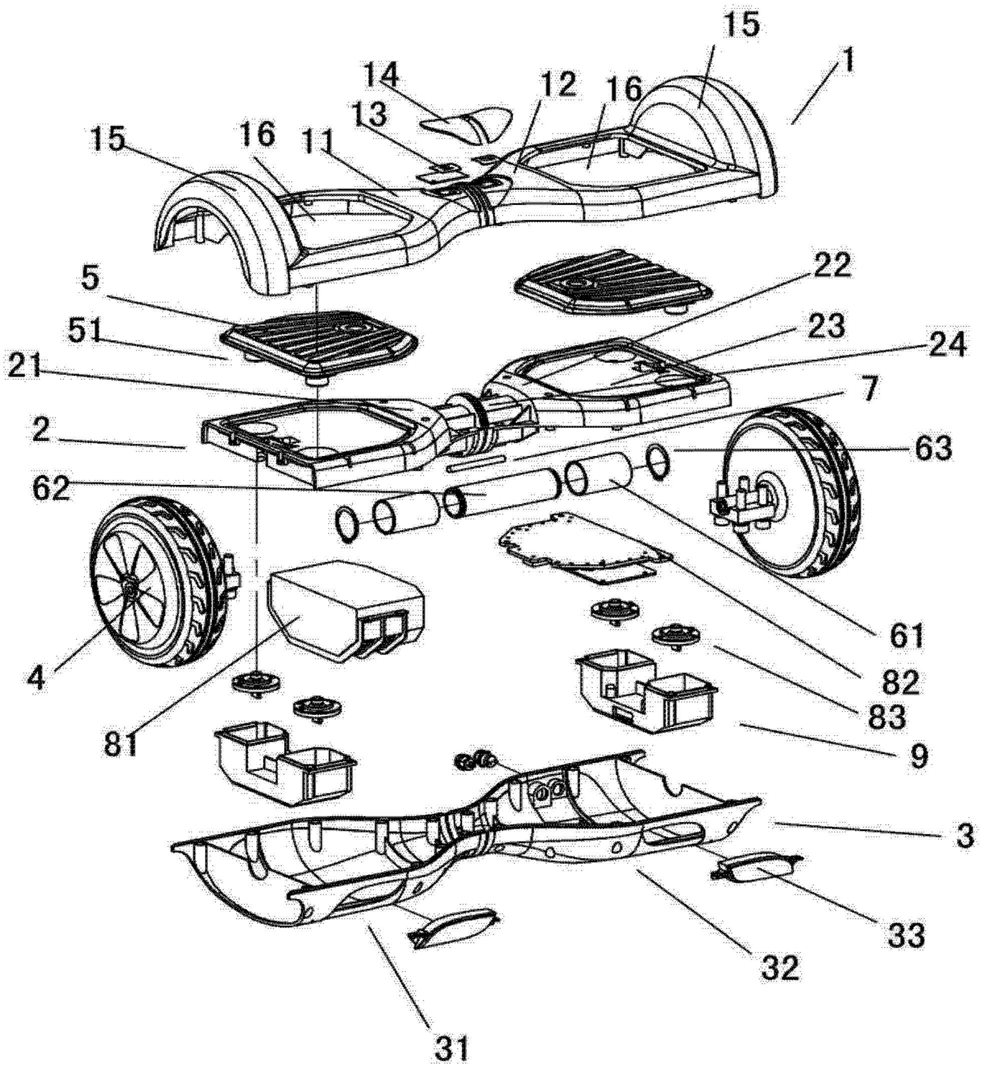

15
14
13
12
16
1
15
16
11
5
51
21
22
23
24
7
2
63
62
4
81
61
82
83
9
3
33
32
31

图 2

Espacenet

Bibliographic data: CN104149899 (A) — 2014-11-19

Split type vehicle frame structure of self-balance two-wheeled vehicle

Inventor(s): ZHU ZHENHAI ± (ZHU ZHENHAI)

Applicant(s): ZHU ZHENHAI ± (ZHU ZHENHAI)

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

Application number: CN201410359859 20140725 Global Dossier

Priority number(s): CN201410359859 20140725

Abstract of CN104149899 (A)

The invention discloses a split type vehicle frame structure of a self-balance two-wheeled vehicle. The split type vehicle frame structure comprises a vehicle body main frame. Wheels are arranged on two sides of the vehicle body main frame, motors and gyroscopes capable of controlling the rotation speeds of the motors are arranged in the vehicle body main frame, the vehicle body main frame comprises two separate split type vehicle frames, a connecting shaft is arranged between the two split type vehicle frames, the two split type vehicle frames individually rotate around the connecting shaft which is used as rotation centers of the two split vehicle frames, the corresponding gyroscope and the corresponding motor are individually arranged in each split type vehicle frame, threads are arranged at two ends of the connecting shaft, two plane bearings are arranged in the middle of the connecting shaft, a bearing bush is arranged between the two plane bearings, through holes are formed in joints of the split type vehicle frames and the connecting shaft, bearing counter-bored holes are formed in the outer sides of the through holes, and the inner sides of the through holes are axially fixed to the ends of the connecting shaft by the aid of nuts. The split type vehicle frame structure has the advantages that acceleration, deceleration and corner turning functions can be implemented by the aid of the feet of a user, and the split type vehicle frame structure is simple.

Notice

CLAIMS CN104149899

1.

A split frame structure of a self-balancing two-wheeled vehicle includes a main frame of the vehicle body, and wheels (1) are arranged on both sides of the main frame of the vehicle body, and a motor (2) and a motor speed can be controlled in the main frame of the vehicle body. The gyroscope (3) is characterized in that: the main frame of the vehicle body comprises two separate frame (4) separated from each other, and one connecting shaft (5) is arranged in the middle of the two divided frames, two points The body frame rotates independently with the connecting shaft as the rotating center. Each of the split frames is provided with a gyroscope and a motor separately. The two ends of the connecting shaft are provided with threads, and two plane bearings (51) are arranged in the middle. A bearing bushing (52) is arranged in the middle of the plane bearing, the through hole is provided with a through hole at the joint of the split frame, and a bearing counterbore (421) is arranged outside the through hole, and the inner side of the through hole passes through the nut (53) Axial fixation with the shaft end.

2.

The split frame structure of a self-balancing two-wheeled vehicle according to claim 1, wherein the split frame comprises a lower casing (42) and an upper cover pedal (41), and the gyroscope is fixed on the upper Cover the bottom of the pedal, the gyroscope is connected to the circuit board, the circuit board is connected to the motor, and the motor drives the wheel.

3.

The split frame structure of a self-balancing two-wheeled vehicle according to claim 2, wherein the top of the upper cover pedal is provided with a concave surface (411) for placing the foot, and the concave surface is provided with a non-slip strip (411a)).

4

The split frame structure of a self-balancing two-wheeled vehicle according to claim 3 wherein the motor is fixed to an inner wall of the lower casing and connected to the wheel through a reduction gear set (425), the gear Both are helical gears.

5

The split frame structure of a self-balancing two-wheeled vehicle according to claim 4 wherein: one of the lower casings is provided with a battery, and the side wall of the lower casing is provided with a charging port (422). .

6

The split frame structure of a self-balancing two-wheeled vehicle according to claim 5 wherein: one of the lower casing front walls is provided with a front spotlight (423), and the tail wall is provided with a reflector lamp. (424).

7.

The split frame structure of a self-balancing two-wheeled vehicle according to claim 6 wherein a horn and two or more colored lights are distributed around the side wall of the lower casing.

DESCRIPTION CN104149899

The invention discloses a split frame structure of a self-balancing two-wheeled vehicle, comprising a main frame of the vehicle body, and wheels are arranged on both sides of the main frame of the vehicle body, and a motor and a gyroscope capable of controlling the rotation speed of the motor are arranged in the main frame of the vehicle body. The main frame of the vehicle body comprises two separate frame frames separated from each other, and one of the two separate body frames is provided with a connecting shaft, and the two separate body frames are rotated independently by the connecting shaft as a rotating center. The girder and the motor are separately provided in the body frame, the two ends of the coupling shaft are provided with threads, two plane bearings are arranged in the middle, and bearing bushings are arranged in the middle of the two plane bearings, the split frame and the split frame A through hole is arranged at the joint of the shaft, and a bearing counterbore is arranged outside the through hole. The inner side of the through hole is axially fixed by the nut and the end of the shaft, so that the function of accelerating deceleration and turning with the foot can be realized, and the structure is simple.

Split frame structure of self-balancing two-wheeled vehicle

Technical field

The invention relates to a frame structure of a self-balancing two-wheeled vehicle.

Background technique

Nowadays, self-balancing two-wheelers have emerged in the market, and they are increasingly favored by young people. They are also called camera cars in foreign countries. The advantages of this type of car are small size, convenient travel, and built-in high-precision gyroscopes. According to the tilt angle, the motor speed can be controlled to achieve self-balancing. Nowadays, the popular self-balancing two-wheeled vehicles are equipped with a rotating handle to control the steering function of the vehicle, and a steering shaft and the like are arranged inside. The disadvantage is that the rotating handle takes up a considerable amount of space and it is necessary to control the direction with both hands.

There is also a self-balancing two-wheeled vehicle that does not use a handle to control steering, such as the CN 103600795A Chinese invention patent published on February 26, 2014, in which a self-balancing two-wheeled vehicle based on a disk grating is disclosed. In the two-wheeled vehicle, the original rotating handle is cancelled, and the rotation of one foot is used instead of the original hand rotation, which liberates the driver's hands and improves driving pleasure. However, the patent still has the disadvantage of being complicated in structure. Because the two-wheeled car is rotated relative to the traditional handle, the patent adds a new disk grating sensor.

Summary of the invention

The technical problem to be solved by the present invention is to provide a split frame structure of a self-balancing two-wheeled vehicle, which can realize the functions of acceleration deceleration and turning with the foot, and has a simple structure.

The technical scheme of the invention is: a split frame structure of a self-balancing two-wheeled vehicle, comprising a main frame of the vehicle body, wheels are arranged on both sides of the main frame of the vehicle body, and a motor and a controllable motor speed are arranged in the main frame of the vehicle body The gyroscope, the main frame of the vehicle body comprises two separate frame bodies separated from each other, and one of the two split body frames is provided with a connecting shaft, and the two split body frames rotate independently by the connecting shaft as a rotating center. Each of the split frames is provided with a gyroscope and a motor separately, the two ends of the shaft are provided with threads, two plane bearings are arranged in the middle, and bearing bushes are arranged between the two plane bearings, the split body A through hole is arranged at the joint of the frame and the connecting shaft, and a bearing counterbore is arranged outside the through hole, and the inner side of the through hole is axially fixed by the nut and the connecting shaft end.

Preferably, the split frame comprises a lower casing and an upper cover pedal, the gyroscope is fixed at the bottom of the upper cover pedal, the gyroscope is connected to the circuit board, the circuit board is connected to the motor, and the motor drives the wheel.

Preferably, the top of the upper cover pedal is provided with a concave surface for placing the foot, and the concave surface is provided with a non-slip strip.

Preferably, the motor is fixed to the inner wall of the lower casing and connected to the wheel through the reduction gear set.

Preferably, the battery is disposed in the lower casing, and the charging port is disposed on the sidewall of the lower casing.

Preferably, one of the front walls of the lower casing is provided with a front spotlight, and the tail wall is provided with a reflector lamp.

Preferably, a horn and two or more colored lights are distributed around the side wall of the lower casing.

After adopting the technical scheme, the original integrated frame body is divided into two separate and rotatable split frames, and the motor and the gyroscope are separately provided in the two separate frames, one of which is divided into one. When the body frame rotates, the internal gyroscope will sense the tilt angle. When the gyroscope senses forward tilt or backward tilt, it transmits a signal to the motor to increase its rotational speed. The larger the angle, the larger the motor speed, when driving, One foot steps on the split frame, and when the other one does not step on, the wheel of the stepped frame that is stepped on rotates, and the other split frame wheel does not rotate, thus achieving the turning function, and The larger the stepping angle is, the more obvious the angle of turning is, and the smaller the turning angle is, so that the stepping with the two feet can realize the forward and backward advance and retreat, and the turning function is realized by the single foot stepping method, the operation is very convenient, and the internal structure is simple. No additional parts for turning are required.

DRAWINGS

Figure 1 is a three-dimensional schematic view of the present invention;

Figure 2is a schematic exploded view of the present invention;

Figure 3is a schematic view of the lower casing after installation;

Figure 4is an enlarged schematic view of the coupling shaft.

detailed description

The specific embodiments of the present invention are further described below in conjunction with the accompanying drawings:

As shown in FIG. 1 to FIG. 4, a split frame structure of a self-balancing two-wheeled vehicle includes a main frame of the vehicle body, and wheels 1 are arranged on both sides of the main frame of the vehicle body, and a motor 2is arranged in the main frame of the vehicle body. The gyroscope 3can control the motor speed, the main frame of the vehicle body comprises two separate frame 4separated from each other, and a connecting shaft 5is arranged in the middle of the two divided frames, and the two ends of the connecting shaft are arranged Threaded, two plane bearings 51 are arranged in the middle, and bearing bushings 52are arranged in the middle of the two plane bearings. The split frame and the connecting shaft are provided with through holes, and the bearing holes 421 are provided outside the through holes. The outer ring of the planar bearing 51 is internally clamped in the bearing counterbore, and the inner side of the through hole is axially fixed by the nut and the shaft end. After the fixing, the two split frames can rotate smoothly, and the left and right direction The frame is dead and does not slide left and right. Each of the split frames has a gyroscope and a motor separately. The split frame includes an upper cover 41 and a lower case 42. The inner wall of the lower case is provided with six The threaded column and the upper cover pedal are fixed to the lower casing through the six threaded posts, and the gyroscope is fixed on the bottom of the upper cover pedal, and the gyroscope is one The tilting angle sensing device can sense the inclination angle of the upper cover pedal and the horizontal plane, the gyroscope is connected to the circuit board, and the gyroscope transmits the induced inclination signal to the circuit board, and the current of the motor is controlled by the circuit board, thereby controlling the rotation speed of the motor, and finally The motor drives the wheels to rotate, so the driver only needs to step on the upper cover pedal to rotate a certain inclination angle along the coupling shaft 5, and the two-wheeled vehicle can advance or retreat. When the inclination angle is larger, the motor rotation speed is larger; When a turn is needed, one of the feet steps on the split frame, the other does not step on, the wheel of the stepped frame that is stepped on rotates, and the other split frame wheel is stepped when it does not rotate. The wheels of the split frame continue to move forward, while the other wheels that do not rotate remain in place, thus achieving the turning function with the non-rotating wheel as the center of rotation, and the greater the angle of the turn, the turning The more obvious the angle is, the smaller the turning angle is. The way to step forward and backward with the two feet can realize the turning function with one foot stepping, the operation is very convenient, and the internal structure is simple, no need Add other turning parts.

As shown in FIG. 2, the top of the upper cover pedal is provided with a concave surface 411 for placing the foot, and the concave surface is provided with a non-slip strip 411a. The concave surface is for the foot to be better placed on the upper cover pedal, and the redundant anti-slip The strip is designed to prevent foot slippage during pedaling and improve driving safety. The motor is fixed on the inner wall of the lower casing and connected to the wheel through the reduction gear set 425. The gear of the reduction gear set adopts a helical gear. The helical gear transmission is more stable and the noise is small.

As shown in FIG. 3, a battery is disposed in the lower casing, and a charging port 422is disposed on the sidewall of the lower casing to facilitate charging of the battery by the two-wheeled vehicle. The front wall of one of the lower casings is provided with a front spotlight. The tail wall is provided with a reflector lamp, and the front spotlight and the reflector lamp improve the safety of the invention at night; the side wall of the lower casing is distributed with a horn and two or more lanterns, which also enhances the entertainment of the present invention. The two-wheelers are generally younger, and it is more fashionable to accompany some music and lighting while driving, and it improves driving pleasure.

The above description of the preferred embodiments of the present invention has been made by way of example only, but not by the claims. The present invention is not limited to the above examples, and the specific structure thereof is subject to change. Those skilled in the art can make various changes and modifications in accordance with the present invention, as long as they do not depart from the spirit of the present invention. range.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 104149899 A
(43)申请公布日 2014.11.19

(21)申请号 201410359859.1

(22)申请日 2014.07.25

(71)申请人 祝珍海
地址 313117 浙江省湖州市长兴县槐坎乡东风村曹家村 52-1 号

(72)发明人 祝珍海

(74)专利代理机构 杭州华鼎知识产权代理事务所（普通合伙） 33217
代理人 秦晓刚

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

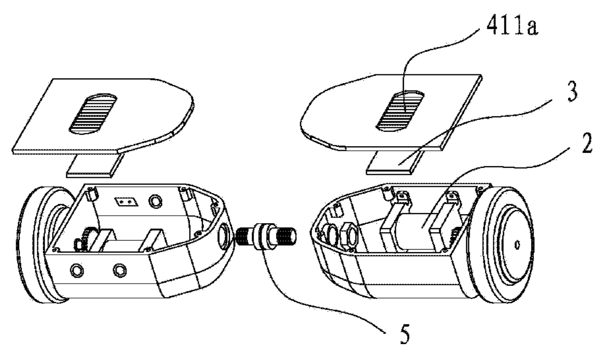
权利要求书1页 说明书3页 附图2页

(54)发明名称

一种自平衡两轮车的分体车架结构

(57)摘要

本发明公开了一种自平衡两轮车的分体车架结构，包括车体主架，车体主架两侧设有轮子，车体主架内设有电机及可控制电机转速的陀螺仪，所述的车体主架包括两个相互分离的分体车架，两个分体车架中间设有一根连轴，两个分体车架以连轴为转动中心独自转动，每个分体车架内单独设有陀螺仪和电机，所述的连轴两端设有螺纹，中间设有两个平面轴承，两个平面轴承中间设有轴承衬套，所述的分体车架与连轴连接处设有通孔，通孔外侧设有轴承沉孔，通孔内侧通过螺母与连轴端部实现轴向固定，能实现用脚进行加速减速、转弯功能，并且结构简单。



CN 104149899 A

1. 一种自平衡两轮车的分体车架结构，包括车体主架，车体主架两侧设有轮子（1），车体主架内设有电机（2）及可控制电机转速的陀螺仪（3），其特征在于：所述的车体主架包括两个相互分离的分体车架（4），两个分体车架中间设有一根连轴（5），两个分体车架以连轴为转动中心独自转动，每个分体车架内单独设有陀螺仪和电机，所述的连轴两端设有螺纹，中间设有两个平面轴承（51），两个平面轴承中间设有轴承衬套（52），所述的分体车架与连轴连接处设有通孔，通孔外侧设有轴承沉孔（421），通孔内侧通过螺母（53）与连轴端部实现轴向固定。

2. 根据权利要求 1 所述的一种自平衡两轮车的分体车架结构，其特征在于：分体车架包括一个下壳体（42）与上盖踏板（41），陀螺仪固定在上盖踏板底部，陀螺仪连接电路板，电路板连接电机，电机驱动轮子。

3. 根据权利要求 2 所述的一种自平衡两轮车的分体车架结构，其特征在于：所述的上盖踏板顶部设有放置脚的凹面（411），凹面内设有防滑条（411a）。

4. 根据权利要求 3 所述的一种自平衡两轮车的分体车架结构，其特征在于：所述的电机固定在下壳体的内壁上，并通过减速齿轮组（425）与轮子连接，齿轮均为斜齿轮。

5. 根据权利要求 4 所述的一种自平衡两轮车的分体车架结构，其特征在于：所述的其中一个下壳体内设有蓄电池，下壳体侧壁上设有充电口（422）。

6. 根据权利要求 5 所述的一种自平衡两轮车的分体车架结构，其特征在于：所述的其中一个下壳体前壁设有前射灯（423）、尾壁设有反光灯（424）。

7. 根据权利要求 6 所述的一种自平衡两轮车的分体车架结构，其特征在于：下壳体周围侧壁分布有喇叭及 2 个以上的彩灯。

一种自平衡两轮车的分体车架结构

技术领域

[0001] 本发明涉及一种自平衡两轮车的车架结构。

背景技术

[0002] 现在市面逐渐出现了自平衡两轮车，并且越来越受到年轻人的青睐，在国外也叫摄位车，这种车的优点在于体积小，出行比较方便，而且内置有高精密的陀螺仪，可以根据倾斜角度来保持控制电机转速以达到自平衡的目的，现在普遍流行的自平衡两轮车都设有转动手柄来控制车的转向功能，内部设有转向轴等零件，这种车的缺点就是转动手柄占用相当大的空间，而且要借助双手控制方向。

[0003] 市面上也出现了一种不用手柄控制转向的自平衡两轮车，比如 2014 年 2 月 26 日公开的 CN 103600795 A 中国发明专利，其中就公开了一种基于圆盘光栅的自平衡两轮车，该两轮车中取消了原有的转动手柄，用一种脚转动来代替原有的手转动，解放了驾驶者的双手，提升驾驶乐趣，但是该专利还是存在着结构比较复杂的缺点，因为相对传统的手柄转动两轮车，该专利新加装了圆盘光栅传感器。

发明内容

[0004] 本发明需要解决的技术问题是，提供一种自平衡两轮车的分体车架结构，能实现用脚进行加速减速、转弯功能，并且结构简单。

[0005] 本发明的技术方案是：一种自平衡两轮车的分体车架结构，包括车体主架，车体主架两侧设有轮子，车体主架内设有电机及可控制电机转速的陀螺仪，所述的车体主架包括两个相互分离的分体车架，两个分体车架中间设有一根连轴，两个分体车架以连轴为转动中心独自转动，每个分体车架内单独设有陀螺仪和电机，所述的连轴两端设有螺纹，中间设有两个平面轴承，两个平面轴承中间设有轴承衬套，所述的分体车架与连轴连接处设有通孔，通孔外侧设有轴承沉孔，通孔内侧通过螺母与连轴端部实现轴向固定。

[0006] 优选的，分体车架包括一个下壳体与上盖踏板，陀螺仪固定在上盖踏板底部，陀螺仪连接电路板，电路板连接电机，电机驱动轮子。

[0007] 优选的，所述的上盖踏板顶部设有放置脚的凹面，凹面内设有防滑条。

[0008] 优选的，所述的电机固定在下壳体的内壁上，并通过减速齿轮组与轮子连接。

[0009] 优选的，所述的其中一下壳体内设有蓄电池，下壳体侧壁上设有充电口。

[0010] 优选的，所述的其中一个下壳体前壁设有前射灯、尾壁设有反光灯。

[0011] 优选的，下壳体周围侧壁分布有喇叭及 2 个以上的彩灯。

[0012] 采用本技术方案后，将原本的一体式的车架主体分成两个相互分离、而且可以转动的分体车架，两个分体车架内都单独设有电机与陀螺仪，当其中一个分体车架转动时，其内部的陀螺仪会感应到倾斜角度，当陀螺仪感应到前倾或者后倾时传递信号给电机使其转速增加，角度越大，电机转速越大，驾驶时，其中一只脚踩动分体车架，另一只不踩动时，被踩动的分体车架的轮子发生转动，另一个分体车架轮子不转动时，如此便实现了转弯功能，

而且踩动角度越大，转弯的角度越明显，反之转弯角度越小，这样用双脚踩动的方式能实现前后进退，用单脚踩动方式实现转弯功能，操作非常方便，而且内部结构简单，无需加装其他转弯用的零件。

附图说明

[0013] 附图 1 为本发明整体三维示意图；

[0014] 附图 2 为本发明的爆炸示意图；

[0015] 附图 3 为下壳体安装好后的示意图；

[0016] 附图 4 为连轴处放大示意图。

具体实施方式

[0017] 下面结合附图对本发明的具体实施方式作进一步说明：

[0018] 如图 1 至图 4 所示，一种自平衡两轮车的分体车架结构，包括车体主架，车体主架两侧设有轮子 1，车体主架内设有电机 2 及可控制电机转速的陀螺仪 3，所述的车体主架包括两个相互分离的分体车架 4，两个分体车架中间设有一根连轴 5，所述的连轴两端设有螺纹，中间设有两个平面轴承 51，两个平面轴承中间设有轴承衬套 52，所述的分体车架与连轴连接处设有通孔，通孔外侧设有轴承沉孔 421，所述的平面轴承 51 的外圈内置卡紧在轴承沉孔内，通孔内侧通过螺母与连轴端部实现轴向固定，固定后两个分体车架都能平滑转动，而且左右方向被限位死，不发生左右滑动，每个分体车架内单独设有陀螺仪和电机，分体车架包括一个上盖踏板 41 与下壳体 42，下壳体内壁上设有 6 个螺纹柱，上盖踏板通过这 6 个螺纹柱与下壳体固定，陀螺仪固定在上盖踏板底部，陀螺仪为一种倾角感应装置，能感应到上盖踏板与水平面的倾角，陀螺仪连接电路板，陀螺仪将感应到的倾角信号传输给电路板，由电路板控制电机的电流，从而控制电机的转速，最终电机驱动轮子转动，所以驾驶者只需要踩动上盖踏板，使其沿连轴 5 转动某一倾角，两轮车就能前进或者后退，当踩动倾斜角度越大，电机转速越大；在需要转弯时，其中一只脚踩动分体车架，另一只不踩动，被踩动的分体车架的轮子发生转动，另一个分体车架轮子不转动时，被踩动的分体车架的轮子继续往前前行，而另一个不转动的轮子则在原地不动，如此便实现了以不转动的轮子为旋转中心的转弯功能，而且踩动角度越大，转弯的角度越明显，反之转弯角度越小，这样用双脚踩动的方式能实现前后进退，用单脚踩动方式实现转弯功能，操作非常方便，而且内部结构简单，无需加装其他转弯零件。

[0019] 图 2 中所示，所述的上盖踏板顶部设有放置脚的凹面 411，凹面内设有防滑条 411a，凹面是为了让双脚更好的放置在上盖踏板上，而冗起的防滑条则是为了防止在踩动过程中发生脚滑现象，提高驾驶安全性，所述的电机固定在下壳体的内壁上，并通过减速齿轮组 425 与轮子连接，减速齿轮组的齿轮采用斜齿轮，斜齿轮传动更平稳，噪音小。

[0020] 图 3 中所示，其中一下壳体内设有蓄电池，下壳体侧壁上设有充电口 422，方便两轮车为蓄电池充电，所述的其中一个下壳体前壁设有前射灯、尾壁设有反光灯，前射灯与反光灯提高了本发明在夜间行驶的安全性；下壳体周围侧壁分布有喇叭及 2 个以上的彩灯，这个也是提高了本发明的娱乐性，一般使用本两轮车的都比较年轻，在驾驶时陪伴一些音乐及灯光更显得时尚，而且提升了驾驶乐趣。

[0021] 以上仅就本发明较佳的实例作了说明,但不能理解为是对权利要求的限制。本发明不仅局限与以上实例,其具体结构允许有变化,本领域技术人员可以根据本发明作出各种改变和变形,只要不脱离本发明的精神,均应属于本发明所附权利要求所定义的范围。

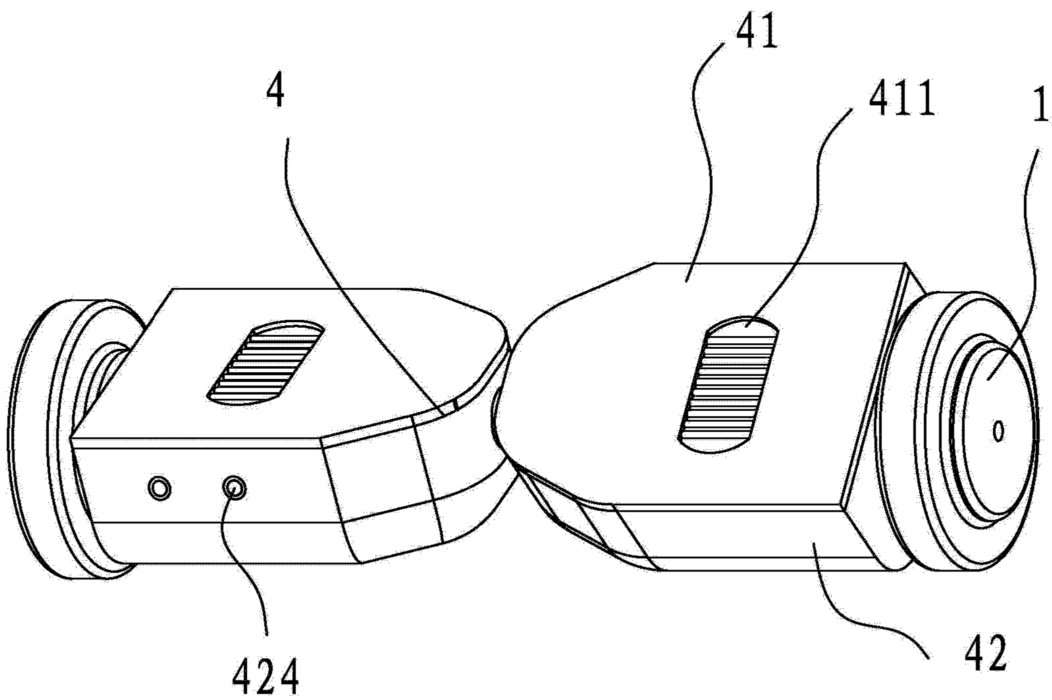


图 1

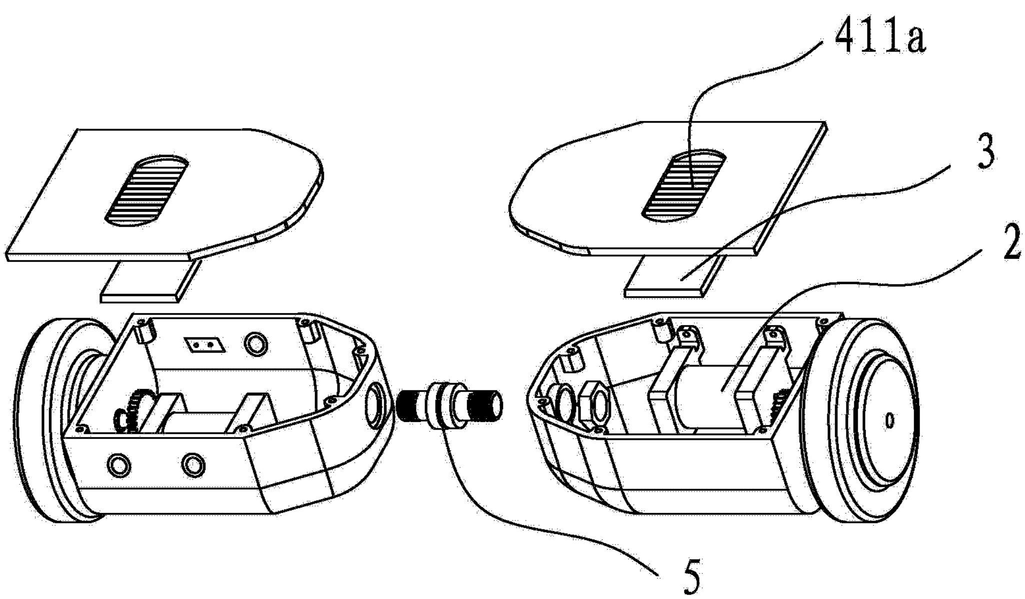


图 2

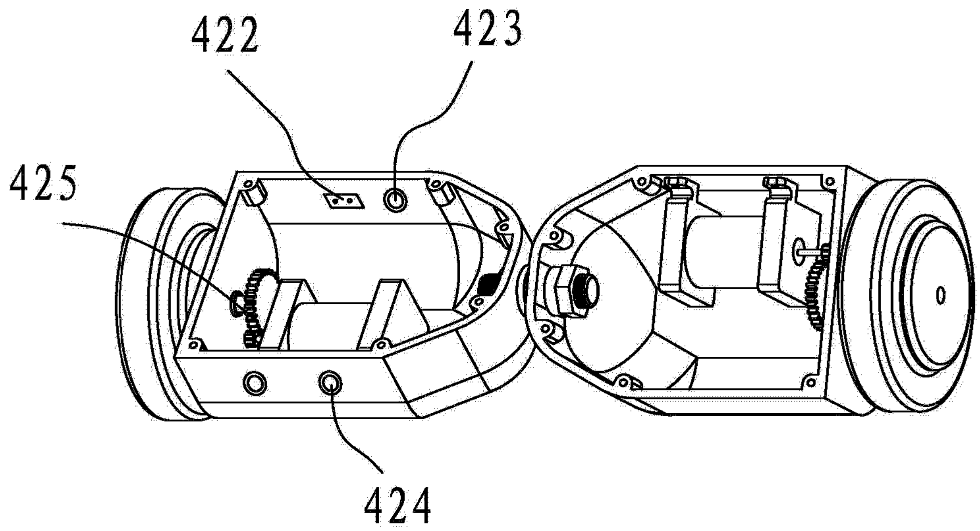


图 3

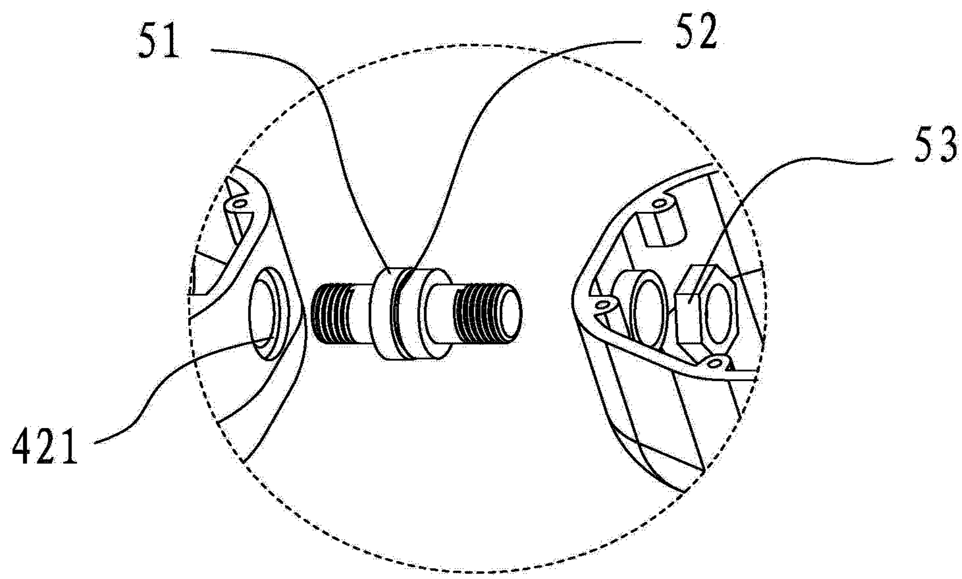


图 4

Espacenet

Bibliographic data: CN104163222 (A) — 2014-11-26

Steering control method for self-balancing two-wheeled vehicle

Inventor(s):	ZHU ZHENHAI ± (ZHU ZHENHAI, ; 王跃鹏)
Applicant(s):	ZHU ZHENHAI ± (ZHU ZHENHAI, ; 重庆鹏得基业汽车部件有限公司)
Classification:	**- international:** *B62K11/00; B62M6/45* **- cooperative:** B62K11/007 (EP)
Application number:	CN201410360797 20140725 Global Dossier
Priority number(s):	CN201410360797 20140725
Also published as:	CN104163222 (B)

Abstract of CN104163222 (A)

The invention discloses a steering control method for a self-balancing two-wheeled vehicle. The two-wheeled vehicle comprises two separated split frames, a connecting shaft is arranged between the two split frames, and motors and gyroscopes capable of controlling the rotating speed of the motors are arranged in the split frames. The steering control method for the self-balancing two-wheeled vehicle comprises the following steps that firstly, the outer split frame needing to turn is treaded by the foot, and the inner split frame is kept horizontal. According to the split frame in the horizontal state, due to the fact that the gyroscope does not induct changes of the inclination angle, the motor does not rotate, the gyroscope at the bottom of an upper cover pedal inducts the changes of the inclination angle after inclination, signals are output to a circuit board to enable the motor to rotate, and therefore wheels are driven to rotate. Finally, one wheel does not rotate, the other wheel rotates, the two-wheeled vehicle turns and moves with the wheel which does not rotate as the center, the acceleration, speed reduction and turning functions can be achieved through foot treading, and the structure is simple.

DGL Exhibit 1002
Page 0307

Notice

CLAIMS CN104163222

1.

A steering control method for a self-balancing two-wheeled vehicle, the two-wheeled vehicle includes a main frame of the vehicle body, and wheels (1) are arranged on both sides of the main frame of the vehicle body, and a motor (2) and a motor speed can be controlled in the main frame of the vehicle body. The gyroscope (3) is characterized in that: the main frame of the vehicle body comprises two separate frame (4) separated from each other, and a connecting shaft (5) is arranged in the middle of the two divided frames, two The split frame rotates independently with the connecting shaft as the rotating center, and each of the split frames is separately provided with a gyroscope and a motor, and the split frame includes an upper cover pedal (41) and a lower casing (42), and the gyroscope It is fixed at the bottom of the upper cover pedal, the gyroscope is connected to the circuit board, the circuit board is connected to the motor, and the motor drives the wheel. The steering control method is as follows:

1)Maintaining the horizontal state of the split frame on one side that needs to turn, and the split frame on the other side to step on the top cover pedal of the top to tilt the whole body along the coupling axis;

2)

The split frame in the horizontal state does not rotate because the gyroscope does not sense the tilt angle, and the gyroscope at the bottom of the upper cover pedal senses the tilt angle after the tilt, and the output signal is sent to the circuit board to rotate the motor. Thereby driving the wheel to start rotating;

3)

One wheel does not rotate, and the other wheel rotates to achieve a turning action centered on the wheel of the two-wheeled vehicle.

2The steering control method for a self-balancing two-wheeled vehicle according to claim 1, characterized in that: the two ends of the coupling shaft are provided with threads, and two plane bearings (51) are arranged in the middle, and two plane bearings are intermediate A bearing bushing (52) is provided.

3The steering control method for a self-balancing two-wheeled vehicle according to claim 2, characterized in that: the lower casing and the connecting shaft are provided with a through hole, and the outer side of the through hole is provided with a bearing counterbore (421) The inner side of the through hole is axially fixed by the nut (53) and the end portion of the shaft.

4

The steering control method for a self-balancing two-wheeled vehicle according to claim 1, wherein the top of the upper cover pedal is provided with a concave surface (411) for placing the foot, and the concave surface is provided with a non-slip strip (411a).

5

The steering control method for a self-balancing two-wheeled vehicle according to claim 1, wherein the motor is fixed to an inner wall of the lower casing and connected to the wheel through a reduction gear set, and the gears are all helical gears.

6

The steering control method for a self-balancing two-wheeled vehicle according to claim 1, wherein a battery is disposed in one of the lower casings, and a charging port (422) is disposed on a side wall of the lower casing.

7.

The steering control method for a self-balancing two-wheeled vehicle according to claim 6 wherein a front wall of the lower casing is provided with a front spotlight (423), and a tail wall is provided with a reflector lamp (424).
).

8

The steering control method for a self-balancing two-wheeled vehicle according to claim 7, characterized in that a horn and two or more colored lights are distributed around the side wall of the lower casing.

Notice

DESCRIPTION CN104163222

The invention discloses a steering control method for a self-balancing two-wheeled vehicle. The two-wheeled vehicle comprises two split frame frames separated from each other, and two split frames are provided with a connecting shaft in the middle, and the split frame is provided inside. There are motors and gyroscopes that can control the speed of the motor. The steering control method is as follows: firstly, the outer split frame that needs to be turned by the foot, and the other inner split frame to keep the horizontal, the split frame in the horizontal state. Because the gyroscope does not sense the change of the inclination angle, the motor does not rotate, and the gyroscope at the bottom of the upper cover pedal senses the inclination change after the tilt, and the output signal is sent to the circuit board to rotate the motor, thereby driving the wheel to start rotating, and the last one The wheel does not rotate, and the other wheel rotates to realize the turning action of the two-wheeled vehicle centering on the non-rotating wheel, which can realize the acceleration deceleration and turning function with the foot stepping, and has a simple structure.

Steering control method for self-balancing two-wheeled vehicle

Technical field

The invention relates to a steering control method for a self-balancing two-wheeled vehicle.

Background technique

Nowadays, self-balancing two-wheelers have emerged in the market, and they are increasingly favored by young people. They are also called camera cars in foreign countries. The advantages of this type of car are small size, convenient travel, and built-in high-precision gyroscopes. According to the tilt angle, the motor speed can be controlled to achieve self-balancing. Nowadays, the popular self-balancing two-wheeled vehicles are equipped with a rotating handle to control the steering function of the vehicle, and a steering shaft and the like are arranged inside. The disadvantage is that the rotating handle takes up a considerable amount of space and it is necessary to control the direction with both hands.

There is also a self-balancing two-wheeled vehicle that does not use a handle to control steering, such as the CN 103600795A Chinese invention patent published on February 26, 2014, in which a self-balancing two-wheeled vehicle based on a disk grating is disclosed. In the two-wheeled vehicle, the original rotating handle is cancelled, and the rotation of one foot is used instead of the original hand rotation, which liberates the driver's hands and improves driving pleasure. However, the patent still has the disadvantage of being complicated in structure. Because the two-wheeled car is rotated relative to the traditional handle, the patent adds a new disk grating sensor.

Summary of the invention

The technical problem to be solved by the present invention is to provide a steering control method for a self-balancing two-wheeled vehicle, which can realize an acceleration deceleration and a turning function by pedaling, and has a simple structure.

The technical scheme of the invention is: a steering control method for a self-balancing two-wheeled vehicle, the two-wheeled vehicle comprises a main frame of the vehicle body, and wheels are arranged on both sides of the main frame of the vehicle body, and a motor and a controllable motor are arranged in the main frame of the vehicle body In the gyro of the rotating speed, the main frame of the vehicle body comprises two separate frame bodies separated from each other, and one of the two separate body frames is provided with a connecting shaft, and the two separate body frames rotate independently with the connecting shaft as a rotating center. Each of the split frames is provided with a gyroscope and a motor separately. The split frame includes an upper cover pedal and a lower casing, the gyroscope is fixed at the bottom of the upper cover pedal, the gyroscope is connected to the circuit board, and the circuit board is connected to the motor. Motor drive wheels, the steering control method is as follows:

1)

Maintaining the horizontal state of the split frame on one side that needs to turn, and the split frame on the other side to step on the top cover pedal of the top to tilt the whole body along the coupling axis;

2)
The split frame in the horizontal state does not rotate because the gyroscope does not sense the tilt angle, and the gyroscope at the bottom of the upper cover pedal senses the tilt angle after the tilt, and the output signal is sent to the circuit board to rotate the motor. Thereby driving the wheel to start rotating;

3)
One wheel does not rotate, and the other wheel turns to realize the turning action of the two-wheeled vehicle centered on the non-rotating wheel.

Preferably, the two ends of the coupling shaft are provided with a thread, two plane bearings are arranged in the middle, and a bearing bushing is arranged between the two plane bearings.

Preferably, the lower casing and the connecting shaft are provided with a through hole, and the outer side of the through hole is provided with a bearing counterbore, and the inner side of the through hole is fixed by the nut and the connecting shaft end.

Preferably, the top of the upper cover pedal is provided with a concave surface for placing the foot, and the concave surface is provided with a non-slip strip.

Preferably, the motor is fixed to the inner wall of the lower casing and connected to the wheel through the reduction gear set.

Preferably, one of the lower casings is provided with a battery, and the side wall of the lower casing is provided with a charging port.

Preferably, one of the front walls of the lower casing is provided with a front spotlight, and the tail wall is provided with a reflector lamp.

Preferably, a horn and two or more colored lights are distributed around the side wall of the lower casing.

After adopting the technical scheme, the original integrated frame body is divided into two separate and rotatable split frames, and the motor and the gyroscope are separately provided in the two separate frames, one of which is divided into one. When the body frame rotates, the internal gyroscope will sense the tilt angle. When the gyroscope senses forward tilt or backward tilt, it transmits a signal to the motor to increase its rotational speed. The larger the angle, the larger the motor speed, when driving, One foot steps on the split frame, and when the other one does not step on, the wheel of the stepped frame that is stepped on rotates, and the other split frame wheel does not rotate, thus achieving the turning function, and The larger the stepping angle is, the more obvious the angle of turning is, and the smaller the turning angle is, so that the stepping with the two feet can realize the forward and backward advance and retreat, and the turning function is realized by the single foot stepping method, the operation is very convenient, and the internal structure is simple. There is no need to install other turning parts, and the traditional two-wheeled vehicle frame is one-piece, which cannot solve the problem of horizontal tilting on both sides of the frame.

DRAWINGS

Figure 1 is a three-dimensional schematic view of the present invention;

Figure 2is a schematic exploded view of the present invention;

Figure 3is a schematic view of the lower casing after installation;

Figure 4is an enlarged schematic view of the coupling shaft.

detailed description

The specific embodiments of the present invention are further described below in conjunction with the accompanying drawings:

As shown in FIG. 1 to FIG. 4, a steering control method for a self-balancing two-wheeled vehicle includes a main frame of the vehicle body, and wheels 1 are arranged on both sides of the main frame of the vehicle body, and a motor 2is disposed in the main frame of the vehicle body and can be controlled. The gyro 3of the motor speed, the main frame of the vehicle body comprises two separate frame 4separated from each other, and one of the two split frames is provided with a connecting shaft 5, and the two split frames are connected by a shaft The rotating center rotates by itself, and each of the split frames is separately provided with a gyroscope and a motor. The split frame includes an upper cover pedal 41 and a lower casing 42. The inner wall of the lower casing is provided with six threaded columns and an upper cover. The pedal is fixed to the lower casing through the six threaded posts, and the gyroscope is fixed at the bottom of the upper cover pedal. The gyroscope is a tilting sensing device, which can sense the inclination of the upper cover pedal and the horizontal plane, the gyroscope is connected to the circuit board, and the gyroscope is connected. The induced dip signal is transmitted to the circuit board, and the current of the motor is controlled by the circuit board, thereby controlling the rotation speed of the motor, and finally the motor drives the wheel to rotate. The steering control method of the two-wheeled vehicle is as follows:

1) Maintaining the horizontal state of the split frame on one side that needs to turn, and the split frame on the other side to step on the top cover pedal of the top to tilt the whole axis along the axis, for example, the driver needs to turn right. , the right foot is placed on the right side of the split frame to remain stationary, keeping the right side of the split frame in a horizontal state without tilting, and the left foot is stepping on the left side of the split frame to cause rotation to produce a tilt angle;

2) The split frame in the horizontal state does not rotate because the gyroscope does not sense the tilt angle, and the gyroscope at the bottom of the upper cover pedal senses the tilt angle after the tilt, and the output signal is sent to the circuit board to rotate the motor. Thereby driving the wheel to start rotating;

3) One wheel does not rotate, and the other wheel turns to realize the turning action of the two-wheeled vehicle centered on the non-rotating wheel.

Therefore, the driver only needs to step on the upper pedal at the same time to rotate the tilting angle along the connecting shaft 5, and the two-wheeled vehicle can advance or retreat. When the tilting angle is larger, the motor speed is larger, and the turning is needed. When one of the feet steps on the split frame, the other one does not step on, the wheel of the split frame that is stepped on rotates, and the other split frame wheel does not rotate, the step is stepped The wheel of the body frame continues forward, and the other wheel that does not rotate remains in place, thus achieving the turning function with the rotating wheel as the center of rotation, and the angle of the turning is larger, the angle of the turning The more obvious, the smaller the turning angle is, so that the stepping with the two feet can realize the forward and backward advance and retreat, and the turning function can be realized by the single foot stepping method, the operation is very convenient, and the internal structure is simple, and no other turning parts need to be added.

4, the two ends of the shaft are provided with a thread, and two plane bearings 51 are disposed in the middle, and a bearing bushing 52 is disposed between the two plane bearings, and the lower casing and the shaft joint are provided. a through hole, a bearing counterbore 421 is arranged outside the through hole, and the outer ring of the planar bearing 51 is internally clamped in the bearing counterbore, and the inner side of the through hole is fixed by the nut and the shaft end, and the two lower shells are fixed It can rotate smoothly, and the left and right direction is limited to death, and no left and right sliding occurs.

As shown in FIG. 2, the top of the upper cover pedal is provided with a concave surface 411 for placing the foot, and the concave surface is provided with a non-slip strip 411a. The concave surface is for the foot to be better placed on the upper cover pedal, and the redundant anti-slip The strip is designed to prevent foot slippage during pedaling and improve driving safety. The motor is fixed on the inner wall of the lower casing and connected to the wheel through the reduction gear set 425. The gear of the reduction gear set adopts a helical gear. The helical gear transmission is more stable and the noise is small.

As shown in FIG. 3, a battery is disposed in the lower casing, and a charging port 422 is disposed on the sidewall of the lower casing to facilitate charging of the battery by the two-wheeled vehicle. The front wall of one of the lower casings is provided with a front spotlight. The tail wall is provided with a reflector lamp, and the front spotlight and the reflector lamp improve the driving safety of the invention at night; the side wall of the lower casing is distributed with a horn and two or more lanterns, which also enhances the entertainment of the invention. The two-wheelers are generally younger, and it is more fashionable to accompany some music and lighting while driving, and it improves driving pleasure.

The above description of the preferred embodiments of the present invention has been made by way of example only, but not by the claims.

The present invention is not limited to the above examples, and the specific structure thereof is subject to change. Those skilled in the art can make various changes and modifications in accordance with the present invention, as long as they do not depart from the spirit of the present invention. range.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 104163222 A
(43)申请公布日 2014.11.26

(21)申请号 201410360797.6

(22)申请日 2014.07.25

(71)申请人 祝珍海
地址 313117 浙江省湖州市长兴县槐坎乡东风村曹家村52-1号

(72)发明人 祝珍海

(74)专利代理机构 杭州华鼎知识产权代理事务所(普通合伙) 33217
代理人 秦晓刚

(51)Int.Cl.
B62K 11/00(2013.01)
B62M 6/45(2010.01)

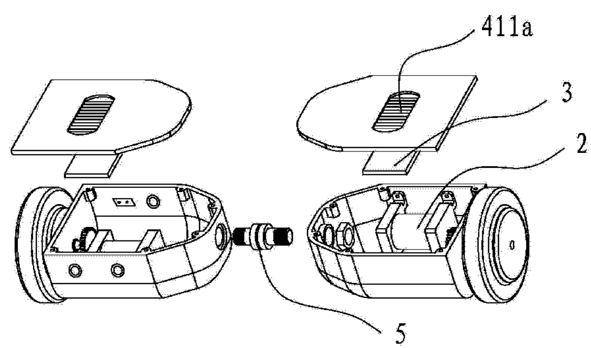
权利要求书1页 说明书3页 附图2页

(54)发明名称

一种自平衡两轮车的转向控制方法

(57)摘要

本发明公开了一种自平衡两轮车的转向控制方法,两轮车包括包括两个相互分离的分体车架,两个分体车架中间设有一根连轴,分体车架内设有电机及可控制电机转速的陀螺仪,其转向控制方法如下:首先用脚踩动需要转弯的外侧分体车架,另一只内侧分体车架保持水平,处于水平状态的分体车架因为陀螺仪没有感应到倾角发生变化,所以电机不发生转动,而倾斜后上盖踏板底部的陀螺仪感应到倾角发生变化,输出信号给电路板使电机发生转动,从而驱动轮子开始转动,最后一个轮子不转动,另一个轮子转动实现了两轮车以不转动的轮子为中心的转弯行动,能实现用脚踩动进行加速减速、转弯功能,并且结构简单。



1. 一种自平衡两轮车的转向控制方法，两轮车包括车体主架，车体主架两侧设有轮子（1），车体主架内设有电机（2）及可控制电机转速的陀螺仪（3），其特征在于：所述的车体主架包括两个相互分离的分体车架（4），两个分体车架中间设有一根连轴（5），两个分体车架以连轴为转动中心独自转动，每个分体车架内单独设有陀螺仪和电机，分体车架包括一个上盖踏板（41）与下壳体（42），陀螺仪固定在上盖踏板底部，陀螺仪连接电路板，电路板连接电机，电机驱动轮子，其转向控制方法如下：

1）保持需要转弯的一侧分体车架的水平状态，另一侧的分体车架用脚踩动其顶部的上盖踏板使其整体沿连轴为中心转动发生倾斜；

2）处于水平状态的分体车架因为陀螺仪没有感应到倾角发生变化，所以电机不发生转动，而倾斜后上盖踏板底部的陀螺仪感应到倾角发生变化，输出信号给电路板使电机发生转动，从而驱动轮子开始转动；

3）一个轮子不转动，另一个轮子转动实现了两轮车以不转动的轮子为中心的转弯动作。

2. 根据权利要求 1 所述的一种自平衡两轮车的转向控制方法，其特征在于：所述的连轴两端设有螺纹，中间设有两个平面轴承（51），两个平面轴承中间设有轴承衬套（52）。

3. 根据权利要求 2 所述的一种自平衡两轮车的转向控制方法，其特征在于：所述的下壳体与连轴连接处设有通孔，通孔外侧设有轴承沉孔（421），通孔内侧通过螺母（53）与连轴端部实现轴向固定。

4. 根据权利要求 1 所述的一种自平衡两轮车的转向控制方法，其特征在于：所述的上盖踏板顶部设有放置脚的凹面（411），凹面内设有防滑条（411a）。

5. 根据权利要求 1 所述的一种自平衡两轮车的转向控制方法，其特征在于：所述的电机固定在下壳体的内壁上，并通过减速齿轮组与轮子连接，齿轮均为斜齿轮。

6. 根据权利要求 1 所述的一种自平衡两轮车的转向控制方法，其特征在于：所述的其中一个下壳体内设有蓄电池，下壳体侧壁上设有充电口（422）。

7. 根据权利要求 6 所述的一种自平衡两轮车的转向控制方法，其特征在于：所述的其中一个下壳体前壁设有前射灯（423）、尾壁设有反光灯（424）。

8. 根据权利要求 7 所述的一种自平衡两轮车的转向控制方法，其特征在于：下壳体周围侧壁分布有喇叭及 2 个以上的彩灯。

一种自平衡两轮车的转向控制方法

技术领域

[0001] 本发明涉及一种自平衡两轮车的转向控制方法。

背景技术

[0002] 现在市面逐渐出现了自平衡两轮车，并且越来越受到年轻人的青睐，在国外也叫摄位车，这种车的优点在于体积小，出行比较方便，而且内置有高精密的陀螺仪，可以根据倾斜角度来保持控制电机转速以达到自平衡的目的，现在普遍流行的自平衡两轮车都设有转动手柄来控制车的转向功能，内部设有转向轴等零件，这种车的缺点就是转动手柄占用相当大的空间，而且要借助双手控制方向。

[0003] 市面上也出现了一种不用手柄控制转向的自平衡两轮车，比如 2014 年 2 月 26 日公开的 CN 103600795 A 中国发明专利，其中就公开了一种基于圆盘光栅的自平衡两轮车，该两轮车中取消了原有的转动手柄，用一种脚转动来代替原有的手转动，解放了驾驶者的双手，提升驾驶乐趣，但是该专利还是存在着结构比较复杂的缺点，因为相对传统的手柄转动两轮车，该专利新加装了圆盘光栅传感器。

发明内容

[0004] 本发明需要解决的技术问题是，提供一种自平衡两轮车的转向控制方法，能实现用脚踩动进行加速减速、转弯功能，并且结构简单。

[0005] 本发明的技术方案是：一种自平衡两轮车的转向控制方法，两轮车包括车体主架，车体主架两侧设有轮子，车体主架内设有电机及可控制电机转速的陀螺仪，所述的车体主架包括两个相互分离的分体车架，两个分体车架中间设有一根连轴，两个分体车架以连轴为转动中心独自转动，每个分体车架内单独设有陀螺仪和电机，分体车架包括一个上盖踏板与下壳体，陀螺仪固定在上盖踏板底部，陀螺仪连接电路板，电路板连接电机，电机驱动轮子，其转向控制方法如下：

[0006] 1) 保持需要转弯的一侧分体车架的水平状态，另一侧的分体车架用脚踩动其顶部的上盖踏板使其整体沿连轴为中心转动发生倾斜；

[0007] 2) 处于水平状态的分体车架因为陀螺仪没有感应到倾角发生变化，所以电机不发生转动，而倾斜后上盖踏板底部的陀螺仪感应到倾角发生变化，输出信号给电路板使电机发生转动，从而驱动轮子开始转动；

[0008] 3) 一个轮子不转动，另一个轮子转动实现了两轮车以不转动的轮子为中心的转弯行动。

[0009] 优选的，所述的连轴两端设有螺纹，中间设有两个平面轴承，两个平面轴承中间设有轴承衬套。

[0010] 优选的，所述的下壳体与连轴连接处设有通孔，通孔外侧设有轴承沉孔，通孔内侧通过螺母与连轴端部实现固定。

[0011] 优选的，所述的上盖踏板顶部设有放置脚的凹面，凹面内设有防滑条。

[0012]　优选的，所述的电机固定在下壳体的内壁上，并通过减速齿轮组与轮子连接。

[0013]　优选的，所述的其中一个下壳体内设有蓄电池，下壳体侧壁上设有充电口。

[0014]　优选的，所述的其中一个下壳体前壁设有前射灯、尾壁设有反光灯。

[0015]　优选的，下壳体周围侧壁分布有喇叭及 2 个以上的彩灯。

[0016]　采用本技术方案后，将原本的一体式的车架主体分成两个相互分离，而且可以转动的分体车架，两个分体车架内都单独设有电机与陀螺仪，当其中一个分体车架转动时，其内部的陀螺仪会感应到倾斜角度，当陀螺仪感应到前倾或者后倾时传递信号给电机使其转速增加，角度越大，电机转速越大，驾驶时，其中一只脚踩动分体车架，另一只不踩动时，被踩动的分体车架的轮子发生转动，另一个分体车架轮子不转动时，如此便实现了转弯功能，而且踩动角度越大，转弯的角度越明显，反之转弯角度越小，这样用双脚踩动的方式能实现前后进退，用单脚踩动方式实现转弯功能，操作非常方便，而且内部结构简单，无需加装其他转弯零件，而传统的两轮车车架是一体式的，无法完成车架两边单独发生水平倾斜的问题。

附图说明

[0017]　附图 1 为本发明整体三维示意图；

[0018]　附图 2 为本发明的爆炸示意图；

[0019]　附图 3 为下壳体安装好后的示意图；

[0020]　附图 4 为连轴处放大示意图。

具体实施方式

[0021]　下面结合附图对本发明的具体实施方式作进一步说明：

[0022]　如图 1 至图 4 所示，一种自平衡两轮车的转向控制方法，包括车体主架，车体主架两侧设有轮子 1，车体主架内设有电机 2 及可控制电机转速的陀螺仪 3，所述的车体主架包括两个相互分离的分体车架 4，两个分体车架中间设有一根连轴 5，两个分体车架以连轴为转动中心独自转动，每个分体车架内单独设有陀螺仪和电机，分体车架包括一个上盖踏板 41 与下壳体 42，下壳体内壁上设有 6 个螺纹柱，上盖踏板通过这 6 个螺纹柱与下壳体固定，陀螺仪固定在上盖踏板底部，陀螺仪为一种倾角感应装置，能感应到上盖踏板与水平面的倾角，陀螺仪连接电路板，陀螺仪将感应到的倾角信号传输给电路板，由电路板控制电机的电流，从而控制电机的转速，最终电机驱动轮子转动，本两轮车的转向控制方法如下：

[0023]　1) 保持需要转弯的一侧分体车架的水平状态，另一侧的分体车架用脚踩动其顶部的上盖踏板使其整体沿连轴为中心转动发生倾斜，例如驾驶者需要右转，则右脚放置在右侧的分体车架上保持不动，保持右侧分体车架处于水平状态不倾斜，左脚则踩动左侧的分体车架使其发生转动产生倾角；

[0024]　2) 处于水平状态的分体车架因为陀螺仪没有感应到倾角发生变化，所以电机不发生转动，而倾斜后上盖踏板底部的陀螺仪感应到倾角发生变化，输出信号给电路板使电机发生转动，从而驱动轮子开始转动；

[0025]　3) 一个轮子不转动，另一个轮子转动实现了两轮车以不转动的轮子为中心的转弯行动。

[0026]　所以驾驶者只需要双脚同时踩动上盖踏板，使其沿连轴 5 转动某一倾角，两轮车就能前进或者后退，当踩动倾斜角度越大，电机转速越大，在需要转弯时，其中一只脚踩动分体车架，另一只不踩动时，被踩动的分体车架的轮子发生转动，另一个分体车架轮子不转动时，被踩动的分体车架的轮子继续往前前行，而另一个不转动的轮子则在原地不动，如此便实现了以不转动的轮子为旋转中心的转弯功能，而且踩动角度越大，转弯的角度越明显，反之转弯角度越小，这样用双脚踩动的方式能实现前后进退，用单脚踩动方式实现转弯功能，操作非常方便，而且内部结构简单，无需加装其他转弯零件。

[0027]　图 4 所示，所述的连轴两端设有螺纹，中间设有两个平面轴承 51，两个平面轴承中间设有轴承衬套 52，所述的下壳体与连轴连接处设有通孔，通孔外侧设有轴承沉孔 421，所述的平面轴承 51 外圈内置卡紧在轴承沉孔内，通孔内侧通过螺母与连轴端部实现固定，固定后两个下壳体都能平滑转动，而且左右方向被限位死，不发生左右滑动。

[0028]　图 2 中所示，所述的上盖踏板顶部设有放置脚的凹面 411，凹面内设有防滑条 411a，凹面是为了让双脚更好的放置在上盖踏板上，而冗起的防滑条则是为了防止在踩动过程中发生脚滑现象，提高驾驶安全性，所述的电机固定在下壳体的内壁上，并通过减速齿轮组 425 与轮子连接，减速齿轮组的齿轮采用斜齿轮，斜齿轮传动更平稳，噪音小。

[0029]　图 3 中所示，其中一下壳体内设有蓄电池，下壳体侧壁上设有充电口 422，方便两轮车为蓄电池充电，所述的其中一个下壳体前壁设有前射灯、尾壁设有反光灯，前射灯与反光灯提高了本发明在夜间的行驶安全性；下壳体周围侧壁分布有喇叭及 2 个以上的彩灯，这个也是提高了本发明的娱乐性，一般使用本两轮车的都比较年轻，在驾驶时陪伴一些音乐及灯光更显得时尚，而且提升了驾驶乐趣。

[0030]　以上仅就本发明较佳的实例作了说明，但不能理解为是对权利要求的限制。本发明不仅局限与以上实例，其具体结构允许有变化，本领域技术人员可以根据本发明作出各种改变和变形，只要不脱离本发明的精神，均应属于本发明所附权利要求所定义的范围。

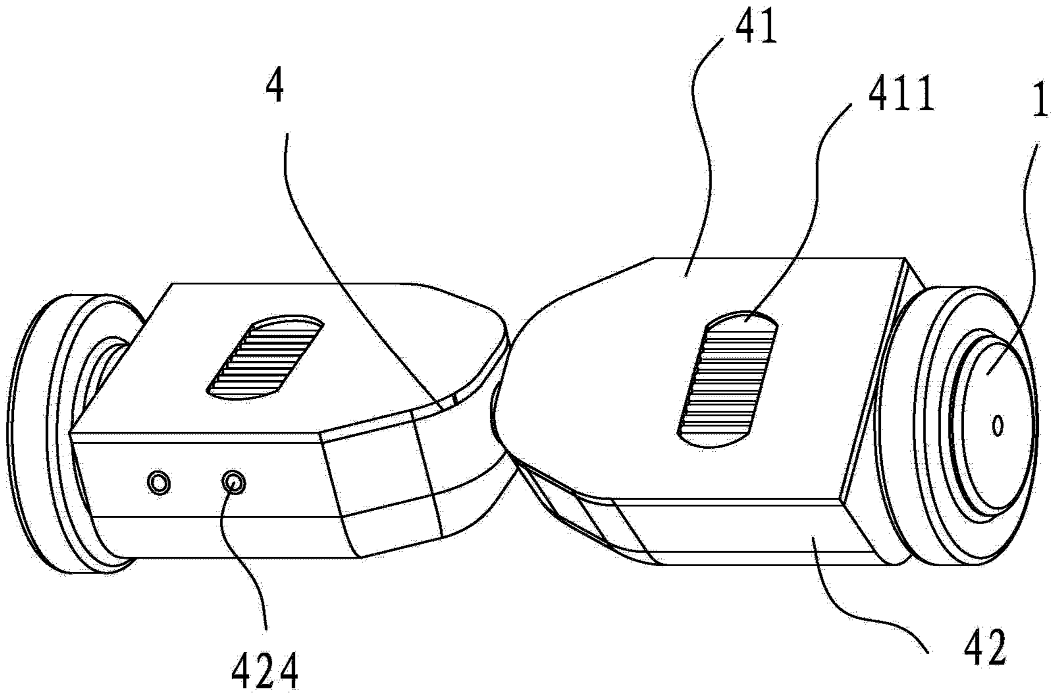


图 1

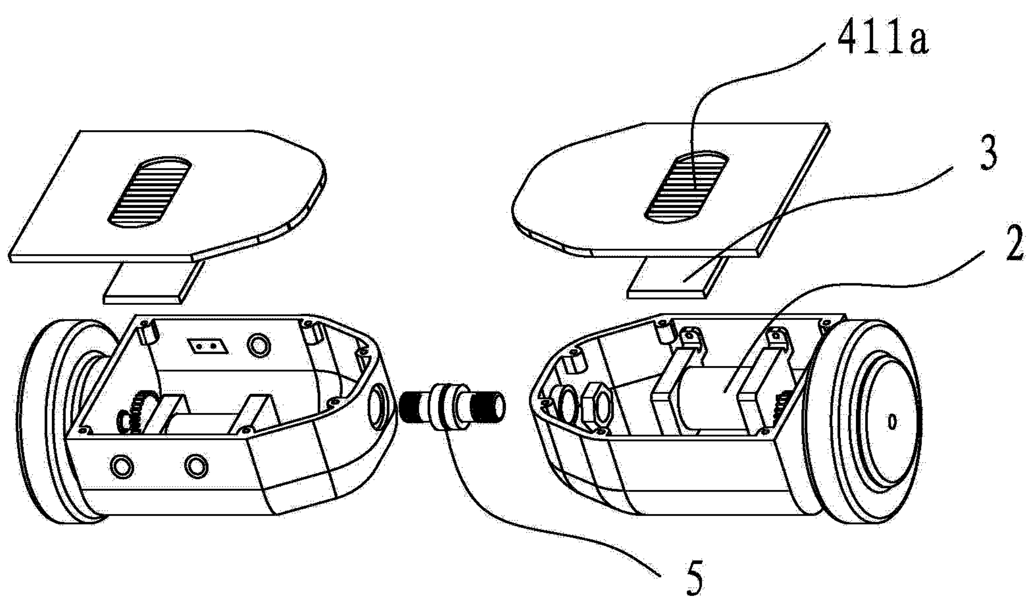


图 2

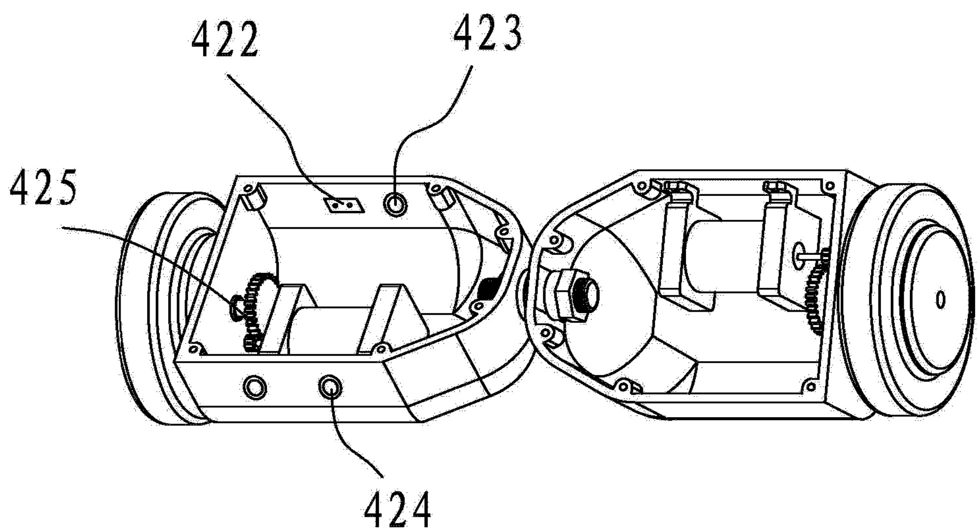


图 3

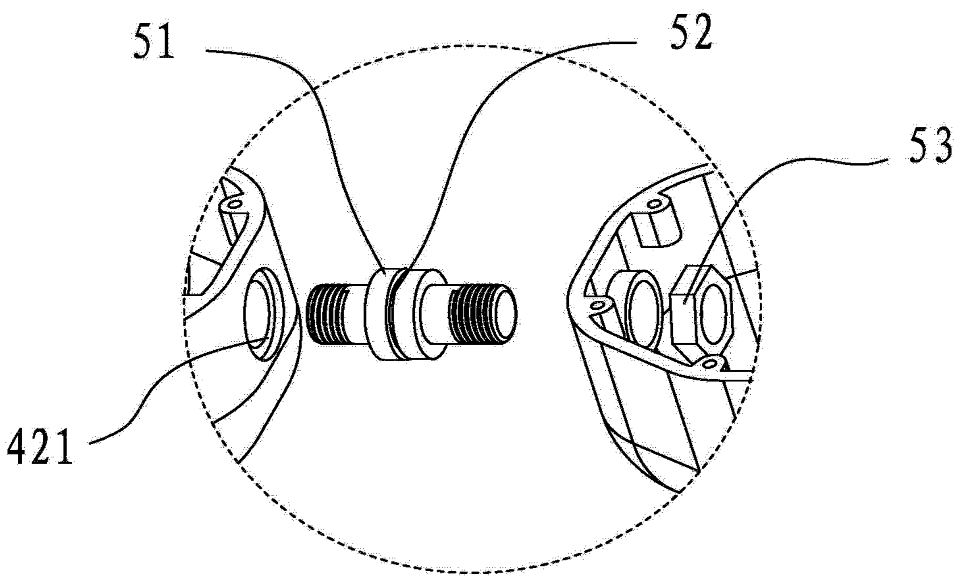


图 4

Espacenet

Bibliographic data: CN202201103 (U) — 2012-04-25

Electric two-wheel balance vehicle

Inventor(s):	BIN FENG + (FENG BIN)
Applicant(s):	JIUJIANG JIAYUAN TECHNOLOGY CO LTD + (JIUJIANG JIAYUAN TECHNOLOGY CO., LTD)
Classification:	**- international:** ***B62K3/00*** **- cooperative:**
Application number:	CN201120291319U 20110811
Priority number (s):	CN201120291319U 20110811

Abstract of CN202201103 (U)

The utility model relates to an electric two-wheel balance vehicle including a main shaft, the two ends of the main shaft are provided with a right driving wheel and a left driving wheel, a pedal, a battery, a turning handle and a control means are arranged on the main shaft. The control means includes a main gyro controller, a turning control circuit and a brushless motor drive circuit. The main gyro controller includes a master processing computer MCU, a group of vertical solid angular velocity sensors, a group of horizontal solid angular velocity sensors, a three-axial direction accelerometer, and a three-axial direction magnetic field sensor. The vehicle provided has the characteristics of light weight, flexible operation, and smooth driving, in addition, the vehicle is less in occupied area and high in efficiency.

Patent Translate

Powered by EPO and Google

Notice

CLAIMS CN202201103

1.

An electric two-wheel balance vehicle comprising a main shaft (3), a right driving wheel (1) and a left driving wheel (2) are arranged at both ends of the main shaft (3), and a pedal (5) and a battery (7) are arranged on the main shaft (3) And steering handle (4) and control device, characterized in that said control device comprises a main gyro controller (6), a steering control circuit and a brushless motor drive circuit (8), said main gyro controller (6) A central processing computer MCU, a set of vertical solid angular velocity sensors, a horizontal solid angular velocity sensor, a triaxial acceleration sensor and a triaxial magnetic field sensor.

Notice

DESCRIPTION CN202201103

The utility model relates to an electric two-wheel balance vehicle, which comprises a main shaft. Both ends of the main shaft are provided with a right driving wheel and a left driving wheel. The main shaft is provided with a pedal and a battery, and a steering handle and a control device. The control device comprises a main gyro a controller, a steering control circuit and a brushless motor drive circuit, the main gyro controller including a central processing computer MCU, a set of vertical solid angular velocity sensors, a set of horizontal solid angular velocity sensors, and a triaxial acceleration sensor And a three-axis magnetic field sensor. It has the characteristics of light weight, flexible operation and stable driving, and it has small floor space and high efficiency.

Electric two-wheel balance car

Technical field

The utility model relates to an electric two-wheel balance car.

Background technique

The development direction of electric vehicles is energy-saving and environmentally friendly. The traditional electric vehicles adopt the basic structure of internal combustion engines. They only replace the drive equipment with motors and battery packs. This structure makes the weight of electric vehicles increase, the cost is too high, and the energy is converted. From the perspective, the reduction in energy consumption is not obvious. Although the efficiency of electric drive is high, the energy-saving gain of conventional electric vehicles is limited considering factors such as the charge and discharge efficiency of the battery.

Utility model content

The utility model aims to provide an electric two-wheel balance vehicle, which has the characteristics of light weight, flexible operation and driving balance, and has small occupied area and high efficiency.

The technical solution adopted to achieve the above object includes a spindle having a right driving wheel and a left driving wheel at both ends thereof, a pedal and a battery on the main shaft, and a steering handle and a control device, wherein the control device includes a main gyro controller. A steering control circuit and a brushless motor drive circuit, the main gyro controller including a central processing computer MCU, a set of vertical solid angle velocity sensors, a set of horizontal solid angular velocity sensors, a triaxial acceleration sensor and a third Axial ground magnetic field sensor.

Compared with the prior art, the utility model has the beneficial effects that

Due to the structural design of "gyro electric control stabilization", the support and steering mechanism necessary for the traditional electric bicycle or motorcycle are omitted, so that it has the characteristics of light weight, flexible operation and stable running, and has a small footprint. efficient.

DRAWINGS

The present invention will be further described in detail below with reference to the accompanying drawings.

Figure 1 is a schematic diagram of the structure of the device.

Figure 2is a schematic view of the state of use of the device.

detailed description

The main shaft 3is provided with a right driving wheel 1 and a left driving wheel 2, the main shaft 3is provided with a pedal 5and a battery 7, and a steering handle 4and a control device, and the control device comprises a main gyro controller 6, a steering control circuit and a brushless motor drive circuit 8, the main gyro controller 6 comprising a central processing computer MCU, a set of vertical solid angle sensors, a set of horizontal solid angular velocity sensors, a triaxial acceleration sensor and A three-axis magnetic field sensor.

The device is a coaxial parallel two-wheel electric trolley. The electronic control allows the vehicle to automatically maintain balance and advance without human power. The occupant stands on the pedal of the main shaft when driving, as shown in Fig. 2, the occupant takes the initiative to move forward. Tilt the body, the car will drive forward, tilt backwards to brake or retreat, no need to distract the balance, hands can move freely. The car uses two left and right back-up wheels with a brushless hub motor. The controller controls two wheels of independent driving to provide energy by battery. Solid micro-mechanical gyro sensors and geomagnetic sensors are used to sense the vehicle's attitude.

The control device comprises a main gyro controller 6, a steering handle circuit and a brushless motor drive circuit 8. The main gyro controller 6has a central processing computer MCU, a set of vertical solid angular velocity sensors, and a set of horizontal solid angular velocity sensors. , a three-axis acceleration sensor and a three-axis magnetic field sensor. When the vehicle body is tilted, the vertical angular velocity sensor emits an angular velocity signal, and the central processing computer MCU receives this signal, and generates a corrective control signal through a proportional integral operation to send to the brushless motor driver to cause the motor and the wheel to generate a corrective torque in the opposite direction. To restore the balance of the car body, this process is completed within 20ms. During the forward process, the driving direction will be deviated due to the change of the road condition. When the horizontal angular velocity sensor detects the change of the traveling direction, the angle deviation signal is output, and the computer calculates the correction signal to control the brushless motor driver to make the left and right wheels differential. Correct the driving direction; the geomagnetic field sensor detects the magnetic flux component of the earth's magnetic field in the spatial direction, and obtains the angle information in the three-dimensional direction. The accuracy of the angle information can reach 5degrees, and the accuracy of the angle information is insufficient for motion control but has long-term stability; The solid angular velocity sensor will have an inherent "drift" phenomenon due to temperature changes, which makes the integrated angle information inaccurate. Therefore, the MCU needs to obtain absolute direction information through the geomagnetic field sensor to correct the "drift" of the angular velocity sensor to avoid cumulative error; The acceleration sensor detects the acceleration of the body in all directions to avoid violent tilting, rotation or acceleration and deceleration. In case the single-sided wheel loses control or loses the angle signal, this mechanism is used to make the body stop smoothly. The direction of gravity acceleration is also used to correct the cumulative angular error of the angular velocity sensor. The steering handle is a movable handle, and the occupant rotates the handle in the left and right direction. The main control circuit detects the rotation of the handle through the Hall sensor in the handle to obtain a steering signal, thereby controlling the differential directions of the left and right wheels as the traveling direction.

(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 202201103 U

(45)授权公告日 2012.04.25

(21)申请号 201120291319.6

(22)申请日 2011.08.11

(73)专利权人 九江嘉远科技有限公司

地址 332500 江西省九江市湖口县洋港路 18 号(老织布厂)

(72)发明人 冯斌

(74)专利代理机构 南昌新天下专利商标代理有限公司 36115

代理人 施秀瑾

(51)Int.Cl.

B62K 3/00(2006.01)

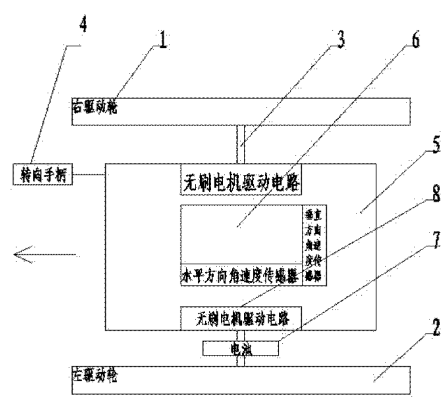
权利要求书 1 页 说明书 2 页 附图 2 页

(54)实用新型名称

一种电动两轮平衡车

(57)摘要

本实用新型涉及一种电动两轮平衡车，包括主轴，主轴两端设有右驱动轮和左驱动轮，主轴上设踏板和电池，以及转向手柄和控制装置，所述的控制装置包括主陀螺控制器，转向控制电路和无刷电机驱动电路，所述的主陀螺控制器包括中央处理计算机 MCU，一组垂直方向的固体角速度传感器，一组水平方向的固体角速度传感器，一个三轴向加速度传感器和一个三轴向地磁场传感器。具有重量轻，操纵灵活和行驶平稳的特点，且占地面积小、效率高。



CN 202201103 U

权 利 要 求 书

1. 一种电动两轮平衡车，包括主轴（3），主轴（3）两端设有右驱动轮（1）和左驱动轮（2），主轴（3）上设踏板（5）和电池（7），以及转向手柄（4）和控制装置，其特征在于，所述的控制装置包括主陀螺控制器（6），转向控制电路和无刷电机驱动电路（8），所述的主陀螺控制器（6）包括中央处理计算机MCU，一组垂直方向的固体角速度传感器，一组水平方向的固体角速度传感器，一个三轴向加速度传感器和一个三轴向地磁场传感器。

一种电动两轮平衡车

技术领域

[0001]　本实用新型涉及一种电动两轮平衡车。

背景技术

[0002]　电动车辆的发展方向是节能、环保，传统的电动车辆采用内燃机汽车的基本结构，仅仅将驱动设备换成电机与电池组，这种结构使电动汽车的重量增加，成本过高，从能量转换的角度来看，其能量消耗的降低并不明显，虽然电力驱动的效率较高，但是考虑到电池的充放电效率等因素，传统电动车辆的节能增益是有限的。

实用新型内容

[0003]　本实用新型其目的就在于提供一种电动两轮平衡车，具有重量轻，操纵灵活和行驶平衡的特点，且占地面积小、效率高。

[0004]　实现上述目的而采取的技术方案，包括主轴，主轴两端设有右驱动轮和左驱动轮，主轴上设踏板和电池，以及转向手柄和控制装置，所述的控制装置包括主陀螺控制器，转向控制电路和无刷电机驱动电路，所述的主陀螺控制器包括中央处理计算机 MCU，一组垂直方向的固体角速度传感器，一组水平方向的固体角速度传感器，一个三轴向加速度传感器和一个三轴向地磁场传感器。

[0005]　与现有技术相比，本实用新型的有益效果在于，

[0006]　由于采用了“陀螺电控增稳”的结构设计，省去了传统电动自行车或摩托车所必须的支撑和转向机构，因而具有重量轻，操纵灵活和行驶平稳的特点，且占地面积小、效率高。

附图说明

[0007]　下面结合附图对本实用新型作进一步详述。

[0008]　图 1 为本装置结构原理示意图。

[0009]　图 2 为本装置使用状态示意图。

具体实施方式

[0010]　包括主轴 3，主轴 3 两端设有右驱动轮 1 和左驱动轮 2，主轴 3 上设踏板 5 和电池 7，以及转向手柄 4 和控制装置，所述的控制装置包括主陀螺控制器 6，转向控制电路和无刷电机驱动电路 8，所述的主陀螺控制器 6 包括中央处理计算机 MCU，一组垂直方向的固体角速度传感器，一组水平方向的固体角速度传感器，一个三轴向加速度传感器和一个三轴向地磁场传感器。

[0011]　本装置是一种同轴并行的两轮电动小车，通过电子控制使该车无须人力可以自动保持平衡和前进，行驶时乘员站立在主轴部位的踏板上，如图 2 所示，乘员主动向前倾斜身体，小车即向前行驶，向后倾斜即可制动或后退，无须分神掌握平衡，双手可自由动作。该车采用左右两个积压自带有无刷轮毂电机的车轮，由控制器控制两轮独立驱动，以电池提供

能源，采用固体微机械陀螺传感器和地磁场传感器来感测车辆姿态。

[0012] 控制装置包括主陀螺控制器 6，转向手柄电路和和无刷电机驱动电路 8，主陀螺控制器 6 上有中央处理计算机 MCU、一组垂直方向的固体角速度传感器、一组水平方向的固体角速度传感器，一个三轴向加速度传感器和一个三轴向地磁场传感器。当车身倾斜时，垂直方向的角速度传感器会发出一个角速度信号，中央处理计算机 MCU 接收这一信号，通过比例积分运算产生一个矫正控制信号发送给无刷电机驱动器使电机和车轮产生反方向的矫正力矩，令车身恢复平衡，这一过程在 20ms 内完成。在前进过程中，由于路况变化，行驶方向会产生偏差，水平方向的角速度传感器检测行驶方向变化时，输出角度偏差信号，计算机据此计算出矫正信号控制无刷电机驱动器，使左右车轮差动从而修正行驶方向 ；地磁场传感器检测空间方向的地球磁场磁通分量，得到三维方向的角度信息，这一角度信息精度可达到 5 度，该角度信息精度不足以做运动控制但是具有长期稳定性 ；由于固体角速度传感器会由于温度变化产生固有的“漂移”现象，使得累计角度信息不准确，因此 MCU 需要通过地磁场传感器获得绝对方向信息，以校正角速度传感器的“漂移”，避免累积误差 ；三轴向加速度传感器检测车身在各个方向的加速度，以避免剧烈地倾斜、旋转或加减速运动，万一单侧车轮失去控制或失去角度信号，这一机制用于令车身平稳地停止。其中重力加速度的方向也用来校正角速度传感器的累积角度误差。转向手柄是一个活动把手，乘员向左右方向转动把手，主控电路通过手柄内的霍尔传感器检测其转动获得转向信号，从而控制左右车轮差动发言为行驶方向。

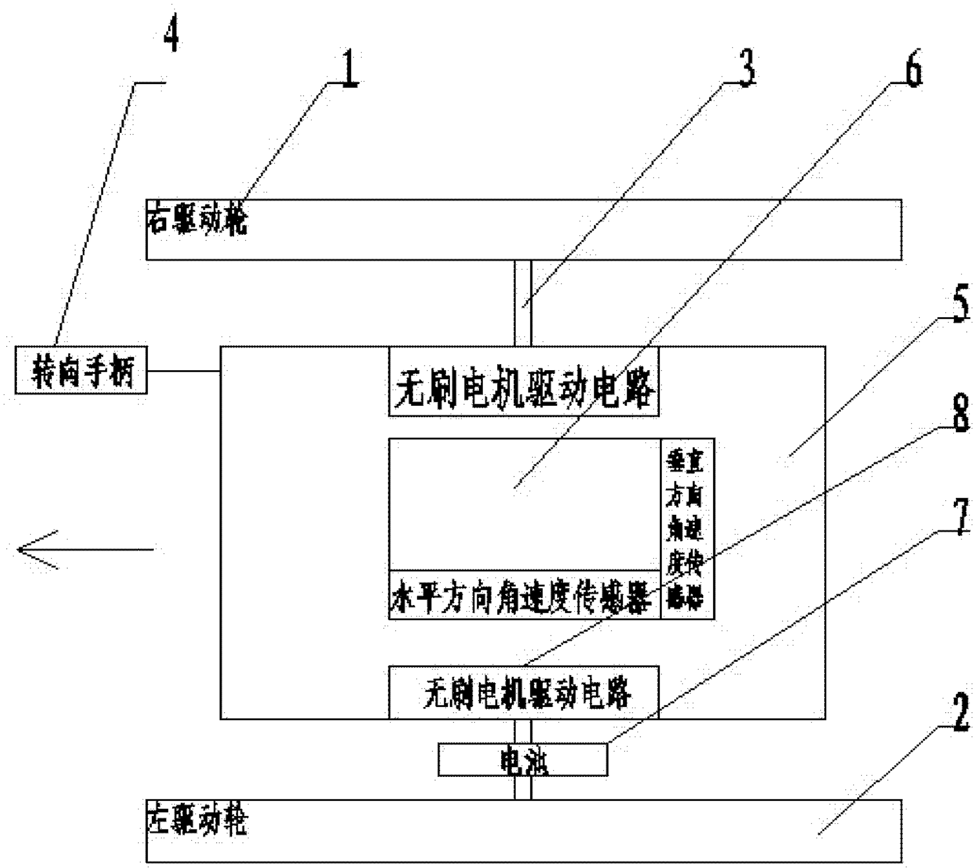

4
1
3
6
右驱动轮
5
转向手柄
无刷电机驱动电路
8
垂直方向角速度传感器
7
水平方向角速度传感器
无刷电机驱动电路
2
电池
左驱动轮

图 1

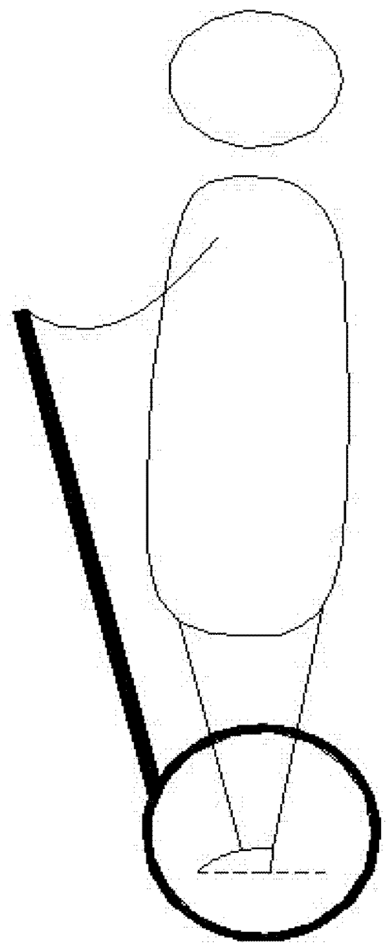


图 2

Espacenet

Bibliographic data: CN203158157 (U) — 2013-08-28

Two-wheel electromobile

Inventor(s):	CHEN HE + (CHEN HE)	
Applicant(s):	CHEN HE + (CHEN HE)	
Classification:	**- international:** **- cooperative:**	*B62K11/00*
Application number:	CN201320128469U 20130320	
Priority number(s):	CN201320128469U 20130320	

Abstract of CN203158157 (U)

The utility model provides a novel two-wheel electromobile. The two-wheel electromobile comprises two wheels which are basically parallel to each other, are arranged side by side in the right and left direction and can rotate independently. An electromobile frame is omitted to reduce the size and the weight, and a footboard also has the function of the electromobile frame. The footboard is composed of two parts which can independently tilt forwards or backwards. The two wheels are placed on two sides of the footboard, and are operated and controlled by an electronic self-balancing control system to enable the footboard to be horizontally balanced in the front and back direction. A driver standing on the footboard can operate the electromobile to run forwards or backwards or steer with two feet only by changing the gravity center of the driver. Therefore, the two-wheel electromobile is flexible in control, stable in operation, very light, easy to carry and capable of being applied in various fields.

Notice

CLAIMS CN203158157

1.

A two-wheeled electric vehicle consisting of the following components:

a first wheel and a second wheel, which are disposed substantially parallel to each other, have no common axle, and can rotate independently;

The step board is composed of a first step board and a second step board. The first step board is matched with the first wheel, the second step board is matched with the second wheel, and between the first step board and the second step board They are rotatably connected to each other, and each of them can be independently tilted forward or backward. The upper surfaces of the first and second step boards are respectively provided for the left and right legs of the driver, and the first wheel and the second wheel are located. The left and right sides of the footboard;

a first motor and a second motor, the first motor drives the first wheel, the second motor drives the second wheel, the first motor and the second motor are controlled by at least one electronic system, and the electronic control system controls the rotational speed of the wheel so that The footboard maintains a horizontal balance in the front-rear direction for the driver to control the forward, backward and steering of the two-wheeled electric vehicle.

2

A two-wheeled electric vehicle consisting of the following components:

a first wheel and a second wheel, which are disposed substantially symmetrically to each other, and which have no common axle and can rotate independently;

a torsionally deformable stepping board which is matched with the first wheel and the second wheel, and the part of the stepping board which is matched with the first wheel and the upper surface of the part of the stepping board which is matched with the second wheel are respectively provided for the driver Standing on the left and right feet, the two parts of the footboard are torsionally deformable, each of which can independently tilt forward or backward, and the first wheel and the second wheel are located on the left and right sides of the footboard;

a first motor and a second motor, the first motor drives the first wheel, the second motor drives the second wheel, the first motor and the second motor are controlled by at least one electronic system, and the electronic control system controls the rotational speed of the wheel so that The footboard maintains a horizontal balance in the front-rear direction for the driver to control the forward, backward and steering of the two-wheeled electric vehicle.

Notice

DESCRIPTION CN203158157

The utility model provides a novel two-wheel electric vehicle. There are two substantially parallel, side-by-side, independently rotatable wheels. In order to reduce the size and weight, the frame is eliminated, and the stepping board functions as a frame. The footboard consists of two parts, each of which can be tilted independently forward or backward; two wheels are placed on either side of the footboard; the two wheels are controlled by an electronic self-balancing control system, so that the footboard remains in the front-rear direction Horizontal balance. A motorist standing on a stepping board can use two feet to control the car to move forward, backward or turn, just by changing its center of gravity. Therefore, the two-wheeled electric vehicle is not only flexible in operation, stable in operation, but also particularly lightweight and easy to carry, and can be applied in various fields.

Two-wheel electric vehicle

Technical field

The invention proposes a self-balancing two-wheel electric vehicle. Its two wheels are arranged under the footboards and are arranged substantially parallel on the left and right sides. Each wheel has an independent electronic self-balancing control system and a power drive system. The driver's feet stand on the footboard. Maneuver the forward, reverse and steering of the two-wheeled electric vehicle. Specifically, this is a standing, self-balancing electric two-wheeled vehicle that is controlled by the driver.

Background technique

A technical example of one of the most well-known two-wheeled self-balancing electric vehicles in the world is disclosed by Kamen et al. (U.S. Patent No. 6, 302, 230B1, Oct. 16, 2001). Kamen's patent summarizes the background technology of self-balancing two-wheel electric vehicles at the time, revealing their related technologies of power drive and electronic control balance. The self-balancing two-wheeled electric vehicle disclosed in the Kamen patent has two wheels arranged in parallel, with a platform between the two wheels (or above) for the rider (operator) to stand; it is a single The shaft double wheel design has a common drive shaft connecting the two wheels; it also provides a handlebar for steering to improve the stability of the rider's standing and to control the direction in which the car travels. This self-balancing two-wheeled electric vehicle was produced and put on the market in 2002. The product of the two-wheeler is called Segway. This two-wheeled vehicle has been applied in many countries and in many aspects, and it is an effective medium and short distance transportation vehicle.

The Segway has a weight of about 40kg, which is cumbersome and expensive. These shortcomings hinder its further promotion and application. Some users want to use a lighter two-wheeled electric vehicle, which requires easy disassembly and assembly and greater portability. It also requires lowering costs to meet the needs of a wider range of markets.

In addition, we have successfully developed an extremely lightweight self-balancing unicycle electric vehicle and have disclosed its technical features and technical solutions (CN 102275621A, 20111214). The uni-wheel electric vehicle has a maximum speed of about 15km/h and a weight of about 13kg. When riding, the operator's two feet stand on two footboards respectively. The footboards are fixed on the wheel frame and are placed on both sides of the wheel, which are located below the axle. When the reference vertical axis between the operator's center of gravity and the axle is perpendicular to the ground, the speed of the self-balancing unicycle is zero. Because the footboard is fixed on the wheel frame, when the operator standing on the footboard tilts the center of gravity forward or backward, the wheel frame is also tilted forward or backward with the action of the operator. The status signal of the front low or rear tilt (ie, the position state of the car) is transmitted to the micro-processing through the gyroscope, and the micro-processing drive motor advances or retracts the single-wheel electric vehicle. If the operator tilts the center of gravity toward the left and right, the vehicle can be turned. Lightweight, flexible and easy to carry are the outstanding advantages of this self-balancing unicycle. However, the market also calls for the development of a lightweight, stand-up, two-wheeled electric vehicle that is not hand-operated.

Therefore, it is a common expectation in the related field to develop a self-balancing two-wheel electric vehicle that is portable, low in cost, simple in operation and stable in operation, and is used in relevant occasions.

Summary of the invention

The self-balancing two-wheeled electric vehicle proposed by the invention has two substantially parallel, side-by-side, independently rotatable wheels. In order to reduce the size and weight, the frame is eliminated, and the stepping board functions as a frame. Two wheels are placed below the footboard. Each wheel has an electronic self-balancing control system and a power drive system that drives the wheels to roll forward or backward based on positional changes in the fore and aft direction of the footboard, keeping the footrests balanced in the fore and aft direction. Thus, the driver standing on the footboard can control the two-wheeled electric vehicle to advance, retreat or turn.

In summary, the invention disclosed in the present invention is: a two-wheeled electric vehicle having the following components: a first wheel and a second wheel, which are disposed substantially parallel to each other, without a common axle The pedal can be independently rotated; the step board is composed of the first step board and the second step board, the first step board is matched with the first wheel, the second step board is matched with the second wheel, and the first step board is matched with the first step board The second tread plates are rotatably connected to each other, and each of them can be independently tilted forward or backward. The upper surfaces of the first tread plate and the second tread plate are respectively provided for the left and right legs of the driver, first The wheel and the second wheel are located on the left and right sides of the footboard; the first motor and the second motor, the first motor drives the first wheel, the second motor drives the second wheel, and the first motor and the second motor are at least one electronic system Controlled, the electronic control system controls the rotational speed of the wheel so that the footboard maintains a horizontal balance in the front-rear direction for the driver to control the forward, backward and steering of the two-wheeled electric vehicle.

The driver standing on the footboard, the two feet stand in the same direction as the wheel rotates. Just change the center of gravity to control the car to move forward, backward or turn. Therefore, the two-wheeled electric vehicle is not only flexible in operation, stable in operation, but also particularly lightweight and easy to carry, and can be applied in various fields.

Those skilled in the art will be able to further understand the technical features of the present invention and other related advantages after reviewing the detailed description below in conjunction with the drawings.

DRAWINGS

BRIEF DESCRIPTION OF THE DRAWINGS Figure 1 is a side elevational perspective view of an example in accordance with the present invention. Its footboard is composed of two parts.

2is a top perspective view of a side view in accordance with another example of the present invention. Its footboard is a whole.

Figure 3is a side elevational perspective view of the example of Figure 2.

4is a side perspective view of still another example in accordance with the present invention.

These examples will be detailed below.

detailed description

Referring to Figure 1, this is an embodiment of a two-wheeled self-balancing electric vehicle for personal use as set forth in the present invention, which is a side elevational view thereof. The footrest of the two-wheel self-balancing electric vehicle 100in the figure is composed of two parts, a left half foot board 110and a right half foot board 111. The tread plates of the two halves are rotatably coupled to each other, and they can each be tilted forward or backward without affecting each other. There are also two wheels that are respectively mated with the footboard, the left wheel 120is mated with the left half footboard 110, and the right wheel 121 is mated with the right half footboard 111. The left wheel 120and the right wheel 121 are arranged opposite each other in parallel, and the two wheels are independently rotatable and are rotatable in different directions with different speeds. The left wheel 120and the right wheel 121 are each driven by a single motor. The upper surfaces of the left half foot board 110and the right half foot board 111 are respectively provided for the driver's foot and are the driver's foot plane. When the two legs of the driver stand on the left half foot plate 110and the right half foot board 111 substantially in parallel, the front and rear directions of the standing driver are the front and rear directions of the two-wheeled electric vehicle. Relative to the ground, the two halves of the footboard can each be tilted forward or backward; the two wheels can also roll on the ground forward or backward. Each of the motors is individually controlled by an electronic self-balancing control system that maintains the balance of the two-wheeled electric vehicle's footboard in the fore and aft direction. The electronic control system is usually set to be balanced when the plane of the footboard is parallel to the ground, that is to say: the electronic control system makes the footboard of the two-wheeled electric vehicle generally tend to be parallel to the ground. When the electronic self-balancing control system detects that the footboard has an oblique angle with respect to the ground in the front-rear direction, the motor is instructed to drive the wheel to accelerate or decelerate, so that the two-wheeled electric vehicle's footboard is balanced in the front-rear direction. Of course, the electronic control system can also set a certain position of the footboard to a balanced state, which can be used to control the balance of the car. The technology of the electronic self-balancing control system is well known to those skilled in the art and can be implemented, for example, by electronic kits and circuits such as various gyro sensors or electronic accelerometers. The electronic self-balancing control system can be used in two sets, or an electronic system can be used to control two separate subsystems. The electronic self-balancing control system drives the wheel rotation through a drive system including an electric motor and a transmission mechanism. Both the electronic self-balancing control system and the drive system are placed on the underside of the footboard. For safety reasons, the cover is covered with an electronic system and a transmission system.

When the electronic self-balancing control system is working, the plane of the footboard is tilted forward, the wheel rolls forward; the foot plane is tilted back, and the wheel rolls backwards. As the angle of the tilt increases, the acceleration becomes larger; when the angle of the tilt decreases, the acceleration becomes smaller. Because each wheel has its own independent motor controlled by the electronic self-balancing control system, the driver can change the center of gravity before and after, so that the footboard is tilted to control the forward speed of the two-wheel self-balancing electric vehicle; when the driver's left foot and The footboards on which the right foot is stepped are tilted at different angles so that the speeds of the two wheels are different, and the running direction of the two-wheeled self-balancing electric vehicle can be controlled.

By the way, the functions of the left and right halves of the two-wheeled self-balancing electric vehicle are the same. Only when the driver stands on the top, there is a sense of left and right, so there is no practical point. The above is for the convenience of the description, only the name of the "left" and "right" in front of the parts, such as the use of "first" and "second" instead, will be more precise. Therefore, the name of the specification can be replaced with the names of the first wheel, the second wheel, the first foot plate, the second foot plate, the first motor, the second motor, and the like.

Referring to Figure 2, this is another embodiment of a two-wheeled self-balancing electric vehicle for personal use in accordance with the present invention, which is a perspective view from a side elevation. Figure 3 is a side elevational perspective view of the embodiment. The difference between this solution and the solution of Fig. 1 is that the step board is not split into two parts. As can be seen from the figure, the foot plate 230 of the two-wheel self-balancing electric vehicle 200 in the present embodiment appears to be an integral continuous component, and the left and right two-step tread plates are connected by a twistable connection structure. . The twistable connector is disposed on the bottom surface of the footboard. The middle part of the step board, that is, the left and right parts of the foot board can be connected by a twistable flexible material, and the left and right parts of the foot board are connected as a whole. The twistable connecting structure is arranged on the bottom surface of the step board, and the step board after the structure connecting member can be twisted, so that the step board becomes a torsionally deformable step board.

The technical features of the connector of the twistable structure have been disclosed in another patent (CN 101513569B, 2011.07.06). It is a new, flexible, twistable connection for personal skating sports equipment. The part can be twisted and cannot be bent; it is both a twistable spring and a connecting piece. It is simple to manufacture and install; it is easy to precisely control the uniformity of performance; there is no slack; there is no wear during work. It has high reliability.

The left and right ends of the overall continuous step board 230have considerable strength and can withstand the standing of the driver. The middle part of it can be distorted. As the driver's center of gravity moves forward and backward, on the step board 230, the foot planes of the left and right portions on which the driver's feet are stepped may be twisted toward the front or the back, similar to the scheme shown in FIG. 1, the step board 230 The functions of the left half and the right half correspond to the left half foot plate 110and the right half foot board 111 in the plan of Fig. 1, each of which can be tilted forward or backward.

The two wheels of the two-wheeled electric vehicle 200are respectively mated with the footboard 230and also coupled to the bottom surface of the footboard 230. The left wheel 210is mated to the left half of the footplate 230, and the right wheel 211 is mated to the right half of the footplate 230. The left wheel 210and the right wheel 211 are arranged opposite each other in parallel, and the two wheels are independently rotatable and are rotatable in different directions at different speeds. As with the solution of Fig. 1, the left wheel 211 and the right wheel 211 are also each driven by a motor. Each of the motors is also individually controlled by an electronic self-balancing system such that the upper surface of the two-wheeled electric vehicle's footboard is generally intended to be parallel to the ground. For safety reasons, the motor and electronic self-balancing control system are also placed in the cavity of the footboard or covered with a cover. The same principle, because each wheel has its own independent motor and electronic self-balancing control system, the driver can use two feet to tilt the foot plane to control the forward speed and running direction of the two-wheel self-balancing electric vehicle.

3is a further embodiment of a two-wheeled self-balancing electric vehicle for personal use according to the present invention. The footboard of the two-wheel self-balancing electric vehicle 300is composed of two-part stepping boards that can be independently twisted: a first step board 310and a second step board 330. The upper surfaces 312and 332of the two portions of the footboard are respectively supported by the operator's feet, and the lower portions of the two stepping boards are respectively covered by the bottom covers 311 and 331. The two-wheel self-balancing electric vehicle also has two left and right wheels and a wheel cover: a first wheel 315and its wheel cover 316, a second wheel 335and its wheel cover 336.

The standing direction of the operator's feet on the footboard is substantially parallel to the direction of rotation of the wheels on both sides. The width of the upper surfaces 312and 332of the footboard (the width of the direction of rotation of the wheel) and the area are such as to accommodate the standing of the operator's feet. The upper surfaces 312and 332of the footboard should be of sufficient strength to support the operator's standing on both feet. As with the principle of the above example, the cavity between the upper surface of the footboard and the bottom cover is also used to place the electronic self-balancing control system and the drive system. In order to protect these built-in components, the bottom cover of the footboard should also have considerable strength. The upper surface and bottom cover of the footboard can be made of metal, reinforced plastic or composite material.

As in the previous example, the wheels 315and 335to which the left and right ends of the entire footboard are coupled are each driven by an electric motor. Each of the motors is also individually controlled by an electronic self-balancing system such that the upper surface of the two-wheeled electric vehicle's footboard is generally intended to be parallel to the ground. The left and right parts of the footboard can be twisted independently forward or backward. When the electronic self-balancing control system is working, the plane of the footboard is tilted forward, the wheel rolls forward; the foot plane is tilted back, and the wheel rolls backwards. As the angle of the tilt increases, the acceleration becomes larger; when the angle of the tilt decreases, the acceleration becomes smaller. Because each wheel has its own independent motor controlled by the electronic self-balancing control system, the driver can change the center of gravity before and after, so that the footboard is tilted to control the forward speed of the two-wheel self-balancing electric vehicle; when the driver's left foot and The footboards on which the right foot is stepped are tilted at different angles so that the speeds of the two wheels are different, and the running direction of the two-wheeled self-balancing electric vehicle can be controlled. As in the previous example, the functions of the left and right halves of the two-wheeled self-balancing electric vehicle are the same.

Incidentally, it should be noted that, for the sake of safety, the upper surfaces of the first and second tread plates of the above examples may each be provided with one sensor (for example, a pressure sensor), and when they perceive the operator's left and right feet, they stand still. The electronic self-balancing control system can be activated to start the work on the upper surface of the footboard. This is a technique known in the art and is described here.

In general, the present invention proposes a novel two-wheeled electric vehicle, the footboard is composed of two halves, which can be independently turned forward or backward, and the two wheels disposed on the left and right have no common axle. Rotating independently, the left and right legs of the driver stand on the left and right footboards respectively, and it is safe and autonomous to control the forward, backward and steering of the two-wheeled electric vehicle.

While the above-described embodiments are intended to be illustrative of a particular embodiment, the invention is not limited to the scope of the embodiments. Therefore, the scope of the present invention should be determined by the appended claims and their corresponding documents, and not by the examples given above. In addition, it should be understood that further modifications can be made to the invention. The patent is intended to cover various modifications, uses, or improvements in accordance with the principles of the present invention. It is also intended to be deviated from the known embodiments or embodiments disclosed herein. The scope of the principle.

(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 203158157 U
(45)授权公告日 2013.08.28

(21)申请号 201320128469.4

(22)申请日 2013.03.20

(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)发明人 陈和

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

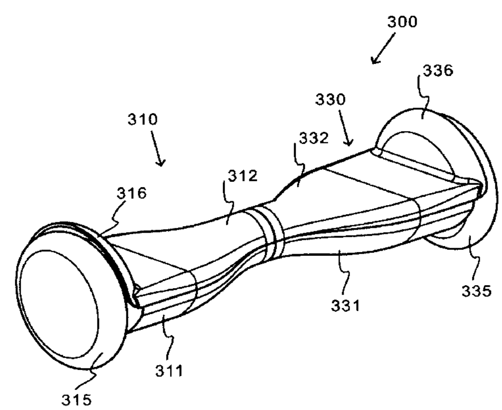
权利要求书1页 说明书5页 附图2页

(54)实用新型名称

两轮电动车

(57)摘要

本实用新型提出了一种新型的两轮电动车。有两个基本平行的、左右并排的、能独立转动的轮子。为了缩小体积与重量，省去了车架，踏脚板兼任车架的功能。踏脚板由两部分组成，它们各自能够独立地朝前或朝后倾斜；两个车轮设置在踏脚板的两侧；两个车轮被电子自平衡控制系统所操控，使踏脚板保持前后方向上的水平平衡。站立在踏脚板上的驾车者，只要改变其重心即可用两脚来操控车子朝前、朝后或转向行进了。因此，该种两轮电动车不仅操纵灵活、运行稳定，而且特别轻便、易于携带，可以在多种领域内得到应用。



CN 203158157 U

1. 一种两轮电动车，它是有如下部件所构成：

第一车轮与第二车轮，它们是彼此基本平行地左右设置的，没有共同的车轴，能独立地转动；

踏脚板是由第一踏脚板与第二踏脚板所组成的，第一踏脚板与第一车轮相配接，第二踏脚板与第二车轮相配接，第一踏脚板与第二踏脚板之间是互相可转动地连接着的，它们各自能够独立地朝前或朝后倾斜，第一踏脚板与第二踏脚板的上表面分别供驾车者左右两脚站立，第一车轮与第二车轮位于踏脚板的左右两侧；

第一电动机与第二电动机，第一电动机驱动第一车轮，第二电动机驱动第二车轮，第一电动机与第二电动机至少被一套电子系统所控制，电子控制系统控制车轮的转动速度，使踏脚板保持前后方向上的水平平衡，供驾车者用来操控两轮电动车的向前、朝后与转向。

2. 一种两轮电动车，它是有如下部件所构成：

第一车轮与第二车轮，它们是彼此基本对称地左右设置的，它们没有共同的车轴，能独立地转动；

一个可扭转变形的踏脚板，它与第一车轮、第二车轮相配接，与第一车轮相配接的那部分踏脚板以及与第二车轮相配接的那部分踏脚板的上表面分别供驾车者左右两脚站立，这两部分踏脚板之间是可扭转变形的，它们各自能够独立地朝前或朝后倾斜，第一车轮与第二车轮都位于踏脚板的左右两侧；

第一电动机与第二电动机，第一电动机驱动第一车轮，第二电动机驱动第二车轮，第一电动机与第二电动机至少被一套电子系统所控制，电子控制系统控制车轮的转动速度，使踏脚板保持前后方向上的水平平衡，供驾车者用来操控两轮电动车的向前、朝后与转向。

两轮电动车

技术领域

[0001]　本发明提出了一种自平衡式的两轮电动车。它的两个轮子设置在踏脚板的下方，基本平行地排列在左右两边，每个轮子都有独立的电子自平衡控制系统与动力驱动系统，驾车者的两脚站立在踏脚板上，即可操纵两轮电动车的前进、后退与转向。确切地说，这是一种站立式的、由驾车者操控的、自平衡式电动两轮车。

背景技术

[0002]　当前世界上最有名的一种两轮自平衡电动车的技术实例，是由 Kamen 等人的专利 (U.S.Patent No.6,302,230B1，Oct.16，2001) 所揭示的。Kamen 的专利总结了当时自平衡两轮电动车的背景技术，揭示了它们动力驱动与电子控制平衡的相关技术。Kamen 专利所揭示的自平衡两轮电动车，它有相对平行排列的两个轮子，两个轮子之间（或之上）设有一个供骑车人（操作者）站立的平台；它是单轴双轮的设计，有一根共同的驱轴将两个轮子相连；它还设置了一个操纵用的手把杆，用来改善骑车人站立的稳定性，以及控制车子行进的方向。这种自平衡两轮电动车，于 2002 年开始生产并投入市场，该两轮车的商品，名叫"赛格威"(Segway)。这种两轮车在多个国家、多个方面都已得到了应用，不啻为一种有效的中、短距离的运输工具。

[0003]　赛格威车的自重约有 40 公斤，比较笨重，价格也比较昂贵。这些缺点妨碍了它的进一步推广应用。某些用户希望使用较轻便的两轮电动车，要求拆装方便，具有较大的可携带性。还要求降低成本，满足更大范围市场的需要。

[0004]　另外，我们成功研制出了一种极其轻便的自平衡独轮电动车，并已公开了它的技术特征与技术方案 (CN102275621A，20111214)。该独轮电动车的最大速度约为 15 公里 / 小时，自重约 13 公斤。骑行时，操作者的两只脚分别站立两只踏脚板上，踏脚板是固定在轮架上的，设置在轮子的两侧，位在轮轴的下方。当操作者的重心与轮轴之间的参考纵轴垂直于地面时，自平衡独轮电动车的速度为零。因为踏脚板是固定在轮架板上的，当站在踏脚板上的操作者将重心前倾或后仰时，致使轮架板也随着操作者的行动一同前倾或后翘，轮架板前低或后翘（即是车子的位置状态）的状态信号通过陀螺仪传给微处理，微处理驱动电机使独轮电动车前进或后退。如操作者将重心朝左右倾侧时，则可使车辆转向。轻巧灵活、便于携带是该自平衡独轮电动车的突出优点。然而，市场还要求发展一种轻便的、站立式的、不用手操控的两轮电动车。

[0005]　因此，研制一台可便携、成本较低、操作简单、运行稳定的自平衡两轮电动车，供有关场合使用，是有关领域的普遍期望。

发明内容

[0006]　本发明提出的自平衡式两轮电动车是有两个基本平行的、左右并排的、能独立转动的轮子。为了缩小体积与重量，省去了车架，踏脚板兼任车架的功能。两个轮子设置在踏脚板的下方。每个轮子各有一个电子自平衡控制系统和一个动力驱动系统，它们是根据踏

脚板的前后方向上的位置变化，来驱动车轮向前或朝后滚动，使踏脚板在前后方向上保持平衡。从而使站立在踏脚板上的驾车者能驾驭两轮电动车前进、后退或转向。

[0007] 总结来说，本发明所揭示的发明内容是：一种两轮电动车，它是有如下部件所构成：第一车轮与第二车轮，它们是彼此基本平行地左右设置的，没有共同的车轴，能独立地转动；踏脚板是由第一踏脚板与第二踏脚板所组成的，第一踏脚板与第一车轮相配接，第二踏脚板 与第二车轮相配接，第一踏脚板与第二踏脚板之间是互相可转动地连接着的，它们各自能够独立地朝前或朝后倾斜，第一踏脚板与第二踏脚板的上表面分别供驾车者左右两脚站立，第一车轮与第二车轮位于踏脚板的左右两侧；第一电动机与第二电动机，第一电动机驱动第一车轮，第二电动机驱动第二车轮，第一电动机与第二电动机至少被一套电子系统所控制，电子控制系统控制车轮的转动速度，使踏脚板保持前后方向上的水平平衡，供驾车者用来操控两轮电动车的向前、朝后与转向。

[0008] 站立在踏脚板上的驾车者，两脚站立的方向与轮子转动的方向一致，只要改变其重心即可操控车子朝前、朝后或转向行进了。因此，该种两轮电动车不仅操纵灵活、运行稳定，而且特别轻便、易于携带，可以在多种领域内得到应用。

[0009] 业内有经验人士在结合图纸审阅下文的详细叙述后，可以进一步了解本发明的技术特点以及其它有关的优点了。

附图说明

[0010] 图 1 是根据本发明所提出的一个实例的仰视侧向的透视图。它的踏脚板是有两部分所组成的。

[0011] 图 2 是根据本发明所提出的另一个实例的俯视侧向的透视图。它的踏脚板是一个整体。

[0012] 图 3 是图 2 实例的仰视侧向的透视图。

[0013] 图 4 是根据本发明所提出的又一个实例的侧向透视图。

[0014] 这些实例，将在下文中详述。

具体实施方式

[0015] 参阅图 1，这是本发明所提出的个人使用的两轮自平衡电动车的一种实施方案，该图是它的仰视侧向的透视图。图中的两轮自平衡电动车 100 的踏脚板是有两部分组成，左半踏脚板 110 与右半踏脚板 111。这两半部分的踏脚板互相是可转动地连接着的，它们能够互不影响地各自朝前或朝后倾斜。还有两个车轮分别与踏脚板相配接，左车轮 120 与左半踏脚板 110 相配接，右车轮 121 与右半踏脚板 111 相配接。左车轮 120 与右车轮 121 是互相平行地相对排列的，这两个轮子能够独立地转动，彼此可以用不同的速度、朝不同的方向旋转。左车轮 120 与右车轮 121 各自用一个电动机驱动。左半踏脚板 110 与右半踏脚板 111 的上表面，可分别供驾车者的脚站立，是驾车者的踏脚平面。驾车者的两脚基本平行地分别站在左半踏脚板 110 与右半踏脚板 111 上时，站立着的驾车者的前后方向也就是两轮电动车的前后方向。相对于地面而言，两半部分的踏脚板各自都可朝前或朝后倾斜；两个轮子也可朝前或朝后在地面上滚动。每一个电动机各自被一套电子自平衡系统所控制，该电子自平衡控制系统使两轮电动车的踏脚板在前后方向上保持平衡。电子控制系统通常设

定，踏脚板的平面与地面相平行时为平衡状态，也就是说 ：电子控制系统使两轮电动车的踏脚板通常是倾向于要与地面保持平行。当电子自平衡控制系统探测到踏脚板相对于地面在前后方向上有一倾斜角度时，就会指令电动机驱使轮子加速或减速，使得两轮电动车的踏脚板在前后方向上保持平衡。当然，电子控制系统也可将踏脚板的某一位置设定为平衡状态，同理可以用来控制车子的平衡。该电子自平衡控制系统的技术已为业内人士所熟知，例如可用各种陀螺传感器或电子加速度计等电子套件与线路来实现。电子自平衡控制系统可以用两套，也可以用一个电子系统控制两个独立的分系统。电子自平衡控制系统通过包括电动机与传动机构的驱动系统驱动车轮转动。电子自平衡控制系统与驱动系统都被设置在踏脚板的底面，为了安全起见，用罩子盖住，图上未画出电子系统与传动系统。

[0016] 当电子自平衡控制系统工作时，踏脚板的平面朝前倾斜，轮子就朝前滚动 ；踏脚平面朝后倾斜，轮子就朝后滚动。倾斜的角度增大，则加速度变大 ；倾斜的角度减小，则加速度变 小。因为每个轮子有自己独立的被电子自平衡控制系统控制的电动机，驾车者可以前后改变其重心，使踏脚板发生倾斜，来操控两轮自平衡电动车的前进速度 ；当驾车者左脚与右脚所踩的踏脚板，分别倾斜不同的角度，使得两只轮子的速度不同，就可以操控两轮自平衡电动车的运行方向。

[0017] 顺便指出，该两轮自平衡电动车左右两半部分的功能是相同的，只有当驾车者站在上面时才有左右的意义，所以没有实际意义的左右之分。上文是为了叙述上的方便，才在部件前冠以“左”与“右”的名称，如用“第一”与“第二”来代替，会更确切一些。因此，规范的名称可以改用第一车轮、第二车轮，第一踏脚板、第二踏脚板，第一电动机、第二电动机等名称来替代。

[0018] 参阅图 2，这是根据本发明所提出的个人使用的两轮自平衡电动车的另一种实施方案，这是俯视侧向的透视图。图 3 是该实施方案的仰视侧向的透视图。本方案与图 1 方案的不同处是没有将踏脚板分裂成两部分。从图上可见，本方案中的两轮自平衡电动车 200 的踏脚板 230，看起来是一个整体连续的组件，它的左右两部分踏脚板是用一种可扭转的连接结构相连接起来的。该种可扭转的连接件设置在踏脚板的底面。踏脚板上的中间部分，即左右两部分踏脚板之间可用可扭转的柔性材料相连接，将左右两部分踏脚板连接成一个整体。可扭转的连接结构设置在踏脚板的底面，设置可扭转结构连接件后的踏脚板，使踏脚板成为可扭转变形的踏脚板了。

[0019] 该种可扭转结构的连接件的技术特点，本人已在另一个专利 (CN101513569B，2011.07.06) 中揭示。它是一种崭新的、用于个人滑行运动器材的、可扭转的柔性连接结构。该部件能扭转，不能弯曲 ；既是可扭转的弹簧，又是连接件。它的制作与安装较为简单 ；易于精确控制性能的均一性 ；而且没有松弛现象 ；工作过程中没有磨损。它具有很高的可靠性。

[0020] 整体连续的踏脚板 230 的左右两端是有相当的强度，能承受驾车者的站立。它的中间部分能够扭曲。随着驾车者的重心前后的移动，在踏脚板 230 上，驾车者两脚所踩踏的左右部分的踏脚平面，可以朝前或朝后扭曲，与图 1 所示的方案相似，踏脚板 230 的左半部分与右半部分的功能相当于图1 方案中的左半踏脚板 110 与右半踏脚板 111，各自可以随意地朝前或朝后倾斜。

[0021] 两轮电动车 200 的两个车轮分别与踏脚板 230 相配接，也配接在踏脚板 230 的底

面。左车轮 210 配接在踏脚板 230 的左半部分，右车轮 211 配接在踏脚板 230 的右半部分。左车轮 210 与右车轮 211 是互相平行地相对排列的，这两个轮子能够独立地转动，彼此可以用不同的速度、朝不同的方向旋转。与图 1 的方案相同，左车轮 211 与右车轮 211 也是各自被一个电动机驱动。每一个电动机也各自被一套电子自平衡系统控制，使两轮电动车的踏脚板的上表面通常是倾向于要与地面保持平行。为了安全起见，电动机与电子自平衡控制系统也都被设置在踏脚板的空腔内，或用罩子盖住。同样的原理，因为每个轮子有自己独立的电动机与电子自平衡控制系统，驾车者可以用两脚使踏脚平面发生倾斜，来操控两轮自平衡电动车的前进速度以及运行方向。

[0022] 图 3 是本发明所提出的个人使用的两轮自平衡电动车的又一个实施方案。两轮自平衡电动车 300 的踏脚板是由可独立扭转的两部分踏脚板所组成的 ：第一踏脚板 310 以及第二踏脚板 330。这两部分踏脚板的上表面 312 与 332 分别供操作者的两脚站立，这两部分踏脚板的下方分别被底盖板 311 与 331 所包覆。两轮自平衡电动车还有左右两个车轮以及轮罩 ：第一车轮 315 及其轮罩 316，第二车轮 335 及其轮罩 336。

[0023] 踏脚板上操作者双脚的站立方向，与两侧车轮的转动方向基本上是平行的。踏脚板的上表面 312 与 332 的宽度（车轮转动方向的宽度）与面积要能容纳操作者双脚的站立。踏脚板的上表面 312 与 332 应有足够的强度，能支撑操作者双脚的站立。与上述实例的原理相同，踏脚板的上表面与底盖板之间的空腔也是用来放置电子自平衡控制系统与驱动系统。为了保 护这些内置的部件，踏脚板的底盖板也应具有相当的强度。踏脚板的上表面与底盖板可用金属、增强塑料或复合材料来制造。

[0024] 与上例相同，整个踏脚板的左右两端所配接的轮子 315 与 335，各自被一个电动机驱动。每一个电动机也各自被一套电子自平衡系统控制使两轮电动车的踏脚板的上表面通常是倾向于要与地面保持平行。踏脚板的左右两部分是可以独立朝前或朝后扭转的。当电子自平衡控制系统工作时，踏脚板的平面朝前倾斜，轮子就朝前滚动 ；踏脚平面朝后倾斜，轮子就朝后滚动。倾斜的角度增大，则加速度变大 ；倾斜的角度减小，则加速度变小。因为每个轮子有自己独立的被电子自平衡控制系统控制的电动机，驾车者可以前后改变其重心，使踏脚板发生倾斜，来操控两轮自平衡电动车的前进速度 ；当驾车者左脚与右脚所踩的踏脚板，分别倾斜不同的角度，使得两只轮子的速度不同，就可以操控两轮自平衡电动车的运行方向。与前例相同，该两轮自平衡电动车左右两半部分的功能是相同的。

[0025] 还要顺便指出的是，为了安全起见，以上各实例的第一与第二踏脚板的上表面都可各设置一个传感器（例如 ：压力传感器），当它们感知操作者的左右双脚都站稳在踏脚板的上表面时，才能许可电子自平衡控制系统启动工作。这是业内已知的技术，毋用在此细述了。

[0026] 总的来说，本发明提出了一种新颖的两轮电动车，踏脚板是由两半部分组成，它们可以独立地朝前或朝后扭转，左右设置的两个车轮没有共同的车轴，能独立地转动，驾车者的左右两脚分别站立在左右踏脚板上，就能安全自主地操控两轮电动车的向前、朝后与转向了。

[0027] 虽然以上叙述的实施方案包含了许多特定的细节，但是不应构成对实施方案包括范围的限制，而且也不应仅仅限于目前提出的这些特定方案的图示上。因此，这些实施方案的涵盖范围应该由所附的权利要求及其相应的文件所确定的，而不是由上述给出的实例所

决定的。此外,还应该理解为本发明还能作进一步的改动。本专利旨在涵盖根据本发明的原理所进行的各种变化、用途或改良;也涵盖了与本发明所揭示的已知方案或实施方案有所偏离,但仍然从属于本发明技术及其应用原理的范围。

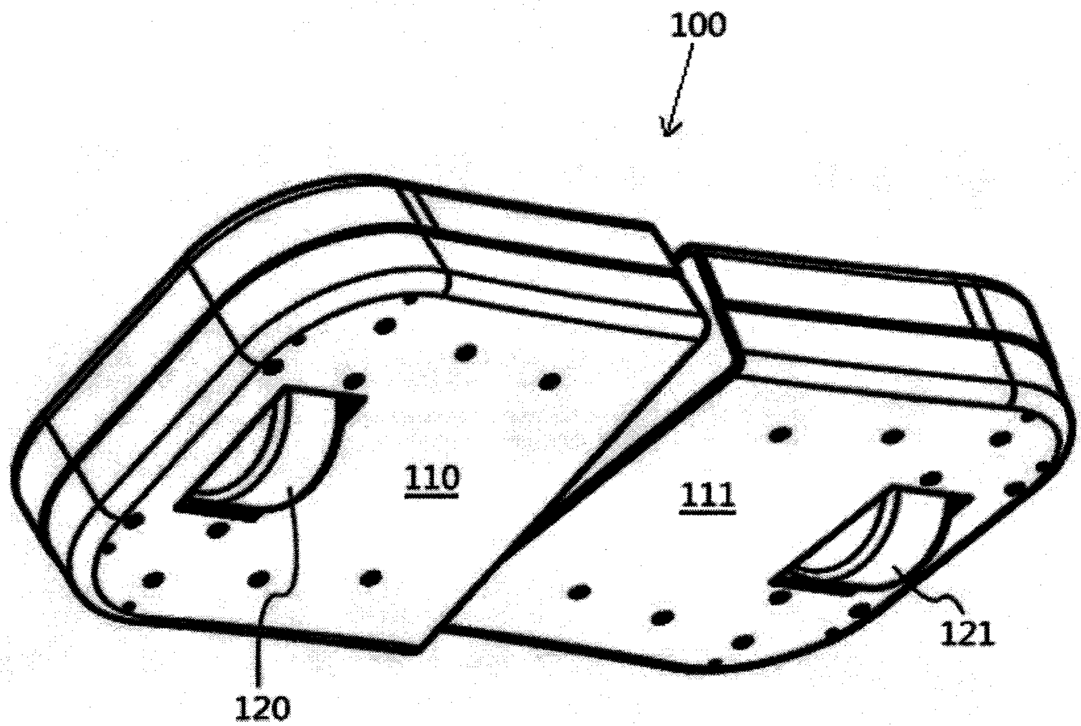


图 1

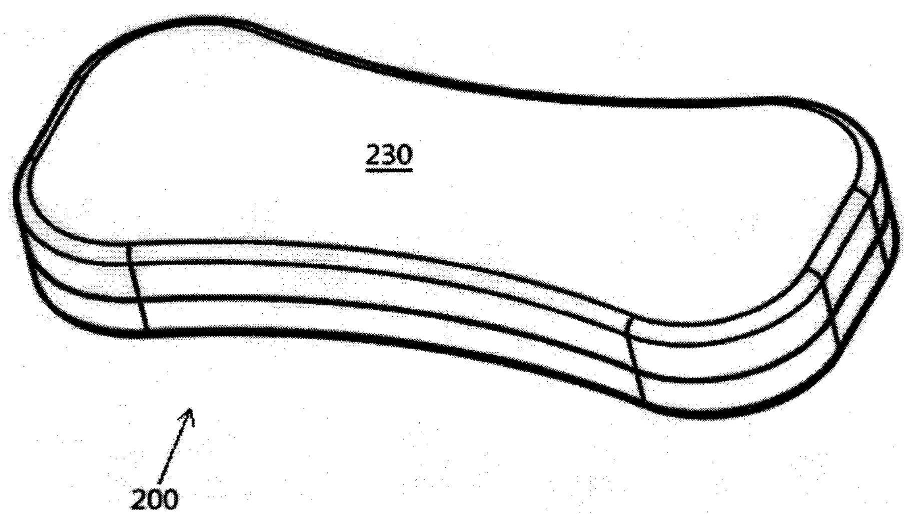


图 2

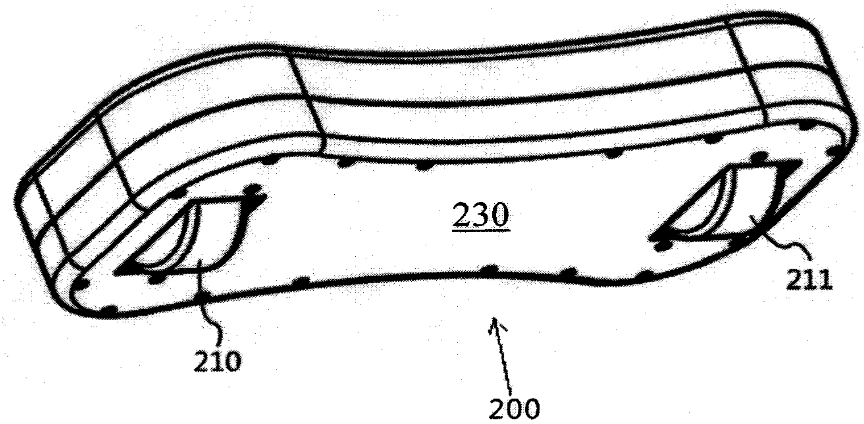


图 3

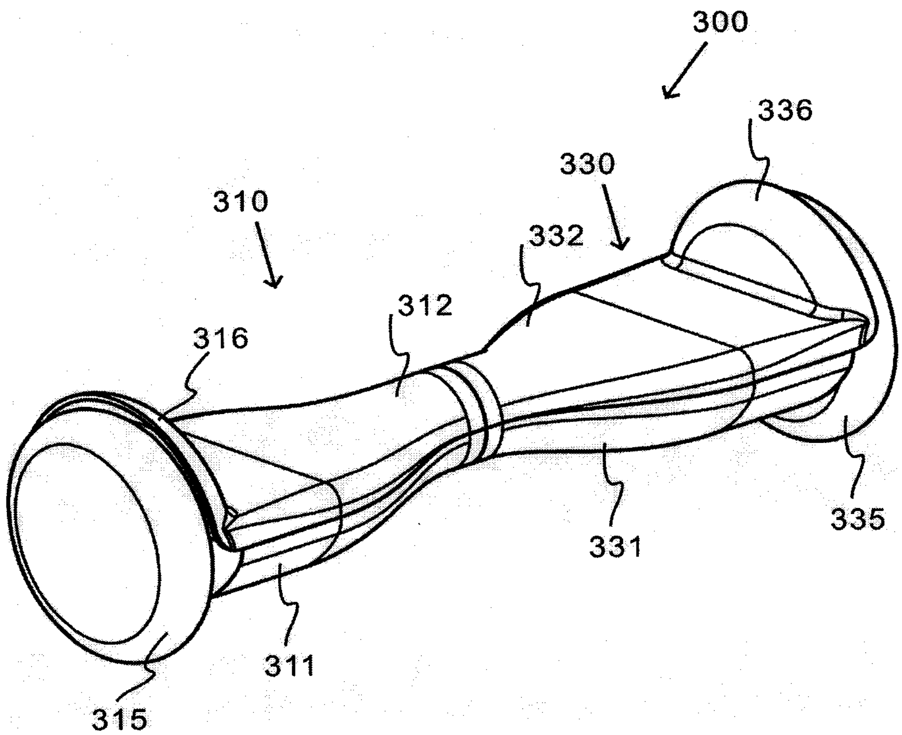


图 4

Espacenet

Bibliographic data: CN203186511 (U) — 2013-09-11

Segway without handle

Inventor(s): LIU HUI; LIU ZHIYONG ± (LIU HUI, ; LIU ZHIYONG)

Applicant(s): UNIV NORTHWEST A&F ± (NORTHWEST A&F UNIVERSITY)

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

Application number: CN201320184311U 20130414

Priority number(s): CN201320184311U 20130414

Abstract of CN203186511 (U)

The utility model discloses a Segway without a handle. The Segway without the handle comprises a Segway body, wherein Segway wheels are installed on the two sides of the Segway body. Each Segway wheel is connected with one end of a main shaft through an insert bearing. The other end of each main shaft is connected with a direct-current speed reduction motor through a plum shaft coupler. Each direct-current speed reduction motor is installed on the lower side of the Segway body through a motor fixing support. An incremental encoder is installed on each direct-current speed reduction motor. Two pedals used for treading are arranged on the Segway body. A storage battery is installed in the middle of the two pedals through a battery fixing support. A protective outer shell is installed outside the storage battery. A driving motor is installed on each Segway wheel. A three-shaft tilt angle sensor is arranged at the position where each Segway wheel is connected with the Segway body. The three-shaft tilt angle sensors and a control system are further installed on the Segway body. The control system is sequentially connected with the incremental encoders, the three-shaft tilt angle sensors and three-shaft tilt angle sensor data lines. In the moving process of the Segway, data are collected through a sensor module, and the objective that balancing of the Segway body can be automatically kept is achieved after the data are processed by the control system.

Patent Translate

Powered by EPO and Google

Notice

This translation is machine-generated. It cannot be guaranteed that it is intelligible, accurate, complete, reliable or fit for specific purposes. Critical decisions, such as commercially relevant or financial decisions, should not be based on machine-translation output.

CLAIMS CN208186511

1.

A handleless self-balancing two-wheel electric vehicle comprising a vehicle body (1) with wheels (3) mounted on both sides, characterized in that: the wheel (3) passes through an outer spherical bearing (8) and one end of the main shaft (7) Connected, the other end of the main shaft (7) is connected to a DC gear motor (5) through a plum coupling (6), and the DC gear motor (5) is mounted on the vehicle body (1) through a motor mount (9). The DC motor (5) is provided with an incremental encoder (14); the vehicle body (1) is provided with two pedals (2) for pedaling; the two pedals (2) is installed with a battery (10) through a battery holder (13), a protective casing (4) is mounted on the outside of the battery (10); a drive motor is mounted on the wheel (3); (3) a three-axis tilt sensor is connected to the vehicle body (1), and a three-axis tilt sensor and a control system are further mounted on the vehicle body (1); the control system is sequentially connected to the incremental encoder (14), the triaxial tilt sensor, the triaxial tilt angle transmission Data lines connected.

Notice

DESCRIPTION CN203186511

The utility model discloses a handleless self-balancing two-wheel electric vehicle, which comprises a vehicle body with wheels mounted on both sides, the wheel is connected with one end of the main shaft through an outer spherical bearing, and the other end of the main shaft is connected with a DC reduction motor through a plum coupling. The DC geared motor is mounted on the lower side of the vehicle body through the motor mount; the DC gear motor is equipped with an incremental encoder; the vehicle body is provided with two pedals for stepping on; the middle of the two pedals is installed through the battery holder The battery has a protective outer casing installed on the outside of the battery; a driving motor is mounted on the wheel; a three-axis tilt sensor is arranged at the connection between the wheel and the vehicle body, and a three-axis tilt sensor and a control system are mounted on the vehicle body; the control system is sequentially and incrementally Encoder, three-axis tilt sensor, three-axis tilt sensor data line connection. The car collects data through the sensing module during the movement process, and is processed by the control system to automatically maintain the balance of the vehicle body.

Self-balancing two-wheel electric vehicle without handle

Technical field

The utility model belongs to the technical field of mechanical control, in particular to a two-wheel electric vehicle without handle and self-balancing.

Background technique

The wheels of traditional electric bicycles are distributed back and forth, the turning radius of the vehicle is large, and it is impossible to flexibly move in a small space, and the driver's body control ability is completely relied on to maintain the balance of the vehicle body, and it is easy to roll over. There are two rounds of Segway on the market, the wheels of which are distributed left and right. The vehicle's control device automatically adjusts the speed of the vehicle according to the driver's posture to balance the vehicle. The driver's body leans forward, and the body slows down when the body leans back. This self-balancing car, which is flexible, easy to control and compact, can solve the problem that cars can't pass in pedestrian streets, squares, playgrounds and large venues.

Summary of the invention

In view of the above problems and shortcomings in the prior art, the object of the present invention is to provide a two-wheeled electric vehicle without a handle self-balancing, which collects data through a sensing module during motion and is automatically processed by a control system. Keep the car body balanced.

The self-balancing two-wheel electric vehicle according to the present invention comprises: a self-balancing two-wheel electric vehicle without a handle, comprising a vehicle body with wheels mounted on both sides, the wheel being connected to one end of the main shaft through an outer spherical bearing, the main shaft The other end is connected to the DC gear motor through a plum blossom coupling, and the DC gear motor is mounted on the lower side of the vehicle body through a motor mounting bracket; the DC gear motor is mounted with an incremental encoder; There are two pedals for stepping on;

a battery is installed in the middle of the two pedals through a battery holder, and a protective casing is mounted on the outside of the battery;

a drive motor is mounted on the wheel;

a three-axis tilt sensor is disposed at a junction of the wheel and the vehicle body, and a three-axis tilt sensor and a control system are further mounted on the vehicle body;

The control system is sequentially connected to the incremental encoder, the triaxial tilt sensor, and the triaxial tilt sensor data line.

Body, left and right wheels, wheel drive motors, sensor modules and control systems. The wheel and the vehicle body are connected by a rotating shaft, and the center lines of the rotating shafts of the left and right wheels are located on the same straight line, and a platform for supporting the human body is arranged on the vehicle body, and the vehicle body can swing around the rotating shaft of the wheel; the sensor module includes a wheel speed sensor and Pose detection system; the corresponding program for controlling the balance is stored or solidified in the control system circuit. The driver controls the running speed of the electric vehicle through its own attitude adjustment. The control system receives the signals input by the wheel speed sensor and the attitude detecting system, calculates the control signals required by the wheel driving motor according to the above signals, and then controls the wheel driving motor. The electric vehicle can automatically adjust the posture of the car body, and finally realize the self-balancing of the car body.

The body support of the vehicle body is realized by recognizing the legs, and there is no rod handle. That is to say, the utility model utilizes a program to realize automatic balance of the vehicle body, thereby simplifying the structure of the vehicle body.

The structure of the utility model only includes a vehicle body, a wheel and an electric drive system. The wheels of the bicycle adopt ordinary bicycle spoke wheels, and the wheels are installed on both sides of the vehicle body to form two rounds of left and right distribution structures to reduce the turning radius of the vehicle. The wheel and the vehicle body are connected by a rotating shaft, and the vehicle body can form a horizontal swing around the rotating shaft of the wheel. The body of the car has only the body and should have sufficient load bearing strength. The body is plated, which is suitable for the placement of power and control systems. The sensor is placed on the car body to directly sense the running and balance of the car body. The core device of the control circuit uses a PIC microcontroller, and the driver circuit uses an appropriate form to enable the motor to rotate forward and reverse.

The sensor used in the utility model includes a speed sensor and an angle sensor, through which the running condition and balance condition of the vehicle body, including the rotation angle of the two wheels and the inclination angle information of the vehicle body, feedback to the control system, and calculation of the two rounds and The angular velocity and angular acceleration of the car body are used to calculate the motor torque required for the two wheels to achieve control of the vehicle body.

The control method adopted by the utility model is:

When the car body is not tilted and does not move, the angle sensor obtains the vehicle body inclination signal (almost zero) and sends it to the control system. The control system calculates the two based on the signal and synthesizes the speed sensor signals of the left and right wheels (almost zero). The motor torque control amount required by the wheel is input into the drive circuit, processed by power amplification, and then transmitted to the drive motor to keep the vehicle body in place. When the vehicle body is to be advanced, the driver tilts the vehicle body slightly forward, and the angle sensor obtains the inclination signal and sends it to the control system. Based on the signal and the integrated left and right wheel speed sensor signals, the control system calculates the motor required for the two wheels. The torque control amount is input into the drive circuit, processed by power amplification, etc., and then transmitted to the drive motor to control the wheel to rotate forward and always maintain the balance of the vehicle body. The greater the angle of inclination, the faster the acceleration. When it is necessary to decelerate, brake or retreat, the driver tilts the car body slightly backwards, and the control system can also calculate the required counter-torque, thereby controlling the wheel to turn backwards to keep the car body balanced. The greater the angle of inclination, the faster the reverse acceleration. When a turn is needed, the driver turns left and turns left and turns right.

In summary, the utility model has the following advantages compared with the existing electric vehicle:

1 The two wheels are distributed left and right, and the turning radius of the vehicle is zero, which can be flexibly moved in a small space;

2Calculate the output control amount through the program, and control the two sides of the wheel by the control circuit, which not only enables the car body to automatically maintain balance, but also does not require mechanically constructed braking, reversing, and balancing system, which makes the mechanism simple;

3Wide range of uses. For example, it can be used as a pedestrian in a large square or entertainment venue, as a means of maintaining order in a large-scale venue, as a means of transport for golf course staff, or as a fast electric vehicle in densely populated cities and regions.

BRIEF DESCRIPTION OF THE DRAWINGS:

1 is an oblique side view of the handleless self-balancing two-wheeled electric vehicle of the present invention.

2is a bottom view of the handleless self-balancing two-wheeled electric vehicle of the present invention.

3is a front view of the handleless self-balancing two-wheeled electric vehicle of the present invention.

detailed description

1 is an oblique side view of the handleless self-balancing two-wheeled electric vehicle of the present invention, comprising a vehicle body 1 with wheels 3mounted on both sides, the wheel 3being connected to one end of a main shaft 7via an outer spherical bearing 8, the main shaft 7The other end is connected to the DC reduction motor 5via a plum blossom coupling 6which is mounted on the lower side of the vehicle body 1 via a motor mount 9, the DC gear motor 5is provided with an incremental encoder 14The car body 1 is provided with two pedals 2for stepping on;

a battery 10is mounted in the middle of the two pedals 2through a battery holder 13, and a protective casing 4is mounted on the outside of the battery 10;

a drive motor is mounted on the wheel 3;

a three-axis tilt sensor is disposed at a junction of the wheel 3and the vehicle body 1, and a three-axis tilt sensor and a control system are further mounted on the vehicle body 1;

The control system is sequentially connected to the incremental encoder 14, the triaxial tilt sensor, and the triaxial tilt sensor data line.

The control system may be a microprocessor such as a single chip microcomputer, and the control system receives the signals input by the speed sensor and the three-axis tilt sensor, and calculates the control signals required by the DC gear motor and the wheel drive motor according to the above signals, and the control signal DC The motor and the wheel are moved, so that the electric vehicle can automatically adjust the posture of the vehicle body according to the input speed, and finally realize the self-balancing of the electric vehicle. The triaxial tilt sensor is used to measure the attitude of the vehicle body relative to the ground plane.

As shown in FIG. 1, the left and right wheels 3are driven by different motors, and the rotation axes of the left and right wheels 3are different. The center lines of the two wheel shafts are on the same line, and the vehicle body can swing around the rotation axis of the wheel, inside the vehicle body. A control system is installed. In order to protect the electrical safety, a charger protection housing 4is mounted outside the battery.

As shown in Fig. 2, after the pedal 2is opened, the internal components fixed to the chassis 1 can be seen. A battery 10is mounted on the battery holder 13, and an incremental encoder 14is also provided. The entire energy source of the trolley is taken as a power source. FIG. 1 is an oblique side view of the handleless self-balancing two-wheeled electric vehicle of the present invention.

Battery 10is provided. The incremental encoder 14converts the displacement into a periodic electrical signal, converts the electrical signal into a counting pulse, uses the number of pulses to represent the magnitude of the displacement, and transmits the pulse to the control system to facilitate speed control.

As shown in FIG. 3, the battery 10is located at the bottom of the bottom of the chassis 1, which can reduce the center of gravity of the vehicle body and make the vehicle more stable. The wheel 3is connected to one end of the main shaft 7via an outer spherical bearing 8, and the other end of the main shaft 7is connected to the direct current reduction motor 5via a plum coupling 6to reduce the vibration of the vehicle body and to cushion the shock absorption. The DC gear motor 5is connected to the plum coupling to form a driving device, which is more effective in saving space and making the car more portable.

(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 203186511 U
(45)授权公告日 2013.09.11

(21)申请号 201320184311.9
(22)申请日 2013.04.14
(73)专利权人 西北农林科技大学
地址 712100 陕西省西安市杨凌示范区邰城路3号
(72)发明人 刘辉 刘志勇
(51)Int.Cl.
B62K 11/00(2013.01)

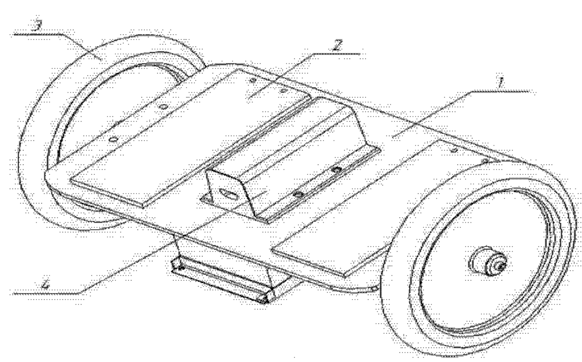
权利要求书1页 说明书3页 附图2页

(54)实用新型名称

一种无手柄自平衡两轮电动车

(57)摘要

本实用新型公开一种无手柄自平衡两轮电动车,包括两边安装有车轮的车体,车轮通过外球面轴承与主轴的一端连接,主轴的另一端通过梅花联轴器与直流减速电动机连接,直流减速电动机通过电机固定架安装在车体的下边;直流减速电动机上安装有增量式编码器;车体上设有两块用于踩踏的踏板;两块踏板的中间通过电池固定架安装有蓄电池,蓄电池的外面安装有保护外壳;车轮上安装有驱动电机;在车轮与车体的连接处有三轴倾角传感器,车体上还安装有三轴倾角传感器、控制系统;控制系统依次与增量式编码器、三轴倾角传感器、三轴倾角传感器数据线连接。该车在运动过程中通过传感模块采集数据,经过控制系统处理来实现自动保持车体平衡。



CN 203186511 U

1. 一种无手柄自平衡两轮电动车，包括两边安装有车轮（3）的车体（1），其特征在于：所述车轮（3）通过外球面轴承（8）与主轴（7）的一端连接，所述主轴（7）的另一端通过梅花联轴器（6）与直流减速电动机（5）连接，所述直流减速电动机（5）通过电机固定架（9）安装在车体（1）的下边；所述直流减速电动机（5）上安装有增量式编码器（14）；所述车体（1）上设有两块用于踩踏的踏板（2）；

所述两块踏板（2）的中间通过电池固定架（13）安装有蓄电池（10），所述蓄电池（10）的外面安装有保护外壳（4）；

所述车轮（3）上安装有驱动电机；

在所述车轮（3）与所述车体（1）的连接处有三轴倾角传感器，所述车体（1）上还安装有三轴倾角传感器、控制系统；

所述控制系统依次与所述增量式编码器（14）、所述三轴倾角传感器、所述三轴倾角传感器数据线连接。

一种无手柄自平衡两轮电动车

技术领域

[0001] 本实用新型属于机械控制技术领域，具体涉及一种无手柄自平衡两轮电动车。

背景技术

[0002] 传统的电动自行车的轮子前后分布，车辆转弯半径大，无法在小空间范围内灵活运动，而且完全依靠驾驶者的身体控制能力来保持车体平衡，容易发生侧翻。目前市场上出现了两轮平衡车（Segway），其车轮是左右分布的，车辆的控制装置根据驾驶者的姿态来自动调节车辆的速度，以使车辆达到平衡。驾驶者身体前倾车速加快，身体后仰则车速减慢。这种为人代步、运行灵活、控制方便而又体积小巧的自平衡车可以很好的解决在步行街、广场、游乐场和大型会场等场合汽车无法通行的难题。

发明内容

[0003] 针对上述现有技术中存在的问题与缺陷，本实用新型的目的在于提供一种无手柄自平衡两轮电动车，该车在运动过程中通过传感模块采集数据，经过控制系统处理来实现自动保持车体平衡。

[0004] 本实用新型所涉及的自平衡两轮电动车包括：一种无手柄自平衡两轮电动车，包括两边安装有车轮的车体，所述车轮通过外球面轴承与主轴的一端连接，所述主轴的另一端通过梅花联轴器与直流减速电动机连接，所述直流减速电动机通过电机固定架安装在车体的下边；所述直流减速电动机上安装有增量式编码器；所述车体上设有两块用于踩踏的踏板；

[0005] 所述两块踏板的中间通过电池固定架安装有蓄电池，所述蓄电池的外面安装有保护外壳；

[0006] 所述车轮上安装有驱动电机；

[0007] 在所述车轮与所述车体的连接处有三轴倾角传感器，所述车体上还安装有三轴倾角传感器、控制系统；

[0008] 所述控制系统依次与所述增量式编码器、所述三轴倾角传感器、所述三轴倾角传感器数据线连接。

[0009] 车体、左右分布的车轮、车轮驱动电机、传感器模块和控制系统。车轮与车体之间为转轴连接，左右车轮的转轴中心线位于同一条直线上，在车体上设有用于支撑人体的平台，车体能够绕车轮的转轴摆动；传感器模块包括车轮转速传感器和位姿检测系统；控制系统电路中存储或固化了相应的用于控制平衡的程序。驾驶者通过自身姿态调整来控制电动车的运行速度，控制系统接收车轮转速传感器和位姿检测系统所输入的信号，根据上述信号计算出车轮驱动电机所需要的控制信号，进而控制车轮驱动电机使得电动车能够自动调节车体姿态，最终实现车体的自平衡。

[0010] 所述车体的人体支撑是依靠认得双腿来实现，并无杆状手柄。也就是说，本实用新型是利用程序来实现车体的自动平衡，从而简化了车体的结构。

[0011] 本实用新型的结构仅包括车体、车轮和电驱动系统等。其车轮采用普通自行车辐条车轮，车轮安装在车体两侧，形成两轮左右分布结构，以减小车辆的转弯半径。车轮与车体之间为转轴连接，是车体可以绕车轮的转轴形成水平摆动。车体只有车身并且应该具有足够的承载强度。车身是板式的，这适合电源、控制系统的放置。传感器设置在车体上，以便于直接感受车体的运行及平衡情况。控制电路的核心器件采用 PIC 单片机，驱动电路则采用适当的形式使电机能够正转、也能反转。

[0012] 本实用新型所采用的传感器包括速度传感器和角度传感器，通过他们可以测量出车体的运行状况及平衡状况、包括两轮的转角和车体的倾角信息，反馈给控制系统，计算出两轮和车体的角速度及角加速度，从而计算出两轮所需要的电机转矩，实现对车体的控制。

[0013] 本实用新型采用的控制方式为：

[0014] 车体不倾斜不运动时，角度传感器得到车体倾角信号（几乎为零）并送入控控制系统，控制系统据此信号并综合左、右车轮的速度传感器信号（几乎为零）计算出两轮所需的电机力矩控制量，把该控制量输入驱动电路中，经功率放大等处理后传送到驱动电机中，使车体保持原地平衡。当要使车体前进时，驾驶者使车体微微向前倾斜，角度传感器得到倾角信号并送入控制系统，控制系统据此信号并综合左、右车轮速度传感器信号算出两轮所需的电机力矩控制量，将该控制量输入驱动电路中，经功率放大等处理后传送到驱动电机中，控制车轮向前转动并始终保持车体平衡。倾角越大，加速越快。当需要减速、刹车或者后退时，驾驶者使车体稍微向后倾斜，控制系统同样也可以计算出所需反力矩，进而控制车轮向后转动兵始终保持车体平衡。倾角越大，反向加速越快。需要转弯时，驾驶者左倾左转、右倾右转。

[0015] 综上所述，本实用新型与已有的电动车相比具有以下优点：

[0016] ① 两车轮为左右分布，车辆的转弯半径为零，可以在小空间范围里灵活运动；

[0017] ② 通过程序计算输出控制量，由控制电路分别控制两侧车轮，不仅使车体能自动保持平衡，而且不需要机械构造的刹车、倒车、平衡系统，使得机构简单；

[0018] ③ 用途广泛。例如：可作为大型广场或娱乐场所的步行人员、大范围场地维持秩序的相关人员、高尔夫球场工作人员的代步工具；也可应用在人口密集的城市及地区的快速电动交通工具。

[0019] 附图说明：

[0020] 图 1 是本实用新型无手柄自平衡两轮电动车的斜侧图。

[0021] 图 2 是本实用新型无手柄自平衡两轮电动车的仰视图。

[0022] 图 3 是本实用新型无手柄自平衡两轮电动车的主视图。

具体实施方式

[0023] 图 1 是本实用新型无手柄自平衡两轮电动车的斜侧图，包括两边安装有车轮 3 的车体 1，所述车轮 3 通过外球面轴承 8 与主轴 7 的一端连接，所述主轴 7 的另一端通过梅花联轴器 6 与直流减速电动机 5 连接，所述直流减速电动机 5 通过电机固定架 9 安装在车体 1 的下边；所述直流减速电动机 5 上安装有增量式编码器 14；所述车体 1 上设有两块用于踩踏的踏板 2；

[0024] 所述两块踏板 2 的中间通过电池固定架 13 安装有蓄电池 10，所述蓄电池 10 的外

面安装有保护外壳 4；

[0025] 所述车轮 3 上安装有驱动电机；

[0026] 在所述车轮 3 与所述车体 1 的连接处有三轴倾角传感器，所述车体 1 上还安装有三轴倾角传感器、控制系统；

[0027] 所述控制系统依次与所述增量式编码器 14、所述三轴倾角传感器、所述三轴倾角传感器数据线连接。

[0028] 其中控制系统可以是单片机等微处理器，控制系统接收速传感器和三轴倾角传感器所输入的信号，根据上述信号分别计算出直流减速电动机和车轮驱动电机所需的控制信号，该款控制信号直流减速电动机和车轮运动，从而使电动车能够根据所输入的速度自动调节车体的姿势，最终实现电动车的自平衡。所述三轴倾角传感器用来测量车体相对于地平面的姿态。

[0029] 如图 1 所示，所述左右车轮 3 由不同的电机驱动，左右车轮 3 的转轴不同，两个车轮转轴的中心线位于同一条线上，车体能够绕车轮的转轴摆动，在车体内部安装有控制系统。为了保护用电安全，在蓄电池外面安装有充电器保护外壳 4。

[0030] 如图 2 所示，打开踏板 2 后，可以看见固定在底盘 1 的内部元件。在电池固定架 13 上安装有蓄电池 10，另有增量式编码器 14。小车的全部能源由作为电源的图 1 是本实用新型无手柄自平衡两轮电动车的斜侧图。

[0031] 蓄电池 10 提供。增量式编码器 14 将位移转换成周期性的电信号，再把这个电信号转变成计数脉冲，用脉冲的个数表示位移的大小，将脉冲传递到控制系统，便于实施速度控制。

[0032] 如图 3 所示，蓄电池 10 位于底盘 1 底部中间位置，这样能降低车体的重心，使车更加趋于稳定。车轮 3 通过外球面轴承 8 与主轴 7 的一端连接，所述主轴 7 的另一端通过梅花联轴器 6 与直流减速电动机 5 连接，可以减缓车体的震动，起到缓冲减震的作用。直流减速电动机 5 连接梅花联轴器，组成驱动装置，这样更加有效的节省空间，使小车更加便携。

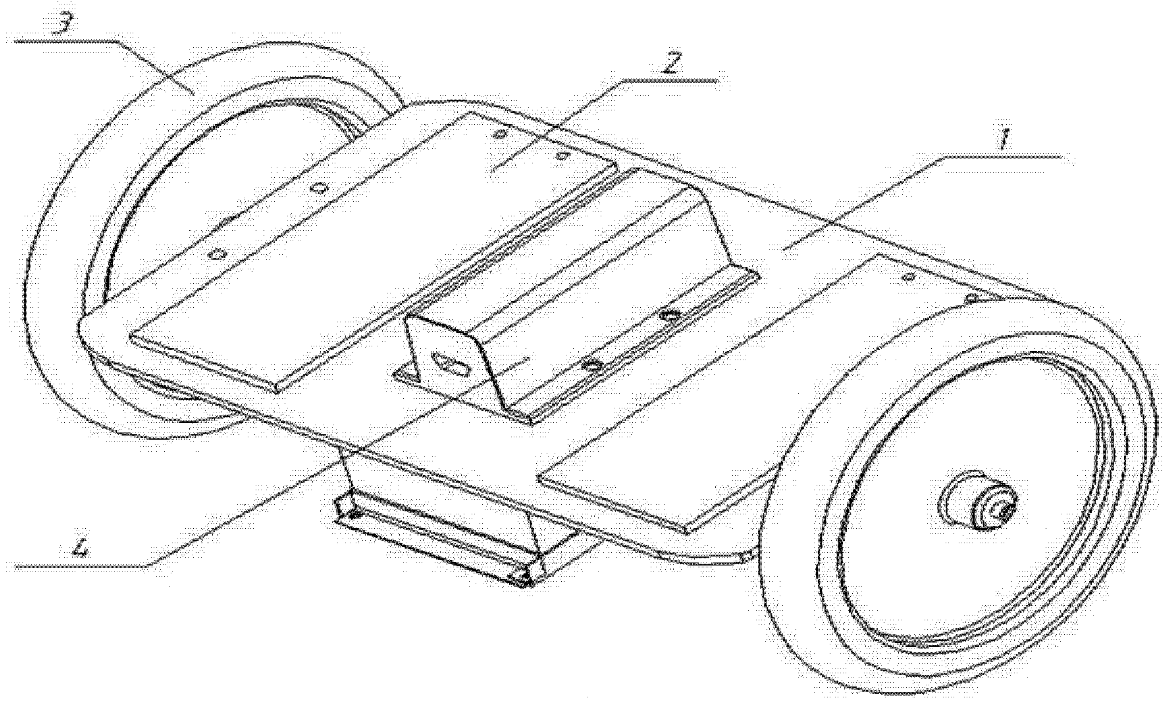


图 1

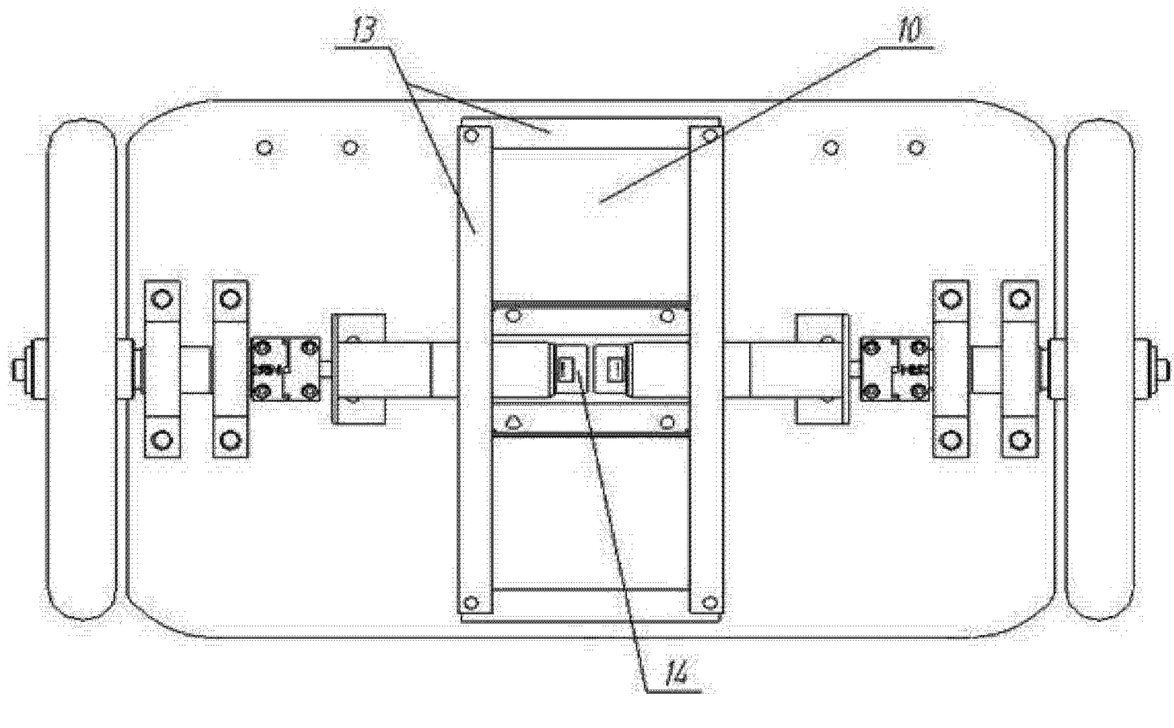


图 2

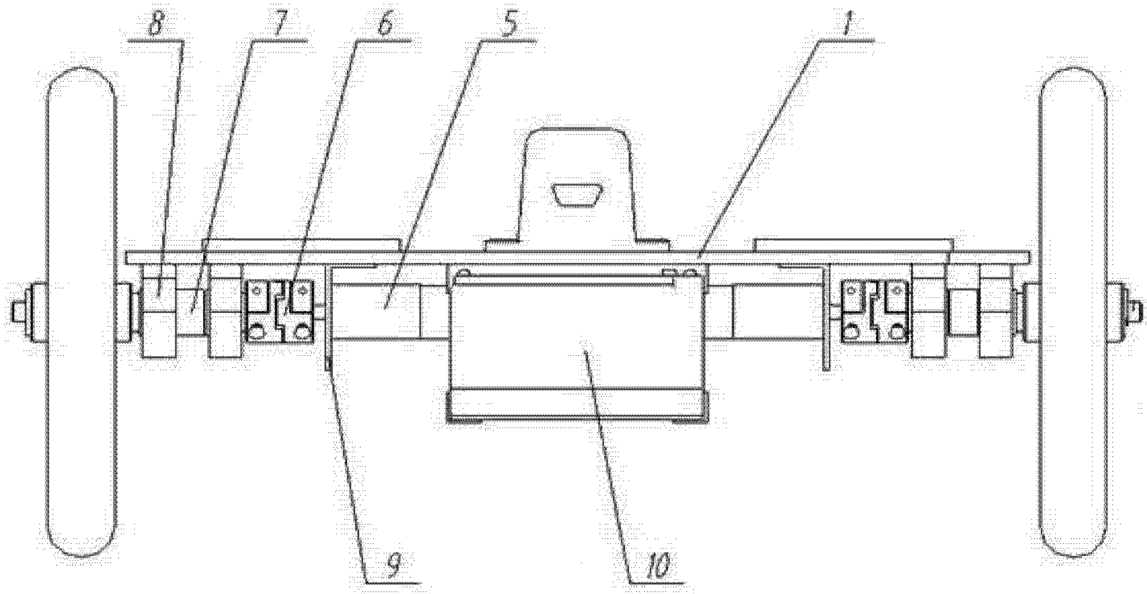


图 3

Espacenet

Bibliographic data: CN203268232 (U) — 2013-11-06

Balance control device of intelligent balance car and intelligent balance car

Inventor(s): YING JIAWEI + (YING JIAWEI)

Applicant(s): HANGZHOU YINAO INTELLIGENT TECHNOLOGY CO LTD + (HANGZHOU YINAO INTELLIGENT TECHNOLOGY CO., LTD)

Classification: **- international:** ***B60L15/32; B62K3/00***
- cooperative:

Application number: CN20132050547U 20130130

Priority number (s): CN20132050547U 20130130

Abstract of CN203268232 (U)

The utility model relates to a balance control device of an intelligent balance car and the intelligent balance car. The balance control device comprises a direction controller, an internal control sensor, a pedal sensor, a control circuit and a driving circuit which are respectively arranged at the central position of a car body, wherein the direction controller is connected with a steering shaft of the car body; the internal control sensor comprises an angular velocity sensor and an acceleration sensor; the control circuit comprises a gyroscope circuit board, an automatic control and driving circuit board and an infrared photoelectric switch circuit for controlling an infrared photoelectric switch; and all the sensors and the direction controller are respectively connected together with the control circuit by the driving circuit. The utility model has the advantage that the technical problem of how to improve the automatic balance capability of the balance car can be solved.

Patent Translate

Powered by EPO and Google

Notice

CLAIMS CN208268232

1.

The intelligent balance vehicle balance control device is characterized in that: a direction controller, an internal control sensor, a foot sensor, a control circuit and a drive circuit which are all disposed at a center position of the vehicle body; the direction controller is connected with the steering shaft of the vehicle body, and the inside The control sensor comprises an angular velocity sensor and an acceleration sensor; the control circuit comprises a gyroscope circuit board, an automatic control and driving circuit board, and an infrared photoelectric switch circuit for controlling the infrared photoelectric switch; the sensor and the direction controller are respectively connected to the control circuit through the driving circuit together.

2.

The intelligent balance vehicle is characterized in that it comprises: a vehicle body, a steering adjustment mechanism and a balance control device; the vehicle body comprises a support rod, a support platform and a wheel; the steering adjustment mechanism comprises a steering shaft and a steering shaft balance mechanism; and the balance control device comprises both Direction controller, internal control sensor, control circuit and drive circuit of the car center of gravity; one end of the steering shaft is fixed at the bottom end of the pole and fixedly connected with the direction controller; the other end is fixed with the direction controller; On the steering shaft and at the same time fixed inside the support table, the internal control sensor comprises an angular velocity sensor and an acceleration sensor; the two sensors together with the direction controller are respectively connected to the control circuit through a driving circuit, and the support bar includes an upper support rod and The lower support bar, the upper support bar and the lower support bar are hingedly connected, and an angle adjustment mechanism is arranged between the upper support bar and the lower support bar, the mechanism comprises an angle rotation button and a spring connected together; the upper support bar and the lower support bar are mutually connected The snap-fit, spring-loaded angle rotation button is fixed on the side of the upper lever.

DESCRIPTION CN203268232

The utility model relates to a smart balance car balance control device and a smart balance car. The intelligent balance vehicle balance control device comprises a direction controller, an internal control sensor, a foot sensor, a control circuit and a drive circuit which are all disposed at a center position of the vehicle body; the direction controller is connected with the steering shaft of the vehicle body, and the internal control sensor includes an angular velocity The sensor and the acceleration sensor; the control circuit comprises a gyroscope circuit board, an automatic control and driving circuit board, and an infrared photoelectric switch circuit for controlling the infrared photoelectric switch; the above sensor and the direction controller are respectively connected to the control circuit through the driving circuit. The utility model can solve the technical problem of how to improve the automatic balancing ability of the balance car.

Intelligent balance car balance control device and smart balance car

Technical field

The utility model relates to a vehicle control device, in particular to a single or two-wheel intelligent balance vehicle balance control device, and the utility model also relates to a balance car using the control device.

Background technique

For squares, pedestrian streets, shopping malls, golf courses, gardens, villas and other places, cars can't pass, and walking is tiresome. There is a need for a new generation of vehicles that can be small, light, flexible, and easy to control. Although the traditional rickshaw or two-wheel electric vehicle is a means of transportation for the majority of users, due to their two-wheel distribution, there are the following disadvantages: (1) the body is long, the turning radius of the vehicle is large, and it is impossible to flexibly move in a small space. (2) Non-intelligent, can not rely on the body to maintain balance, can only rely on manual control, the rider has to have a long learning process, and the stability during riding is also affected by the rider's proficiency. (3) The front and rear wheel distribution body is not suitable for electric reversing operation. 1988 In the year, Japanese Patent Specification No. JP63-305082 discloses a car that can automatically maintain dynamic balance only with two left and right wheels. The application is only an experimental solution capable of demonstrating an inverted pendulum, and the technical riding from the user is still technical. There is a long distance. On the basis of the Japanese patent application, the US patent specification US 5,701,965 realizes the rider's standing riding function, but the main disadvantage is that the technical solution is cumbersome, complicated, poor in reliability, and high in manufacturing cost.

Utility model content

The purpose of the utility model is to provide a smart balance vehicle balance control device and solve the technical problem of how to improve the automatic balance ability of the balance car.

The intelligent balance vehicle balance control device comprises a direction controller, an internal control sensor, a foot sensor, a control circuit and a drive circuit which are all disposed at a center position of the vehicle body; the direction controller is connected with the steering shaft of the vehicle body, and the internal control sensor includes an angular velocity The sensor and the acceleration sensor; the control circuit comprises a gyroscope circuit board, an automatic control and driving circuit board, and an infrared photoelectric switch circuit for controlling the infrared photoelectric switch; the above sensor and the direction controller are respectively connected to the control circuit through the driving circuit.

The intelligent balance car comprises a vehicle body, a steering adjustment mechanism and a balance control device; the vehicle body comprises a support rod, a support platform and a wheel; the steering adjustment mechanism comprises a steering shaft and a steering shaft balance mechanism; and the balance control device comprises a position of the weight center of the vehicle. a direction controller, an internal control sensor, a control circuit and a drive circuit; one end of the steering shaft is disposed at a bottom end of the pole and fixedly connected thereto, and the other end is fixed with the direction controller; the steering shaft balance mechanism is disposed on the steering shaft At the same time, it is fixed inside the support table. The internal control sensor includes an angular velocity sensor and an acceleration sensor. The two sensors together with the direction controller are respectively connected to the control circuit through a driving circuit, and the support rod includes an upper support rod and a lower support rod. The upper support rod and the lower support rod are hingedly connected, and an angle adjustment mechanism is arranged between the upper support rod and the lower support rod, the mechanism comprises an angle rotation button and a spring connected together; the upper support rod and the lower support rod are mutually coupled, and the sleeve A spring angled rotary button is attached to the side of the upper bar.

The utility model has the beneficial effects that: the balance control device is provided at the position of the center of gravity of the vehicle; and the balance condition and the running condition of the vehicle body can be measured instantly by the acceleration sensor and the angular velocity sensor, including the inclination angle of the vehicle body and the rotation angle information of the wheel. Feedback to the control processor, calculate the angular velocity and acceleration of the two wheels and the car body, so as to achieve balance control of the car body, so that the car body has a self-balancing function, the driver only needs to slightly tilt the car body forward In the forward direction, the car body does not have any mechanical brakes. The driver only needs to tilt the car body slightly backwards to achieve deceleration, braking and retreat. The two-wheel balance car wheels are distributed on both sides of the car body and can be electrically controlled. The system realizes positive and negative reversal, so the turning radius is almost zero, the driver swings the handle from side to side, and through the signal processing of the sensor, the turning or the in-situ turning can be realized, and the flexible operation can be performed in a small space.

DRAWINGS

Figure 1 is a block diagram of a balance control device;

Figure 2is a general block diagram of the composition of the balance control device;

Figure 3is an exploded view of the balance car;

Figure 4is a partial enlarged view of A in Figure 3;

detailed description

Referring to FIG. 1 to FIG. 4, the balance control device includes a direction controller such as a potentiometer 24, an internal control sensor, a control circuit such as an automatic control microprocessor, and a drive circuit, which are all disposed in the center position of the vehicle body.

The potentiometer 24 is used to collect direction information, and can provide data of the left and right turns of the pole, which can be replaced by a linear Hall sensor or a position encoder.

The internal control sensor includes an angular velocity sensor for controlling the state of the vehicle body 30, such as a gyro sensor, an acceleration sensor for detecting a horizontal tilt angle of the vehicle body, and a foot sensor for detecting whether a person is on the pedal; the above sensor and the direction controller are respectively The drive circuit is connected to the control circuit. In practical applications, the gyro sensor has two pieces, which respectively detect the pitch rate and the yaw rate of the car body. Acceleration sensor and angular velocity sensor can instantly measure the balance condition and running condition of the car body, including the inclination angle of the car body and the rotation angle information of the wheel, and feed back to the control processor to calculate the angular velocity and acceleration of the two wheels and the vehicle body. Achieve balance control of the car body. The internal control sensor described above may also include a turn Hall sensor. The foot sensor can be a metal impact switch, an infrared photoelectric switch, and other devices that can be used to detect a person getting on and off the vehicle. Preferably, this embodiment employs an infrared photoelectric switch.

The control circuit includes an embedded microcontroller chip, a complex programmable logic controller and ancillary circuits. The embedded micro-control chip is used to collect the input, filtering, and other input and output of the sensor. Through the control algorithm, the output controls the attitude and motion data of the entire vehicle body. Complex programmable logic is responsible for driving the forward and reverse of two brushless motors and their speed. The control data comes from the embedded microcontroller. The control circuit is solidified with intelligently controlled program software. The program software includes sensor data acquisition algorithm, filtering algorithm, control data fusion algorithm, motor PID double closed loop control algorithm.

The control circuit obtains the AD sample value through digital sampling, so it must pass a certain algorithm to control the required data information. The gyro sensor finally outputs the yaw rate and the pitch rate, which can be integrated to obtain the yaw angle and the pitch angle at each moment. The acceleration sensor detects the inclination angle of the vehicle body 30 and the horizontal plane. The motor speed magnetic encoder outputs the speed and steering of the motor. The potentiometer 24 outputs the desired value of the steering of the vehicle body 30, each of which corresponds to an algorithm.

The filtering algorithm may use a Kalman filtering algorithm in this embodiment.

The use of the data fusion algorithm in the present embodiment is to calculate the acceleration of the vehicle body 30, and the gyro yaw rate, the pitch rate, the acceleration tilt angle, and the expected direction of the turning direction need to be merged into one data information, and sent to the speed loop. Perform PID closed loop control.

The PID double closed loop control algorithm is a commonly used control algorithm, including three steps of proportional, integral and differential. P is mainly used to improve the dynamic performance of the system; I eliminate the deviation; D is to improve the dynamic performance and strengthen the anti-interference ability. Double closed-loop control, the inner loop is a current PID closed loop, which is used to increase the output PWM within the current allowable range to improve the response speed. When the current is overcurrent, the output PWM is reduced to prevent the hardware hardware circuit from being damaged due to overcurrent, and the person is in the driving process. Security in the middle. The outer ring is a speed PID closed loop. When the speed is out of range, the tilt angle of the balance car is dynamically changed by changing the balance car to realize that the person cannot continue to accelerate, limit the speed of the vehicle, and prevent the driver from overspeeding to cause a safety accident. Outer loop speed PID closed loop, inner loop current PID closed loop, actually only use PI, that is, only proportional, integral, and not differential.

The drive circuit consists of a three-phase bridge circuit.

The utility model can instantly measure the balance condition and the running condition of the vehicle body 30, including the inclination angle of the vehicle body 30and the rotation angle information of the wheel 6through the acceleration sensor and the angular velocity sensor, and feed back to the automatic control microprocessor to calculate two wheels 6The angular velocity and the angular acceleration of the vehicle body 30are used to calculate the motor torque required for the wheel 6, and the balance control of the vehicle body 30is realized. The speed of the acquisition motor can be either a magnetically encoded sensor or an optically encoded or line Hall sensor.

When the vehicle body 30does not move or tilt, the acceleration sensor obtains the inclination signal of the vehicle body 30, at which time the center voltage is 2.5V, and is sent to the control microprocessor, and the microprocessor integrates the left and right wheels 6according to the signal. The speed signal, at this time, the speed is almost zero, and the motor torque control amount required for the two wheels is calculated, and the control amount is sent to the drive controller to drive the microprocessor, thereby driving the corresponding output power of the motor to keep the body 30balanced in situ. . When the vehicle body 30is required to advance, the rider controls the center of gravity to shift forward, so that the vehicle body 30is slightly tilted forward, and the acceleration sensor obtains a tilt signal, at which time the voltage is increased and sent to the control microprocessor to control the microprocessor. According to this signal and synthesizing the left and right wheel 6speed signals, the motor torque control amount required for the two wheels is calculated, and the control amount is sent to the drive controller, and the motor drive circuit drives the motor to rotate forward and maintain the vehicle body balance at all times. The larger the dip angle, the larger the voltage signal output from the sensor deviates from the center voltage and the faster the acceleration. When it is necessary to decelerate, brake or retreat, the rider controls the center of gravity to move backward, so that the vehicle body 30is tilted slightly backward, and the control microprocessor can also calculate the required reverse torque according to the sensor signal, thereby controlling the motor to rotate backward. And always keep the car body balanced. The greater the backward tilt angle, the faster the reverse acceleration. When a turn is needed, the rider swings the handrail so that the potentiometer installed under the armrest gets different voltage values, and the control microprocessor calculates the different torques of the left and right wheels, thereby controlling the two wheels 6at different speeds. Or the direction is rotated and the vehicle body 30is always balanced, whereby the vehicle body 30can be controlled to rotate to the desired direction.

Referring to FIG. 3to FIG. 4, a smart balance vehicle includes a vehicle body 30supporting other components, a steering adjustment mechanism, and a balance control device.

The vehicle body 30includes a support bar, a support platform for supporting the human body, and a traveling device including two wheels 6.

The pole is generally a "T" shaped rod; comprising a handle 1, an upper rod 2, a lower rod 8with an angle adjustment mechanism mounted therebetween, the mechanism comprising an angular rotation button 26and a spring 7connected together Hex bolt; the upper rod 2and the lower rod 8are engaged with each other, and the upper rod 2and the lower rod 8are connected with the spring 7and the angle rotation button 26by a hexagon bolt, and the rotation lever 26can be adjusted to adjust the upper rod The inclination angle of 2, the mechanism is mainly to make the upper pole can rotate on the lower pole, and its structure is a common structure. The lower support bar 8is a height adjustable lower support bar, which comprises an outer rod and an inner rod. The inner rod sleeve is inside the outer rod, and a height adjustment button 9is connected between the outer rod and the inner rod. The elastic height adjustment button 9can adjust the handle 1 to a suitable height. In order to save transportation space, the elastic height adjustment button 9can remove the upper lever 2.

A pedal is provided on the support table, and a pedal sensor for detecting whether a person is on the pedal is provided inside the pedal. The foot sensor can be a metal impact switch, an infrared photoelectric switch 29, and other devices that can be used to detect a person getting on and off the vehicle. Preferably, the present embodiment employs an infrared photoelectric switch 29. As a foot sensor, when a person gets on the vehicle, the infrared light detects that the infrared photoelectric switch 29is turned on, and the microprocessor operates in an automatic balance state. A battery is arranged inside the support base, and a lead-acid battery or a nickel-hydrogen battery or a lithium battery can be selected according to requirements. Correspondingly, a battery for charging the battery 33is processed at an intermediate position of the rear lamp 15at the rear of the vehicle body 30. Charging interface 16.

The steering adjustment mechanism includes a steering shaft 18and a steering shaft balancing mechanism; one end of the steering shaft 18is fixed to the bottom end of the pole and fixedly connected thereto, and the other end is fixed with the direction controller; the steering shaft balancing mechanism is fixed to the steering shaft 24 and at the same time fixed inside the support table. The steering shaft balancing mechanism includes a bearing housing, a steering housing 10that protects internal components of the steering device, a rectangular spring 22, a spring stop 20connected to the rectangular spring 22, and a hex flange bolt 19, a steering shaft 18that traverses the bearing housing, and a hexagon Flange nut 21, flat key 17, potentiometer connector 23

The lower end of the lower bar 8is provided with a steering coupling and is connected to the steering shaft 18in the steering device via a flat key 17, and the steering shaft 18is fixed to the front and rear ends of the steering housing 10through bearings and bearing housings, and the rear end of the steering shaft 18passes through A potentiometer connector 23is coupled to the rotary shaft of the potentiometer 24to change its output resistance. Swinging the handle 1 to the left and right, driving the steering shaft 18to rotate, restricting the angle of the handle 1 to the left and right by the left and right rectangular springs 22and the spring stop 20, and returning to the intermediate position, and changing the resistance of the potentiometer 24to change the running device The speed and direction of the turn to achieve a turn or turn in place.

The traveling device further includes a protective support tube 3, a fender 4, a slab decorative cover 5, a slab fixing seat 28, and a motor mount 14. A motor is mounted in the wheel 6, and is connected to the two sides of the vehicle body 30through the motor fixing base 14. The fender 4and the protective support tube 3are fixed to the slab fixing base 28and are connected to the vehicle body 30to enhance the safety of the driver. . The motor employs an in-wheel motor in the present embodiment, and a rotating shaft of the in-wheel motor is fixed in the vehicle body 30. In order to facilitate night travel, a vehicle body headlight 27, a vehicle body headlight 12, and a vehicle body rear lamp 15may be attached to the rear end of the vehicle body 30at the front end of the vehicle body 30. Of course, in order to facilitate carrying the article, a device for mounting the bag 25can be provided on the upper pole 2. The size and shape of the bag 25can be determined on a case-by-case basis.

(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 203268232 U
(45)授权公告日 2013.11.06

(21)申请号 201320050547.3

(22)申请日 2013.01.30

(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 应佳伟

(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 3/00(2006.01)
B60L 15/32(2006.01)

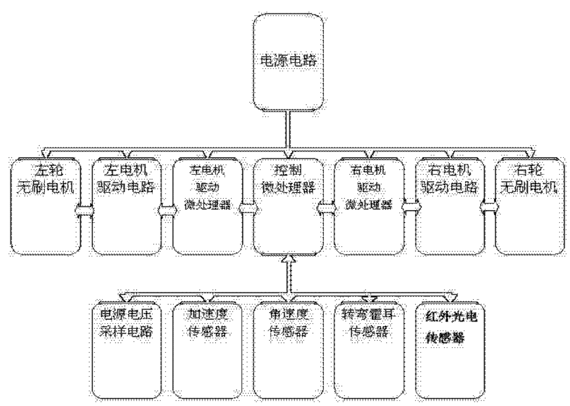
权利要求书1页　说明书4页　附图3页

(54)实用新型名称

智能平衡车平衡控制装置及智能平衡车

(57)摘要

本实用新型涉及一种智能平衡车平衡控制装置及智能平衡车。智能平衡车平衡控制装置，包括均设置在车体中心位置的方向控制器、内部控制传感器、脚踏传感器、控制电路及驱动电路；方向控制器与车体的转向轴连接，内部控制传感器包括角速度传感器、加速度传感器；控制电路包括陀螺仪电路板、自动控制及驱动电路板、控制红外光电开关的红外光电开关电路；上述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。本实用新型可解决如何提高平衡车的自动平衡能力的技术问题。



CN 203268232 U

1. 智能平衡车平衡控制装置，其特征在于：包括均设置在车体中心位置的方向控制器、内部控制传感器、脚踏传感器、控制电路及驱动电路；方向控制器与车体的转向轴连接，内部控制传感器包括角速度传感器、加速度传感器；控制电路包括陀螺仪电路板、自动控制及驱动电路板、控制红外光电开关的红外光电开关电路；上述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。

2. 智能平衡车，其特征在于：包括车体、转向调节机构、平衡控制装置；车体包括扶杆、支撑台、车轮；转向调节机构包括转向轴、转向轴平衡机构；平衡控制装置包括均设置在车体重心位置的方向控制器、内部控制传感器、控制电路及驱动电路；转向轴一端设置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；转向轴平衡机构设置在转向轴上并同时又固定在支撑台内部，内部控制传感器包括角速度传感器、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，扶杆包括上扶杆和下扶杆，上扶杆与下扶杆铰接连接，上扶杆与下扶杆之间设置有角度调节机构，该机构包括连接在一起的角度旋转按钮及弹簧；上扶杆与下扶杆相互卡接，套有弹簧的角度旋转按钮固定在上扶杆侧面上。

智能平衡车平衡控制装置及智能平衡车

技术领域

[0001] 本实用新型涉及一种车辆控制装置，尤其涉及一种单轮或者双轮的智能平衡车平衡控制装置，本实用新型还涉及一种使用该控制装置的平衡车。

背景技术

[0002] 对于广场、步行街、商场、高尔夫球场、花园、别墅周围等场所，汽车无法通行，步行又令人产生疲倦。需要一种可以为人代步的体积小、重量轻、运行灵活、控制方便的新一代车辆。传统的人力车或两轮电动车虽然是广大用户的代步工具，但是由于它们的两轮前后分布，存在着以下缺点：⑴车身长，车辆的转弯半径大，无法在小空间范围内灵活运动；⑵非智能化，无法靠车身来维持平衡，只能靠人工控制，骑行者还得有个漫长的学习过程，并且骑行过程中的稳定性还受到骑行者的熟练程度影响。⑶前后轮分布车体不适合电动倒车操作。1988 年，日本专利说明书 JP63-305082 公开了一种只有左右两轮、能自动保持动态平衡的小车，该申请只是一种能演示一级倒立摆的实验方案，离使用者的骑行在技术上尚有一段遥远的距离。在日本专利申请的基础上，美国专利说明书 US5.701.965 实现了骑行者的站立骑行功能，但存在主要缺点是技术方案烦琐、复杂，可靠性差，制造成本高。

实用新型内容

[0003] 本实用新型的目的是提供一种智能平衡车平衡控制装置，解决如何提高平衡车的自动平衡能力的技术问题。

[0004] 智能平衡车平衡控制装置，包括均设置在车体中心位置的方向控制器、内部控制传感器、脚踏传感器、控制电路及驱动电路；方向控制器与车体的转向轴连接，内部控制传感器包括角速度传感器、加速度传感器；控制电路包括陀螺仪电路板、自动控制及驱动电路板、控制红外光电开关的红外光电开关电路；上述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。

[0005] 智能平衡车，包括车体、转向调节机构、平衡控制装置；车体包括扶杆、支撑台、车轮；转向调节机构包括转向轴、转向轴平衡机构；平衡控制装置包括均设置在车体重心位置的方向控制器、内部控制传感器、控制电路及驱动电路；转向轴一端设置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；转向轴平衡机构设置在转向轴上并同时又固定在支撑台内部，内部控制传感器包括角速度传感器、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，扶杆包括上扶杆和下扶杆，上扶杆与下扶杆铰接连接，上扶杆与下扶杆之间设置有角度调节机构，该机构包括连接在一起的角度旋转按钮及弹簧；上扶杆与下扶杆相互卡接，套有弹簧的角度旋转按钮固定在上扶杆侧面上。

[0006] 本实用新型的有益效果是：由于在车体重心位置设有平衡控制装置；通过加速度传感器和角速度传感器，可以即时测量车体的平衡状况及运行状况，包括车体的倾角和车轮的转角信息，反馈给控制处理器，计算出两个车轮和车体的角速度及加速度，从而实现对

车体的平衡控制，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。

附图说明

[0007] 图 1 是平衡控制装置的框图；

[0008] 图 2 是平衡控制装置组成总体框图；

[0009] 图 3 为平衡车的爆炸图；

[0010] 图 4 是图 3 中 A 处局部放大图；

具体实施方式

[0011] 请参考图 1 至图 4，平衡控制装置包括均设置在车体中心位置的采集方向信息的方向控制器如电位器 24、内部控制传感器、控制电路如自动控制微处理器、驱动电路。

[0012] 电位器 24 用于采集方向信息，可以提供扶杆的左右转弯的数据，可以用线性霍尔传感器或者位置编码器替代。

[0013] 内部控制传感器包括用于控制车体 30 状态的角速度传感器如陀螺仪传感器、用于检测车体水平倾斜角的加速度传感器、检测是否有人在踏板上的脚踏传感器；上述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。在实际应用中，陀螺仪传感器有两块，分别检测车体的俯仰角速率、偏航角速率。采用加速度传感器和角速度传感器，可以即时测量车体的平衡状况及运行状况，包括车体的倾角和车轮的转角信息，反馈给控制处理器，计算出两个车轮和车体的角速度及加速度，从而实现对车体的平衡控制。上述内部控制传感器还可以包括转弯霍耳传感器。脚踏传感器可以是金属抗冲击开关、红外光电开关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。

[0014] 控制电路包括一块嵌入式微控制器芯片，一块复杂可编程逻辑控制器及附属电路。嵌入式微控制芯片用于负责采集传感器的输入、滤波、以及其它的输入、输出量，通过控制算法，输出控制整台车体的姿态和运动的数据。复杂可编程逻辑负责驱动两台无刷电机的正反转及其转速，其控制数据来自嵌入式微控制器。控制电路固化有智能控制的程序软件。该程序软件包含了传感器数据的采集算法、滤波算法，控制数据的融和算法，电机 PID 双闭环控制算法。

[0015] 控制电路通过数字采样得到的是 AD 采样值，因此必须经过一定的算法，对应控制所需的数据信息。陀螺仪传感器最终输出偏航角速率，俯仰角速率，对其积分可以得到每个时刻的偏航角度和俯仰角度。加速度传感器检测车体 30 与水平面的倾斜角。电机转速磁编码器输出的是电机的转速及转向。电位器 24 输出车体 30 转向的期望值，上述每种传感器都对应一种算法。

[0016] 滤波算法在本实施例中可使用卡尔曼滤波算法。

[0017] 数据的融合算法在本实施例中的使用是计算车体 30 的加速度，需要把陀螺仪偏航角速率，俯仰角速率，加速度倾斜角，转弯方向期望值融和到一个数据信息上，送给速度

环进行 PID 闭环控制。

[0018] PID 双闭环控制算法是个常用的控制算法，包括了比例，积分，微分三环节。其中 P 主要是用来改善系统的动态性能 ；I 消除偏差 ；D 是改善动态性能，加强抗干扰能力。采用双闭环控制，内环为电流 PID 闭环，用于在电流允许范围内增大输出 PWM 以提高响应速度，过流时减小输出 PWM，防止因过流导致硬件硬件电路损坏，保证人在行驶过程中的安全。外环为速度 PID 闭环，速度超出范围时通过更改平衡车动态改变平衡车的倾斜角度以实现人无法继续加速，限制车速，防止驾驶者超速行驶造成安全事故。外环速度 PID 闭环，内环电流 PID 闭环，实际可能只用到 PI，即只采用比例、积分，而不用微分。

[0019] 驱动电路由一个三相桥电路组成。

[0020] 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。

[0021] 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。

[0022] 请参考图 3 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、一个平衡控制装置。

[0023] 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。

[0024] 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。

[0025] 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。

[0026] 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。

[0027] 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。

[0028] 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。

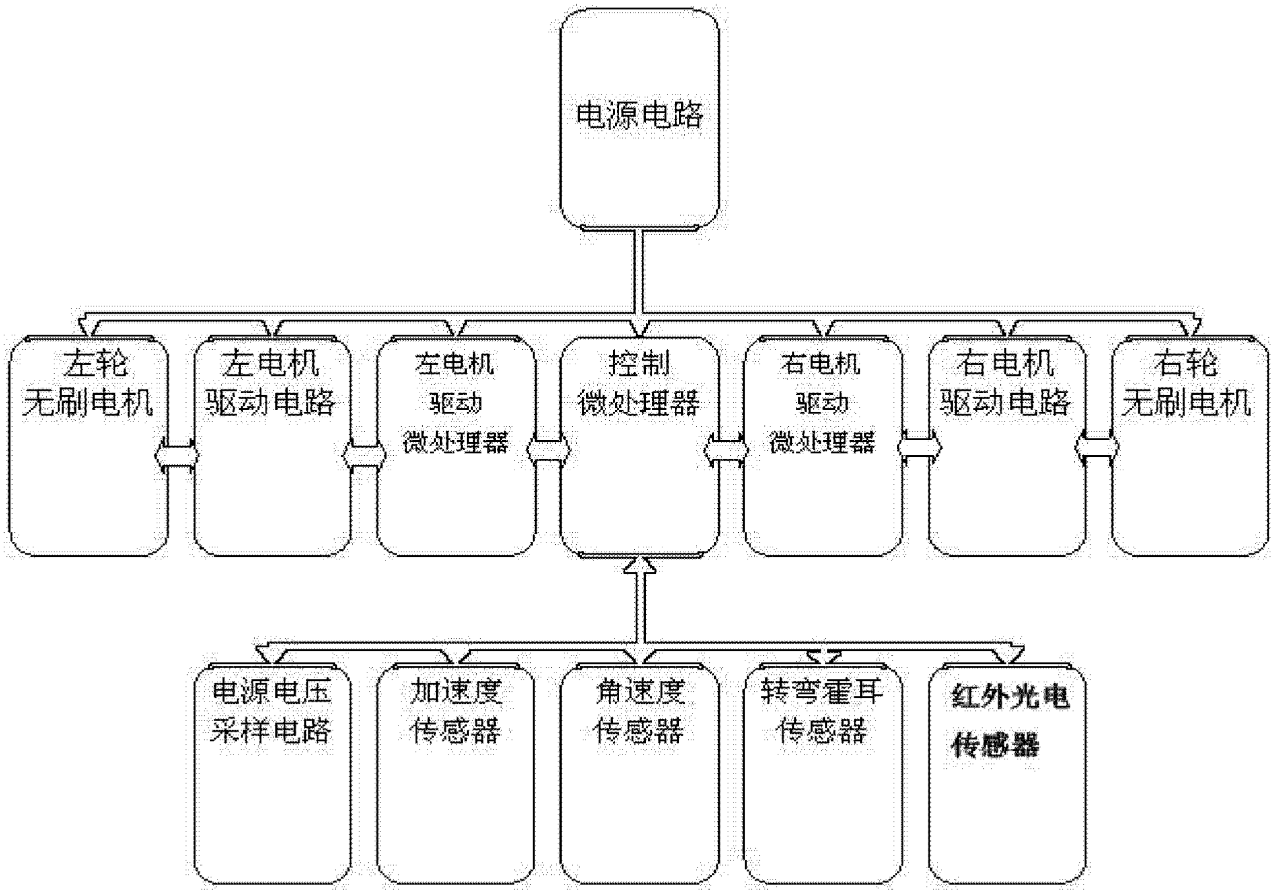

电源电路
左轮
无刷电机
左电机
驱动电路
左电机
驱动
微处理器
控制
微处理器
右电机
驱动
微处理器
右电机
驱动电路
右轮
无刷电机
电源电压
采样电路
加速度
传感器
角速度
传感器
转弯霍耳
传感器
红外光电
传感器

图 1

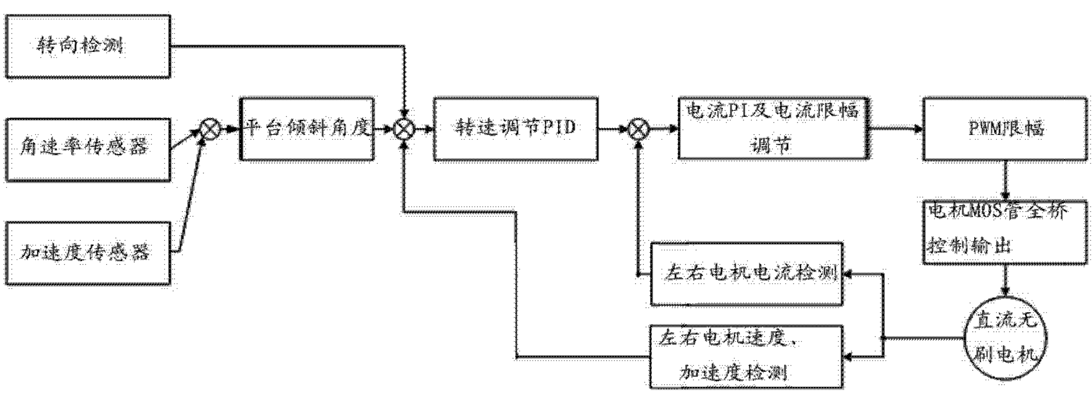

转向检测
角速率传感器
加速度传感器
平台倾斜角度
转速调节PID
电流PI及电流限幅
调节
PWM限幅
电机MOS管全桥
控制输出
直流无
刷电机
左右电机电流检测
左右电机速度、
加速度检测

图 2

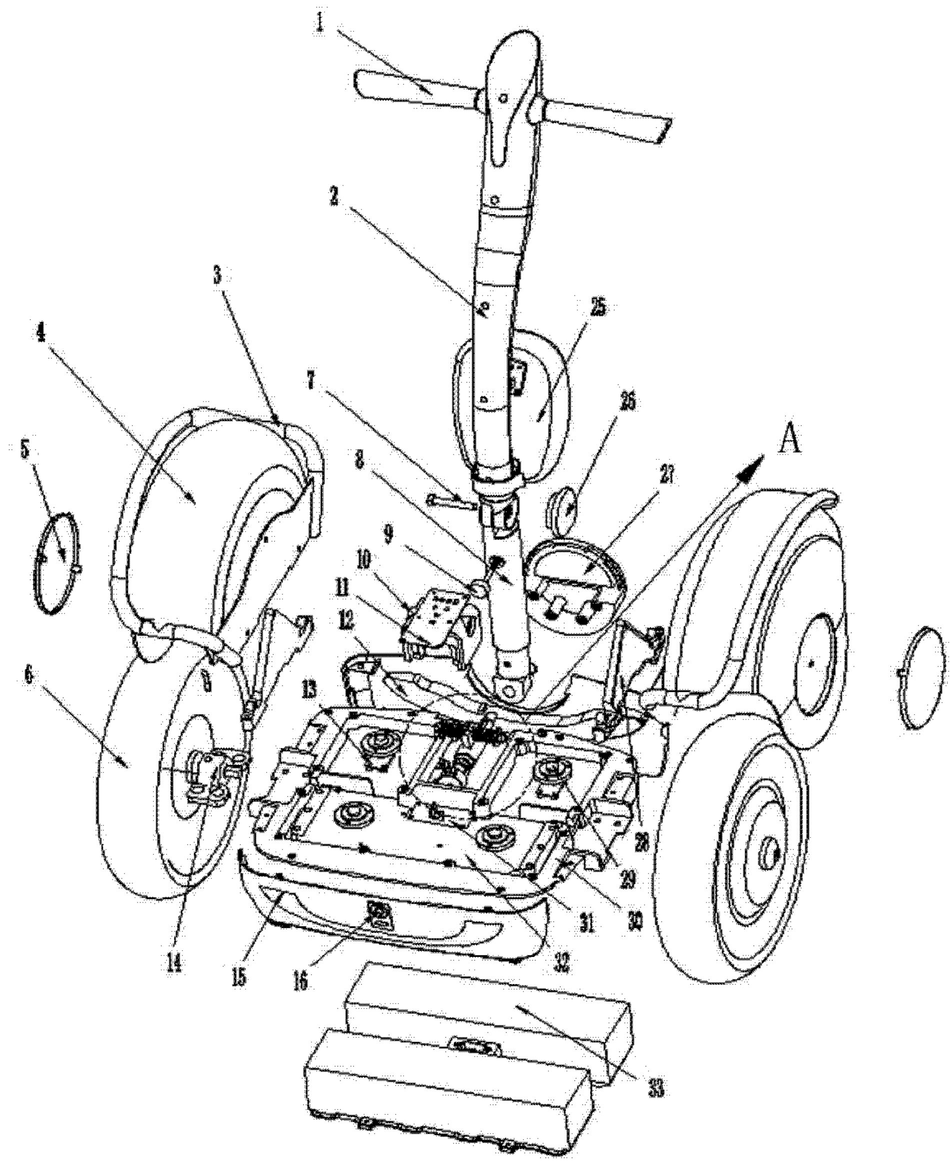


图 3

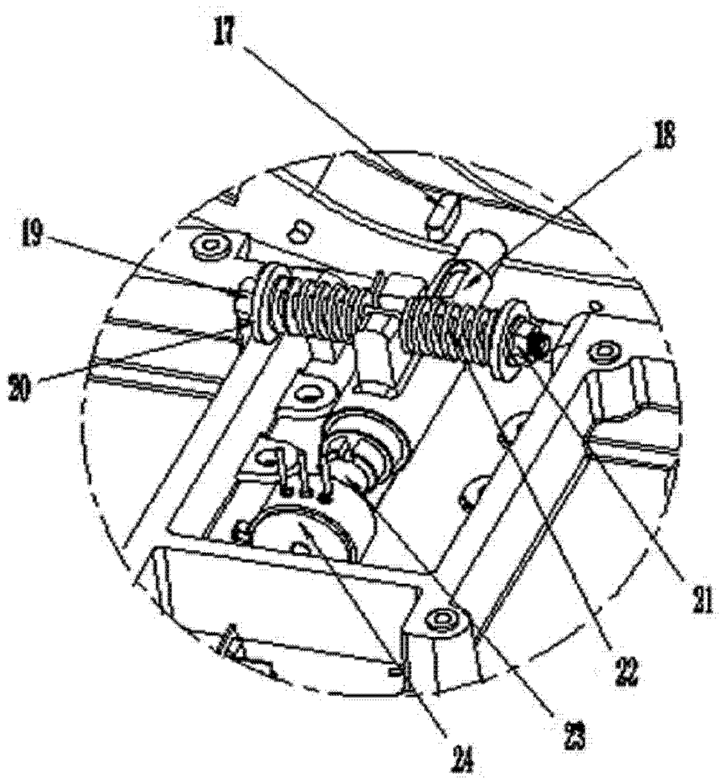


图 4

Espacenet

Bibliographic data: CN203268242 (U) — 2013-11-06

Intelligent balance car

Inventor(s): YING JIAWEI + (YING JIAWEI)

Applicant(s): HANGZHOU YINAO INTELLIGENT TECHNOLOGY CO LTD + (HANGZHOU YINAO INTELLIGENT TECHNOLOGY CO., LTD)

Classification: **- international:** ***B62K11/00; B62K3/00***
- cooperative:

Application number: CN20132050700U 20130130

Priority number (s): CN20132050700U 20130130

Abstract of CN203268242 (U)

The utility model discloses an intelligent balance car. The intelligent balance car comprises a car body, a steering adjusting mechanism and an electrically-driven control device, wherein the car body comprises a hand rod, a supporting platform and wheels; the steering adjusting mechanism comprises a steering shaft and a steering shaft balancing mechanism; the electrically-driven control device comprises a direction controller, an internal control sensor, a control circuit and a driving circuit which are respectively at the center position of gravity of the car body; one end of the steering shaft is arranged at the bottom end of the hand rod in a manner of fixed connection, and the other end of the steering shaft is fixed together with the direction controller; the steering shaft balancing mechanism is arranged on the steering shaft and simultaneously is fixed in the supporting platform; the internal control sensor comprises an angular velocity sensor and an acceleration sensor; and the angular velocity sensor, the acceleration sensor and the direction controller are respectively connected together with the control circuit by the driving circuit. The intelligent balance car has the advantage that the technical problem of how to improve the automatic balance capability of the balance car can be solved.

Notice

CLAIMS CN208268242

1.

A smart balance vehicle, comprising a vehicle body, characterized in that: further comprising a steering adjustment mechanism and an electric drive control device; the vehicle body comprises a support rod, a support platform and a wheel; the steering adjustment mechanism comprises a steering shaft and a steering shaft balance mechanism; and the electric drive The control device comprises a direction controller, an internal control sensor, a control circuit and a driving circuit which are all disposed at the center of gravity of the vehicle; one end of the steering shaft is disposed at a bottom end of the pole and fixedly connected thereto, and the other end is fixed with the direction controller The steering shaft balancing mechanism is disposed on the steering shaft and is simultaneously fixed inside the support platform. The internal control sensor includes an angular velocity sensor and an acceleration sensor; the two sensors together with the direction controller are respectively connected to the control circuit through the driving circuit.

2.

A smart balance vehicle according to claim 1, wherein the support rod is a "T" shaped rod as a whole; and comprises an upper support rod and a lower support rod, the upper support rod being hingedly connected with the lower support rod.

3.

A smart balance vehicle according to claim 2, characterized in that: an angle adjustment mechanism is arranged between the upper support rod and the lower support rod, the mechanism comprises an angle rotation button and a spring connected together; The rod and the lower rod are engaged with each other, and the angled rotating button with a spring is fixed on the side of the upper rod.

4

A smart balance vehicle according to claim 2 wherein said lower pole is a height adjustable lower pole, which comprises an outer rod and an inner rod, the inner rod is sleeved inside the outer rod, and the outer rod is A height adjustment button is connected between the inner rods.

5

A smart balance vehicle according to claim 1, wherein said support table is provided with a pedal, and a pedal sensor for detecting whether or not a person is on the pedal is provided inside the pedal.

6

A smart balance vehicle according to claim 5 wherein said foot sensor is an infrared photoelectric switch.

7.

A smart balance vehicle according to claim 1, wherein said steering shaft balance mechanism comprises a rectangular spring distributed on both sides of the steering shaft, and the other side of the spring is fixed to the frame inside the support table.

8

A smart balance vehicle according to claim 1, wherein said direction controller is a potentiometer.

9

A smart balance vehicle according to claim 1, wherein a battery is provided inside said support table.

10

A smart balance vehicle according to claim 9 wherein said battery is a lead-acid battery or a nickel-hydrogen battery or a lithium battery.

Notice

DESCRIPTION CN203268242

The utility model discloses an intelligent balance vehicle, which comprises a vehicle body, a steering adjustment mechanism and an electric drive control device; the vehicle body comprises a support rod, a support platform and a wheel; the steering adjustment mechanism comprises a steering shaft and a steering shaft balance mechanism; and the electric drive control The device comprises a direction controller, an internal control sensor, a control circuit and a driving circuit which are all disposed at the center of gravity of the vehicle; one end of the steering shaft is disposed at a bottom end of the pole and fixedly connected thereto, and the other end is fixed with the direction controller; The steering shaft balancing mechanism is disposed on the steering shaft and is simultaneously fixed inside the support table. The internal control sensor includes an angular velocity sensor and an acceleration sensor; the two sensors together with the direction controller are respectively connected to the control circuit through the driving circuit. The utility model solves the technical problem of how to balance the automatic balancing ability of the vehicle.

Smart balance car

Technical field

The utility model relates to a vehicle, in particular to a single or two-wheel intelligent balance car.

Background technique

For squares, pedestrian streets, shopping malls, golf courses, gardens, villas and other places, cars can't pass, and walking is tiresome. There is a need for a new generation of vehicles that can be small, light, flexible, and easy to control. Although the traditional rickshaw or two-wheel electric vehicle is a means of transportation for the majority of users, due to their two-wheel distribution, there are the following disadvantages: (1) the body is long, the turning radius of the vehicle is large, and it is impossible to flexibly move in a small space. (2) Non-intelligent, can not rely on the body to maintain balance, can only rely on manual control, the rider has to have a long learning process, and the stability during riding is also affected by the rider's proficiency. (3) The front and rear wheel distribution body is not suitable for electric reversing operation. 1988In the year, Japanese Patent Specification No. JP63-305082 discloses a car that can automatically maintain dynamic balance only with two left and right wheels. The application is only an experimental solution capable of demonstrating an inverted pendulum, and the technical riding from the user is still technical. There is a long distance. On the basis of the Japanese patent application, the US patent specification US 5,701,965 realizes the rider's standing riding function, but the main disadvantage is that the technical solution is cumbersome, complicated, poor in reliability, and high in manufacturing cost.

Utility model content

The purpose of the utility model is to provide a smart balance car and solve the technical problem of how to improve the automatic balancing ability of the balance car.

The utility model relates to a smart balance vehicle, which comprises a vehicle body, a steering adjustment mechanism and an electric drive control device; the vehicle body comprises a support rod, a support platform and a wheel; the steering adjustment mechanism comprises a steering shaft and a steering shaft balance mechanism; and the electric drive control device comprises both Direction controller, internal control sensor, control circuit and drive circuit of the car center of gravity; one end of the steering shaft is fixed at the bottom end of the pole and fixedly connected with the direction controller; the other end is fixed with the direction controller; On the steering shaft and at the same time fixed inside the support table, the internal control sensor comprises an angular velocity sensor and an acceleration sensor; the two sensors together with the direction controller are respectively connected to the control circuit through the driving circuit.

The support rod is a "T"-shaped rod as a whole; and includes an upper support rod and a lower support rod, and the upper support rod is hingedly connected with the lower support rod.

An angle adjustment mechanism is disposed between the upper support rod and the lower support rod, the mechanism includes an angle rotation button and a spring connected together; the upper support rod and the lower support rod are mutually coupled, and the angle rotation button provided with the spring is fixed at the On the side of the upper pole.

The lower support bar is a height adjustable lower support bar, which comprises an outer rod and an inner rod, the inner rod sleeve is inside the outer rod, and a height adjustment button is connected between the outer rod and the inner rod.

A pedal is provided on the support table, and a pedal sensor for detecting whether a person is on the pedal is provided inside the pedal.

The foot sensor is an infrared photoelectric switch.

The steering shaft balancing mechanism includes a rectangular spring distributed on both sides of the steering shaft, and the other side of the spring is fixed to a frame inside the support table.

The direction controller is a potentiometer.

A battery is arranged inside the support table.

The battery is a lead acid battery or a nickel hydrogen battery or a lithium battery.

The utility model has the beneficial effects that: the electric drive control device is arranged at the center of gravity of the vehicle; the electric drive control device is provided with a direction controller, an internal control sensor, a control circuit and a drive circuit, so that the vehicle body has a self-balancing function. The driver only needs to slightly tilt the car forward to move forward. The car body does not have any mechanical brakes. The driver only needs to tilt the car body slightly backward to achieve deceleration, braking and retreat; two-wheel balance car The wheels are distributed on both sides of the vehicle body, and can be reversed and reversed by the electric control system. Therefore, the turning radius is almost zero, the driver swings the handle from side to side, and the signal processing of the sensor can realize turning or in-situ turning. Flexible operation in a small space; the lower end of the pole has a tension bolt as a height adjustment button, which can be adjusted to the most comfortable height according to the driver's needs; the upper and lower ends of the pole have an angle rotation button, the driver can adjust the support The rod is tilted to a suitable angle; the infrared light is also installed on the support table of the vehicle body to identify whether the driver is on the vehicle body

DRAWINGS

Figure 1 is an exploded view of the present invention;

Figure 2is a partial enlarged view of A in Figure 1;

Figure 3is a block diagram of the power supply circuit of the system of the present invention;

Figure 4is a general block diagram of the system components;

detailed description

Referring to FIGS. 1 through 4, a smart balance vehicle includes a vehicle body 30supporting other components, a steering adjustment mechanism, and an electric drive control device.

The vehicle body 30includes a support bar, a support platform for supporting the human body, and a traveling device including two wheels 6

The pole is generally a "T" shaped rod; comprising a handle 1, an upper rod 2, a lower rod 8with an angle adjustment mechanism mounted therebetween, the mechanism comprising an angular rotation button 26and a spring 7connected together Hex bolt; the upper rod 2and the lower rod 8are engaged with each other, and the upper rod 2and the lower rod 8are connected with the spring 7and the angle rotation button 26by a hexagon bolt, and the rotation lever 26can be adjusted to adjust the upper rod The inclination angle of 2, the mechanism is mainly to make the upper pole can rotate on the lower pole, and its structure is a common structure. The lower support bar 8is a height adjustable lower support bar, which comprises an outer rod and an inner rod. The inner rod sleeve is inside the outer rod, and a height adjustment button 9is connected between the outer rod and the inner rod. The elastic height adjustment button 9can adjust the handle 1 to a suitable height. In order to save transportation space, the elastic height adjustment button 9can remove the upper lever 2.

A pedal is provided on the support table, and a pedal sensor for detecting whether a person is on the pedal is provided inside the pedal. The foot sensor can be a metal impact switch, an infrared photoelectric switch 29, and other devices that can be used to detect a person getting on and off the vehicle. Preferably, the present embodiment employs an infrared photoelectric switch 29. As a foot sensor, when a person gets on the vehicle, the infrared light detects that the infrared photoelectric switch 29is turned on, and the microprocessor operates in an automatic balance state. A battery is arranged inside the support base, and a lead-acid battery or a nickel-hydrogen battery or a lithium battery can be selected according to requirements. Correspondingly, a battery for charging the battery 33is processed at an intermediate position of the rear lamp 15at the rear of the vehicle body 30. Charging interface 16.

The steering adjustment mechanism includes a steering shaft 18and a steering shaft balancing mechanism; one end of the steering shaft 18is fixed to the bottom end of the pole and fixedly connected thereto, and the other end is fixed with the direction controller; the steering shaft balancing mechanism is fixed to the steering shaft 24 and at the same time fixed inside the support table. The steering shaft balancing mechanism includes a bearing housing, a steering housing 10that protects internal components of the steering device, a rectangular spring 22, a spring stop 20connected to the rectangular spring 22, and a hex flange bolt 19, a steering shaft 18that traverses the bearing housing, and a hexagon Flange nut 21, flat key 17, potentiometer connector 23.

The electric drive control device includes a direction controller, such as a potentiometer 24, an internal control sensor, a control circuit, and a drive circuit, both disposed at a central position of the vehicle body 30, the internal control sensor includes an angular velocity sensor such as a gyro sensor, an acceleration sensor; and the above two sensors Together with the direction controller, the drive circuit and the control circuit are respectively connected. The wheel 6may also be provided with a single wheel body or a plurality of wheel bodies as needed, and the distribution manner may be parallel or relative arrangement. The control circuit includes a gyro circuit board 31, an automatic control and drive circuit board 32, an infrared photoelectric switch circuit 13for controlling the infrared photoelectric switch, and an indicator circuit board 11.

The lower end of the lower bar 8is provided with a steering coupling and is connected to the steering shaft 18in the steering device via a flat key 17, and the steering shaft 18is fixed to the front and rear ends of the steering housing 10through bearings and bearing housings, and the rear end of the steering shaft 18passes through A potentiometer connector 23is coupled to the rotary shaft of the potentiometer 24to change its output resistance. Swinging the handle 1 to the left and right, driving the steering shaft 18to rotate, restricting the angle of the handle 1 to the left and right by the left and right rectangular springs 22and the spring stop 20, and returning to the intermediate position, and changing the resistance of the potentiometer 24to change the running device The speed and direction of the turn to achieve a turn or turn in place.

The traveling device further includes a protective support tube 3, a fender 4, a slab decorative cover 5, a slab fixing seat 28, and a motor mount 14. A motor is mounted in the wheel 6, and is connected to the two sides of the vehicle body 30through the motor fixing base 14. The fender 4and the protective support tube 3are fixed to the slab fixing base 28and are connected to the vehicle body 30to enhance the safety of the driver. . The motor employs an in-wheel motor in the present embodiment, and a rotating shaft of the in-wheel motor is fixed in the vehicle body 30. In order to facilitate night travel, a vehicle body headlight 27, a vehicle body headlight 12, and a vehicle body rear lamp 15may be attached to the rear end of the vehicle body 30at the front end of the vehicle body 30. Of course, in order to facilitate carrying the article, a device for mounting the bag 25can be provided on the upper pole 2. The size and shape of the bag 25can be determined on a case-by-case basis. The motor is driven by a drive circuit, that is, a drive controller.

The specific working principle of the above automatic balancing vehicle is as follows:

The support rod composed of the handle 1, the upper support rod 2and the lower support rod 8is a T-shaped rod, and the lower end is connected with the steering shaft 18, and can be rotated about 32degrees from the center normal, and simultaneously drives the potentiometer connector 23to rotate. . When the pole is swung left and right, the rotating shaft in the potentiometer 24will also rotate, and the output voltage in the potentiometer 24will change, thereby detecting the moving position of the pole, and the internal microprocessor will correspondingly Control left and right turn operations.

The block diagram of the system power supply circuit is shown in Figure 3. The power supply is safe and durable. It is suitable for high-current discharge lead-acid batteries. The power supply voltage is 48V. The positive pole of the battery supplies power to the system through the power switch. Because the brushless motor is inductive load, when working, The induced voltage caused by the self-inductance and mutual inductance of the motor coil can cause system interference. In order to prevent the power supply part of the motor drive controller from interfering with the automatic control system through the power supply loop, the power supply loop of the automatic control system, that is, the control circuit should adopt an independent power supply, through multiple stages. The linear regulator stabilizes the 48V DC voltage to 5V, powering the automatic control microprocessor, accelerometer, angular velocity sensor and potentiometer 24. The motor drive controller power supply is regulated from a linear regulator to a front-end driver from 48V to 5V. The two-wheel electric vehicle distributed on the left and right has two motor drive controllers, which are respectively powered by independent two-way regulated power supply; the single-wheeled vehicle has only one motor drive controller, and accordingly the internal circuit has only one motor drive controller power supply. It is powered.

The motor drive controller adopts six high-power switch-type CMOS tubes as the rear-stage drive. The connected motor is a three-phase star-six-state drive mode. Each two high-power CMOS tubes are bridged as one phase output of the motor and connected to the DC. The CMOS tube of the busbar positive pole is the upper bridge arm tube, and the CMOS tube connecting the current sampling resistor to the negative pole of the DC busbar is the lower bridge arm tube. After the three PWM outputs of the drive controller pass through the buffer drive circuit, three upper-bridge CMOS transistors are respectively driven, and three strobe signals pass through the buffer drive circuit to respectively drive three lower-bridge CMOS transistors. The drive control microprocessor is connected to the automatic control micro-processing chip through the parallel port communication interface, and is controlled by the automatic control microprocessor. The drive microprocessor can instantly measure the motor speed and transmit the speed signal to the automatic control micro through the uplink data. The processor and the microprocessor compare the measurement data uploaded by the left and right motor drive controllers, and after the compensation algorithm, the rotation speed of the two wheels 6is not affected by the parameter inconsistency and deviates from the walking direction. The lower CMOS tube of the motor drive circuit is connected with a constant copper resistor, which can sample and measure the current flowing through the motor. Once the motor overcurrent is encountered, the microprocessor turns off the PWM output and the strobe signal in time to prevent the motor from overcurrent. Or circuit failure caused by accidental short circuit to ensure safe operation of the motor.

As shown in FIG. 4, the utility model can instantly measure the balance condition and running condition of the vehicle body 30, including the inclination angle of the vehicle body 30and the rotation angle information of the wheel 6through the acceleration sensor and the angular velocity sensor, and feed back to the automatic control microprocessor to calculate The angular velocity and angular acceleration of the two wheels 6and the vehicle body 30are calculated, thereby calculating the motor torque required for the wheel 6, and achieving balance control of the vehicle body 30. The speed of the acquisition motor can be either a magnetically encoded sensor or an optically encoded or line Hall sensor.

When the vehicle body 30does not move or tilt, the acceleration sensor obtains the inclination signal of the vehicle body 30, at which time the center voltage is 2.5V, and is sent to the control microprocessor, and the microprocessor integrates the left and right wheels 6according to the signal. The speed signal, at this time, the speed is almost zero, and the motor torque control amount required for the two wheels is calculated, and the control amount is sent to the drive controller to drive the microprocessor, thereby driving the corresponding output power of the motor to keep the body 30balanced in situ. . When the vehicle body 30is required to advance, the rider controls the center of gravity to shift forward, so that the vehicle body 30is slightly tilted forward, and the acceleration sensor obtains a tilt signal, at which time the voltage is increased and sent to the control microprocessor to control the microprocessor. According to this signal and synthesizing the left and right wheel 6speed signals, the motor torque control amount required for the two wheels is calculated, and the control amount is sent to the drive controller, and the motor drive circuit drives the motor to rotate forward and maintain the vehicle body balance at all times. The larger the dip angle, the larger the voltage signal output from the sensor deviates from the center voltage and the faster the acceleration. When it is necessary to decelerate, brake or retreat, the rider controls the center of gravity to move backward, so that the vehicle body 30is tilted slightly backward, and the control microprocessor can also calculate the required reverse torque according to the sensor signal, thereby controlling the motor to rotate backward. And always keep the car body balanced. The greater the backward tilt angle, the faster the reverse acceleration. When a turn is needed, the rider swings the handrail so that the potentiometer installed under the armrest gets different voltage values, and the control microprocessor calculates the different torques of the left and right wheels, thereby controlling the two wheels 6at different speeds. Or the direction is rotated and the vehicle body 30is always balanced, whereby the vehicle body 30can be controlled to rotate to the desired direction.

In practical applications, the automatic balance car is not limited to two wheels. When it is a single-wheel electric vehicle, there is only one hub motor, which is installed between the two pedals, and the rider has two legs on the two pedals. The hub motor axles of the single-wheeled vehicle or the two-wheeled vehicle are fixed on the vehicle body 30, and the internal control sensors are angular velocity sensors and acceleration sensors, which are all installed at the center of gravity of the vehicle body 30, and the control circuit is solidified with intelligent control program software.

(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 203268242 U

(45)授权公告日 2013.11.06

(21)申请号 201320050700.2

(22)申请日 2013.01.30

(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 应佳伟

(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)

B62K 3/00(2006.01)

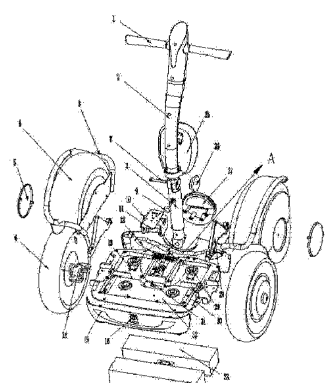
权利要求书1页 说明书4页 附图4页

(54)实用新型名称

智能平衡车

(57)摘要

本实用新型公开了一种智能平衡车，包括车体、转向调节机构、电驱动控制装置；车体包括扶杆、支撑台、车轮；转向调节机构包括转向轴、转向轴平衡机构；电驱动控制装置包括均设置在车体重心位置的方向控制器、内部控制传感器、控制电路及驱动电路；转向轴一端设置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；转向轴平衡机构设置在转向轴上并同时又固定在支撑台内部，内部控制传感器包括角速度传感器、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。本实用新型科解决如何平衡车的自动平衡能力的技术问题。



CN 203268242 U

1. 一种智能平衡车，包括车体，其特征在于：还包括转向调节机构、电驱动控制装置；车体包括扶杆、支撑台、车轮；转向调节机构包括转向轴、转向轴平衡机构；电驱动控制装置包括均设置在车体重心位置的方向控制器、内部控制传感器、控制电路及驱动电路；转向轴一端设置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；转向轴平衡机构设置在转向轴上并同时又固定在支撑台内部，内部控制传感器包括角速度传感器、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。

2. 依据权利要求 1 中所述的一种智能平衡车，其特征在于：所述扶杆整体为“T”形杆；包括上扶杆和下扶杆，上扶杆与下扶杆铰接连接。

3. 依据权利要求 2 中所述的一种智能平衡车，其特征在于：所述上扶杆与下扶杆之间设置有角度调节机构，该机构包括连接在一起的角度旋转按钮及弹簧；上扶杆与下扶杆相互卡接，套有弹簧的角度旋转按钮固定在上扶杆侧面上。

4. 依据权利要求 2 中所述的一种智能平衡车，其特征在于：所述下扶杆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。

5. 依据权利要求 1 中所述的一种智能平衡车，其特征在于：所述支撑台上设有踏板，在该踏板内部设有检测是否有人在踏板上的脚踏传感器。

6. 依据权利要求 5 中所述的一种智能平衡车，其特征在于：所述脚踏传感器为红外光电开关。

7. 依据权利要求 1 中所述的一种智能平衡车，其特征在于：所述转向轴平衡机构包括分布在转向轴两侧的矩形弹簧，该弹簧另一侧固定在支撑台内部的框架上。

8. 依据权利要求 1 中所述的一种智能平衡车，其特征在于：所述方向控制器为电位器。

9. 依据权利要求 1 中所述的一种智能平衡车，其特征在于：所述支撑台内部设有蓄电池。

10. 依据权利要求 9 中所述的一种智能平衡车，其特征在于：所述蓄电池为铅酸电池或镍氢电池或锂电电池。

智能平衡车

技术领域

[0001] 本实用新型涉及一种车辆，尤其涉及一种单轮或者双轮的智能平衡车。

背景技术

[0002] 对于广场、步行街、商场、高尔夫球场、花园、别墅周围等场所，汽车无法通行，步行又令人产生疲倦。需要一种可以为人代步的体积小、重量轻、运行灵活、控制方便的新一代车辆。传统的人力车或两轮电动车虽然是广大用户的代步工具，但是由于它们的两轮前后分布，存在着以下缺点 :⑴车身长，车辆的转弯半径大，无法在小空间范围内灵活运动 ;⑵非智能化，无法靠车身来维持平衡，只能靠人工控制，骑行者还得有个漫长的学习过程，并且骑行过程中的稳定性还受到骑行者的熟练程度影响。⑶前后轮分布车体不适合电动倒车操作。1988 年，日本专利说明书 JP63-305082 公开了一种只有左右两轮、能自动保持动态平衡的小车，该申请只是一种能演示一级倒立摆的实验方案，离使用者的骑行在技术上尚有一段遥远的距离。在日本专利申请的基础上，美国专利说明书 US5. 701. 965 实现了骑行者的站立骑行功能，但存在主要缺点是技术方案烦琐、复杂，可靠性差，制造成本高。

实用新型内容

[0003] 本实用新型的目的是提供一种智能平衡车，解决如何提高平衡车的自动平衡能力的技术问题。

[0004] 一种智能平衡车，包括车体、转向调节机构、电驱动控制装置 ;车体包括扶杆、支撑台、车轮 ;转向调节机构包括转向轴、转向轴平衡机构 ;电驱动控制装置包括均设置在车体重心位置的方向控制器、内部控制传感器、控制电路及驱动电路 ;转向轴一端设置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 ;转向轴平衡机构设置在转向轴上并同时又固定在支撑台内部，内部控制传感器包括角速度传感器、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。

[0005] 所述扶杆整体为“T”形杆 ;包括上扶杆和下扶杆，上扶杆与下扶杆铰接连接。

[0006] 所述上扶杆与下扶杆之间设置有角度调节机构，该机构包括连接在一起的角度旋转按钮及弹簧 ;上扶杆与下扶杆相互卡接，套有弹簧的角度旋转按钮固定在上扶杆侧面上。

[0007] 所述下扶杆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。

[0008] 所述支撑台上设有踏板，在该踏板内部设有检测是否有人在踏板上的脚踏传感器。

[0009] 所述脚踏传感器为红外光电开关。

[0010] 所述转向轴平衡机构包括分布在转向轴两侧的矩形弹簧，该弹簧另一侧固定在支撑台内部的框架上。

[0011] 所述方向控制器为电位器。

[0012] 所述支撑台内部设有蓄电池。