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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 |

**CONFIRMATION NO. 5063**

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

**POWER OF ATTORNEY NOTICE**

*OC000000058025085*

Date Mailed: 06/09/2023

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/25/2023.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sleutchit/



Textron Specialized Vehicles Inc., Exh. 1002, p. 1

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 00203.1506.0BUS |

**CONFIRMATION NO. 5063**

136725
Anova Law Group, PLLC
21495 Ridgetop Circle, Suite 300
Sterling, VA 20166

**POA ACCEPTANCE LETTER**

*OC000000058025122*

Date Mailed: 06/09/2023

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/25/2023.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sleutchit/

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 48059930 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | Li Jiang/Yapei Zhang |
| **Filer Authorized By:** | Li Jiang |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 25-MAY-2023 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 16:20:44 |
| **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 | Power of Attorney | POA0020315060Bp.pdf | 672495<br>0fb6a29a866e3a04c8f5e85b706d2dbe65a97c60 | no | 2 |

**Warnings:**

| Information: | |
|---|---|
| Total Files Size (in bytes): | 672495 |

**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.**

PTO/AIA/81A (02-15)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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# PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

| | |
|---|---|
| Patent Number | 11462116 |
| Issue Date | 10/04/2022 |
| First Named Inventor | Xinan XU |
| Title | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| Attorney Docket No. | 00203.1506.0BUS |

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 136725

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

| Practitioner(s) Name | Registration Number |
|---|---|
| | |
| | |
| | |
| | |

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☒ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

| | | | | | |
|---|---|---|---|---|---|
| ☐ Firm or Individual Name | | | | | |
| Address | | | | | |
| City | | State | | Zip | |
| Country | | | | | |
| Telephone | | Email | | | |

I am the:

☒ Applicant. SZ DJI TECHNOLOGY CO., LTD.

OR

☐ Patent owner.

*Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on* _____

**SIGNATURE of Applicant or Patent Owner**

| | | | |
|---|---|---|---|
| Signature | Wenhao ZHOU | Date | 2023. 4. 11 |
| Name | Wenhao ZHOU | Telephone | |
| Title and Company | IP Manager, SZ DJI TECHNOLOGY CO., LTD. | | |

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☑ A total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 3 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## 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.

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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 |
|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 |

**CONFIRMATION NO. 5063**

**IMPROPER CPOA LETTER**

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

*OC000000056157651*

Date Mailed: 04/20/2023

## NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 04/14/2023. The power of attorney in this application is not accepted for the reason(s) listed below:

The power of attorney filed 04/14/2023 has not been accepted because the power of attorney must be signed by the applicant for patent. See 37 CFR 1.32(b)(4).

- The person or entity attempting the change to power of attorney is not the applicant of record in the application. Any request to change the applicant once the applicant has been specified must include (1) an application data sheet (ADS) specifying the new applicant in the Applicant Information section, and (2) a statement under 37 CFR 3.73(c) (USPTO Form PTO/AIA/96 or an equivalent) to show chain of title to the new applicant. The ADS must contain markings to show the information that is being changed, with underlining for insertions and strike-through or brackets for text removed. See 37 CFR 1.76(c)(2).

Because the request to change or update the applicant cannot be accepted, the power of attorney is not properly signed by the applicant and cannot be accepted. The change to applicant must be acceptable before the new applicant can appoint power of attorney.

/tmbrooks/

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

136725
Anova Law Group, PLLC
21495 Ridgetop Circle, Suite 300
Sterling, VA 20166
UNITED STATES

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 47844498 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | Li Jiang/Yapei Zhang |
| **Filer Authorized By:** | Li Jiang |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 14-APR-2023 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 13:14:37 |
| **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 | Power of Attorney | POA0020315060Bp.pdf | 655246<br>efe7d39d5c6e4ee0e3d19d9c722a1c072ac5300b | no | 2 |

**Warnings:**

| Information: | |
|---|---|
| Total Files Size (in bytes): | 655246 |

**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.**

PTO/AIA/81A (02-15)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

# PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

| | |
|---|---|
| Patent Number | 11462116 |
| Issue Date | 10/04/2022 |
| First Named Inventor | Xinan XU |
| Title | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| Attorney Docket No. | 00203.1506.0BUS |

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 136725

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

| Practitioner(s) Name | Registration Number |
|---|---|
| | |
| | |
| | |
| | |

Please recognize or change the correspondence address for the above-identified patent to:

☒ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

| | | | | | |
|---|---|---|---|---|---|
| ☐ Firm or Individual Name | | | | | |
| Address | | | | | |
| City | | State | | Zip | |
| Country | | | | | |
| Telephone | | Email | | | |

I am the:

☒ Applicant.

OR

☐ Patent owner.

*Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on* _____

**SIGNATURE of Applicant or Patent Owner**

| | | | |
|---|---|---|---|
| Signature | Wenhao ZHOU | Date | 2023. 4. 11 |
| Name | Wenhao ZHOU | Telephone | |
| Title and Company | IP Manager, SZ DJI TECHNOLOGY CO., LTD. | | |

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☑ A total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 3 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

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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.

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/523,847 | 10/04/2022 | 11462116 | 144604-8001.US00 | 5063 |

25096 7590 09/14/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

# 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 Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

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

Xinan XU, Shenzhen, CHINA;
Yun YU, Shenzhen, CHINA;
Canlong LIN, Shenzhen, CHINA;
Xi CHEN, Shenzhen, CHINA;
Mingyu WANG, Shenzhen, CHINA;

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

SZ DJI TECHNOLOGY CO., LTD., Shenzhen, CHINA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Receipt date: 08/25/2022

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

**U.S. PATENTS**

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 10733895 | B2 | 2020-08-04 | Liu, et al. | |

**U.S. PATENT APPLICATION PUBLICATIONS**

| 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 |
|---|---|---|---|---|---|---|

**FOREIGN PATENT DOCUMENTS**

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T[5] |
|---|---|---|---|---|---|---|---|---|
| | 1 | 1222969 | CN | A | 1999-07-14 | SEXTANT AVIONIQUE | | |
| | 2 | 1222970 | CN | A | 1999-07-14 | SEXTANT AVIONIQUE | | |

**NON-PATENT LITERATURE DOCUMENTS**

| 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, page(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | Response to Feb. 7, 2022 Non-Final Office Action in U.S. Patent Application 16/942,096 filed with the U.S. Patent Office on June 1, 2022, 13 pages. | |
| | 2 | United States Patent and Trademark Office, Final Office Action, U.S. Patent Application 16/942,096, mailed Jun. 24, 2022, 7 pages. | |
| | 3 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 16/810,631, mailed Jun. 15, 2022, 5 pages. | |
| | 4 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 17/523,859, mailed Jul. 11, 2022, 6 pages. | |

**EXAMINER SIGNATURE**

| Examiner Signature | /MARY CHEUNG/ | Date Considered | 08/29/2022 |
|---|---|---|---|

*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.



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

[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.

## 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.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

## 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 | /Anni Siitonen/ | Date (YYYY-MM-DD) | 2022-08-25 |
| Name/Print | Anni Siitonen | Registration Number | 74,974 |

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.**



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | **Examiner** | **Art Unit** |
| | MARY D CHEUNG | 3665 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| G08G | / | 5 | / | 006 | F | 2013-01-01 |
| G08G | / | 5 | / | 0069 | I | 2013-01-01 |
| G05D | / | 1 | / | 0214 | I | 2013-01-01 |
| G08G | / | 5 | / | 0021 | I | 2013-01-01 |
| G08G | / | 5 | / | 0026 | I | 2013-01-01 |
| G08G | / | 5 | / | 0052 | I | 2013-01-01 |
| G08G | / | 5 | / | 0082 | I | 2013-01-01 |
| G08G | / | 5 | / | 0013 | I | 2013-01-01 |
| G05D | / | 1 | / | 106 | I | 2019-05-01 |
| G08G | / | 5 | / | 0004 | I | 2013-01-01 |
| B64C | / | 39 | / | 024 | I | 2013-01-01 |
| B64D | / | 47 | / | 08 | I | 2013-01-01 |
| B64C | / | 2201 | / | 024 | A | 2013-01-01 |
| B64C | / | 2201 | / | 141 | A | 2013-01-01 |
| B64C | / | 2201 | / | 146 | A | 2013-01-01 |
| B64C | / | 2201 | / | 127 | A | 2013-01-01 |

| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | / | | / | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 29 August 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220829



Textron Specialized Vehicles Inc., Exh. 1002, p. 15

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | **Examiner** | **Art Unit** |
| | MARY D CHEUNG | 3665 |

| INTERNATIONAL CLASSIFICATION | | | | |
|---|---|---|---|---|
| **CLAIMED** | | | | |
| G08G | / | 5 | / | 00 |

| NON-CLAIMED | | | | |
|---|---|---|---|---|
| | / | | / | |

| US ORIGINAL CLASSIFICATION | |
|---|---|
| **CLASS** | **SUBCLASS** |
| | |

| CROSS REFERENCES(S) | | | | | | |
|---|---|---|---|---|---|---|
| **CLASS** | **SUBCLASS (ONE SUBCLASS PER BLOCK)** | | | | | |
| | | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 29 August 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220829



Textron Specialized Vehicles Inc., Exh. 1002, p. 16

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | Examiner | Art Unit |
| | MARY D CHEUNG | 3665 |

☐ 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 9 | 10 | 18 | 19 | - | 28 | | | | | | | | |
| 2 | 2 | 10 | 11 | 19 | 20 | - | 29 | | | | | | | | |
| 3 | 3 | 11 | 12 | 20 | 21 | - | 30 | | | | | | | | |
| - | 4 | 12 | 13 | 21 | 22 | | | | | | | | | | |
| 4 | 5 | 13 | 14 | 22 | 23 | | | | | | | | | | |
| 5 | 6 | 14 | 15 | 23 | 24 | | | | | | | | | | |
| 6 | 7 | 15 | 16 | - | 25 | | | | | | | | | | |
| 7 | 8 | 16 | 17 | - | 26 | | | | | | | | | | |
| 8 | 9 | 17 | 18 | - | 27 | | | | | | | | | | |

| NONE | | Total Claims Allowed: | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 29 August 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office

Part of Paper No.: 20220829



Textron Specialized Vehicles Inc., Exh. 1002, p. 17

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. |
|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 | 5063 |

25096 7590 09/01/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

| EXAMINER | |
|---|---|
| CHEUNG, MARY DA ZHI WANG | |
| **ART UNIT** | **PAPER NUMBER** |
| 3665 | |
| **NOTIFICATION DATE** | **DELIVERY MODE** |
| 09/01/2022 | 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):

patentprocurement@perkinscoie.com

| ***Corrected*** ***Notice of Allowability*** | **Application No.** 17/523,847 | **Applicant(s)** XU et al. | |
|---|---|---|---|
| | **Examiner** MARY D CHEUNG | **Art Unit** 3665 | **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 8/25/2022.
   ☐ 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 1-3 and 5-24 . 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. 15/699,359 .
   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 8/25/22.
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 _____.

/MARY CHEUNG/
Primary Examiner, Art Unit 3665

# PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the 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, VA 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)

Perkins Coie LLP
P.O. Box 1247
PATENT - SEA
Seattle, WA, 98111-1247
US

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 |
|---|---|---|---|---|
| 17/523,847 | 2021-11-10 | Xinan Xu | 144604-8001.US00 | 5063 |

TITLE OF INVENTION: POLYGON SHAPED VEHICLE RESTRICTION ZONES

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| UTILITY | LARGE | 1200 | 0 | 0 | 1200 | 2022-09-01 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| Mary Cheung | 3665 | - |

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. Perkins Coie LLP
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: SZ DJI TECHNOLOGY CO., LTD.

(B) RESIDENCE: (CITY and STATE or COUNTRY): Shenzhen, CN

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. 50-0665

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29. 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.

☐ Applicant asserting small entity status. See 37 CFR 1.27. NOTE: If the application was previously under micro entity status, checking this box will be taken as a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status. NOTE: Checking this box will be taken as 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 /Anni Siitonen/ Date 2022-08-30

Typed or printed name Anni Siitonen Registration No. 74,974



Textron Specialized Vehicles Inc., Exh. 1002, p. 20

## 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.

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 46520094 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | Anni Johanna Siitonen/Wade Barbus |
| **Filer Authorized By:** | Anni Johanna Siitonen |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 30-AUG-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 20:13:52 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $1200 |
| RAM confirmation Number | E20228TK15040037 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## 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) | IssueFee.pdf | 184624<br>87c8d7a3334aad5c880c8b218e41f9a2b09cc85d | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Miscellaneous Incoming Letter | Comments.pdf | 17852<br>8489fc2dd1a45fe0671fb4790a2877ca010dd093 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 38077<br>ae00421596337752b3d588e3500a7d50f6ab0a24 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 240553 | | |

**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.**

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 17523847 |
| **Filing Date:** | 10-Nov-2021 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Filer:** | Anni Johanna Siitonen/Wade Barbus |
| **Attorney Docket Number:** | 144604-8001.US00 |

Filed as Large 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:** | | | | |
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| UTILITY APPL ISSUE FEE | 1501 | 1 | 1200 | 1200 |

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| **Extension-of-Time:** | | | | |
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Docket No.: 144604-8001.US00
(PATENT)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:
Xinan Xu et al.

| | |
|---|---|
| Application No.: 17/523,847 | Confirmation No.: 5063 |
| Filed: November 10, 2021 | Art Unit: 3665 |
| For: POLYGON SHAPED VEHICLE RESTRICTION ZONES | Examiner: Mary Da Zhi Wang Cheung |

**COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE**

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

Dear Commissioner:

In the Notice of Allowability mailed June 1, 2022, the Examiner allowed claims 1-3 and 5-24. Applicant acknowledges Examiner's statements of Reasons for Allowance of the above-referenced patent application and agrees that the claimed subject matter is patentable. However, Applicant takes no position regarding the Reasons for Allowance presented by the Examiner other than the positions Applicant may have previously taken during prosecution. Therefore, the Examiner's Reasons for Allowance should not be attributed to Applicant as an indication of the basis for Applicant's belief that the claims are patentable. Furthermore, Applicant respectfully asserts that there may also be additional reasons for patentability of the claimed subject matter not explicitly stated in this record and Applicant does not waive its rights to such arguments by not further addressing such reasons herein.

Dated: August 30, 2022 Respectfully submitted,





Textron Specialized Vehicles Inc., Exh. 1002, p. 26

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Attorneys for Applicant

| Electronic Acknowledgement Receipt | |
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| **EFS ID:** | 46490668 |
| **Application Number:** | 17523847 |
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| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | Anni Johanna Siitonen/Pamela Baumgart |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | 2022_08_25_SuppIDS_144604 8001US00.PDF | 189973<br>ae6b42fe48829a0e0efe44454ccef3e946c8 0142 | no | 2 |
| **Warnings:** | | | | | |
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| This is not an USPTO supplied IDS fillable form | | | | | |
| 2 | Foreign Reference | CN1222969A.PDF | 1313793<br>ea6cf99efe38fb0e2bf46ef4c790d67ecf909 d47 | no | 13 |
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| 3 | Foreign Reference | CN1222970A.PDF | 1337399<br>15d532aab5a9bd558fdbf2bea8ff749a01a2 a5ae | no | 15 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Non Patent Literature | 2022_06_01_RespNFOA_Amen dment_1446048002US01.PDF | 166716<br>e199a489fa852e0760b1f82792a0ac5427dff e0f | no | 13 |
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| 5 | Non Patent Literature | 2022_06_24_FOA_16942096. PDF | 265823<br>05611775fb8f1e3b5bd35ac333d5aab5dba 526d4 | no | 7 |
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| **Information:** | | | | | |
| 6 | Non Patent Literature | 2022_06_15_NOA_16810631. PDF | 354746<br>2960f5b2281e8bdd8e877fce2be1ad42b8c a0dc9 | no | 5 |
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| **Information:** | | | | | |
| 7 | Non Patent Literature | 2022_07_11_NOA_17523859.PDF | 542225<br>27d0cd2ac935bec212e20cb82f7cfe13a18257c4 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 8 | Fee Worksheet (SB06) | fee-info.pdf | 38195<br>9e6d5b7e4723bd764a608c0b3d505b9d7a58b260 | no | 2 |
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**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.**

| Electronic Patent Application Fee Transmittal | | | | | |
|---|---|---|---|---|---|
| **Application Number:** | 17523847 | | | | |
| **Filing Date:** | 10-Nov-2021 | | | | |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES | | | | |
| **First Named Inventor/Applicant Name:** | Xinan XU | | | | |
| **Filer:** | Anni Johanna Siitonen/Pamela Baumgart | | | | |
| **Attorney Docket Number:** | 144604-8001.US00 | | | | |
| Filed as Large Entity | | | | | |
| **Filing Fees for Utility under 35 USC 111(a)** | | | | | |
| **Description** | | **Fee Code** | **Quantity** | **Amount** | **Sub-Total in USD($)** |
| **Basic Filing:** | | | | | |
| **Pages:** | | | | | |
| **Claims:** | | | | | |
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| **Petition:** | | | | | |
| **Patent-Appeals-and-Interference:** | | | | | |
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| **Miscellaneous:** | | | | |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 1806 | 1 | 260 | 260 |
| | | **Total in USD ($)** | | **260** |

# 1. CN1222970 - METHOD FOR CONTROLLING VEHICLE IN ORDER TO CHANGE COURSE AND APPLICATION OF METHOD FOR LATERAL AVOIDANCE OF A ZONE

National Biblio. Data Description Claims Drawings Patent Family Documents

Permalink Machine translation

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**Title**
**[EN]** Method for controlling vehicle in order to change course and application of method for lateral avoidance of a zone
**[ZH]** 以改变航向为目的的驾驶飞行器的方法及该方法在水平绕过一个区域上的应用

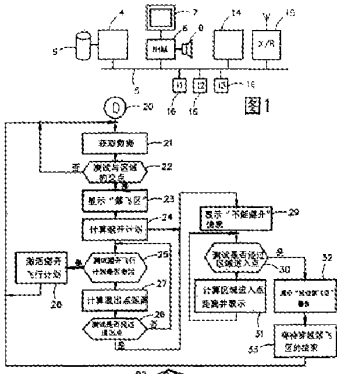


图1

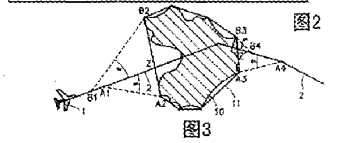


图2



图3

**Abstract**
**[EN]** For controlling a vehicle in order to change course, the vehicle [1] following a first rectilinear route portion [R1], to join a second rectilinear route portion [R2] forming a predetermined angle [ theta ] with the first route portion [R1], passing through the junction point [A] between the two route portions [R1, R2], a method is proposed which involves computing a curved trajectory [17] to be followed by the vehicle [1] for a change of course, passing through the said junction point [A], of which the gyration centre [0] is found on the internal bisectrix [3] of the angle [ theta ] formed by the two route portions [R1, R2].
**[ZH]**
为了改变方向的目的驾驶飞行器，飞行器[1]跟随路径的第一直线部分[R1],以便通过路径的两部分[R1、R2]的交会点[A]与第一路径部分[R1]构成预定的角度[θ]的路径的第二直线部分[R2]会合,按照本发明的方法包括飞行器[1]计算与跟随通过所述交会点[A]的弯曲的改变方向航线[17],该航线的转弯中心[0]位于由路径的两部分[R1、R2]构成的角[θ]的内角分角航线[3]上。

**Related patent documents**
FR2749650 SG60771 EP0902878 CA2257335 WO/1997/047946 DE000069711873 JP2000512016 US6269301



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[19]中华人民共和国国家知识产权局

[51]Int. Cl[6]
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[71]申请人 塞克斯丹航空电子公司
地址 法国韦利济－维拉库布莱
[72]发明人 居伊·德凯尔

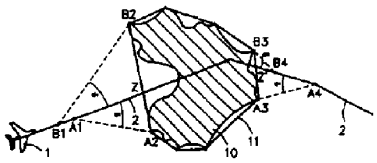
[74]专利代理机构 永新专利商标代理有限公司
代理人 蹇 炜

权利要求书3页 说明书8页 附图页数2页

[54]发明名称 以改变航向为目的的驾驶飞行器的方法及该方法在水平绕过一个区域上的应用

[57]摘要

为了改变方向的目的驾驶飞行器，飞行器(1)跟随路径的第一直线部分(R 1)，以便通过路径的两部分(R1、R2)的交会点(A)与第一路径部分(R1)构成预定的角度(θ)的路径的第二直线部分(R2)会合，按照本 发明的方法包括飞行器(1)计算与跟随通过所述交会点(A)的弯曲的改变 方向航线(17)，该航线的转弯中心(O)位于由路径的两部分(R1、R 2)构成的角(θ)的内角分角航线(3)上。




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# 权 利 要 求 书

1、一种以改变航向为目的驾驶飞行器的方法，飞行器（1）跟随第一路径直线部分（R1），通过两部分路径（R1、R2）的交会点（A）以便与和第一部分路径（R1）构成预定的角度（θ）的第二直线部分路径（R2）会合，

其特征在于，该方法包括由飞行器（1）计算与跟随通过所述交会点（A）的弯曲的改变方向航线（17），其转弯中心（O）位于两部分路径（R1、R2）构成的角（θ）的内角分角线（3）上。

2、按照权利要求 1 的方法，

其特征在于，该方法还包括计算与跟随分别在第一部分路径（R1）与改变方向航线（17）之间及后者与第二部分路径（R2）之间的两部分弯曲的连接航线（18、19），这两部分连接航线（18、19）具有与改变方向航线（17）相同的转弯半径（R），并且分别与后者及两部分路径（R1、R2）相切。

3、按照权利要求 1 或 2 的方法，

其特征在于，在两次靠近的改变方向（A、B）的情况中，该方法还包括计算与跟随用与两条弯曲的改变方向航线（17、17'）相切的直线连接航线（20）连接在第一改变方向航线（17）上的第二弯曲的改变方向航线（17'）。

4、按照前面的权利要求之一的方法，

其特征在于，以符合飞行器的预定滚动角的方式，作为飞行器（1）的速度的函数计算转弯半径（R）。

5、一种飞行器通过跟随包括一系列方向改变的避开路径来水平避



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开一禁飞区（10）的方法，所述方法将按照前面的权利要求之一的驾驶方法应用在路径的各方向改变点上，

其特征在于，包括计算避开路径的阶段（24），该阶段包括：

－通过用一系列线段逼近要避开的区域（10）的轮廓及消除凹入点及过份短的线段，用一个凸多边形（11）来建立该区域的模型，

－相对于建模的区域（11）定位计划的路径（2），

－计算退出与返回到计划的路径（2）的、与后者构成预定的角（α）且与多边形轮廓（11）的顶点（A2、B2、A3、B3）会合的左侧与右侧路径段（A1－A2、B1－B2、A3－A4、B3－B4），以便得出两条避开路径，左侧（B1－B4）及右侧（A1－A4）这两条路径由路径的退出（A1－A2、B1－B2）与返回（A3－A4、B3－B4）段以及分别连接路径的左侧与右侧退出与返回段（A1－A2、B1－B2、A3－A4、B3－B4）的建模的轮廓（11）的部分（A2－A3、B2－B3）构成，以及

－选择两条避开路径，左侧（B1－B4）及右侧（A1－A4）之一（A1－A4）。

6、按照权利要求 5 的方法，

其特征在于，路径的左侧与右侧退出与返回段（A1－A2、B1－B2、A3－A4、B3－B4）分别将计划的路径（2）连接在多边形轮廓（11）的顶点（A2、B2、A3、B3）上，这些顶点是位于计划的路径的两侧上的，并且它们最靠近计划的路径（2）与多边形轮廓（11）的交点（Z、Z’）。

7、按照权利要求 5 或 8 的方法，

其特征在于，还包括以使得两条避开路径具有相同的端点的方式将初始路径（2）的段（B1－A1、B4－A4）加到两条避开路径，右侧（A1－A4）与左侧（B1－B4）上，以及计算与比较所得出的左侧（B1－B4



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－A4）与右侧（B1－A1－A4）避开路径的长度，并选择较短的避开路径（B1－A1－A4）。

8、按照权利要求 5 至 7 之一的方法，

其特征在于，该方法包括下述先行步骤：搜索计划的路径（2）穿过禁飞区（10）的段，及计算进入所述区域的计划进入点（2），如果考虑进去飞行器的速度之后，飞行器（1）位于距计划的进入点（Z）足够地远，便执行避开路径的计算。

9、按照权利要求 5 至 8 之一的方法，

其特征在于，该方法还包括周期性地计算与显示（27）飞行器（1）的当前位置与从初始路径（2）退出到选择的避开路径（A1－A4）的退出点（A1）之间的距离，如果已确认这一新的路径便执行启动（28）包含所选择的避开路径的新路径。

10、按照权利要求 5 至 9 之一的方法，

其特征在于，该方法包括周期性地计算与显示（31）飞行器（1）的当前位置与要避开的区域（10）之间的距离，如果退出点（A1）已经过而新路径未得到确认，并在飞行器（1）进入要避开的区域（10）时，显示（32）报警报文。



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# 说　明　书

## 以改变航向为目的的驾驶飞行器的方法及该方法在水平绕过一区域上的应用

本发明涉及沿航线驾驶飞行器的方法，该航线包括定义方向改变的路径的两个不成一直线的段，并强制要求飞越两段的公共点。

它具体但不局限于应用在沿路径驾驶航空器上，该路径通常由一组用航线的直线段连接的过渡点定义，这些过渡点或“航线点”表示方向的改变。

这些方向的改变通常必须以预定的转弯半径进行，例如，以保持滚动角不变的方式作为航空器的速度的函数变化的转弯半径。为了遵照预定的转弯半径，因此必须在过渡点之前开始转弯，在这一情况中航空器将位于计划的转弯内侧；或者在飞越过渡点的时刻上转弯，在这一情况中，航空器在飞越过渡点之后将位于计划的转弯外侧，而随后必须沿旨在与初始计划的路径会合的航线飞行。

在第二种情况中，如图 4 中所示，在其改变方向△ψ期间，在飞越过渡点的时刻上，航空器明显偏离计划的路径 R1、R2，并且甚至离开它相对大的距离 d，这一方面导致相对大的延长航线而另一方面对于管制与航空控制又是不希望的（依照可变水平宽度边界）。

本发明的目的为消除这些缺点。为了这一目的，提出了以改变方向为目的的驾驶飞行器的方法，该飞行器沿路径的第一直线部分航行以便与通过两部分的交点与该路径的第一部分构成预定的角度的第二



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直线部分会合。

按照本发明，这一方法的特征在于：包括计算与跟随通过所述交会点的弯曲的改变方向的航线，其转弯中心位于这两部分路径所构成的内角分角线上。

与图 4 所示的先有技术航线相比，这一改变方向航线提供许多优点。因为它有可能节省若干秒（对于 90 转弯高达 35 秒或 4.5 海里）。它从路径的直线部分所定义的计划路径偏离较少（小于传统的过渡航线产生的偏离的 30%），对于管制与航空控制这是可观的好处。它在连接在一起的转弯中（如果路径段较短时，它们是拐来拐去的）还带有较少转折点的危险。

此外，如将这一改变方向航线与传统的由位于转弯内侧与路径的两部分相切的曲线组成的航线相比，可看到按照本发明的航线比传统航线偏离路径部分较少。

有利地，按照本发明的方法包括计算与跟随分别在路径第一部分与改变方向航线之间及后者与路径的第二部分之间的两部分弯曲的连接航线，这两部分连接航线具有与改变方向航线相同的转弯半径，并且是分别与后者及这两部分路径相切的。

本发明还涉及将改变方向方法应用在多边形区域的各角上而避开静止的多边形区域。

这是因为在某些情况中，已经证明有必要绕过禁止进入的区域。尤其是在禁止飞越诸如军事区域国家的空域区时会出现这些情况。

这一避开方法的目的在于尽可能少地减少要航行的距离来确定要跟随的新路径。为此目的，该方法包括下述步骤：

— 通过用一系列线段逼近该区域的轮廓及消除凹入点与过份短的线



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段而用凸多边形来建立要避开的区的轮廓的模型，

— 相对于建模的区域定位计划的路径，

— 计算退出与返回到计划的路径的左侧与路径的右侧部分，与计算的路径形成预定的角度并与最接近计划的路径的多边形顶点会合，以便得到由路径的退出与返回部分及分别连接左侧与右侧退出与路径的返回过渡部分的建模的轮廓部分构成的两条避开路径、左侧与右侧，以及

— 选择两条避开路径之一、左侧或右侧。

依靠这些措施，所跟随的航线尽可能靠近该区域的边界通过但不进入这一区域。

下面参照附图以非限制性示例的方式描述按照本发明的实施例，附图中：

图 1 用图形表示航空器机载的使之有可能实现按照本发明的避开方法的电子设备；

图 2 用图形示出实现本避开方法所执行的算法；

图 3 示出位于航空器路径上的禁飞区，以便展示该避开方法；

图 4 用图形表示按照先有技术的两段路径之间的过渡航线；

图 5 示出用按照本发明的导航方法计算的改变方向航线；以及

图 6 示出在两次靠近的方向改变的情况中的优化过渡航线。

如图 1 中所示，按照本发明的避开方法是特别设计成用航空器的机载计算机 4 执行的，该计算机用称作“飞机总线”的数据传输总线 5 耦合在包含自动驾驶仪 14 及导航设备 16 的导航装置、诸如数据链路等数据传输装置 15、以及包含控制部件及装在驾驶舱中的诸如显示屏 7 及扬声器 8 等发信号部分的人/机接口装置（MMI）6 上。



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以已知的方式，自动驾驶仪 14 包括存储器，其中记录有由一系列起飞点与目的地点之间的直线段及使得一个段有可能连接在另一段上的过渡航线构成的飞行器的计划航线。

数据传输装置 15 能够接收例如用其名字指示的暂时禁止飞越的空区的信息 。此外，计算机 4 例如耦合在地理导航数据库 9 上，其中具体存储有该航空器正常飞越的地区的空域的轮廓。也有可能航空器的驾驶员本人用人/机接口 6 输入禁飞区的轮廓。

图 2 中所示的算法是由航空器的机载计算机 4 执行的。它包含首先采集由数据传输装置 15 及驾驶员用人/机接口装置 6 提供的数据（步骤 21）。

当接收到关于禁止穿过的空域的信息时，计算机 4 便相对于禁飞区定位由计划的飞行计划确定的路径。为了做到这一点，当所接收的信息没有用该区域的轮廓的定义补充时，计算机 4 将在其数据库 9 中搜索这一信息并访问例如存储在自动驾驶仪 14 中的计划的飞行计划的定义（步骤 22）。

如果航空器不会进入禁飞区，通过返回到算法的起点 20 继续分析数据传输装置 15 及 MMI6 提供的信息。在相反的情况中，在步骤 23 中计算机 4 向显示器 7 发出报文以便警告驾驶员航空器 1 要经过的路径 2 穿过禁飞区 10（图 3）。这一信息可用在屏幕 7 上显示飞越区域的地图，上面叠加禁飞区及其特征的可能程度的指示来补充。

接着，计算机触发避开航线的计算（步骤 24），它包括首先建立禁飞区 10 的轮廓的模型。这一建模包含将区域 10 的轮廓近似成多边形，然后消除多边形的凹入顶点与过份短的边，以便得出完全凸的多边形 11。



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接着必须确定退出计划的路径的左侧 B1－B2 与右侧 A1－A2 路径部分以便避开禁飞区 10。为了这一目的，计算机 4 相对于区 10 的模型轮廓定位计划的路径 2。取决于飞越区中现行的航空规定，路径的这些部分偏离计划的路径 2 45 度或 30 度的预定角度 α，并且分别与多边形 11 的点 B2、A2 会合，这两个点在计划路径 2 进入多边形 11 的进入点 2 两侧之一上最靠近计划路径 2。

然而，可证明当航空器 1 位于太靠近禁飞区 10 时，不可能确定路径的退出部分。这一情况出现在有可能避开该区域的从初始路径退出的角度大于预定角度 α 时。出现这一情况时，计算机 4 执行从步骤 29 开始的算法，在那里触发显示报文“自动避开不可能”。

在相反的情况中，计算机 4 接着确定返回到计划的路径 2 的左侧 B3－B4 与右侧 A3－A4 路径部分。这些路径部分在角度 α 上与计划的路径会合，并且在计划路径 2 从多边形 11 的出口点 Z’ 的两侧之一上分别在最靠近计划路径 2 的点 B3、A3 上连接在多边形 11 上。

为了全面确定避开禁飞区 10 的右侧 A1－A4 及左侧 B1－B2 路径，接着只要将路径的右侧 A1－A2 与左侧 B1－B2 退出部分通过分别连接点 A2 与 A3、及点 B2 与 B3 的多边形 11 的轮廓部分 A2－A3、B2－B3 分别连接在路径的右侧 A3－A4 与左侧 B3－B4 返回部分上即可。

由于右侧 A1 与左侧 B1 路径退出点可以是不同的，到计划路径的右侧 A4 与左侧 B4 返回点也一样，重构具有相同的端点的避开路径是重要的。从而，如果如图 3 中所示 A1 比 B1 更靠近该区，便将线段 B1－A1 加在右侧航线 A1－A2－A3－A4 上。类似地，如果返回点 B4 比 A4 更靠近该区，便将线段 B4－A4 加在左侧航线 B1－B2－B3－B4 上。

接着必须选择这样确定的两条避开路径，右侧 A1－A4 与左侧 B1



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－B4 之一。为了做到这一点，计算机 4 计算两条新路径 B1－A1－A2－A3－A4、B1－B2－B3－B4－A4 中各条的长度以便选择较短者，如果这两条新路径长度相等，便选择位于区 10 上风侧上的。

有可能用选择的避开路径来修正自动驾驶仪 14 提供的初始飞行计划，可以将其显示在屏幕 7 上请求驾驶员确认。

在步骤 25 中，计算机 4 等待驾驶员确认包含所选择的避开路径 A1－A4 的新飞行计划，一直等到已经通过了从初始计划的路径 2 的退出点 A1 为止（步骤 26）。在等待中，计算机 4 计算与显示这一退出点 A1 到航空器 1 的当前位置的距离的值，周期性地刷新该值（步骤 27）。

如果在这一等待期间，驾驶员确认了新飞行计划，便将后者发送到自动驾驶仪 14 来替代初始计划的路径 2，然后成为有效的（步骤 28）。如果飞行计划管理与水平模式自动驾驶系统是起作用的，这一新飞行计划便能自动避开该区域。

如果在通过退出点 A1 之前驾驶员未确认新飞行计划，则在步骤 29 中，计算机 4 发送报文给驾驶员指出退出点已通过而避开该区域现在已经不可能。接着在步骤 30 中，它计算航空器 1 的当前位置与进入用多边形 11 界定的禁飞区的进入点 Z 之间的距离。只要航空器 1 尚未到达点 Z，便以周期性刷新显示这一距离（步骤 31）。通过了这一点 Z 之后，计算机 4 发出报警报文用信号通知驾驶员航空器 1 在禁飞区中（步骤 32）。然后计算机 4 等待从禁飞区 10 出口，并考虑从这一区域的出口点 Z 的位置以及航空器 1 的当前位置与速度（步骤 33），然后返回到步骤 18 去采集数据及擦除报警报文。

在发送新飞行计划给自动驾驶仪之前但在驾驶员确认之后，在步骤 28 中计算机 4 使遵照这一新的飞行计划成为可能的航线，而具体地，



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计算使它有可能从飞行计划的一段路径通过到另一段的过渡航线。

在传统方式中转弯内部进行离开多边形区 11 的轮廓的在诸如 A1 与 A4 等方向改变点上的过渡是通过确定与要连接的两段路径相切的预定半径的圆进行的。

当它们是属于凸多边形区 11 的轮廓的方向改变点时，便不可能从转弯内部进行方向改变，因为这要求进入禁飞区 10。从而，计算机 4 将按照本发明计算经过转弯外部且通过转弯点的航线。

如图 5 中所示，两段路径连接在点 A 上，形成角度 θ，并要求改变方向一个角度△ψ，计算机 4 计算通过点 A 的弯曲航线 17，其转弯中心 O 位于角 θ 的内角分角线 3 上且距点 A 距离 R。这一距离 R 对应于弯曲的航线 17 的转弯半径，这是作为必须以预定的滚动角进行转弯的航空器 1 的速度的函数确定的。

接着必须确定沿路径段 R1、R2 的直线航线与弯曲航线 17 之间的连接航线部分 18、19，使得有可能将段 R1 与弯曲的航线 17 连接的连接航线 18 包含具有相同的转弯半径 R 的一部分弯曲的航线，它在 T1 上与路径段 R1 相切且在 T2 上与弯曲航线 17 相切。同样，连接航线 19 为具有转弯半径 R 的一部分弯曲航线，它在 T3 上与弯曲航线 17 相切并在 T4 上与路径段 R2 相切。

应指出点 T2 与 T3 对应于弯曲的航线 17 与线段 d 的中垂线的交点，线段 d 分别由通过转弯中心 O 的垂直于路径段 R1、R2 的直线与路径段 R1、R2 及弯曲的航线 17 的交点 I1、I2、I3、I4 定界。

在图 6 中也可观察到，当存在着两个靠近的方向改变点 A、B 时，按照本发明的方法也是完全适用的。这一图示出用点 A 与 B 连接并在 A 与 B 上构成角 θ 与 θ' 的三段路径 R1、R2、R3。如上所述，为了



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进行这两次改变方向，计算分别通过 A 与 B 及具有转弯中心 O、O’与转弯半径 R 的两条弯曲的航线 17、17’，这两条弯曲的航线分别通过两条连接航线 18、19’在点 T1 与 T4’上与路径段 R1 与 R3 会合。

在图 6 的例子中，不可能将弯曲的航线 17、17’连接在路径段 R2 上，后者太短。在这一情况中，只要用在点 T5 与 T5’上与两条航线 17、17’相切的连接航线 20 将它们连接即可。

如果将图 4 的航线与图 5 与 6 所示的航线相比，后者偏离计划的路径 R1－R2 小得多，并且更快地与它会合，这便能更高效地管制及航空控制。

从而，在传统的飞越该点的绕过情况中的偏离等于 R（1－cos△ψ）。在本发明所提出的解决方法中，这一偏离为 R（1－cos△ψ/2），即在△ψ＝90 度时小三分之二左右。

此外，在短的路径段 R2 的情况中，按照图 6 仍保持靠近计划的路径。与之相反，在图 4 的情况中，很清楚难于与后面的路径段 R3 会合。



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# 说 明 书 附 图

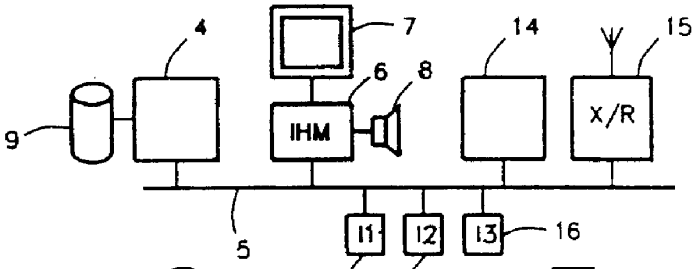



图1

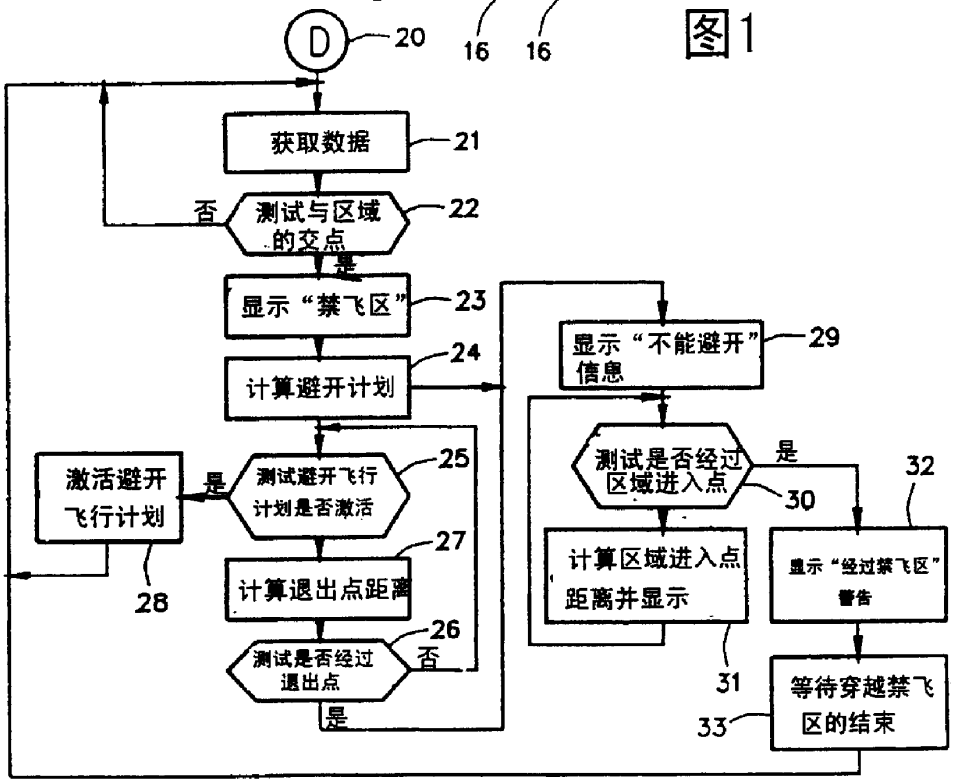



图2

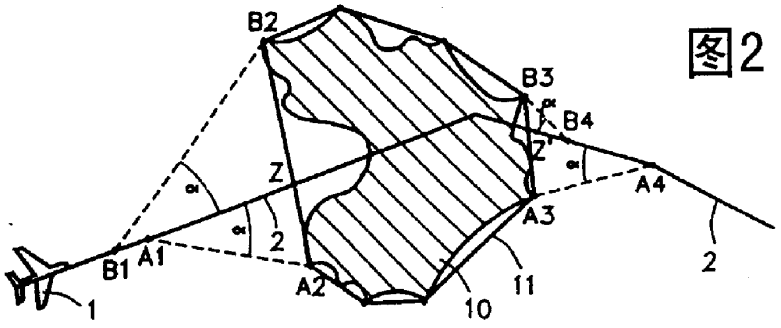



图3



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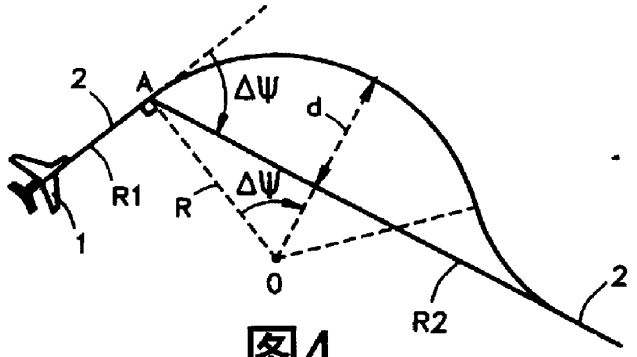



图4

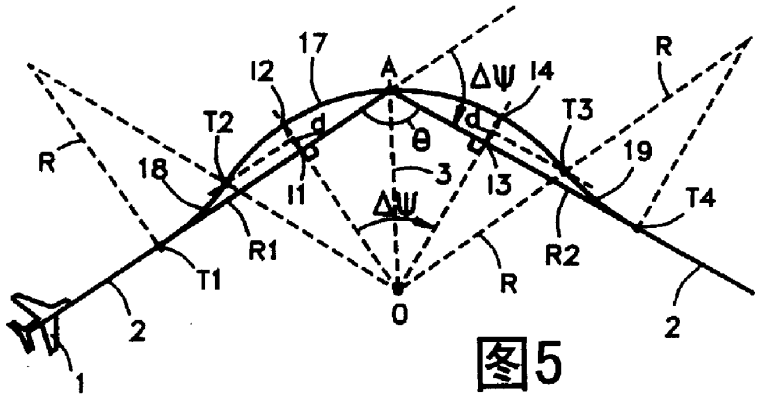



图5

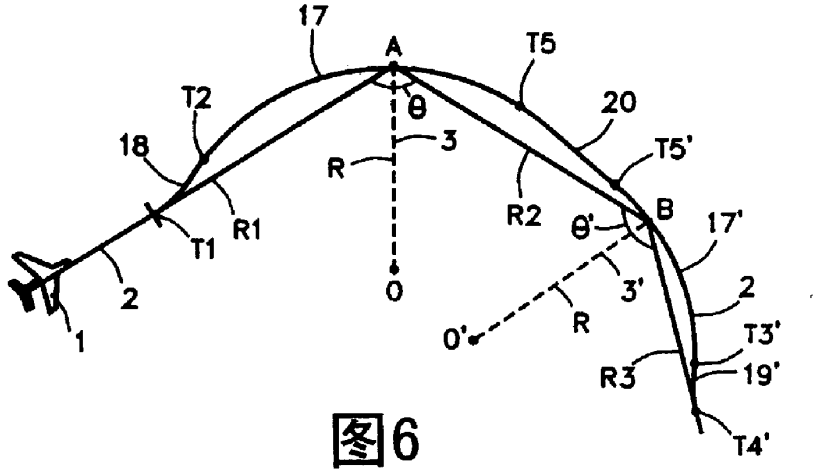



图6



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# 1. CN1222969 - METHOD FOR LATERAL AVOIDANCE OF MOBILE ZONE BY VEHICLE

National Biblio. Data Description Claims Drawings Patent Family Documents

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**Priority Data**
9607075 07.06.1996 FR

**Title**
**[EN]** Method for lateral avoidance of mobile zone by vehicle
**[ZH]** 飞行器横向避开移动区域的方法

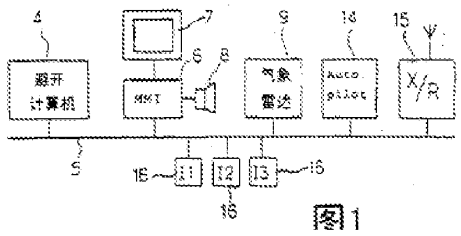


图1

**Abstract**
**[EN]** A method for avoiding a mobile zone by a vehicle. A vehicle laterally avoids a mobile zone using periodically supplied information relating to the zone to be avoided starting from an initially planned route. The envelope of the zone to be avoided is periodically defined and a circumscribed circle about the envelope is determined. The velocity vector of the circle is also determined as is the portion of the route lying over the path of the circle. If the vehicle has to enter the circle, the computation of port and starboard trajectories for the avoidance of the zone is delimited by the circle. The selection of one of these two avoidance trajectories as a function of the length of the new avoidance routes is computed in the direction of the zone to be avoided.
**[ZH]**
根据定期提供的与待避开的移动区域[10]有关的信息和飞行器[1]的原始计划航线[2]使飞行器[1]横向避开该移动区域[10]的方法,按照本发明的方法包括:定期定义[18]待避开区域[10]的包络线,确定[91]所述包络线周围的外切圆[12]以及确定外切圆[12]的速度矢量,确定位于外切圆[12]轨迹上的航线[2]区段,如果飞行器会进入外切圆[12],便计算用于避开由外切圆[12]限定的区域的左侧航线[B1 - B2 - B3]和右侧航线[A1 - A2 - A3],作为计算所避开航线长度和被避开区域[10]移动方向的函数从这两条避开航线[A1 - A2 - A3、B1 - B2 - B3]中选择一条避开航线。

**Related patent documents**
FR2749686 SG60769 EP0902877 CA2257336 WO/1997/047945 DE000069715189 JP2000512015 US6097996



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[19]中华人民共和国国家知识产权局

[51]Int. Cl[6]
G01C 21/00

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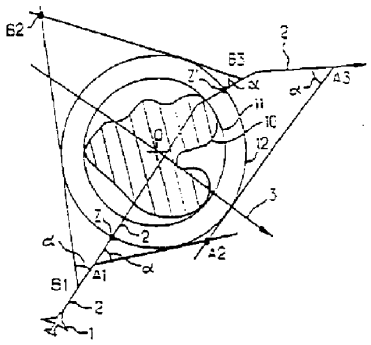
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权利要求书3页 说明书6页 附图页数2页

[54]发明名称 飞行器横向避开移动区域的方法

[57]摘要

根据定期提供的与待避开的移动区域(10)有关的信息和飞行器(1)的原 始计划航线(2)使飞行器(1)横向避开该移动区域(10)的方法，按照 本发明的方法包括：定期定义(18)待避开区域(10)的包络线，确定( 91)所述包络线周围的外切圆(12)以及确定外切圆(12)的速度矢量，确定位于外切圆(12)轨迹上的航线(2)区段，如果飞行器会进入外切 圆(12)，便计算用于避开由外切圆(12)限定的区域的左侧航线(B1 －B2－B3)和右侧航线(A1－A2－A3)，作为计算所避开航线长度 和被避开区域(10)移动方向的函数从这两条避开航线(A1－A2－A3 、B1－B2－B3)中选择一条避开航线。




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# 权 利 要 求 书

1、一种根据原始计划航线（2）和定期得到信息使飞行器（1）横向避开至少一个移动区域（10）的方法，其中，所述信息代表待避开的移动区域（10）的边界的位置和飞行器（1）的当前位置与速度，该方法的特征在于它包括以下步骤：

*借助于所述形状信息定期定义（18）待避开区域（10）的包络线；

*确定（19）待避开区域（10）包络线周围的外切圆（12），并通过记录该外切圆（12）的连续位置确定外切圆的速度矢量（3）；

*确定位于外切圆（12）轨迹上的计划航线（2）区段，并当飞行器（1）位于所述航线（2）区段上时测定外切圆的位置；

*如果外切圆的位置已经确定，并且飞行器（1）的计划航线（2）穿过外切圆（12），便计算（24）用于避开外切圆限定区域的左侧（B1－B2－B3）与右侧航线（A1－A2－A3），该航线连接原始计划航线（2）的退出点（A1、B1）和返回点（A3、B3）；

*从这两条避开航线（A1－A2－A3、B1－B2－B3）中选择一条避开航线作为新航线长度的函数和作为被避开区域（10）周围的外切圆中心的速度矢量的函数，其中，新航线分别包含所计算的避开航线。

2、根据权利要求 1 所述的方法，其特征在于：原始计划航线（2）的退出点（A1、B1）和返回点（A3、B3）是待避开的区域（10）包络线周围的外切圆（12）上与原始计划航线（2）呈预定夹角（α）的切线（A1－A2、A2－A3、B1－B2、B2－B3）与原始计划航线（2）的交点，所述切线限定左侧避开航线（B1－B2－B3）和右侧避开航线（A1－A2－A3）。

3、根据权利要求 1 或 2 所述的方法，其特征在于：它包括用多边形逼近待避开区域的形状并消除凹点以便得到凸多边形，通过计算凸多边形的重心确定外切圆的中心，用所述中心到离该中心最远的多边形边界点之间的距离求出外切圆的半径。



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4、按照上述权利要求之一所述的方法，其特征在于当检测到几个区域（10、10’）时该方法还包括：

*确定每个待避开区域（10、10’）包络线周围的外切圆（12、12’），并通过记录这些外切圆的连续位置确定外切圆的相关速度矢量（3）；

*在飞行器（1）位于被所述区域（10、10’）穿越的航线（2）区段上的相应时刻测定每个区域（10、10’）相对于飞行器（1）计划航线的位置；

*确定落在计划航线（2）上的第一区域（10）并首先选择位于由第一待避开区域（10’）周围的外切圆（12）上的穿过飞行器（1）的当前位置的切线（13、13’）限定的扇形区的待避开区域；

*从前面选出的区域（10、10’）中再次选出离第一区域（10）的距离或离二次选择过程中所选出的区域的距离小于预定值的区域；

*根据第一区域（10）确定从原始计划航线（2）的退出点（A1、B1），根据最后一个选择的区域（10’）确定原始计划航线（2）的返回点（A4’、B4’）；

*计算由前面选出的每个区域（10、10’）周围的外切圆（12、12’）的切线线段（A1－A2、B1－B2、A3’－A4’、B3’－B4’）和穿过计划航线的退出点（A1、B1）与返回点（A4’、B4’）的切线线段（A2－A3’、B2－B3’）构成的左侧与右侧避开航线（A1－A2－A3’－A4’、B1－B2－B3’－B4’）。

5、根据上述权利要求之一所述的方法，其特征在于：每个被待开区域（10、10’）周围的外切圆（12、12’）的半径是通过为所述区域设定安全距离后确定的。

6、根据上述权利要求之一所述的方法，其特征在于：它还包括连续接收气象雷达（9）提供的表示与危险等级有关的区域（10、10’）的形状的信息，当这个危险等级超过某个预定门限值时便检测待避开区域。



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7、根据上述权利要求之一所述的方法，其特征在于：它还包括根据被选择的避开航线（A1－A2－A3）的定义和原始航线（2）确定新航线，这条新航线可以用自动驾驶装置（14）来执行。

8、根据上述权利要求之一所述的方法，其特征在于：它还包括定期计算和显示（27）飞行器（1）的当前位置与从原始航线（2）退出到被选避开航线（A1－A2－A3）上的退出点（A1）之间的距离，如果包含被选避开航线的新航线已得到确认，便使这条新航线起作用（28）。

9、根据权利要求 8 所述的方法，其特征在于：它还包括定期计算和显示（31）飞行器（1）的当前位置与被避开区域（10）之间的距离，如果在新航线还没有得到确认时就已经通过退出点（A1），那么当飞行器（1）进入到待避开区（10）时便显示（32）报警信息。

10、根据上述权利要求中之一所述的方法，其特征在于：通过计算两条新航线（B1－A1－A2－A3、B1－B2－B3－A3）的长度来选择左侧避开航线（B1－B2－B3）或右侧避开航线（A1－A2－A3），其中，两条新航线（B1－A1－A2－A3、B1－B2－B3－A3）分别包含这两条航线和原始航线（2）上的区段（B1－A2、B3－A3），它们具有相同的端点，被选航线（A1－A2－A3）是产生较短的新航线的那条航线，如果两条新航线的长度相等，被选航线便是位于被避开区域（10）的上风侧的那条航线。



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# 说　明　书

## 飞行器横向避开移动区域的方法

本发明涉及一种用于确定供飞行器横向避开不希望穿越的移动区域用的航线的方法。

该方法尤其适用于，但不仅仅适用于重飞行器的驾驶，以便在飞行中帮助驾驶员迅速确定例如用于避开象暴雨群之类的危险气象区域的避开航线。

的确，重飞行器要绝对避开的最具特征的气象现象是积雨云中盛行的暴雨现象，因为其中存在涡流和积水冰等恶劣情况，并且有相当大的雷电轰击危险。

为避开这种现象，大多数配备了零能见度驾驶仪器的重飞行器使用了能提供气象信息的气象雷达，这种信息特地给出与危险等级有关的气象区域的形状。然而，在气象区域被测出之后，是避开该区域的视线范围还是穿越该区域呢？这种气象问题都要靠驾驶员人工处理。

本发明的目的在于为了减轻飞行器驾驶员在通过横向避开发生意外现象的区域而避开该意外现象的情况下的工作负担。为此目的，提出了一种根据原始计划航线和定期得到的信息使飞行器横向避开至少一个移动区域的方法，其中，所述信息给出了被避开移动区域的形状和飞行器的当前位置与速度。

按照本发明，该方法的特征在于它包括以下步骤：

*借助于所述形状信息定期定义待避开区域的包络线；

*确定待避开区域包络线周围的外切圆，并通过记录该外切圆的连续位置确定外切圆的速度矢量；

*确定位于外切圆轨迹上的计划航线区段，并当飞行器位于所述航线区段上时测定外切圆的位置；

*如果外切圆的位置已经确定，并且飞行器的计划航线穿过外切



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圆，便计算用于避开外切圆限定区域的左侧与右侧航线，该航线连接原始计划航线的退出点和返回点；

*从这两条避开航线中选择一条避开航线作为新航线长度的函数和作为被避开区周围的外切圆中心的速度矢量的函数，其中，新航线分别包含所计算的避开航线。

借助于这些措施便完全可以自动避开移动区域。

按照本发明的特征，原始计划航线的退出点和返回点就是原始计划航线与被避开区域包络线周围的外切圆的与原始计划航线成预成预定角度的切线的交点，这些切线限定了左侧与右侧避开航线。

按照本发明的方法还便于应用到多个移动区域的场合。在这种场合，该方法还包括：

*确定每个待避开区包络线周围的外切圆，并通过记录这些外切圆的连续位置确定外切圆的相关速度矢量；

*在飞行器位于被所述区域穿越的航线区段上的相应时刻测定每个区域相对于飞行器计划航线的位置；

*确定落在计划航线上的第一区域并首先选择位于由第一待避开区域周围的外切圆上的穿过飞行器的当前位置的切线限定的扇形区的待避开区域；

*从前面选出的区域中再次选出离第一区域的距离或离二次选择过程中所选出的区域的距离小于预定值的区域；

*根据第一区域确定从原始计划航线的退出点，根据最后一个选择的区域确定原始计划航线的返回点；

*计算由前面选出的每个区域周围的外切圆的切线线段和穿过计划航线的退出点与返回点的切线线段构成的左侧与右侧避开航线。

下面将利用参照附图的非限制性例子来说明按照本发明的方法的实施例，在附图中：

图 1 是重飞行器上的电子设备的示意图，它包括用于执行本发明的方法的计算机；

图 2 示意性地描述了检测待避开区域时要执行的算法；



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图 3 和 4 示出了重飞行器穿越待避开区域航线和可能的避开航线；

图 5 说明了飞行器航线上有两个连续待避开区域时的情况。

如图 1 所示，按照本发明的方法尤其适用于用装在重飞行器上的计算机 4 执行。计算机 4 通过被称之为“飞行器总线”的数据传输总线 5 连接到导航设备、气象雷达 9 和人/机接口装置 6 上，其中，导航设备包括自动驾驶装置 14 和导航仪器 16，人/机接口装置 6 包括控制部件和诸如装在驾驶室内的显示屏 7 和喇叭 8 这类的发信号部件。

在已知的方法中，自动驾驶装置 14 包括记录了重飞行器计划航线的存储器，其中，计划航线由一系列位于出发位置与目的地位置之间的直线区域所组成。

此外，气象雷达 9 用于测定反射由雷达发射的电磁波的物体的密度，如水或冰的颗粒和降水量。这种雷达定期提供用于重构与危险等级有关的区域形状的信息。

图 2 所示的算法是由装在重飞行器内的计算机 4 执行的。其包括首先连续获取由气象雷达 9 定期提供的数据（步骤 18）和检测与接收到的数据有关的危险等级（步骤 19）。为了精确测定现象的强度和危险性，这种分析主要是在与飞行器相同的水平面（零倾角）上进行的，但也可以稍微倾斜一个角度（－5° 到＋15° 倾角）。

当气象雷达 9 检测到例如相当于由积雨云构成的暴雨区这样的待避开区域，即检测到与达到一定限值的危险等级有关的区域时，计算机 4 便根据雷达 9 每次提供的数据确定暴雨区 10 的外切圆 11（见图 3）。外切圆 11 由该圆的中心 O 和半径决定。在初次逼近时，可以用区域中危险等级大的距离较远的边界点来确定这些值。为了更精确地确定这些值以便优化避开航线，首先用一系列直线线段来模拟区域边界，然后消除凹点以便将该区域构造成凸多边形。接着，通过重心计算来确定该区域的中心，这样，外切圆的半径便等于如此算得的区域的中心，这样，外切圆的半径便等于如此算得的区域



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中心与离该中心最远的区域边界点之间的距离。

定期测定这个圆便可以计算区域 10 移动的速度矢量。

当然，这些结果可以与其它由别的机载仪器 16 提供的或由地面装置提供的气象信息合并起来，其中，地面装置通过无线电发射气象信息，接在飞行器总线 5 上的无线电收发机 15 接收气象信息。

在步骤 21 中完成这些计算之后，计算机 4 便在步骤 22 中根据待避开区 10 的恒值速度矢量、当前位置、计划航线 2、重飞行器 1 的当前位置与速度进行搜索，以测定飞行器 1 是否可能进入到用圆 11 构造的区域 10 内。

如果重飞行器不会进入区域 10，便返回到该算法的起始步骤 20，继续对雷达提供的信息进行分析。在相反的情况下，计算机 4 便发送供显示器 7 显示的信息以便预先告诉驾驶员重飞行器 1 要穿过的航线 2 将经过一个最好应避开的危险区域（步骤 23）。然后，计算机 4 开始计算避开航线（步骤 24），如图 3 所示，这种计算首先要确定当重飞行器 1 将位于圆 11 的轨迹上时，圆 11 与计划航线 2 的相对位置。

在这个图形中，计算机 4 确定一个增加了安全系数的与圆 11 同心的安全圆 12，比如可以为 5 海里（取决于区域 10 的尺寸和/或安全系数），这个圆 12 构成了不能被重飞行器 1 穿越的边界。然后通过计算与安全圆 12 相切的并与原始航线的夹角为 30° 或 45°（取决于在该地区的有效空中调节）的线段 A1－A2、A2－A3、B1－B2、B2－B3 确定原始计划航线 2 的退出点 A1、B1 和返回点 A3、B3，所述线段能从安全圆 12 的两侧绕过区域 10。

A1－A2、A2－A3 与 B1－B2、B2－B3 这些线段分别限定了区域 10 的右侧避开航线 A1－A2－A3 和在左侧避开航线 B1－B2－B3，它们连接原始计划航线 2 的退出点 A1、B1 和返回点 A3、B3。

通过将计划航线 2 上的区段 B1－A1、B3－A3 加到避开航线上使得两条避开航线 B1－A1－A2－A3、B1－B2－B3－A3 具有相同的端点 B1、A3。



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接着，需要从如此算出的两条避开航线 B1－A1－A2－A3、B1－B2－B3－A3 中选择一条避开航线。为此，计算机 4 确定这两条分别包含两条算得的避开航线的新航线的长度以便选择其中较短的一条航线，如果这两条新航线的长度相等，便选择位于所述气象上风侧的航线。

如图 4 所示，所选择的避开航线便为经过 A1、A2 点和 A3 点的那条避开航线。

这条新航线使得可能改变原始飞行计划，它可以被显示在显示屏 7 上，请求驾驶员对此确认。这样，A1 点、A2 点和 A3 点之间的原始航线区段便被删除。

在步骤 25 中，计算机 4 等待驾驶员对包含如此算出的避开航线 A1－A2－A3 的新飞行计划进行确认，等待过程一直持续到经过原始计划航线 2 的退出点 A1 为止（步骤 26）。在等待过程中，计算机 4 根据重飞行器 1 上的当前位置计算并显示该退出点 A1 的距离值，这个值被定期刷新（步骤 27）。

在这个等待过程中，如果驾驶员已经确认新飞行计划，那么该新飞行计划便被传送到自动驾驶装置 14 上去替代原始计划，于是新飞行计划开始起作用（步骤 28）。

从线段 A1－A2 到线段 A2－A3 的过渡是一个简单的过渡，即沿着取决于飞行器速度的圆弧进行的，这使得在紧紧跟踪移动区域 10 边界的同时能绕过移动区域 10。

如果在经过退出点 A1 之前驾驶员没有确认新飞行计划，那么在步骤 29 中计算机 4 便向驾驶员发出指示已经经过退出点的指示信息。接着，在步骤 30 中，计算重飞行器 1 的当前位置与由圆 12 限定的区域进入点 Z 之间的距离。只要重飞行器 1 还没有到达进入点 Z，就以定期刷新方式显示这个距离（步骤 31）。在经过这个进入点 Z 之后，计算机 4 便发出报警信息，它告诉驾驶员已位于危险区域内（步骤 32）。 然后，计算机 4 在返回到 18 去获取气象雷达 9 的数据之前等待退出该危险区域，在等待过程中，监视该区域退出



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点 Z’ 的位置和重飞行器 1 的当前位置与速度（步骤 33）。

避开航线的计算可以方便地把出现另一个或其它被雷达公开的危险区域的情况考虑进去。

在检测到有两个区域 10、10’ 的情况下，计算机 4 确定两个分别围绕两个区域 10、10’ 的安全圆 12 和 12’ 。（图 5）

根据第二区域 10’（离飞行器 1 较远的区域）是否与第一区域 10 一起位于由第一区域 10 安全圆 12 上的两条穿过重飞行器 1 的当前位置的切线 13、13’ 限定的扇形区内会出现两种情况。

如果第二区域 10’ 的中心位于这个扇形区之外，那么就不考虑这个区域。在相反的情况下，要适当考虑第二区域 10’ 离第一区域 10 的距离是否很远，例如，其距离是否大于第一区域 10 外圆 12 半径的 5 倍。

如果第二区域 10’ 离第一区域 10 很远，那么就要将各个区域 10，10’ 单独考虑，从避开较近的区域 10 开始执行两次避开。

在相反的情况下，如果这两个区域 10、10’ 同时与重飞行器 1 的原始计划航线 2 相交，那么便象前面那样通过计算构成如图 5 所示避开航线，其中，偏离原始航线 2 的航线线段 A1－A2、B1－B2 是根据第一区域 10 计算的，用于返回原始航线 2 的航线线段 A3’－A4’ 和 B3’－B4’ 是根据第二区域 10’ 计算的。

接着需要计算航线线段 A2－A3’ 和 B2－B3’ ，A2 点与 B2 点是圆 12 上的始于 A1 点和 B1 点的切线与这两个圆 12、12’ 的切线的交点，A3’ 点与 B3’ 点是这两个圆 12、12’ 的切线与圆 12’ 上的穿过返回点 A4’ 和 B4’ 的切线的交点。

与前面一样，最后要考虑的避开航线是产生比较短的新航线的那条避开航线，如果两条新航线的长度相同，便选择位于被避开区 10、10’ 的上风侧的那条新航线。



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# 说 明 书 附 图

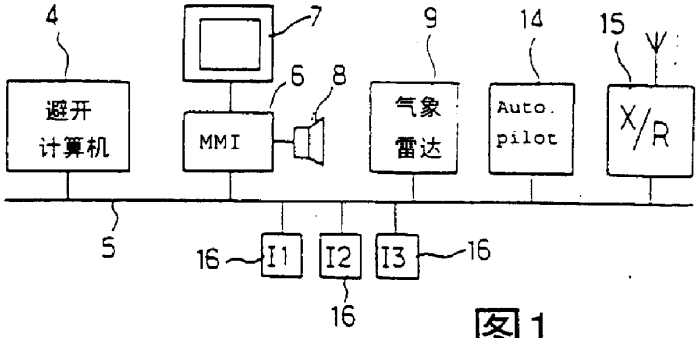



图1

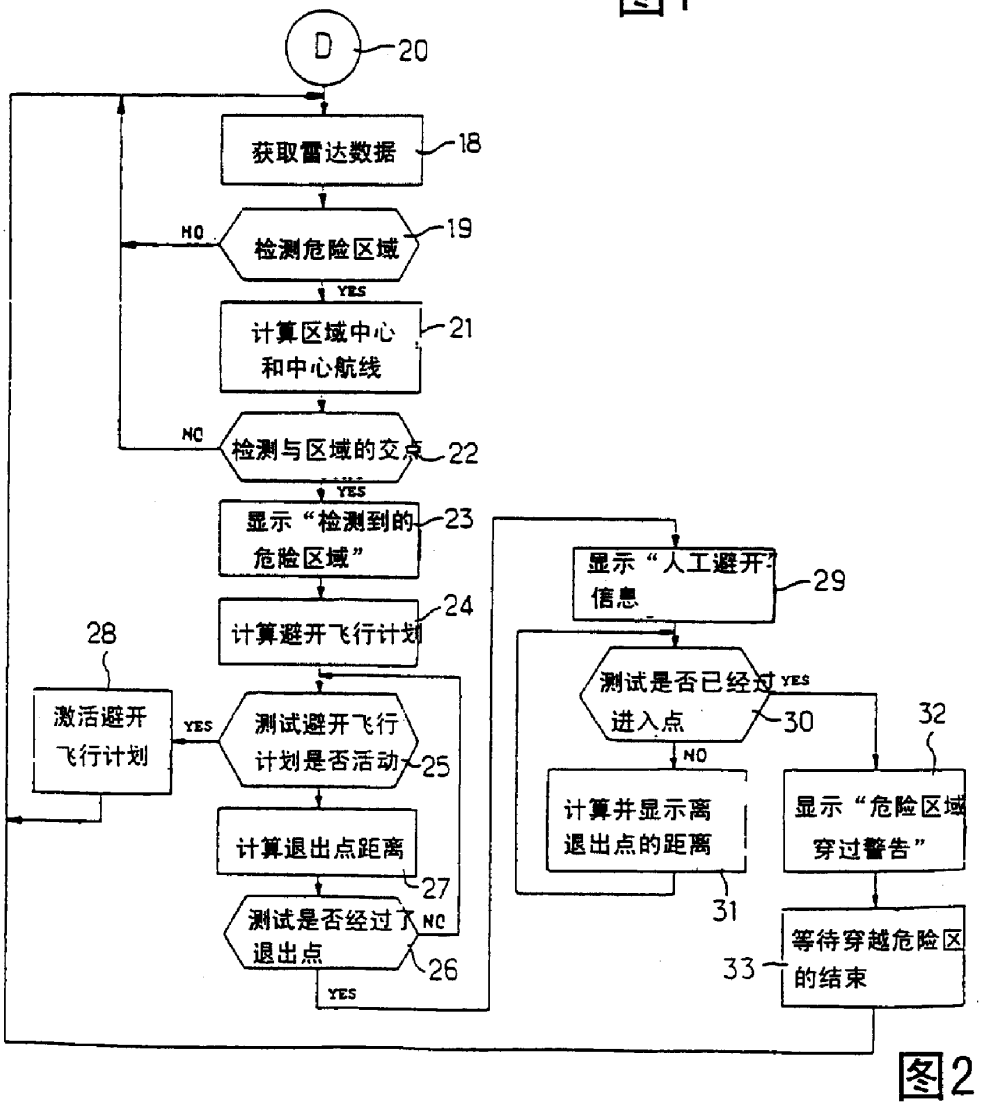



图2



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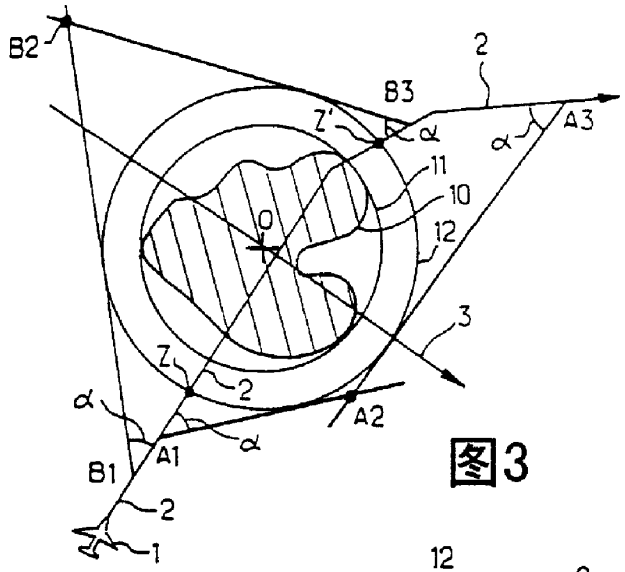



图3

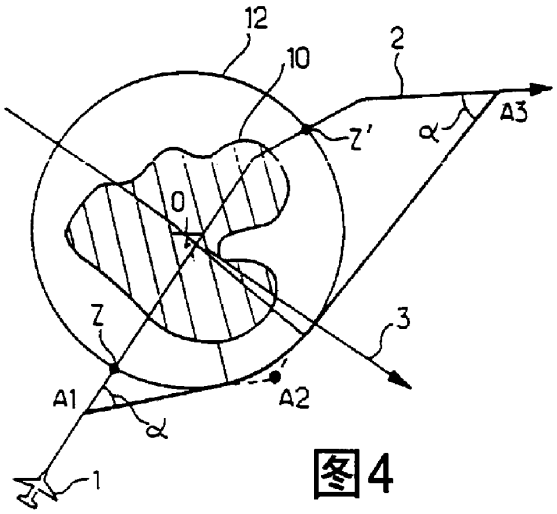



图4

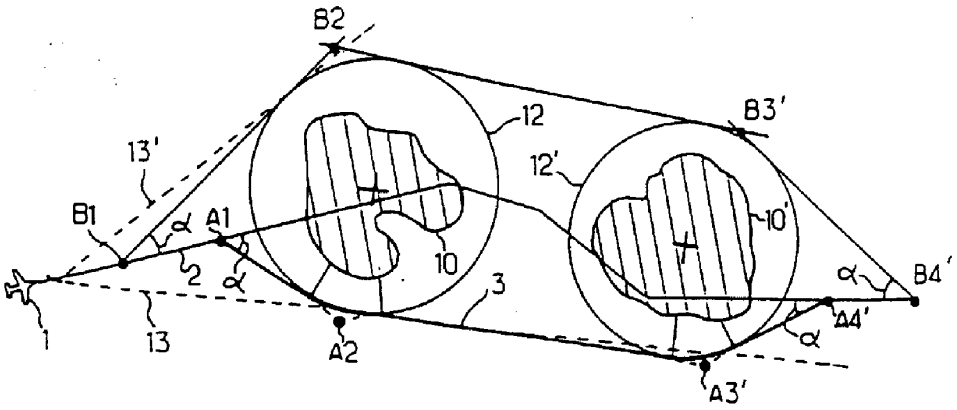



图5



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| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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| | 1 | 10733895 | B2 | 2020-08-04 | Liu, et al. | |

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| | 1 | 1222969 | CN | A | 1999-07-14 | SEXTANT AVIONIQUE | | |
| | 2 | 1222970 | CN | A | 1999-07-14 | SEXTANT AVIONIQUE | | |

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| | 1 | Response to Feb. 7, 2022 Non-Final Office Action in U.S. Patent Application 16/942,096 filed with the U.S. Patent Office on June 1, 2022, 13 pages. | |
| | 2 | United States Patent and Trademark Office, Final Office Action, U.S. Patent Application 16/942,096, mailed Jun. 24, 2022, 7 pages. | |
| | 3 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 16/810,631, mailed Jun. 15, 2022, 5 pages. | |
| | 4 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 17/523,859, mailed Jul. 11, 2022, 6 pages. | |

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☐ See attached certification statement.

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☐ None

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| | | | |
|---|---|---|---|
| Signature | /Anni Siitonen/ | Date (YYYY-MM-DD) | 2022-08-25 |
| Name/Print | Anni Siitonen | Registration Number | 74,974 |

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| | 1 | Response to Jan. 31, 2022 Non-Final Office Action in U.S. Patent Application 17/523,859 filed with the U.S. Patent Office on Apr. 13, 2022, 20 pages. | |

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| | 1 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 17/523,859, mailed Apr. 22, 2022, 6 pages. | |

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| 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 |

| FOREIGN PATENT DOCUMENTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T[5] |

| NON-PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| 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, page(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
| | 1 | European Patent Office, Summons to Oral Proceedings, EP Patent Application No. 15874400.3, mailed Apr. 13, 2022, 17 pages. | |

| EXAMINER SIGNATURE | | | |
|---|---|---|---|
| Examiner Signature | /MARY CHEUNG/ | Date Considered | 06/16/2022 |

*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.



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

## 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.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

## 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 | /Anni Siitonen/ | Date (YYYY-MM-DD) | 2022-05-18 |
| Name/Print | Anni Siitonen | Registration Number | 74,974 |

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.**



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | **Examiner** | **Art Unit** |
| | MARY D CHEUNG | 3665 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| G08G | / | 5 | / | 006 | F | 2013-01-01 |
| G08G | / | 5 | / | 0069 | I | 2013-01-01 |
| G05D | / | 1 | / | 0214 | I | 2013-01-01 |
| G08G | / | 5 | / | 0021 | I | 2013-01-01 |
| G08G | / | 5 | / | 0026 | I | 2013-01-01 |
| G08G | / | 5 | / | 0052 | I | 2013-01-01 |
| G08G | / | 5 | / | 0082 | I | 2013-01-01 |
| G08G | / | 5 | / | 0013 | I | 2013-01-01 |
| G05D | / | 1 | / | 106 | I | 2019-05-01 |
| G08G | / | 5 | / | 0004 | I | 2013-01-01 |
| B64C | / | 39 | / | 024 | I | 2013-01-01 |
| B64D | / | 47 | / | 08 | I | 2013-01-01 |
| B64C | / | 2201 | / | 024 | A | 2013-01-01 |
| B64C | / | 2201 | / | 141 | A | 2013-01-01 |
| B64C | / | 2201 | / | 146 | A | 2013-01-01 |
| B64C | / | 2201 | / | 127 | A | 2013-01-01 |

| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | / | | / | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 16 June 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220616



Textron Specialized Vehicles Inc., Exh. 1002, p. 69

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | **Examiner** | **Art Unit** |
| | MARY D CHEUNG | 3665 |

| INTERNATIONAL CLASSIFICATION | | | | |
|---|---|---|---|---|
| **CLAIMED** | | | | |
| G08G | / | 5 | / | 00 |

| NON-CLAIMED | | | | |
|---|---|---|---|---|
| | / | | / | |

| US ORIGINAL CLASSIFICATION | |
|---|---|
| **CLASS** | **SUBCLASS** |
| | |

| CROSS REFERENCES(S) | | | | | | |
|---|---|---|---|---|---|---|
| **CLASS** | **SUBCLASS (ONE SUBCLASS PER BLOCK)** | | | | | |
| | | | | | | |

| NONE | | Total Claims Allowed: | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 16 June 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220616



Textron Specialized Vehicles Inc., Exh. 1002, p. 70

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | Examiner | Art Unit |
| | MARY D CHEUNG | 3665 |

☐ 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 9 | 10 | 18 | 19 | - | 28 | | | | | | | | |
| 2 | 2 | 10 | 11 | 19 | 20 | - | 29 | | | | | | | | |
| 3 | 3 | 11 | 12 | 20 | 21 | - | 30 | | | | | | | | |
| - | 4 | 12 | 13 | 21 | 22 | | | | | | | | | | |
| 4 | 5 | 13 | 14 | 22 | 23 | | | | | | | | | | |
| 5 | 6 | 14 | 15 | 23 | 24 | | | | | | | | | | |
| 6 | 7 | 15 | 16 | - | 25 | | | | | | | | | | |
| 7 | 8 | 16 | 17 | - | 26 | | | | | | | | | | |
| 8 | 9 | 17 | 18 | - | 27 | | | | | | | | | | |

| NONE | | Total Claims Allowed: | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 16 June 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office

Part of Paper No.: 20220616



Textron Specialized Vehicles Inc., Exh. 1002, p. 71

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 | 5063 |

25096 7590 07/12/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

| EXAMINER | |
|---|---|
| CHEUNG, MARY DA ZHI WANG | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 3665 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 07/12/2022 | 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):

patentprocurement@perkinscoie.com

| ***Corrected*** ***Notice of Allowability*** | **Application No.** 17/523,847 | **Applicant(s)** XU et al. | |
|---|---|---|---|
| | **Examiner** MARY D CHEUNG | **Art Unit** 3665 | **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 IDS filed on 4/14/22, 4/27/22, 5/18/22.
   ☐ 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 1-3 and 5-24 . 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. 15/699,359 .
   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 4/14/22;4/27/22;5/18/22.
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 _____.

/MARY CHEUNG/
Primary Examiner, Art Unit 3665

## EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. The application has been amended as follows:

Claims 25-30 have been canceled.

## ALLOWABLE SUBJECT MATTER

3. This application is in condition for allowance except for the presence of claims 25-30 directed to invention II non-elected without traverse. Although the applicant amended the withdrawn claim 25 to include the subject matter from the original claim 4, other limitations in claim 25 still need to be searched and evaluated such as the disabling feature. Accordingly, claims 25-30 have been cancelled. Claims 1-3 and 5-24 are pending and allowed.

4. The following is an examiner's statement of reasons for allowance:

The closest prior art of Doyen et al. (US 2008/0183344 A1) teaches generating a restricted area alert. as a vehicle nears geographic locations through which traffic is restricted, sensors detect the geographic position of the vehicle, and compare that geographic position with information regarding known restricted areas. Upon actual or anticipated entry of the vehicle into the restricted area, an alert message will be generated, formatted and transmitted to the vehicle, and/or additional recipients.

In regarding to independent claim 1, Doyen taken either individually or in combination with other prior art of record fails to teach or render obvious a method for supporting a vehicle restriction region, comprising: generating one or more restriction strips along a boundary of the restriction region by connecting adjacent points of the two or more points, the one or more restriction strips defining at least a portion of the restriction region, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle; and automatically causing a ground vehicle to undertake one or more response measures based on at least one of a location or a movement characteristic of the ground vehicle relative to the restriction region.

5. 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."

***Inquiry***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary Cheung whose telephone number is (571) 272-6705. The examiner can normally be reached on Monday, Tuesday and Thursday from 10:00 AM to 7:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christian Chace, can be reached on (571) 272-4190.

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).

The fax phone numbers for the organization where this application or proceedings is assigned are as follows:

(571) 273-8300 (Official Communications; including After Final Communications labeled "BOX AF")

(571) 273-6705 (Draft Communications)

/MARY CHEUNG/
Primary Examiner, Art Unit 3665
June 16, 2022

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. |
|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 | 5063 |

25096 7590 06/08/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

| EXAMINER | |
|---|---|
| CHEUNG, MARY DA ZHI WANG | |
| **ART UNIT** | **PAPER NUMBER** |
| 3665 | |
| **NOTIFICATION DATE** | **DELIVERY MODE** |
| 06/08/2022 | 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):

patentprocurement@perkinscoie.com

| Letter Withdrawing a Notice Requiring Inventor's Oath or Declaration | Application No. 17/523,847 | Applicant(s) XU et al. |
|---|---|---|
| | | |

The Notice Requiring Inventor's Oath or Declaration mailed on 01 June 2022 was sent in error, and is hereby withdrawn. The time period set forth in the Notice of Allowance and Fee(s) Due to file a reply and pay the required fees continues to run from the mailing date of the Notice of Allowance and Fee(s) Due. Any time period set forth in the Notice of Allowability continues to run from the mailing date of the Notice of Allowability.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

/Brian Broadfoot/
Office of Data Management, Art Unit 3974
571-272-4200 or 1-888-786-0101
Patent Publication Branch
Office of Data Management

Receipt date: 04/08/2022

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

| U.S. PATENTS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| U.S. PATENT APPLICATION PUBLICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| 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 |

| FOREIGN PATENT DOCUMENTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T[5] |

| NON-PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| 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, page(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
| | 1 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 16/810,631, mailed Mar. 9, 2022, 9 pages. | |
| | 2 | European Patent Office, Communication pursuant to Article 94(3) EPC, EP Patent Application 19198007.7, mailed Mar. 14, 2022, 13 pages. | |
| | 3 | Response to Nov. 2, 2021 Non-Final Office Action in U.S. Patent Application 16/810,631 filed with the U.S. Patent Office on Feb. 7, 2022, 13 pages. | |

| EXAMINER SIGNATURE | | | |
|---|---|---|---|
| Examiner Signature | /MARY CHEUNG/ | Date Considered | 04/12/2022 |

*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.





ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

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

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Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

[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.

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☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

## 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 | /John M. Wechkin/ | Date (YYYY-MM-DD) | 2022-04-07 |
|---|---|---|---|
| Name/Print | John Wechkin | Registration Number | 42,216 |

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.**



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.C./

## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| L1 | 606121 | restrict$3 near5 (area zone region strip) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/04/12 11:45 AM |
| L2 | 21209 | 1 WITH (automobile car vehicle) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/04/12 11:46 AM |
| L3 | 31447 | 1 WITH (point boundary border) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/04/12 11:46 AM |
| L4 | 2668 | 2 AND 3 | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/04/12 11:46 AM |
| L5 | 97 | 4 AND tangent | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/04/12 11:47 AM |

## PE2E SEARCH - Search History (Interference)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| N1 | 196081 | restrict$3 near5 (area zone region strip) | (US-PGPUB; USPAT) | OR | ON | ON | 2022/04/12 11:47 AM |
| N2 | 5768 | 1 WITH (automobile car vehicle taxi) | (US-PGPUB; USPAT) | OR | ON | ON | 2022/04/12 11:47 AM |
| N4 | 9180 | 1 WITH (point boundary border) | (US-PGPUB; USPAT) | OR | ON | ON | 2022/04/12 11:47 AM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N5 | 773 | 2 AND 4 | (US-PGPUB; USPAT) | OR | ON | ON | 2022/04/12 11:48 AM |
| N7 | 34 | 5 AND tangent | (US-PGPUB; USPAT) | OR | ON | ON | 2022/04/12 11:48 AM |

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | Examiner | Art Unit |
| | MARY D CHEUNG | 3665 |

| CPC - Searched* | | |
|---|---|---|
| Symbol | Date | Examiner |
| G08G 5/006; G08G 5/0004; G08G 5/0013; G08G 5/0021; G08G 5/0026; G08G 5/0052; G08G 5/0069; G08G 5/0082; B64C 39/024; B64C 2201/024; B64C 2201/127; B64C 2201/141; B64C 2201/146; B64D 47/08; G05D 1/106; G05D 1/101 | 03/22/2022 | mc |

| 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 |
| EAST | 03/22/2022 | mc |
| CPC with text search | 03/22/2022 | mc |
| EAST | 03/24/2022 | mc |
| Google | 03/24/2022 | mc |
| EAST | 04/12/2022 | mc |

| Interference Search | | | |
|---|---|---|---|
| US Class/CPC Symbol | US Subclass/CPC Group | Date | Examiner |
| EAST | | 04/12/2022 | mc |



Textron Specialized Vehicles Inc., Exh. 1002, p. 84

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | Examiner | Art Unit |
| | MARY D CHEUNG | 3665 |



Textron Specialized Vehicles Inc., Exh. 1002, p. 85

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | **Examiner** | **Art Unit** |
| | MARY D CHEUNG | 3665 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| G08G | / | 5 | / | 006 | F | 2013-01-01 |
| G08G | / | 5 | / | 0069 | I | 2013-01-01 |
| G05D | / | 1 | / | 0214 | I | 2013-01-01 |
| G08G | / | 5 | / | 0021 | I | 2013-01-01 |
| G08G | / | 5 | / | 0026 | I | 2013-01-01 |
| G08G | / | 5 | / | 0052 | I | 2013-01-01 |
| G08G | / | 5 | / | 0082 | I | 2013-01-01 |
| G08G | / | 5 | / | 0013 | I | 2013-01-01 |
| G05D | / | 1 | / | 106 | I | 2019-05-01 |
| G08G | / | 5 | / | 0004 | I | 2013-01-01 |
| B64C | / | 39 | / | 024 | I | 2013-01-01 |
| B64D | / | 47 | / | 08 | I | 2013-01-01 |
| B64C | / | 2201 | / | 024 | A | 2013-01-01 |
| B64C | / | 2201 | / | 141 | A | 2013-01-01 |
| B64C | / | 2201 | / | 146 | A | 2013-01-01 |
| B64C | / | 2201 | / | 127 | A | 2013-01-01 |

| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | / | | / | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 12 April 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220412



Textron Specialized Vehicles Inc., Exh. 1002, p. 86

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | **Examiner** | **Art Unit** |
| | MARY D CHEUNG | 3665 |

| INTERNATIONAL CLASSIFICATION | | | | |
|---|---|---|---|---|
| **CLAIMED** | | | | |
| G08G | / | 5 | / | 00 |

| NON-CLAIMED | | | | |
|---|---|---|---|---|
| | / | | / | |

| US ORIGINAL CLASSIFICATION | |
|---|---|
| **CLASS** | **SUBCLASS** |
| | |

| CROSS REFERENCES(S) | | | | | | |
|---|---|---|---|---|---|---|
| **CLASS** | **SUBCLASS (ONE SUBCLASS PER BLOCK)** | | | | | |
| | | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 12 April 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220412



Textron Specialized Vehicles Inc., Exh. 1002, p. 87

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | Examiner | Art Unit |
| | MARY D CHEUNG | 3665 |

☐ 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 9 | 10 | 18 | 19 | - | 28 | | | | | | | | |
| 2 | 2 | 10 | 11 | 19 | 20 | - | 29 | | | | | | | | |
| 3 | 3 | 11 | 12 | 20 | 21 | - | 30 | | | | | | | | |
| - | 4 | 12 | 13 | 21 | 22 | | | | | | | | | | |
| 4 | 5 | 13 | 14 | 22 | 23 | | | | | | | | | | |
| 5 | 6 | 14 | 15 | 23 | 24 | | | | | | | | | | |
| 6 | 7 | 15 | 16 | - | 25 | | | | | | | | | | |
| 7 | 8 | 16 | 17 | - | 26 | | | | | | | | | | |
| 8 | 9 | 17 | 18 | - | 27 | | | | | | | | | | |

| NONE | | Total Claims Allowed: | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 23 | |
| /MARY CHEUNG/<br>Primary Examiner, Art Unit 3665 | 12 April 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office

Part of Paper No.: 20220412



Textron Specialized Vehicles Inc., Exh. 1002, p. 88

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 | 5063 |

25096 7590 07/12/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

| EXAMINER | |
|---|---|
| CHEUNG, MARY DA ZHI WANG | |
| **ART UNIT** | **PAPER NUMBER** |
| 3665 | |
| **NOTIFICATION DATE** | **DELIVERY MODE** |
| 07/12/2022 | 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):

patentprocurement@perkinscoie.com

| ***Corrected*** ***Notice of Allowability*** | **Application No.** 17/523,847 | **Applicant(s)** XU et al. | |
|---|---|---|---|
| | **Examiner** MARY D CHEUNG | **Art Unit** 3665 | **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 IDS filed on 4/14/22, 4/27/22, 5/18/22.
   ☐ 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 1-3 and 5-24 . 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. 15/699,359 .
   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 4/14/22;4/27/22;5/18/22.
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 _____.

/MARY CHEUNG/
Primary Examiner, Art Unit 3665

## EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. The application has been amended as follows:

Claims 25-30 have been canceled.

## ALLOWABLE SUBJECT MATTER

3. This application is in condition for allowance except for the presence of claims 25-30 directed to invention II non-elected without traverse. Although the applicant amended the withdrawn claim 25 to include the subject matter from the original claim 4, other limitations in claim 25 still need to be searched and evaluated such as the disabling feature. Accordingly, claims 25-30 have been cancelled. Claims 1-3 and 5-24 are pending and allowed.

4. The following is an examiner's statement of reasons for allowance:

The closest prior art of Doyen et al. (US 2008/0183344 A1) teaches generating a restricted area alert. as a vehicle nears geographic locations through which traffic is restricted, sensors detect the geographic position of the vehicle, and compare that geographic position with information regarding known restricted areas. Upon actual or anticipated entry of the vehicle into the restricted area, an alert message will be generated, formatted and transmitted to the vehicle, and/or additional recipients.

In regarding to independent claim 1, Doyen taken either individually or in combination with other prior art of record fails to teach or render obvious a method for supporting a vehicle restriction region, comprising: generating one or more restriction strips along a boundary of the restriction region by connecting adjacent points of the two or more points, the one or more restriction strips defining at least a portion of the restriction region, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle; and automatically causing a ground vehicle to undertake one or more response measures based on at least one of a location or a movement characteristic of the ground vehicle relative to the restriction region.

5. 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."

***Inquiry***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary Cheung whose telephone number is (571) 272-6705. The examiner can normally be reached on Monday, Tuesday and Thursday from 10:00 AM to 7:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christian Chace, can be reached on (571) 272-4190.

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).

The fax phone numbers for the organization where this application or proceedings is assigned are as follows:

(571) 273-8300 (Official Communications; including After Final Communications labeled "BOX AF")

(571) 273-6705 (Draft Communications)

/MARY CHEUNG/
Primary Examiner, Art Unit 3665
June 16, 2022

| Notice Requring Inventor's Oath or Declaration | Application No.<br>17/523,847 | Applicant(s)<br>XU et al. |
|---|---|---|
| | | |

☑ An inventor's oath or declaration in compliance with 37 CFR 1.63 or substitute statement in compliance with 37 CFR 1.64 executed by or with respect to each inventor has not yet been submitted.

The inventor's oath or declaration or substitute statement dated 07 December 2021 is defective. The inventor's oath or declaration does not comply with 37 CFR 1.63 or the substitute statement does not comply with 37 CFR 1.64 because it:

☐ does not include a statement that the person executing the oath or declaration or substitute statement believes the named inventor or joint inventor to be the original inventor or an original joint inventor of a claimed invention in the application for which the oath or declaration is being submitted.

☐ does not state that the application was made or was authorized to be made by the person executing the oath or declaration or substitute statement.

☐ does not acknowledge that any willful false statement made in such oath or declaration or substitute statement is punishable under section 1001 of title 18 by fine or imprisonment of not more than 5 years, or both.

☐ does not identify the person executing the oath or declaration or substitute statement by his or her legal name.

☐ does not identify the application to which the oath or declaration or substitute statement is directed.

☐ Other: _____

The substitute statement dated _____ does not comply with 37 CFR 1.64 because it:

☐ does not identify the inventor with respect to whom the statement applies.

☐ does not identify the relationship to the non-signing inventor.

☐ does not identify the circumstances permitting execution of the statement.

☐ was signed by someone other than the applicant.

☑ Other: The person who signed position is not on the Acceptable Apparent Authority list

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor MUST be filed **no later than the date on which the issue fee is paid.** See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application. This period for reply is not extendable under 37CFR 1.136(a)

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

_____
571-272-4200 or 1-888-786-0101
Patent Publication Branch
Office of Data Management

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 45748361 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | Anni Johanna Siitonen/Pamela Baumgart |
| **Filer Authorized By:** | Anni Johanna Siitonen |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 18-MAY-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 17:04:54 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | 2022_05_18_SuppIDS_144604 8001US00.PDF | 179368<br>4e6ba0c68e5dd486129af1ff5950ac987faf4 fa8 | no | 2 |

**Warnings:**

| Information: | | | | | |
|---|---|---|---|---|---|
| This is not an USPTO supplied IDS fillable form | | | | | |
| 2 | Non Patent Literature | NPL_SummonsOralProceedings_EP158744003.PDF | 1833214<br>89afffff7c33b55106de5de75e634b6804b37fbed | no | 17 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | | **Total Files Size (in bytes):** | 2012582 | |

**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.**

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

## U.S. PATENTS

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|

## U.S. PATENT APPLICATION PUBLICATIONS

| 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 |
|---|---|---|---|---|---|---|

## FOREIGN PATENT DOCUMENTS

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T[5] |
|---|---|---|---|---|---|---|---|---|

## NON-PATENT LITERATURE DOCUMENTS

| 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, page(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | European Patent Office, Summons to Oral Proceedings, EP Patent Application No. 15874400.3, mailed Apr. 13, 2022, 17 pages. | |

## 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** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

## 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.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

## 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 | /Anni Siitonen/ | Date (YYYY-MM-DD) | 2022-05-18 |
| Name/Print | Anni Siitonen | Registration Number | 74,974 |

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.**

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 45580713 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | Anni Johanna Siitonen/Wade Barbus |
| **Filer Authorized By:** | Anni Johanna Siitonen |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 27-APR-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 20:28:54 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $260 |
| RAM confirmation Number | E20224QK29143963 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | IDS.pdf | 43980<br>617b658161367c5c69c20da8580cf0080b46cad5 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| This is not an USPTO supplied IDS fillable form | | | | | |
| 2 | Non Patent Literature | NPL_2022_04_22_NOA_17523859.pdf | 358812<br>3570fc42697bbd3ddd72e86992beff2d6eef79d3 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 38295<br>6b5fa1ff701bfabbfa68acbc6d3ddcd34c305835 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 441087 | | |

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**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.**

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 17523847 |
| **Filing Date:** | 10-Nov-2021 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Filer:** | Anni Johanna Siitonen/Wade Barbus |
| **Attorney Docket Number:** | 144604-8001.US00 |

Filed as Large 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:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
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| **Miscellaneous:** | | | | |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 1806 | 1 | 260 | 260 |
| | | **Total in USD ($)** | | **260** |

| Electronic Patent Application Fee Transmittal | | | | | |
|---|---|---|---|---|---|
| **Application Number:** | 17523847 | | | | |
| **Filing Date:** | 10-Nov-2021 | | | | |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES | | | | |
| **First Named Inventor/Applicant Name:** | Xinan XU | | | | |
| **Filer:** | Anni Johanna Siitonen/Pamela Baumgart | | | | |
| **Attorney Docket Number:** | 144604-8001.US00 | | | | |
| Filed as Large 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:** | | | | | |
| **Extension-of-Time:** | | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 1806 | 1 | 260 | 260 |
| | | **Total in USD ($)** | | **260** |

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

| U.S. PATENTS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| U.S. PATENT APPLICATION PUBLICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| 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 |

| FOREIGN PATENT DOCUMENTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T[5] |

| NON-PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| 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, page(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
| | 1 | Response to Jan. 31, 2022 Non-Final Office Action in U.S. Patent Application 17/523,859 filed with the U.S. Patent Office on Apr. 13, 2022, 20 pages. | |

| 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** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

## 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.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

## 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 | /Anni Siitonen/ | Date (YYYY-MM-DD) | 2022-04-13 |
| Name/Print | Anni Siitonen | Registration Number | 74,974 |

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| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 45427871 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Pamela Baumgart |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 08-APR-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 10:51:15 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $260 |
| RAM confirmation Number | E202248A51511936 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | 2022_04_08_SuppIDS_14460481001US00.PDF | 185673<br>406be809095cd66b6cf368cbcb18b9ee0a3be0fd | no | 3 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| This is not an USPTO supplied IDS fillable form | | | | | |
| 2 | Non Patent Literature | 2022_03_09_NOA_16810631.PDF | 475347<br>cea12fb12fe42c24d97a39b9ff5c85639af60f6b | no | 9 |
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| **Information:** | | | | | |
| 3 | Non Patent Literature | 2022_03_14_CommArt94_EP191980077_.PDF | 8688647<br>cf20292330a85d699560cd47ad9d500d5e148e13 | no | 13 |
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| **Information:** | | | | | |
| 4 | Non Patent Literature | 2022_02_07_ResponseNFOA_16810631.PDF | 435115<br>a34cdaa0575c73f0ffc2c269185e3299327c5618 | no | 13 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Fee Worksheet (SB06) | fee-info.pdf | 38409<br>35f1317ac5205b4fb4b89d103004d464b359b5da | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 9823191 | | |

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**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.**

| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | 17523847 |
| **Filing Date:** | 10-Nov-2021 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Filer:** | John M. Wechkin/Pamela Baumgart |
| **Attorney Docket Number:** | 144604-8001.US00 |
| Filed as Large 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:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 1806 | 1 | 260 | 260 |
| | | **Total in USD ($)** | | **260** |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

| U.S. PATENTS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| U.S. PATENT APPLICATION PUBLICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| 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 |

| FOREIGN PATENT DOCUMENTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T[5] |

| NON-PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| 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, page(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
| | 1 | United States Patent and Trademark Office, Notice of Allowance, U.S. Patent Application 16/810,631, mailed Mar. 9, 2022, 9 pages. | |
| | 2 | European Patent Office, Communication pursuant to Article 94(3) EPC, EP Patent Application 19198007.7, mailed Mar. 14, 2022, 13 pages. | |
| | 3 | Response to Nov. 2, 2021 Non-Final Office Action in U.S. Patent Application 16/810,631 filed with the U.S. Patent Office on Feb. 7, 2022, 13 pages. | |

| 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.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

[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.

## 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.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

## 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 | /John M. Wechkin/ | Date (YYYY-MM-DD) | 2022-04-07 |
| Name/Print | John Wechkin | Registration Number | 42,216 |

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.**

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 45380895 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED VEHICLE RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 01-APR-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 21:21:41 |
| **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.) |
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| 1 | | Amendment.pdf | 52873<br>f26f9021e9015ad5625a5537374c0869f23315c7 | yes | 11 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Amendment/Request for Reconsideration-After Non-Final Rejection | 1 | 1 |
| | Claims | 2 | 7 |
| | Applicant Arguments/Remarks Made in an Amendment | 8 | 11 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 52873 | |

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**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.**
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## REMARKS

Claims 1-30 were pending when the present Office Action was mailed on March 29, 2022, of which claims 25-30 have been withdrawn from consideration. In this response, claim 4 has been canceled and claims 1, 5-7, 25, and 28 have been amended to clarify certain features of these claims and to expedite prosecution of this application. The foregoing cancelation and amendments are made without conceding the merits of any rejections of these claims, and without prejudice to pursuing these claims in unamended or other forms in a continuation or other application. Accordingly, claims 1-3 and 5-30 are currently pending, with claims 25-30 withdrawn.

In the Office Action dated March 29, 2022, claims 1-3 and 8-24 were rejected. More specifically, the status of the application in light of this Office Action is as follows:

a) Claims 1, 3, 8, 15 and 17-19 were rejected under 35 U.S.C. § 102(a)(1) over U.S. Patent Application Publication No. 2008/0183344 to Doyen et al. (hereinafter "Doyen");

b) Claims 2, 9-14, 16, 21 and 23-24 were rejected under 35 U.S.C. § 103 over the combination of Doyen and U.S. Patent Application Publication No. 2016/0253907 to Taveira (hereinafter "Taveira"); and

c) Claims 4-7 were indicated to be allowable but were objected to as being dependent on a rejected base claim;

A. Response to the Section 102(a)(1) Rejection of Claims 1, 3, 8, 15 and 17-19 (Doyen)

Independent claim 1 has been amended to include the subject matter of dependent claim 4, which was indicated to be allowable if rewritten in independent form. Accordingly, without commenting on or conceding the merits of the rejection of claim 1, the Section 102 rejection of claim 1 should be withdrawn.



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Claims 2, 8, 15, and 17-19 each depend from claim 1. Accordingly, without commenting on or conceding the merits of the rejections of the foregoing claims, the Section 102 rejections of these claims should be withdrawn for at least the foregoing reasons and for the additional features of these claims.

B. Response to the Section 103 Rejection of Claims 2, 9-14, 16, 21 and 23-24 (Doyen, Taveira)

Claims 2, 9-14, 16, 21 and 23-24 each depend from claim 1. Accordingly, without commenting on or conceding the merits of the rejections of the foregoing claims, the Section 103 rejections of these claims should be withdrawn for at least the foregoing reasons and for the additional features of these claims..

C. Response to Indication of Allowable Subject Matter

Claims 4-7 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form to include the features of the claim from which they depend. As discussed above, the subject matter of claim 4 has been incorporated into independent claim 1, and claim 4 has been canceled. Accordingly, the objection to claim 4 is now moot. Claims 5-7 have been amended to depend from allowable claim 1, and accordingly, the objections to claims 5-7 should be withdrawn.

D. Request for Consideration and Allowance of Withdrawn Claims

Withdrawn independent claims 25 and 28 have been amended to include the subject matter of claim 4. Withdrawn claims 26 and 27 depend from claim 25, and withdrawn claims 29 and 30 depend from claim 28. In view of the applicant's incorporation of allowable subject matter into claims 25 and 28, applicant respectfully requests consideration and allowance of claim 25-30.

E. Conclusion

In view of the foregoing, the pending claims comply with 35 U.S.C. § 112 and are patentable over the applied art. The applicant accordingly requests reconsideration of the application and respectfully submit that the application is in condition for allowance. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to contact the undersigned attorney at (206) 359-3257.

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, the applicant is not conceding that previously pending claims are not patentable over the cited references; instead, any alteration or characterizations are being made to facilitate expeditious prosecution of this application.

The applicant reserves the right to later pursue any previously pending or other broader or narrow claims that capture any subject matter supported by the present disclosure, including subject matter that might be found disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that the applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Please charge any underpayment or credit any overpayment to our Deposit Account No. 50-0665, under Order No. 144604-8001.US00 from which the undersigned is authorized to draw.

Dated: April 1, 2022

Respectfully submitted,

By __/John M. Wechkin/___
John Wechkin



Textron Specialized Vehicles Inc., Exh. 1002, p. 119

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Attorneys for Applicant

## AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A method for supporting a vehicle restriction region, comprising:

receiving, via one or more processors, two or more points associated with the restriction region;

generating, via the one or more processors, one or more restriction strips along a boundary of the restriction region by connecting adjacent points of the two or more points, the one or more restriction strips defining at least a portion of the restriction region, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle; and

automatically causing a ground vehicle to undertake one or more response measures based on at least one of a location or a movement characteristic of the ground vehicle relative to the restriction region.

2. (Original) The method of claim 1, wherein the two or more points are input by a user.

3. (Original) The method of claim 1, wherein the two or more points correspond to coordinate information of the boundary.

4. (Canceled)



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5. (Currently Amended) The method of ~~claim 4~~claim 1, wherein the first circle and the second circle are centered, respectively, at the adjacent points that are connected, to generate the at least one restriction strip.

6. (Currently Amended) The method of ~~claim 4~~claim 1, wherein the first circle and the second circle have the same radius.

7. (Currently Amended) The method of ~~claim 4~~claim 1, wherein a radius of the first circle or a radius of the second circle is defined based on a width of the at least one restriction strip.

8. (Original) The method of claim 1, wherein the one or more restriction strips correspond to one or more restriction lines that define the restriction region.

9. (Original) The method of claim 1, wherein each of the one or more restriction strips is configured with a width that is larger than or equal to a minimum width.

10. (Original) The method of claim 9, wherein the minimum width is defined to prevent the ground vehicle from encroaching in the restriction region.

11. (Original) The method of claim 1, wherein the boundary is a closed boundary and the restriction region is a closed region.

12. (Original) The method of claim 11, wherein the one or more restriction strips have ends, and wherein an end of one restriction strip overlaps with an end of another restriction strip to enclose the restriction region.

13. (Original) The method of claim 12, wherein the one or more response measures are undertaken only in an area outside the restriction region.

14. (Original) The method of claim 1, wherein the boundary is an open boundary and the restriction region is an open region.

15. (Original) The method of claim 1, wherein the movement characteristic includes at least one of a velocity, an acceleration, a deceleration, a direction of travel, or a projected path of the ground vehicle.

16. (Original) The method of claim 1, wherein causing the ground vehicle to undertake the one or more response measures includes:

calculating a distance between the location of the ground vehicle and the boundary of the restriction region; and

determining whether to cause the ground vehicle to undertake the one or more response measures based at least in part on comparing the calculated distance to a distance threshold.

17. (Original) The method of claim 1, further comprising:

determining which of the one or more response measures to cause the ground vehicle to undertake, based on the location or the movement characteristic of the ground vehicle relative to the restriction region.

18. (Original) The method of claim 1, wherein causing the ground vehicle to undertake the one or more response measures based on the location or the movement characteristic of the ground vehicle includes:

calculating an estimated amount of time for the ground vehicle to approach the restriction region, or a time or distance for the ground vehicle to begin to experience a response measure.

19. (Original) The method of claim 1, wherein the one or more response measures include at least one of:

decelerating the ground vehicle;

providing a safety measure to prevent the ground vehicle from entering the restriction region;

changing a direction of the ground vehicle;

adjusting a path of the ground vehicle; or

providing an alert regarding the ground vehicle .

20. (Original) The method of claim 1, wherein the ground vehicle includes a housing configured to carry a person.

21. (Original) The method of claim 1, wherein causing the ground vehicle to undertake one or more response measures includes taking control away from a user of the ground vehicle.

22. (Original) The method of claim 1, wherein causing the ground vehicle to undertake one or more response measures includes ceasing to take commands from a user of the ground vehicle.

23. (Original) The method of claim 1, wherein the restriction region has an irregular shape.

24. (Original) The method of claim 1, wherein the restriction region corresponds to a man-made feature.

25. (Withdrawn-Currently Amended) A method for restricting motion of a ground vehicle, comprising:

receiving, via one or more processors, multiple points associated with an irregularly-shaped restriction region;

generating, via the one or more processors, a boundary around the restriction region, by forming restriction strips between neighboring points of the multiple points, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle; and

automatically disabling the ground vehicle in response to the ground vehicle penetrating the restriction region, wherein:

the ground vehicle is configured to carry one or more persons;

the ground vehicle is electrically powered; and

the irregularly-shaped restriction region corresponds to a man-made feature.

26. (Withdrawn) The method of claim 25, further comprising taking control of the ground vehicle.

27. (Withdrawn) The method of claim 25, further comprises providing at least one of the one or more persons with limited time to take corrective action before taking control of the ground vehicle.

28. (Withdrawn-Currently Amended) A system for restricting motion of a ground vehicle, comprising:

one or more processors having instructions that, when executed:

receive multiple points associated with an irregularly-shaped restriction region;

generate a boundary around the restriction region, by forming restriction strips between neighboring points of the multiple points, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle; and

automatically disable the ground vehicle in response to the ground vehicle penetrating the restriction region, wherein:

the ground vehicle is configured to carry one or more persons;

the ground vehicle is electrically powered; and

the irregularly-shaped restriction region corresponds to a man-made feature.

29. (Withdrawn) The method of claim 28, wherein the instructions, when executed, take control of the ground vehicle.

30. (Withdrawn) The method of claim 28, wherein the instructions, when executed, provide at least one of the one or more persons with limited time to take corrective action before taking control of the ground vehicle.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:
Xinan Xu et al.

Application No.: 17/523,847 | Confirmation No.: 5063

Filed: November 10, 2021 | Art Unit: 3665

For: POLYGON SHAPED VEHICLE RESTRICTION ZONES | Examiner: Mary Da Zhi Wang Cheung

**AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION UNDER 37 CFR 1.111**

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

Dear Commissioner:

In response to the Non-Final Office Action mailed on March 29, 2022, please amend the above-identified U.S. patent application as follows:

## INTRODUCTORY COMMENTS

**Amendments to the Claims** are reflected in the listing of claims which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 8 of this paper.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>17/523,847 | Filing Date<br>11/10/2021 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☑ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED - PART I

| FOR | (Column 1)<br>NUMBER FILED | (Column 2)<br>NUMBER EXTRA | | RATE ($) | FEE ($) |
|---|---|---|---|---|---|
| ☐ BASIC FEE<br>(37 CFR 1.16(a), (b), or (c)) | N/A | N/A | | N/A | |
| ☐ SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m)) | N/A | N/A | | N/A | |
| ☐ EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q)) | N/A | N/A | | N/A | |
| TOTAL CLAIMS<br>(37 CFR 1.16(i)) | minus 20 = | * | | x $100 = | |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h)) | minus 3 = | * | | x $480 = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | | TOTAL | |

## APPLICATION AS AMENDED - PART II

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | 04/01/2022 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * 29 | Minus | ** 30 | = 0 | | x $100 = | 0 |
| | Independent<br>(37 CFR 1.16(h)) | * 3 | Minus | *** 3 | = 0 | | x $480 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | 0 |

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * | Minus | ** | = | | x $0 = | |
| | Independent<br>(37 CFR 1.16(h)) | * | Minus | *** | = | | x $0 = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | |

| | |
|---|---|
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. | LIE |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". | /LASHAWN A HINTON/ |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". | |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. | |

This collection of information is required by 37 CFR 1.16. 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 12 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

# A navigation device

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**INVENTOR INFORMATION**

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|---|---|---|---|---|
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| TAGUCHI, KIYOTAKA | N/A | N/A | N/A | N/A |

**DATE FILED**
2010-03-05

## Abstract

This invention claims a navigation device, wherein the navigation device receives the information used for determining the traffic condition around the vehicle; the navigation device has a storage unit (19) used for storing the statistical data for collecting the travel time of said vehicle in each road region; the navigation device fetches the passing restriction information and searches the guiding path; the navigation device repeatedly judges whether the run of the vehicle on the guiding path is restricted by passing based on the current position of vehicle and the passing restriction information; the navigation device considers the vehicle delay based on the traffic information and the statistical data under the condition of judging that the vehicle has passing restriction when travelling on the guiding path, searches the guiding path where the vehicle withdraws from the restriction object region and travels on the road out of the restriction object region so as to reach the destination before starting the passing restriction, and guides the travel according to the guiding path.

## Description

INVENTION-TITLE
TECHNICAL-FIELD
Technology field
technical field of [0002] [0003] For example, Japanese patent document JP-2005-121425A discloses has a storage device for storing map data of the navigation device, the map data includes a map is comprised of road of each road (link) of the time limit road data, and information for judging the zone information of each road zone. the navigation device based on the time limit information and time zone information, excluding the arrival time limit of the road estimated time section after searching the departure place and destination between the recommended path.
[0004] However, JP-2005-121425A recorded the device when searching the recommended path excludes the arrival of each link prediction time is a time limit road section, but not excluding the predicted road vehicle can pass before the starting time limit. Therefore, there is a possibility of the following: if the vehicle is slightly later point, be implicated by the time limit but not according to predetermined arrival destination.
DISCLOSURE
Invention contents
[0005] This invention is made and in view of the above problems, the purpose is to provide for more

accurately avoid passing restriction and reaching the destination technology.
[0006] The first aspect of the invention provides a current position determining unit, a traffic information receiving unit, memory card unit, passing limit information obtaining unit, path searching unit, a judging unit, and a first driving guide unit of the navigation device. a current position determining unit for determining the current position of the vehicle. a traffic information receiving unit for receiving traffic information for determining traffic conditions around the vehicle. memory card unit, memory card collecting the vehicles of each road interval travel time of the statistical data. the passing restriction information obtaining unit for obtaining comprises passing restriction period and limits the passing restriction information of the object area. path searching unit refers to the road data to calculate the evaluating value of each road interval and searching the total evaluation value from the departure place to the destination of most small guide path. judging unit, based on the current position of the vehicle and the passing restriction information, repeatedly judges when the vehicle running on the said guiding path is restricted by passing. under the first driving guidance unit, the judging unit judges when the vehicle running on the said guiding path is restricted by passing based on the traffic information and the statistical data considers the vehicle delay, searching the vehicle before the starting the passing restriction period withdraws to the restriction object region and road out of the restriction object region is passing to the guide path of the destination, and the guidance route for travel guide.
[0007] According to the structure, when it is determined that the vehicle travels on the guide path is restricted by passing lower, based on a traffic information for determining the traffic condition around the vehicle and collects the vehicles of each road interval travel time of system meter data to account for delay of the vehicle, and searches out before the period of vehicle starting the passing restriction withdraws from the restriction object region and road out of the restriction object region is passing and to reach the destination of the guide path, and for driving guidance according to the guidance route. Therefore, it can more reliably avoiding passing restriction to arrive at the destination.
MODE-FOR-INVENTION
Preferred Embodiment
[0012] Picture 1 shows the invention relates of one embodiment of navigation device of the structure of FIG. The navigation device 1 has a GPS receiver 10, a traffic information receiver 11, the traffic information received by the communication device 12, speed sensor 13, angular speed sensor 14, a map data input device 15, a display device 16, an operation part 17, and a speaker 18, storage device 19 and a data processing section 20. In this embodiment, the navigation device 1 mounted on the vehicle.
[0013] GPS receiver 10 receives the GPS satellite transmitted waves and is used for determining the current position of the vehicle information to the data processing section 20.
[0014] traffic information receiver 11 using a beacon or FM multiplex broadcast to receive road traffic signal information (VICS information) sent by the information center.
[0015] traffic information received by the communication device 12 and providing traffic information, news, weather, and sightseeing information in content of the information centre communication connection.
[0016] In this embodiment, the navigation device 1 can receive the passing restriction information for communication device 12 through traffic information receiver 11 and the traffic information received.
[0017] output of the vehicle speed sensor 13 corresponding to a vehicle speed signal. angular speed sensor 14 detecting equal angular speed generated when the vehicle turns.
[0018] In this embodiment, the GPS receiver 10, the vehicle speed sensor 13 and the angular speed sensor 14 as a position detector of the current position to determine the vehicle to function.
[0019] a map data input device 15 from the memory card the storage medium of the map data read from the map data of the specific area, and reads the map data to the input data processing unit 20. as the storage medium, DVD, hard disk drive, and so on.
[0020] the map data comprises road data, map matching data, background data, facility data, etc. road data refers to the distance of each road, road class, lane number and position of signal machine, and traffic restrictions. map matching data for improving the position detection precision of said map matching use. background data represent river, lake, sea, rail, and facilities such as the position, shape and name. facility data represents the name of the facility in various regions, the position and type of facility.
[0021] a display device 16 has a liquid crystal display, the liquid crystal display displays the image corresponding to the image signal by the input data processing unit 20.

[0022] operating part 17 has the display device 16 display the periphery of mechanical switch, and set on the front overlap of the display of the display device 16 of the touch switch and so on. the operating part 17 with the switch operation of the user signal which corresponds to the output data processing unit 20.
[0023] a speaker 18 built in the display device 16, and outputs the sound signal input by the data processing section 20 the corresponding sound.
[0024] memory card device 19 to a hard disk drive, flash memory drive, and memory card such as memory card medium for writing data
and a data read. a passing restriction information and the each road of the vehicle for each road section travel time of the statistical data in the memory card of the memory card device 19.
[0025] passing limit information is performed based on vehicle type or number of time limit of the road or information area. in the passing restriction information comprises limit passing of the condition of a vehicle (vehicle type or license number), limiting the passage of time (day, time, etc.) and the restriction object region corresponding to the information. the restriction object region is specified as an inner ring-shaped region specific road, between two of a particular link. Further, the passing restriction information non-working used by the traffic information receiver 11 and the traffic information receiving the latest traffic restrictions information for communication device 12 to receive, can be periodically updated. In addition, the statistical data includes the shortest time travel time of each road section, the average time and the longest time.
[0026] data processing section 20 comprises a CPU R0M, a computer RAM, a memory, I/O, etc. CPU performing various processing on the program in the memory according to the memory card. Furthermore, the data processing section 20 comprises a management year, month, date, week, current time unit of time.
[0027] as the execution data processing unit 20 for processing, such as a traffic information memory card processing, the current position determination process, the destination search processing, path search processing and driving guidance processing. in the traffic information memory card processing, when through non-working receiver of the traffic signal 11 and the traffic information received by the communication device 12 received for determining the traffic condition around the vehicle traffic information, the received traffic information stored in the RAM. a current position determining process, on the basis of the position detector input for determining the information of the current position of the vehicle, determining a current position of the vehicle. in the destination search processing, on the map surrounding the position of the vehicle, overlapped display representing the vehicle position of the vehicle position mark. in the destination search processing, according to the operation by the user to retrieve destination. the route search processing, the reference road data, calculating the each interval path cost, search from the departure place to the total cost of the destination path of most small guide path. the driving guidance processing and the like, for driving guidance according to the guiding path. In addition, in the path search processing, according to the user operation can be suitable for high priority, general road priority, distance priority, one of guiding path search of each priority condition of the time priority and so on.
[0028] Picture 2, picture 3 is the flow chart of one example data processing unit 20 performs a process. The navigation device 1 becomes an operating state is in open state when the ignition switch of the vehicle, the data processing part 20 as shown in FIG. 2, processing shown in FIG. 3.
[0029] First, a APEG determining passing restriction object condition, the current position and the current time. Specifically, determining the current position of the vehicle and the current time, and reference stored on the passing restriction information memory card device 19, determining the passing restriction object condition of the current position of the vehicle. limit the vehicle condition, limiting object area, and limit time herein refers to the passing restriction object condition.
[0030] Next, in S102 determines whether the vehicle is passing restriction area (the restriction object region) in. Specifically, based on the current position of the vehicle is included in the restriction object region so as to judge whether the vehicle is located in the restriction object region is.
(0031) the current position of the vehicle is not located in the restriction object region in lower judgment is no, S102, processing into S104. in S104, the ruled standby time T, then processing returns to S100. Here, the predetermined time such as 5 minutes.
(0032) the current position of the vehicle is located in the restriction object region in lower, S102 judged to be, treated into Sioeo in S106, judging whether the engine of the vehicle is closed. from the engine ECU (not shown) to the data processing unit 20 whether the input indicates that the vehicle engine is in the off-state of the signal, the data processing part 20 based on the engine of the signal determines whether the vehicle is

in the off-state.
[0033] the engine of the vehicle is under the closed state, S106 is judged, the processing ends. In addition, the vehicle
under the engine is the open state, the judgment of S106 is no, processing into S108. in S108, judging whether the current time is limiting the object vehicle. [0034] at the current time is not the lower limit target vehicle judgment is no, S108, processing into S110. in S110, a start display starting passing restriction remaining time and the restriction object region. For example, the present vehicle on the 22 day after 18 hour 00 minute limit line inside ring-shaped No. 5 area, the information is displayed on the display device 16 and the speaker 18 for sound output.
[0035] judging whether the destination input in S112. when the operation for determining the destination of the operation by the user is judged, S112, processing into S114. S114, the departure place to guide path for searching the destination from the path search. Specifically, the reference road data to calculate the path cost of each interval, search from the departure place (e.g. current location) is the smallest guide path to a total path cost of the destination. In addition, based on received by the traffic information receiver 11 and the traffic information such as traffic information received by the communication device 12 for to determine congestion in the path guide is traffic conditions, and considering the congestion in the path guide is caused delay, for searching the guiding path. In addition, in the search of the guide path. The speed priority, general road priority, distance priority and time priority of each priority condition, path cost (evaluation value) calculation method is different.
[0036] In S116, judging whether there is path (guide path) can arrive at the destination before the limiting starting. the through S114 of path search and searching to reach the guide path of the destination before the limiting starting condition of lower, S116 of it is, processing into S118. in S118, to be the passing restriction start time front reaches the destination path start guiding route.
[0037] In S120, judges whether the passing restriction start time front reaches the destination. Specifically, based on received by the traffic information receiver 11 and the traffic information received by the communication device 12 of the traffic information to determine congestion in the path guide is traffic condition, such consideration due to congestion in the path guide is caused delay, to judge the passing restriction start time front is capable of reaching the destination.
[0038] the S120 judgment is able to start time front reaches the destination condition at the passing restriction, S120 of it is, processing into S122. in S122, the ruled standby time T2 (e.g., 30 minutes). after processing into S124. in S124, judging whether to reach the destination.
[0039] lower in the absence of arriving at the destination, the judgment of S124 is no, processing returns to S120.
[0040] congestion is because the S120 judgment and so on but not the passing restriction start time front reaches the destination, the judgment of S120 is no, processing into S126. in S126, judging whether the destination is located outside the current confinement region (the restriction object region).
[0041] the destination is out of the restriction object region lower, S126 of it is, processing into S128. In S128, reference vehicle condition to judge whether there is the path outside the restricted area. Specifically, while considering the delay of the vehicle based on the traffic information and the statistical data, judging whether there is the following guide path on the passing restriction start front vehicle road out of the restriction object region and the outside along the restriction object region passing so as to reach the destination of the guide path. In this embodiment, based on the traffic condition around the vehicle traffic information determined, considering the delay of the vehicle. Further, using the worst value of the travel time of each road section in the statistical data to calculate out the time vehicle withdraws from the restriction object region, thereby taking into account the delayed vehicle.
[0042] when the S128 reference the traffic condition to search out capable to limit the path of the outside of the area is judged, S128, processing into S130. In S130, the vehicle withdraws from the restriction object region outside before carrying out guiding route according to the guiding path. Then, in S132, according to the limit of the road passing outside the target region reaches the guide path of the destination is implemented by
applying path guide.
[0043] In S134, based on the current position of the vehicle is moved to a certain distance of the destination with judging whether to reach the destination.

[0044] lower the vehicle does not arrive at the destination with a certain distance with the front case, S134 judgment is no, processing returns to S132. when the vehicle reaches the destination of the certain distance condition of front lower is judged, S134, ending the processing.
[0045] at the present time the vehicle becomes lower limit target vehicle is judged, S108, processing into S136 (refer to FIG. 3). in S136, cannot guide running on the data processing unit 20 displays the limitation releasing time and other information. for example, the vehicle cannot pass due to current passing restriction. passing restriction releasing time is 22 18 hour 00 minute. to pass the restriction releasing 2 hours 30 minutes. such notification is displayed on the display device 16.
[0046] In S138, judging whether the vehicle is stopping (parking). In this embodiment, based on no input from the speed sensor 13 whether the state of vehicle speed signal continuously over certain time T3 (e.g., 2 seconds), to judge whether the vehicle is stopped.
[0047] under the condition that the vehicle does not stop, the judgment of S138 is no, processing into S140. prohibiting travel warning in S140. Specifically, the display device 16 displays a warning prohibiting driving information and outputting sound by a speaker 18.
[0048] and the S142 standby certain time T4 (e.g., 3 minutes), processing returns to S138.
[0049] under the condition of stopping of the vehicle is judged, S138, processing into S144. judging whether the closed state of the engine of the vehicle in S144.
[0050] an engine of the vehicle is open state lower, S144 judgment is no, processing into S142. On the other hand, the engine of the vehicle is in the off-state condition of lower is judged, S144, ending the processing.
[0051] return to the explanation of FIG. 2. the user performs under the condition for determining the destination of the operation, S112 of the judgment is no, processing into S146 (see FIG. 3). in S146, judging whether remaining time of the front limiting starting is within certain time T2 (e.g., 30 minutes).
[0052] to limit residual time till starting lower than certain long time T2, S146 the judgment is no, the judge result of sub-step S146 is repeated.
[0053] to limit residual time till starting as the certain time T2 in the lower, S146 of it is, processing into S148 at. in S148, judging whether a restricted area (the restriction object region) in the current position of the vehicle.
[0054] Here, in the current position of the vehicle is restricted area (the restriction object region) condition of lower, S148 of judging is yes, processing into S150. In S150, notification time limit start time. Specifically, it indicates the limit time start time of the message displayed on the display device 16, and a speaker 18 for outputting sound.
[0055] In S152, guide capable of arriving before the limit start of parking lot. specifically, capable of passing limiting starts before arrival, and suitable transfer park of public transport means to search, and search to guide path of the parking field searched for driving guidance according to the guidance route. In addition, railway, bus, taxi, ship such as public traffic tool.
[0056] In S154, judging whether to reach the parking lot before the limit time. if not reaching the parking lot before the time limit of the lower, S154 judgment is no, processing into S138. On the other hand, under the condition of reaching the parking lot before the limit time is judged, S154, ending the processing.
[0057] is a restricted area at the current position of the vehicle (the restriction object region) is lower, the judgment of S148 is no, processing into S132 (see FIG. 2).
[0058] return to the explanation of FIG. 2. lower the destination condition in restriction object region judgment is no, S126, processing into S150. S150 notification limit time start time at S152 before leading to the limiting starting reaches 7
the parking lot.
[0059] even if external cause destination located in the restriction object region and the S126 is judged to be lower, taking into account the traffic situation without limiting the path of the outside of the area judgment is no, S128, processing into S150. under this condition, also limit time start time at S150 after the notice S152 to capable of arriving before the limit start of parking lot.
one example path [0060] in FIG. 4 represents the current position of the vehicle located on the passing restriction area (the restriction object region) in the destination located on the passing restriction area (out of the restriction object region).
[0061] path R from the current place via A, B to the destination path. the path R is input after the destination at S114 considered to search based on traffic jam information caused by the delay of the path.

[0062] path R2 is from the current after passing through the A site withdraws from the restriction object region from B point, and passing the path of the destination on the road region out of the restriction object. The path R2 is the vehicle reaches location B before, after the point B of the place such as traffic congestion, and searching out the path is not able to reach the destination before the starting passing restriction condition of the S120 judges. and considering the delay of the vehicle based on the traffic information and the statistical data in the search path R2. the outer path R2 is searching the vehicle withdraws from the restriction object region before passing restriction start time and out of the restriction object region of the road path of the destination.
[0063] path R3 is a path for reaching the parking lot after the A site from the current. As the endpoint of path R3 of parking lot is before the starting passing restriction reaches and suitable transfer parking lot of the public traffic tool. the path R3 before the vehicle reaches the location A, location after the A traffic congestion, traffic restricted destination is judged at S126, and to judge the lower is not able to reach limit condition of the path out of the area before the limit time, out of the S152 search path taking into account traffic conditions.
one example path [0064] in FIG. 5 represents the current position of the vehicle located on the passing restriction area (restriction object region) in the destination or the passing restriction area exists (the restriction object region) in.
[0065] path R4 is a path for reaching the parking lot after the C point from the current. is before the starting passing restriction to reach and it is suitable for transferring public traffic tool path R4 of the lot as a parking field. the path R4 before the vehicle reaches the C location, location after the C traffic congestion, is under the situation of not capable of reaching the destination before the starting passing restriction of the path at S116 determines at S152 the search path.
[0066] According to this embodiment, as shown in FIG. 4 and FIG. 5, based on traffic information, can be random strain corresponding to traffic condition updating the boot path.
[0067] Further, the present invention is not limited to the embodiment, can be performed in a variety of ways based on the spirit of the invention.
[0068] For example, in the embodiment, the SIIO displays the remaining time to passing restriction and the restriction object region, but the remaining time or to passenger notification to traffic restrictions, traffic restrictions of time and limit the object region of at least one.
[0069] In addition, in the embodiment, the S136 display not driving guidance and rest time limitation releasing time, but for example also notifies the passenger vehicle is passing restriction condition in area, the passing restriction is released until the passing time of the restriction, and limiting at least one object in the area.
[0070] The embodiment of the structure with following standpoint. the current position of the APEG determining process corresponds to a current position determining unit. traffic information receiver 11 and the traffic information received by the communication device 12 is equivalent to the bus information receiving unit. memory device 19 corresponds to the storage unit. APEG passing limit information obtaining unit. S114, S128 and S152, the path search processing is equivalent to the path search unit. S120 and S124 is equal to the judging unit. S128, S130, and S132 corresponding to a first driving guide unit. S116 and S152 corresponding to a second driving guide unit. S102, S108.
and S110 is equal to the passing restriction start notification unit. S102, S108, and S136 is equal to the passing restriction release notification unit.
[0071] According to one standpoint, providing a current position determining unit, a traffic information receiving unit, memory card unit passing restriction information obtaining unit, path searching unit, a judging unit, and a first driving guide unit of the navigation device. a current position determining unit determines a current position of the vehicle. a traffic information receiving unit for receiving traffic information for determining the traffic condition around the vehicle. storage unit storing statistical data for collecting the travel time of each road interval in the vehicle of the. passing limit information obtaining unit obtains a period of traffic restrictions and limits the passing restriction information of the object area. path searching unit refers to the road data and calculating the evaluation value of each road interval and searching the total evaluation value from the departure place to the destination of most small guide path. judging unit based on the current position of the vehicle and the passing restriction information, repeatedly judges when the vehicle running on the said guiding path is restricted by passing. first operating guide unit when the judging unit

judges that the vehicle driving on the said guiding path is restricted by passing lower, based on the traffic information, and the statistical data to account for the delay of the vehicle, the vehicle exits out of the restriction object region before the starting the passing restriction period, and out of the restriction object region of road traffic to reach the guide path of the destination search, and to perform a running guide according to the guidance route.

[0072] According to the structure, when it is determined that the vehicle travels on the guide path when under restricted by passing based on collecting traffic information and vehicle of each road interval travel time of the statistic data to account for delay of the vehicle, captures the passing restriction start time front withdraws from the restriction object region and out of the restriction object region of the road traffic reaches the destination of the guide path is searched, and for driving guidance according to the guidance route. Therefore, it is capable of avoiding passing restriction to reach the destination more accurately.

[0073] the navigation device also can form further has a second driving | guide unit. the second driving guide unit if there is no searched outside the passing restriction start front withdraws from the restriction object region and reaches the guide path of the destination by the limitation of traffic condition of road outside the object region lower, searching the passing restriction start front reaches the parking guide path, and according to the guidance route for driving guidance, the parking lot is suitable for transferring the parking lot public traffic tool capable of reaching the destination.

[0074] According to the structure, when it is determined that no search to lower the passing restriction start front withdraws from the restriction object region and the limited road of the object area is passing to the guide path of the destination, searching the passing restriction before beginning to reach suitable to reach destination of transfer guide path of the parking public traffic tool, and for operation guidance according to the guidance route, so it can not violate traffic restrictions to reach the destination.

[0075] The navigation device also can be structured also has passing restriction start notification unit. passing limiting starting notification unit when the judging unit judges that it is under the condition of the vehicle before it reaches the destination is restricted by passing, for limiting information to the passenger notification to the remaining time till starting the passing restriction based on the pass, age of the passing restriction, and at least one in the restriction object region.

[0076] According to the structure, when it is determined that the vehicle front when arriving at the destination is restricted by passing lower, based on the remaining time limit information, notifies the passenger to traffic restrictions, traffic restrictions limiting period, and at least one object in the area, so that the passenger can easily identify various information about traffic restrictions.

[0077] The navigation device also can be structured also has passing restriction release notification unit. based on the current position of the vehicle and the passing restriction information and judges that the vehicle is under condition of the passing restriction by place, traffic restriction release notification unit notifies the occupant of the vehicle is passing in restricted area to the passing restriction is de-remaining time, period of the passing restriction, and at least one in the restriction object region.

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[0078] According to the structure, based on the current position of the vehicle and the passing restriction information determination under the condition that the vehicle is located in the place restricted by passing the notification to the passenger vehicle is passing restriction condition in the area, remaining time until the passing restriction is released, passing restriction period, and limits at least one object region in, so the passenger can easily recognize information about the traffic limit.

[0079] Although the above describes the invention according to various embodiments of the present invention, but it should be understood that the present invention is not limited to the embodiment and structure. The invention is intended to cover all kinds of deformation and equivalent structure. In addition, although the various combination and structure form is considered for carrying out the present invention, but in the range of the embodiment, also can be considered by other combination and structure form, comprising more or less or only a single element.

[0080] each process and interpretation, step or process or any combination of them can be implemented as a software part or a software unit (sub program) and/or a hardware portion or a hardware unit (e.g., circuit or integrated circuit), including or not a function of related device, and the hardware portion or the hardware unit can be constructed inside of a microcomputer.

[0081] any combination of addition, software part or a software unit or a plurality of software part or software

units can be included in a software program, the software program can be embodied on a computer-readable memory card medium, or can be downloaded via a communication network or installed in the computer.

## Claims

1. A navigation device, comprising a current position determining unit (S100) used for determining the current position of vehicle; two traffic information receiving units (11, 12) used for receiving the traffic information for determining the traffic condition around the vehicle; a storage unit (19) used for storing the statistical data for collecting the travel time in each road region of said vehicle; a passing restriction information obtaining unit (S100) used for obtaining the passing restriction information; the passing restriction information comprises the passing restriction date and the restriction object region; three path searching units (S114, S128, S152) used for calculating the evaluation value in each road region referring to the road data, and searching the guiding path with the minimum total evaluation value from the origin place to the destination; two judging units (S120, S124) used for repeatedly judging whether the vehicle has passing restriction when travelling on the guiding path according to the current position of vehicle and the passing restriction information; three first travel guiding units (S128, S130, S132) used for considering the vehicle delay based on the traffic information and the statistical data under the condition of judging that the vehicle has passing restriction when travelling on the guiding path by the judging units (S120, S124), searching the guiding path where the vehicle withdraws from the restriction object region and travels on the road out of the restriction object region so as to reach the destination before starting the passing restriction, and guides the travel according to the guiding path.
2. The navigation device according to claim 1, wherein it further comprises two second travel guiding units (S116, S152) used for searching the guiding path of park of the public traffic tool suitable to transfer and reach the destination before starting the passing restriction under the condition of judging not to search the guiding path of withdrawing from the restriction object and travelling on the road out of the restriction object region so as to reach the destination before starting passing restriction, and guiding the travel according to the guiding path.
3. The navigation device according to claim 1, wherein it further comprises three restriction starting noticing units (S102, S108, S110) used for noticing at least one of the remaining time, the passing restriction date, and the restriction object region to the passenger until starting passing restriction based on the passing restriction information under the condition of judging that the vehicle has passing restriction before reaching the destination by the judging units (S120, S124).
4. The navigation device according to claim 2, wherein it further comprises three passing restriction starting noticing units (S102, S108, S110) used for noticing at least one of the remaining time, the passing restriction date, and the restriction object region to the passenger until starting passing restriction based on the passing restriction information under the condition of judging that the vehicle has passing restriction before reaching the destination by the judging units (S120, S124).
5. The navigation device according to any one of claims 1 to 4, wherein it further comprises three passing restriction releasing noticing units (S102, S108, S136) used for noticing the condition that the vehicle is located in the passing restriction region, the remaining time until the passing restriction is released, the passing restriction date, and the restriction object region under the condition of judging that the vehicle is located on the passing restriction location based on the current position of vehicle and the passing restriction information.

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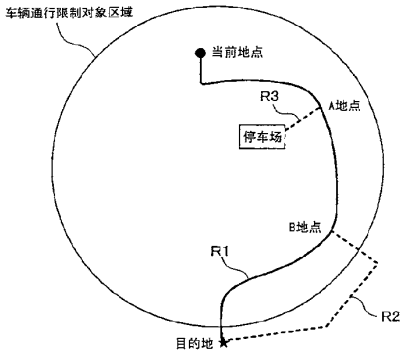
权利要求书 1 页 说明书 8 页 附图 5 页

(54)发明名称

导航装置

(57)摘要

本发明公开一种导航装置。该导航装置接收用于确定车辆周边的交通状况的信息。导航装置具有对收集了所述车辆的每个道路区间的旅行时间的统计数据进行存储的存储单元(19)。导航装置取得通行限制信息，并搜索引导路径。导航装置基于所述车辆的当前位置以及所述通行限制信息反复判断所述车辆在所述引导路径上运行时是否受到通行限制。导航装置在判断为所述车辆在所述引导路径上行驶时受到通行限制的情况下，基于所述交通信息以及所述统计数据考虑所述车辆的延迟，搜索所述车辆在所述通行限制开始前退出到限制对象区域外、并在该限制对象区域外的道路上行驶而到达所述目的地的引导路径，并按照该引导路径进行行驶引导。




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1. 一种导航装置，包括：

当前位置确定单元 (S100)，确定车辆的当前位置；

交通信息接收单元 (11,12)，接收用于确定车辆周边的交通状况的交通信息；

存储单元 (19)，对收集了所述车辆的每个道路区间的旅行时间的统计数据进行存储；

通行限制信息取得单元 (S100)，取得通行限制信息，该通行限制信息包含通行限制的时期以及限制对象区域；

路径搜索单元 (S114，S128，S152)，参照道路数据计算每个道路区间的评价值，并搜索从出发地到目的地的总评价值最小的引导路径；

判断单元 (S120,S124)，根据所述车辆的当前位置以及所述通行限制信息，反复判断所述车辆在所述引导路径上行驶时是否受到通行限制；以及

第一行驶引导单元 (S128,S130,S132)，在所述判断单元 (S120、S124) 判断为所述车辆在所述引导路径上行驶时受到通行限制的情况下，根据所述交通信息以及所述统计数据，考虑所述车辆的延迟来搜索所述车辆在所述通行限制开始的时期前退出到所述限制对象区域外、并在该限制对象区域外的道路上通行而到达所述目的地的引导路径，并按照该引导路径进行行驶引导。

2. 如权利要求 1 所述的导航装置，

还包括第二行驶引导单元 (S116，S152)，在判断为没有搜索到在所述通行限制开始前退出到所述限制对象区域外、并在所述限制对象区域外的道路上通行而到达所述目的地的引导路径的情况下，所述第二行驶引导单元 (S116，S152) 搜索在所述通行限制开始之前到达适合换乘可到达所述目的地的公共交通工具的停车场的所述引导路径，并按照该引导路径进行行驶引导。

3. 如权利要求 1 所述的导航装置，

还包括通行限制开始通知单元 (S102、S108、S110)，所述通行限制开始通知单元 (S102、S108、S110) 在由所述判断单元 (S120、S124) 判断为所述车辆在到达所述目的地之前受到通行限制的情况下，基于所述通行限制信息，向乘员通知到所述通行限制开始为止的剩余时间、所述通行限制的时期、以及所述限制对象区域中的至少一个。

4. 如权利要求 2 所述的导航装置，

还包括通行限制开始通知单元 (S102、S108、S110)，所述通行限制开始通知单元 (S102、S108、S110) 在由所述判断单元 (S120、S124) 判断为所述车辆在到达所述目的地之前受到通行限制的情况下，基于所述通行限制信息，向乘员通知到所述通行限制开始为止的剩余时间、所述通行限制的时期、以及所述限制对象区域中的至少一个。

5. 如权利要求 1 ～ 4 中任一项所述的导航装置，

还包括通行限制解除通知单元 (S102、S108、S136)，在基于所述车辆的当前位置以及所述通行限制信息判断为所述车辆位于受到所述通行限制的地点的情况下，该通行限制解除通知单元 (S102、S108、S136) 向乘员通知所述车辆位于所述通行限制区域内的情况、到所述通行限制被解除为止的剩余时间、所述通行限制的时期、以及所述限制对象区域中的至少一个。



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# 导航装置

## 技术领域

[0001] 本发明涉及一种搜索从出发地到目的地的引导路径，并按照该引导路径进行行驶引导的导航装置。

[0002] 技术领域

[0003] 例如，在日本专利文献 JP-2005-121425A 公开了具有存储地图数据的存储装置的导航装置，所述地图数据包含具有构成地图上的道路的各路段 (link) 的时间限制信息的路段数据、和用于判断各路段所属的时区的时区信息。该导航装置基于时间限制信息和时区信息，排除在该路段的到达预计时刻被时间限制的路段后，搜索出发地与目的地之间的推荐路径。

[0004] 但是，JP-2005-121425A 记载的装置在搜索推荐路径时排除了在各个路段的到达预计时刻被时间限制的路段，但不排除预计在开始时间限制之前车辆能够通行的路段。因此，存在以下的可能性：若车辆稍微晚一点，则会受到时间限制的牵连而不能按照预定到达目的地。

## 发明内容

[0005] 本发明是鉴于上述问题而作出的，其目的在于提供用于更准确地回避通行限制并到达目的地的技术。

[0006] 本发明的第一方面提供具有当前位置确定单元、交通信息接收单元、存储单元、通行限制信息取得单元、路径搜索单元、判断单元、以及第一行驶引导单元的导航装置。当前位置确定单元，确定车辆当前的位置。交通信息接收单元，接收用于确定车辆周边的交通状况的交通信息。存储单元，存储收集了所述车辆的每个道路区间的旅行时间的统计数据。通行限制信息取得单元，取得包含通行限制的时期以及限制对象区域的通行限制信息。路径搜索单元，参照道路数据计算每个道路区间的评价值，并搜索从出发地到目的地的总评价值最小的引导路径。判断单元，基于所述车辆的当前位置以及所述通行限制信息，反复判断所述车辆在所述引导路径上行驶时是否受到通行限制。第一行驶引导单元，在所述判断单元判断为所述车辆在所述引导路径上行驶时受到通行限制的情况下，基于所述交通信息以及所述统计数据考虑所述车辆的延迟，搜索所述车辆在所述通行限制开始时期前退出到所述限制对象区域外并在该限制对象区域外的道路上通行而到达所述目的地的引导路径，并按照该引导路径进行行驶引导。

[0007] 根据该结构，在判断为车辆在引导路径上行驶时受到通行限制的情况下，基于用于确定车辆周边的交通状况的交通信息以及收集了车辆的每个道路区间的旅行时间的统计数据来考虑车辆的延迟，并搜索出车辆在通行限制开始的时期前退出到限制对象区域外并在该限制对象区域外的道路上通行且而到达目的地的引导路径，并按照该引导路径进行行驶引导，因此能够更加可靠地回避通行限制而到达目的地。



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## 附图说明

[0008] 图 1 是示出本发明的一个实施方式的导航装置的模块图。

[0009] 图 2 和图 3 是表示数据处理部执行的处理例子的流程图。

[0010] 图 4 是说明从位于通行限制区域内的出发点到达位于通行限制区域外的目的地的路径的图。

[0011] 图 5 是说明从位于通行限制区域内的出发点到达位于通行限制区域外的目的地的路径的图。

## 具体实施方式

[0012] 图 1 示出了涉及本发明的一个实施方式的导航装置的结构的图。本导航装置 1 具有 GPS 接收机 10、交通信息接收机 11、交通信息接收用通信装置 12、车速传感器 13、角速度传感器 14、地图数据输入装置 15、显示装置 16、操作部 17、扬声器 18、存储装置 19 以及数据处理部 20。在本实施方式中，导航装置 1 搭载在车辆上。

[0013] GPS 接收机 10 接收 GPS 卫星发送的电波，并将用于确定车辆的当前位置的信息发送给数据处理部 20。

[0014] 交通信息接收机 11 利用信标或 FM 复用广播来接收由信息中心发送的道路交通信息 (VICS 信息)。

[0015] 交通信息接收用通信装置 12 与提供交通信息、新闻、天气、以及观光信息等的内容的信息中心进行通信连接。

[0016] 在本实施方式中，导航装置 1 能够通过交通信息接收机 11 以及交通信息接收用通信装置 12 接收后述的通行限制信息。

[0017] 车速传感器 13 输出对应车速的车速信号。角速度传感器 14 检测在车辆转弯时等产生的角速度。

[0018] 在本实施方式中，GPS 接收机 10、车速传感器 13 以及角速度传感器 14 作为用于确定车辆的当前位置的位置检测器而发挥功能。

[0019] 地图数据输入装置 15 从存储了地图数据的存储介质中读出特定区域的地图数据，并将读出的地图数据向数据处理部 20 输入。作为存储介质有 CD、DVD、硬盘驱动器等。

[0020] 地图数据包含道路数据、地图匹配数据、背景数据、设施数据等。道路数据表示各路段的距离、道路类别、行车道数量、信号机的位置、以及通行限制等。地图匹配数据在用于提高位置检测精度的所说的地图匹配中使用。背景数据表示河、湖、海、铁道、以及设施等的位置、形状、名称。设施数据表示各地的设施的名称、所在位置、以及设施种类等。

[0021] 显示装置 16 具有液晶等的显示器，在该液晶显示器显示与由数据处理部 20 输入的影像信号对应的影像。

[0022] 操作部 17 具有配置在显示装置 16 的显示器周围的机械开关、以及在显示装置 16 的显示器的前面重叠设置的触摸开关等。操作部 17 将与用户的开关操作相对应的信号向数据处理部 20 输出。

[0023] 扬声器 18 内置于显示装置 16 内，并输出与由数据处理部 20 输入的声音信号对应的声音。

[0024] 存储装置 19 对硬盘驱动器、闪存驱动器、以及存储卡等的存储介质进行数据写入



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和数据读出。在该存储装置 19 存储有通行限制信息和在各路段行驶的车辆的每路段的旅行时间的统计数据。

[0025] 通行限制信息是表示被进行基于车辆种类或车号牌的号码等的时间限制的道路或者区域的信息。在通行限制信息中包含将限制通行的车辆的条件（车辆种类或车号牌的号码）、限制通行的时间（星期、时间段等）以及限制对象区域对应起来的信息。限制对象区域例如被规定为特定的环状道路的内侧区域、特定道路的两端之间。再者，该通行限制信息使用通过交通信息接收机 11 以及交通信息接收用通信装置 12 而接收的最新的通行限制信息，能够周期地进行更新。另外，在统计数据中，包含各路段的旅行时间的最短时间、平均时间、以及最长时间。

[0026] 数据处理部 20 构成为具有 CPU、ROM、RAM、存储器、I/O 等的计算机。CPU 根据存储于存储器中的程序进行各种处理。另外，数据处理部 20 具有管理年、月、日、星期、当前时刻的时间机构。

[0027] 作为执行数据处理部 20 的处理，例如有交通信息存储处理、当前位置确定处理、目的地检索处理、路径搜索处理、行驶引导处理等。在交通信息存储处理中，当通过交通信息接收机 11 以及交通信息接收用通信装置 12 接收到用于确定车辆周边的交通状况的交通信息时，将接收到的交通信息存储在 RAM 中。在当前位置确定处理中，基于由位置检测器输入的用于确定车辆的当前位置的信息，确定车辆的当前位置。在目的地检索处理中，在本车位置周边的地图上，重叠显示表示本车位置的本车位置标志。在目的地检索处理中，根据用户操作来检索目的地。在路径搜索处理中，参考道路数据，计算出每个区间路径成本，搜索从出发地到目的地的路径的总成本最小的引导路径。在行驶引导处理等中，按照引导路径进行行驶引导。另外，在路径搜索处理中，根据用户操作可进行适合高速优先、一般道路优先、距离优先、时间优先等的各优先条件中的某一个的引导路径的搜索。

[0028] 图 2、图 3 是表示数据处理部 20 执行的处理的一个例子的流程图。本导航装置 1 在车辆的点火开关为打开的状态时成为动作状态，数据处理部 20 开始如图 2、图 3 所示的处理。

[0029] 首先，在 S100 确定通行限制对象条件、当前位置以及当前时刻。具体地说，确定车辆的当前位置以及当前时刻，并参照存储于存储装置 19 的通行限制信息，确定车辆的当前位置的通行限制对象条件。在这里所说的通行限制对象条件是限制车辆条件、限制对象区域、以及限制时间等。

[0030] 接下来，在 S102 判断车辆是否位于通行限制区域（限制对象区域）内。具体地说，基于车辆的当前的位置是否包含在限制对象区域内，来判断车辆是否位于限制对象区域内。

[0031] 在车辆的当前位置没有位于限制对象区域内的情况下，S102 的判断为否，处理进入 S104。在 S104 中，待机规定时间 T1 后，处理返回到 S100。在这里，规定时间 T1 例如是 5 分钟。

[0032] 在车辆的当前位置位于限制对象区域内的情况下，S102 的判断为是，处理进入 S106。在 S106 中，判断车辆的引擎是否为关闭的状态。从引擎 ECU（未图示）向数据处理部 20 输入表示车辆引擎是否为关闭状态的信号，数据处理部 20 基于该信号判断车辆的引擎是否为关闭状态。

[0033] 在车辆的引擎为关闭状态的情况下，S106 的判定为是，本处理结束。另外，在车辆



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的引擎为打开状态的情况下，S106 的判断为否，处理进入 S108。在 S108 中判断在当前时刻车辆是否为限制对象车辆。

[0034] 在当前时刻车辆不是限制对象车辆的情况下，S108 的判断为否，处理进入 S110。在 S110 中，开始显示开始通行限制为止的剩余时间和限制对象区域。例如将“本车辆在 22 日 18 时 00 分以后限制在环状 5 号线内侧区域通行，，的信息显示在显示装置 16 并且由扬声器 18 进行声音输出。

[0035] 在 S112 中判断是否实施了目的地输入。当用户进行了用于确定目的地的操作时，S112 的判断为是，处理进入 S114。在 S114 中，实施对从出发地到目的地的引导路径进行搜索的路径搜索。具体地说，参照道路数据来计算出每个区间的路径成本，搜索从出发地（例如当前位置）到目的地的总路径成本为最小的引导路径。另外，基于由交通信息接收机 11 以及交通信息接收用通信装置 12 接收的交通信息来确定路径引导上的拥塞等交通状况，并考虑因路径引导上的拥塞等而产生的延迟，来搜索引导路径。另外，在上述引导路径的搜索中，根据高速优先、一般道路优先、距离优先、以及时间优先等的各优先条件，路径成本（评价值）的计算方法不同。

[0036] 在 S116 中，判断是否有可在限制开始前到达目的地的路径（引导路径）。在通过 S114 的路径搜索而搜索到可在限制开始前到达目的地的引导路径的情况下，S116 的判断为是，处理进入 S118。在 S118 中，以可在通行限制开始时刻前到达目的地的路径开始路径引导。

[0037] 在 S120 中，判断能否在通行限制开始时刻前到达目的地。具体地说，基于由交通信息接收机 11 以及交通信息接收用通信装置 12 接收的交通信息来确定路径引导上的拥塞等交通状况，考虑因路径引导上的拥塞等而产生的延迟，来判断通行限制开始时刻前是否能够到达目的地。

[0038] 在 S120 判断为能够在通行限制开始时刻前到达目的地的情况下，S120 的判断为是，处理进入 S122。在 S122 中，待机规定时间 T2（例如 30 分钟）。之后处理进入 S124。在 S124 中，判断是否到达了目的地。

[0039] 在没有到达目的地的情况下，S124 的判断为否，处理返回到 S120。

[0040] 在 S120 判断为因拥塞等而不能在通行限制开始时刻前到达目的地时，S120 的判断为否，处理进入 S126。在 S126 中，判断目的地是否位于当前限制区域（限制对象区域）外。

[0041] 在目的地位于限制对象区域外的情况下，S126 的判断为是，处理进入 S128。在 S128 中，参考交通状况来判断是否有可到限制区域外的路径。具体地说，基于交通信息以及统计数据而考虑车辆的延迟，判断是否有以下引导路径：在通行限制开始前车辆退出到限制对象区域外并沿该限制对象区域外的道路通行，从而能够到达目的地的引导路径。在本实施方式中，基于根据交通信息确定的车辆周边的交通状况，考虑车辆的延迟。进而，使用包含在统计数据中的各路段的旅行时间的最差值来计算出车辆退出到限制对象区域外时的时间，从而考虑车辆的延迟。

[0042] 当在 S128 中参考交通状况而搜索出能够到限制区域外的路径时，S128 的判断为是，处理进入 S130。在 S130 中，在车辆退出到限制对象区域外之前按照引导路径实施路径引导。接着，在 S132 中，按照沿限制对象区域外的道路通行来到达目的地的引导路径来实



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施路径引导。

[0043] 在 S134 中，基于车辆的当前位置是否移动到目的地的一定距离跟前来判断是否到达了目的地。

[0044] 在车辆没有到达目的地的一定距离跟前的情况下，S134 的判断为否，处理返回到 S132。在车辆到达目的地的一定距离跟前的情况下，S134 的判断为是，结束本处理。

[0045] 在当前时刻车辆成为限制对象车辆的情况下，S108 的判断为是，处理进入 S136（参考图 3）。在 S136 中，在数据处理部 20 显示不能引导行驶以及限制解除时间等的信息。例如将“该车辆因当前通行限制而不能够通行。通行限制解除时间是 22 日 18 时 00 分。到通行限制解除还有 2 小时 30 分。”这样的通知显示在显示装置 16。

[0046] 在 S138 中，判断车辆是否停止（停车）。在本实施方式中，基于没有从车速传感器 13 输入车速信号的状态是否持续一定时间 T3（例如 2 秒）以上，来判断车辆是否停止。

[0047] 在车辆没有停止的情况下，S138 的判断为否，处理进入 S140。在 S140 中警告禁止行驶。具体地说，在显示装置 16 显示警告禁止行驶的信息并由扬声器 18 输出声音。

[0048] 并且在 S142 待机一定时间 T4（例如是 3 分钟），处理返回到 S138。

[0049] 在车辆停止的情况下，S138 的判断为是，处理进入 S144。在 S144 中判断车辆的引擎是否是关闭状态。

[0050] 在车辆的引擎为打开状态的情况下，S144 的判断为否，处理进入 S142。另一方面，车辆的引擎为关闭状态的情况下，S144 的判断为是，结束本处理。

[0051] 返回到图 2 的说明。在用户进行用于确定目的地的操作的情况下，S112 的判断为否，处理进入 S146（参见图 3）。在 S146 中，判断限制开始前的剩余时间是否为一定时间 T2（例如 30 分钟）以内。

[0052] 在到限制开始为止的剩余时间比一定时间 T2 长的情况下，S146 的判断为否，重复 S146 的判断。

[0053] 在到限制开始为止的剩余时间为一定时间 T2 以内的情况下，S146 的判断为是，处理进入 S148。在 S148 中，判断车辆的当前位置是否在限制区域（限制对象区域）内。

[0054] 在这里，当车辆的当前位置为限制区域（限制对象区域）内的情况下，S148 的判断为是，处理进入 S150。在 S150 中，通知限制时间开始时间。具体地说，将表示限制时间开始时间的消息显示在显示装置 16 上，并且由扬声器 18 输出声音。

[0055] 在 S152 中，引导能够在限制开始之前到达的停车场。具体地说，对能够在通行限制开始之前到达、且适合换乘公共交通工具的停车场进行检索，并搜索到达检索到的停车场之一的引导路径，按照该引导路径进行行驶引导。另外，作为公共交通工具有铁路、公共汽车、出租车、船舶等。

[0056] 在 S154 中，判断在限制时间之前是否到达了停车场。在限制时间之前没有到达停车场的情况下，S154 的判断为否，处理进入 S138。另一方面，在限制时间前到达了停车场的情况下，S154 的判断为是，结束本处理。

[0057] 在车辆的当前位置为限制区域（限制对象区域）外的情况下，S148 的判断为否，处理进入 S132（参见图 2）。

[0058] 返回到图 2 的说明。在目的地位于限制对象区域内的情况下，S126 的判断为否，处理进入 S150。在 S150 通知限制时间开始时间，在 S152 引导到能够在限制开始之前到达



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的停车场。

[0059] 即使因目的地位于限制对象区域外而在 S126 判断为是的情况下，在考虑了交通状况而没有去限制区域外的路径时，S128 的判断为否，处理进入 S150。这种情况下，也在 S150 通知限制时间开始时间后，在 S152 引导到能够在限制开始之前到达的停车场。

[0060] 图 4 表示车辆的当前地位于通行限制区域（限制对象区域）内、目的地位于通行限制区域（限制对象区域）外的情况的路径的一个例子。

[0061] 路径 R1 是从当前地经由 A 地点、B 地点到达目的地的路径。该路径 R1 是输入目的地之后，在 S114 考虑因基于交通信息的拥塞等产生的延迟而搜索的路径。

[0062] 路径 R2 是从当前地经由 A 地点后，从 B 地点退出到限制对象区域外，并在该限制对象区域外的道路通行而达到目的地的路径。该路径 R2 是在车辆到达 B 地点之前，在 B 地点以后的地点发生交通拥塞等，而在 S120 判断为在通行限制开始前不能到达目的地的情况下检索出的路径。在路径 R2 的检索中基于交通信息以及统计数据而考虑了车辆的延迟。路径 R2 是搜索为车辆在通行限制开始时间之前退出到限制对象区域外，并在该限制对象区域外的道路通行而达到目的地的路径。

[0063] 路径 R3 是从当前地通过 A 地点之后到达停车场的路径。作为路径 R3 的终点的停车场是可在通行限制开始前到达并适宜换乘公共交通工具的停车场。该路径 R3 在车辆到达 A 地点之前，在 A 地点以后的地点发生交通拥塞等，在 S126 判断为目的地是通行限制区域外，并且在考虑交通状况而判断为没有在限制时间前能够到达限制区域外的路径的情况下，在 S152 检索出的路径。

[0064] 图 5 表示车辆的当前地位于通行限制区域（限制对象区域）内、目的地也存在于通行限制区域（限制对象区域）内的情况的路径的一个例子。

[0065] 路径 R4 是从当前地通过 C 地点之后到达停车场的路径。作为路径 R4 终点的停车场是在通行限制开始前能够到达并适宜换乘公共交通工具的停车场。该路径 R4 在车辆到达 C 地点之前，在 C 地点以后的地点发生交通拥塞等，在 S116 判断为没有在通行限制开始前能够到达目的地的路径的情况下，在 S152 搜索的路径。

[0066] 根据本实施方式，如图 4、图 5 所示，基于交通信息，可对应交通状况来随机应变地更新引导路径。

[0067] 再者，本发明不限与上述实施方式，基于本发明的主旨可利用各种方式进行实施。

[0068] 例如，在上述实施方式中，在 S110 显示了到通行限制开始为止的剩余时间和限制对象区域，但也可以向乘员通知到通行限制开始为止的剩余时间、通行限制的时期以及限制对象区域的至少一个。

[0069] 另外，在上述实施方式中，在 S136 显示了不能行驶引导以及限制解除时间，但例如也可以向乘员通知车辆位于通行限制区域内的情况、到通行限制被解除为止的剩余时间、通行限制的时间、以及限制对象区域中的至少一个。

[0070] 上述实施方式的结构伴有以下观点。在 S100 的当前位置确定处理相当于当前位置确定单元。交通信息接收机 11 以及交通信息接收用通信装置 12 相当于公交信息接收单元。存储装置 19 相当于存储单元。S100 相当于通行限制信息取得单元。S114、S128、S152 中的路径搜索处理相当于路径搜索单元。S120 以及 S124 相当于判断单元。S128、S130、以及 S132 相当于第一行驶引导单元。S116 以及 S152 相当于第二行驶引导单元。S102、S108、



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以及 S110 相当于通行限制开始通知单元。S102、S108、以及 S136 相当于通行限制解除通知单元。

[0071] 根据一种观点，提供具有当前位置确定单元、交通信息接收单元、存储单元、通行限制信息取得单元、路径搜索单元、判断单元、以及第一行驶引导单元的导航装置。当前位置确定单元确定车辆的当前位置。交通信息接收单元接收用于确定车辆周边的交通状况的交通信息。存储单元存储对所述车辆的每个道路区间的旅行时间进行了收集的统计数据。通行限制信息取得单元取得包含通行限制的时期以及限制对象区域的通行限制信息。路径搜索单元参考道路数据而计算每个道路区间的评价值，并搜索从出发地到目的地的总评价值最小的引导路径。判断单元基于所述车辆的当前位置以及所述通行限制信息，反复判断所述车辆在所述引导路径上行驶时是否受到通行限制。第一运行引导单元在所述判断单元判断为所述车辆在所述引导路径上行驶时受到通行限制的情况下，基于所述交通信息以及所述统计数据来考虑所述车辆的延迟，对所述车辆在所述通行限制开始时期前退出到所述限制对象区域外、且在该限制对象区域外的道路通行而到达所述目的地的引导路径进行搜索，并按照该引导路径而进行行驶引导。

[0072] 根据上述结构，在判断为车辆在引导路径上行驶时受到通行限制的情况下，基于收集了交通信息以及车辆的每个道路区间的旅行时间的统计数据来考虑车辆的延迟，对车辆在通行限制开始时期前退出到限制对象区域外、且在该限制对象区域外的道路通行而达到目的地的引导路径进行搜索，并按照该引导路径进行行驶引导，因此可更加准确地回避通行限制而到达目的地。

[0073] 上述导航装置也能够构成为还具有第二行驶引导单元。第二行驶引导单元在判断为没有搜索到在通行限制开始前退出到限制对象区域外、并在限制对象区域外的道路通行而到达目的地的引导路径的情况下，搜索在通行限制开始前到达停车场的引导路径，并按照该引导路径来进行行驶引导，该停车场为适合换乘能够到达目的地的公共交通工具的停车场。

[0074] 根据上述结构，在判断为没有搜索到在通行限制开始前退出到限制对象区域外并在限制对象区域外的道路上通行而到达目的地的引导路径的情况下，搜索在通行限制开始前到达能够到达目的地的适合换乘公共交通工具的停车场的引导路径，并按照该引导路径进行运行引导，因此能够不违反通行限制而到达目的地。

[0075] 上述导航装置也可构成为还具有通行限制开始通知单元。通行限制开始通知单元在由上述判定单元判定为上述车辆在到达目的地之前受到通行限制的情况下，基于上述通行限制信息，向乘员通知到所述通行限制开始为止的剩余时间、所述通行限制的时期、以及所述限制对象区域中的至少一个。

[0076] 根据上述结构，在判断为车辆在到达目的地前受到通行限制的情况下，基于通行限制信息，向乘员通知到通行限制开始为止的剩余时间、通行限制时期、以及限制对象区域中的至少一个，因此乘员能够容易地识别有关通行限制的各种信息。

[0077] 上述导航装置也可构成为还具有通行限制解除通知单元。基于上述车辆的当前位置以及上述通行限制信息而判断为所述车辆位于受到所述通行限制的地点的情况下，通行限制解除通知单元向乘员通知所述车辆位于通行限制区域内的情况、到所述通行限制被解除为止的剩余时间、所述通行限制的时期、以及所述限制对象区域中的至少一个。



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[0078] 根据上述结构，在基于车辆的当前位置以及通行限制信息判断为车辆位于受到通行限制的地点的情况下，向乘员通知车辆位于通行限制区域内的情况、到通行限制被解除为止的剩余时间、通行限制时期、以及限制对象区域内的至少一个，因此乘员可容易地识别有关通行限制的各信息。

[0079] 尽管上面已参照本发明的各种实施例描述了本发明，但应当理解，本发明并不局限于上述实施例和结构。本发明意欲覆盖各种变形和等同结构。此外，尽管上述各种组合和结构形式被考虑用于实施本发明，但在实施例的范围内，也可考虑采用其他组合和构造形式，包括或多或少或仅单个元件。

[0080] 而且，上面解释的每个过程、步骤或方法或它们的任何组合可被实施为软件部分或软件单元（子程序）和/或硬件部分或硬件单元（例如，电路或集成电路），包括或不包括相关装置的功能；而且，硬件部分或硬件单元可构造在微型计算机内。

[0081] 此外，软件部分或软件单元或多个软件部分或软件单元的任何组合可包含在软件程序中，所述软件程序可包含在计算机可读取的存储媒介中，或可经由通信网络下载或安装在计算机中。



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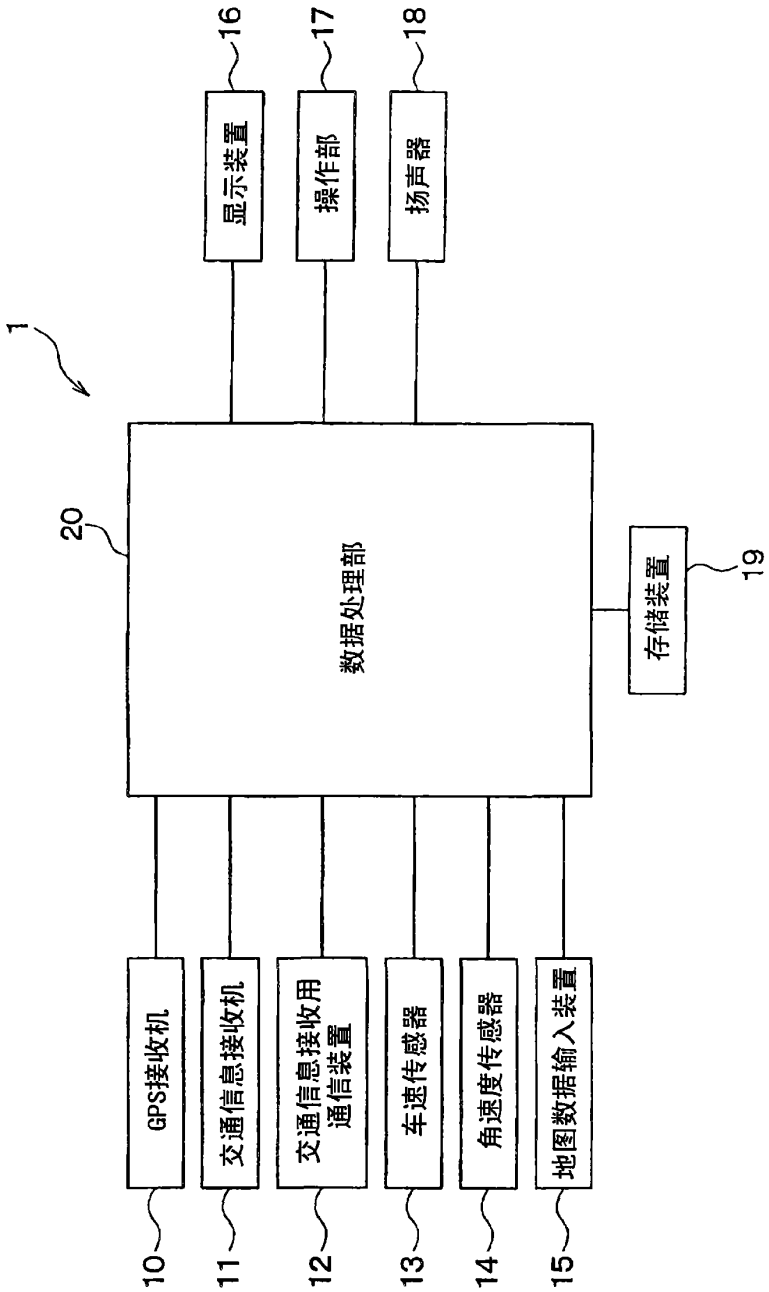



图 1



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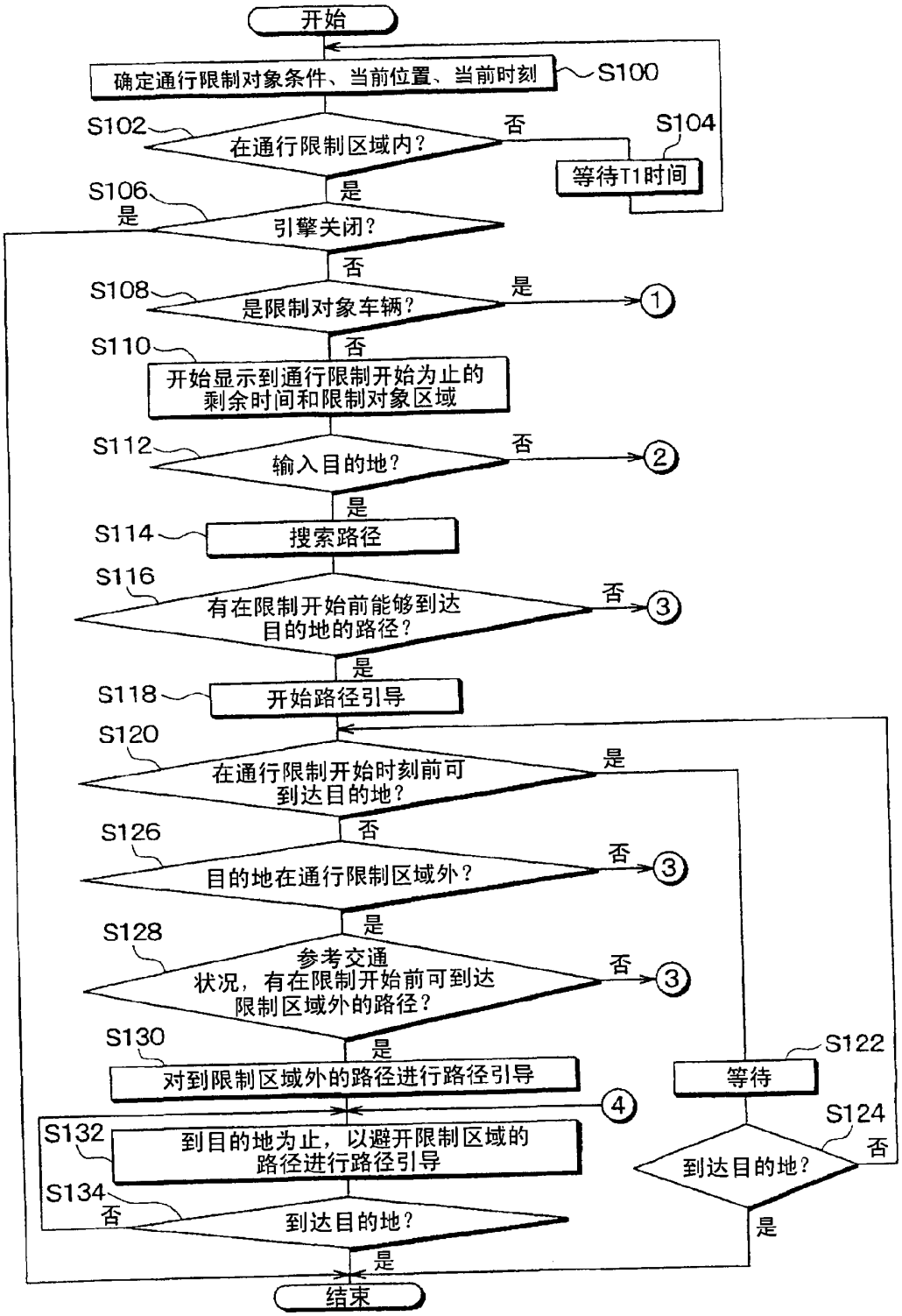



图 2



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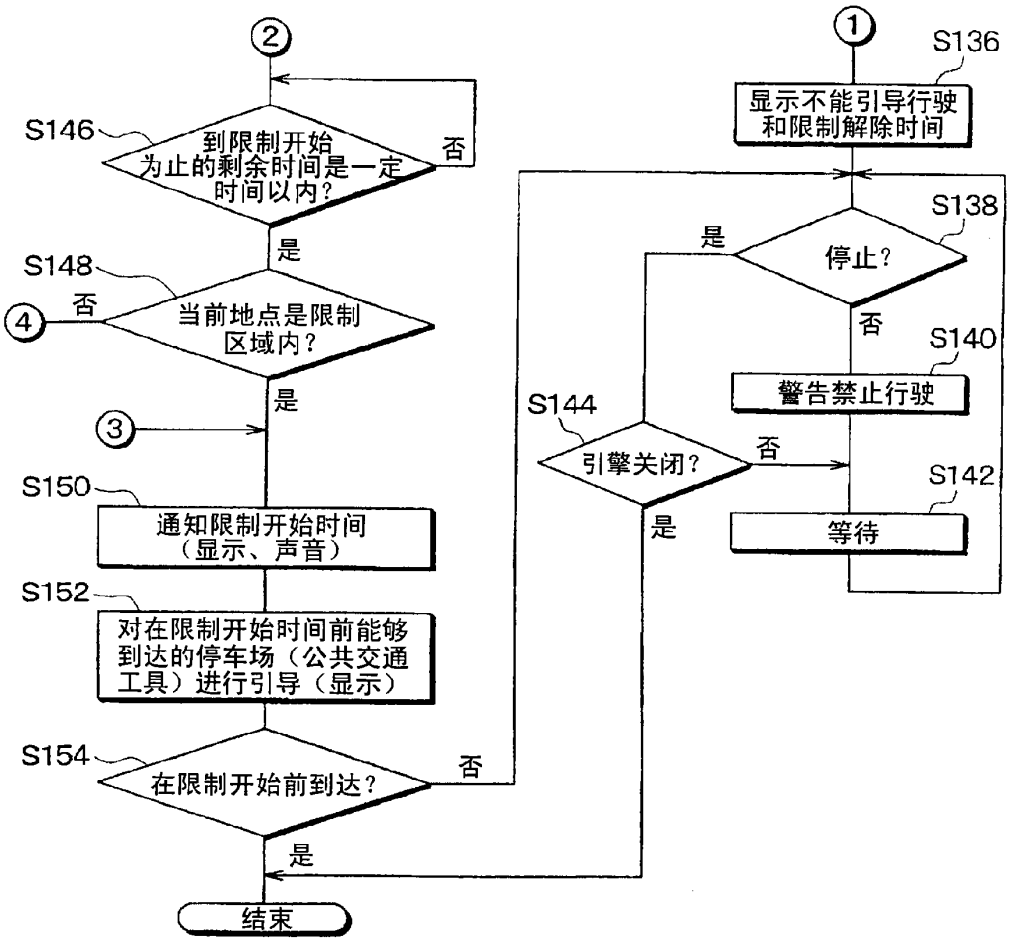



图 3



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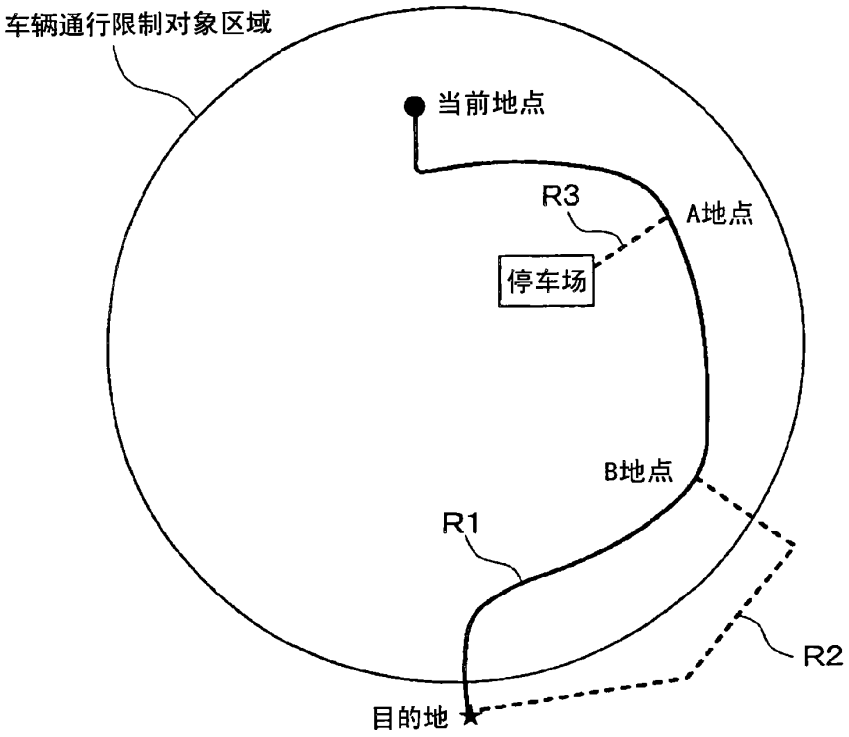



图 4



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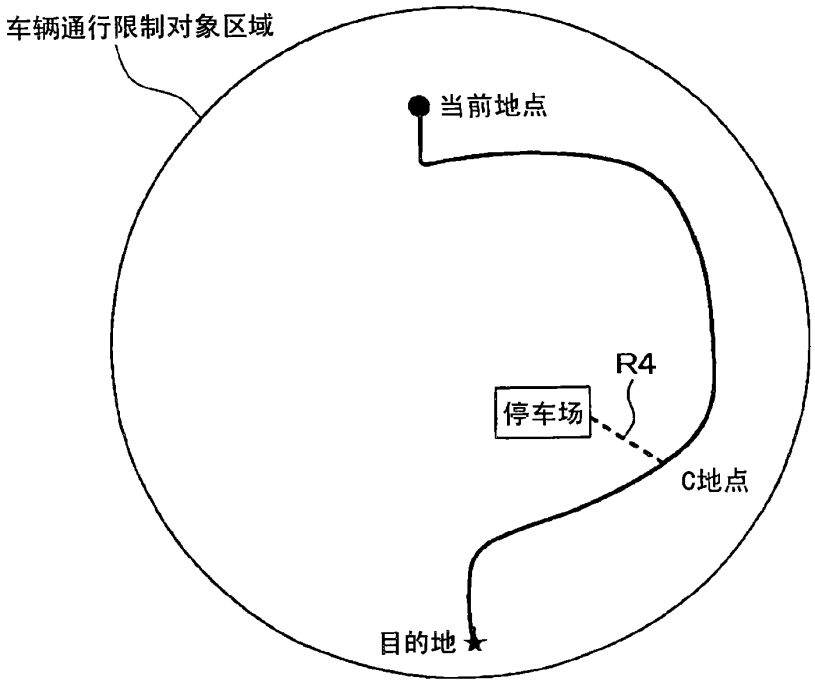



图 5



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# METHOD FOR DATA INTERCHANGE IN A COMPUTER NETWORK (VARIANTS)


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## Abstract

In accordance with a first variant, the method comprises: a computer user (CU) sending a request to a remote server (RS) for transfer and movement of an object (O) from a starting point to a destination point, stating the locations of said points; limiting the range for the position of O and the dimensions of this range and the transfer time period. The RS selects from a database, on the basis of identification numbers, data relating to the locations of the CUs performing the transfer. The RS transmits, over the Internet, a record of the locations of the CUs performing the transfer and located within said limitation of the range for the position of O, the status, the type of vehicle and data relating to means for communicating with the CUs performing the transfer. In accordance with a second variant, the method comprises recording data relating to the type of O intended for transportation, relating to the starting point, relating to the destination point and relating to the transmission time period. The CU of the vehicle determines and specifies the limitation of the range for the position of O at the starting point thereof and the transmission time period.


## Description

METHOD FOR DATA EXCHANGE IN A COMPUTER NETWORK
(OPTIONS)

Technical field

The invention relates to computer technology and can be used in information retrieval and communication technologies of computer device users via the Internet.

State of the art

There is a known method of social networking in which computing devices, for example, consumer computers, transmit information about them to the website on which they are registered, and each computing device creates a consumer profile that includes information about the consumer, while the consumer profile is associated with its identifier .. Consumer ID control is associated with consumer devices that are registered on the website. The website defines the actual (virtual) location. Loaded consumer devices are characterized in a virtual (virtual) location, serving the web pages of computing devices of existing consumers through the network. Moreover, the web page of the existing consumer includes an image of the consumer associated with existing images of the consumer and other existing consumers. I determine !, whether the customer profile associated with the existing customer matches the customer profiles associated with other existing customers according to the criterion of intent. In response to the corresponding intention, the image of the existing consumer is associated with other existing consumers having profiles that match the profile of the consumer according to the relevant criteria and the purpose of the feature for images of other existing consumers. And the necessary profile information of an existing consumer, selected from other existing matching consumers through a linked image, is provided. (US, 7522058).

In this method, they organize a social network by connecting computing devices of various consumers (primarily via the Internet), taking into account the intentions of the consumers themselves. --> The limitation of this technical solution is that building a social network taking into account only the intentions of consumers does not allow you to quickly process a huge array of information about them, and the system that implements this method requires the use of a very powerful server.

Another computer method for building a social network is also known, including building a social network from a variety of disparate, heterogeneous data sources, at least one of the said set of disparate, heterogeneous data sources includes a generated user data source. Many nodes and edits are identified, identifying features of nodes and edits based on a variety of disparate, heterogeneous data sources. However, many disparate, heterogeneous data sources include a combination of the produced user data source and at least one person not using their data source rights. Signs include at least one determinate sign, a probabilistic sign, or a dynamic sign. A mathematical decision-making model is built based on a plurality of nodes and edits and certain attributes of an agreed set of nodes and edits. Next, the features in the specified nodes and edits and the specific features of the specified set of nodes and edits in the second paragraph in time are determined, rebuilding the mentioned mathematical decision model based on the set of nodes and edits, and certain signs of the many nodes and edits in the second paragraph. Moreover, the generated user data source includes at least one review data source, analysis and diagnosis of barriers to cooperation and risks between many nodes of the social network. In this case, the signs of determining nodes and edits in the second paragraph include collecting data from many disparate, heterogeneous data sources, and many disparate, heterogeneous data sources include at least one of the survey data, social computational data, and combinations thereof. (US, 7512628).

The method is quite complex and cannot provide sufficiently fast communication between users of computer devices. --> There is also a method based on the Internet for networking among people with similar interests. (US 6,745,178).

This method includes the following steps: accepting the first question statement from the first user; storage of the first paragraph of information related to the first question; accepting a second question for a second user; storage of the second item of information related to the second issue; calculating the similarity measure of the first question and the second question when using the first paragraph of information and the second paragraph of information, producing a list of answers in the union of the first paragraph of information and the second paragraph of information; producing a series of differences for each answer in the list; the formation of the sum of the set of conditions for differences in the calculation comparing similarity measures with a threshold similarity criterion; if the similarity measure meets the similarity threshold criterion, the first

user of the second user is informed; accepting a request from a first user who invites a second user to participate in a chat session; sending a request to a second user; accepting consent from a second user to talk; and establish a chat session between the first user and the second user.

A limitation of this method is its small functionality and a sufficiently long time to identify people with similar interests.

Electronic interactive maps are also known, which allow the consumer to choose the departure point and destination and draw up a route from the destination to the destination, for example, taking into account the direction of traffic accepted along the city streets and existing interchanges between the streets. (http://www.moscowmap.ru/), (http://maps.yandex.ru).

In this way of estimating the route using electronic interactive maps, you can determine the total path length, average travel time, traffic jams ("traffic jams") on the roads or show the return route from the destination to the departure point.

A limitation of this method is the inability to carry out transportation by other persons or by various means of transport without first finding the carrier. When finding optimized --> of the route on electronic interactive maps, usually the car owner then naturally moves along the route of movement found on the map.

Disclosure of invention

The basis of the present invention is the task of creating a method of exchanging data in a computer network, which allows to accelerate the data processing and expand the functionality of connecting consumers with similar interests - mainly related to the transportation of various objects, providing the consumer with the ability to quickly change his interests in real time or future time and, thus, improve the technical and operational capabilities of the method in the exchange of such data.

To solve the problem with the achievement of the specified technical result, the first embodiment of the method of exchanging data on a computer network is that through the Internet on a remote server register data on users of computer devices connected to the Internet, indicating the location of users, data about the possibility of carrying out transportation, status, type of vehicle, and data on the means of communication with them, store the mentioned data in the server database, drawing identification numbers to users of computer devices, if a computer device user sends a request for transportation and movement of an object from a specified departure point to a specified destination with an indication of their location, then a restriction request is sent to this computer device from a remote server via the Internet the area of the facility and the size of this restriction to meet the requirements for a potential carrier, as well as data on the time interval for the transportation, after the user indicates the computer device limits the location of the object and its size, the time interval for the transportation and the sending of these data via the Internet to a remote server, the user selects from the database the identification numbers of the location of users of computer devices carrying out transportation and located in the computer device specified by the user --> restriction of the location of the object - within its size, status, type of vehicle and data on the means of communication with them, and the remote server via the Internet transmits a list of the whereabouts of users of computer devices engaged in transportation and within the location specified by the user of the computer device to limit the location of the object, the status, type of vehicle and data on means of communication with users of computer devices engaged in transportation, computer the device of the user that sent the transportation request.

Additional embodiments of the method according to the first embodiment are possible, in which it is advisable that:

- the request for the transportation of a computer device by a user and moving an object from a specified departure point to a specified destination with an indication of their location via the Internet from a remote server was sent to users of computer devices engaged in transportation and located within the specified location limit of the object's location, while users of computer devices engaged in transportation are sent data on the time interval of transportation, means communication with a user of a computer device that has sent the transportation request to a remote server;
- after making a request for transportation of a computer device from the user, from the remote server via the Internet, they would send an image of an electronic digital map to the computer device on which the user indicates the markers of the departure and destination points, limiting the area of the object and the size of this area, and indicates data on the time interval for the transportation;
- an image of an electronic digital card with the indicated instructions of the user of the computer device that

made the transportation request, the remote server would send to users of computer devices carrying out transportation via the Internet;
- a remote server would accumulate in its database information on requests for transportation from several users of computer devices about the movement of objects from a specified departure point to a specified destination with --> by indicating their location, this data in the form of a list via the Internet is sent to users of computer devices engaged in transportation and located within the restrictions specified in the request for the location areas of the object, while users of computer devices engaged in transportation are sent data on the time interval for transportation, means of communication with computer device users who have sent the transportation requests to the remote server;
- the size of the mentioned restrictions on the location of the object was regulated by the user of the computer device that sent the request for transportation;
- the point of departure would be located within the limits of the area of the object, the size of this area is limited by a circle with a center coinciding with the location of the point of departure;
- the departure point would be located directly at the indicated location of the user of the computer device that sent the transportation request;
- the location of the departure point and destination would coincide, and the user of the computer device in his transportation request would indicate at least the location of one intermediate destination.
To solve the problem with the achievement of the specified technical result, another embodiment of a method for exchanging data on a computer network is that through the Internet on a remote server register data on users of computer devices connected to the Internet, indicating the location of users, data about the possibility of transporting and data on the means of communication with users of computer devices, and for users of computer devices, the needs during transportation, register data on the type of object intended for transportation, store the mentioned data in the server database, assigning identification numbers to users of computer devices, if the user of the computer device carrying out transportation sends the transportation request via the Internet to the remote server indicating moving --> vehicle from a given departure point to a specified destination with an indication of their location, then from a remote server via the Internet they send a request to this computer device to limit the location of the object for transportation and the size of this area (restriction area), as well as the implementation time interval transportation (the time interval for the transport to the point of departure), after the user indicates the computer device carrying out the transportation, about the boundaries of the object's location region and its size, the time interval for transporting and sending this data via the Internet to a remote server, that database selects data on the location of objects of computer device users who need transportation and are in the specified limitation of the location using their identification numbers object - within its size, type of object and data on means of communication with users of computer devices in need of transport On the other hand, and the remote server via the Internet transmits a list of the location of objects of users of computer devices in need of transportation and located within the specified restriction of the location of the object to the user of the computer device that is carrying out transportation, data on the type of object and data on the means of communication with computer devices of users in need in transportation.
Additional embodiments of the method according to the second embodiment are possible, in which it is advisable that:
- the data of the request for transportation carried out by the user of the computer device and moving the vehicle from the specified departure point to the specified destination with an indication of their location via the Internet from a remote server would be sent to users of computer devices in need of transportation and located within the specified location limit object, while users of computer devices in need of transportation are sent data about transportation time interval, --> means of communication with a user of a computer device that has sent the transportation request to a remote server;
- after making a request for transportation from a user of a computer device from a remote server via the Internet, they would send to this computer device an image of an electronic digital map on which the user indicates the markers of the vehicle's departure point and destination, restricting the location of the object for transportation and the size of this area , and also indicates data on the time interval for the implementation of transportation;
- the image of an electronic digital card with the indicated instructions of the user of the computer device that made the transportation request, the remote server via the Internet would be sent to users of computer

devices in need of transportation of objects;
- a remote server would accumulate in its database information on requests for transportation from several users of computer devices about moving a vehicle from a given departure point to a given destination with an indication of their location, this data is sent as a list via the Internet to users of computer devices in need in transportation and within the limits specified in the requests for the location areas of the object, while users of computer devices c, in need of transportation, data are sent on the time interval for the transportation, data on the means of communication with users of computer devices that have sent these transportation requests to a remote server;
- the dimensions of the mentioned restrictions of the object location area would be regulated by the user of the computer device that sent the transportation request;
- the point of departure would be located within the limits of the area of the object, the size of this area is limited by a circle with a center coinciding with the location of the point of departure of the vehicle; --> - the point of departure would be located directly at the indicated location of the user of the computer device that sent the transportation request;
- the location of the departure point and destination would coincide, and the user of the computer device in his transportation request would indicate at least the location of one intermediate destination;
- for transportation of associated objects, the user of the computer device carrying out the transportation, additionally, specified the area of the object's location between the point of departure and destination;
- for transportation of associated objects, the user of the computer device carrying out the transportation additionally indicated the restriction of the location area of the object at the destination, and the user of the computer device in need of transportation specified the restriction of the area of the object at the departure point and the restriction of the area of the object at the destination, and at the intersection restrictions at points of departure of the location area of the user object of the computer device performing transportation, with the restriction of the location area of the user object of the computer device in need of transportation, and when crossing the restrictions at the destination points of the location of the location of the user object of the computer device in need of transportation, with the restriction of the area of the location of the user object of the computer device in need of transportation, the two mentioned objects from their departure points to destinations.

These advantages, as well as features of the present invention are illustrated by the best options for its implementation with reference to the accompanying figures.

Brief List of Drawings

FIG. 1 shows a typical functional diagram of the interaction of computer devices via the Internet with a remote server; --> FIG. 2 is a possible view of a dialog box image on a monitor of a computer device of a user in need of transportation for registering this user;

FIG. 3 is a possible view of a dialog box image on a monitor of a user computer device providing transportation or transportation of an object for registering this user;

FIG. 4 is a possible view of a dialog box image on the monitor of a computer device of a user in need of transportation to indicate to them markers of the departure and destination points, to limit the area of the object and the size of this area to satisfy the conditions of a potential carrier;

FIG. 5 is a generalized block diagram of the algorithm for the operation of a remote server for users of computer devices in need of transportation;

FIG. 6 is a possible view of a dialog box on a monitor of a computer device of a user in need of transportation according to a first embodiment of the invention;

FIG. 7 is a generalized block diagram of the algorithm for the operation of a remote server for users of computer devices engaged in transportation;

FIG. 8 is a possible view of a dialog box image on a monitor of a computer device of a user transporting objects according to a second embodiment of the invention;

FIG. 9 is an illustration of the transportation principle for users of computer devices with accompanying routes.

The best embodiments of the invention

Under computer devices 1 and 2 in the present invention refers to computing devices having the ability to communicate with the remote server 3 using the Internet (Fig. 1). They can be stand-alone devices, such as a desktop computer or laptop, or they can be communication devices, such as a cell phone, electronic

organizer, transponder, portable radio station or other mobile device that can communicate (exchange data) through a network. --> The remote server 3 stores in its database information about users of computer devices 1 in an amount from m to M that need transportation, and information about users of computer devices 2 in an amount from n to N, which are potential carriers. The total number of computer devices can constantly change as users register. Computer devices 1, 2 and remote server 3 are connected by two-way connections to the Internet. Two-way communications can be any available method of accessing the Internet - dial-up, coaxial cable, fiber, Wi-Fi, satellite and cell phones.

The first client application of the computer device 1 and the second client application of the computer device 2 interact with the web application of the remote server 3 via the data transfer protocol, respectively, which interacts with the database management system through any possible data access interface. The data transfer protocols of computer devices 1 and 2 can be, for example, the http protocol. The data access interface depends on the programming language used in which the web application is written. For java applications (Java), it will be JDBC (Java DataBase Connectivity — connection to Java databases), for PHP (PI, preprocessor hypertext) - PDO (PiDiOu, database access interface). To implement the claimed method, any database management system (DBMS) can be used, for example, MySQL, Oracle or PostgreSQL.

Under the objects for transportation or transportation in the present invention refers to all kinds of material objects: people, various objects and even, for example, animals.

For the practical implementation of the claimed method, the user must register in the web application of the remote server 3. Registration of users of computer devices can be carried out using dialog boxes (Fig. 2, 3), which can have a variety of forms. Moreover, in the database of the remote server 3, users of computer devices 1 and 2, depending on the nature of the request and the specified data, are divided into users who need transportation, for example, when referring to FIG. 2 in the section of the "Vehicle Type" dialog box, the text is "no" or --> carrying out transportation (transportation) of objects (Fig. 3). Figure 3 shows an example of a window for registering an organization providing transportation. But the same type of window can be used to register individuals as carriers, i.e. transporting objects. In the “Organization” status section, the name of the company is indicated. In the section “Transportation area” their range is indicated, for example, by district, city, city and suburb, intercity, international, etc.

When you press the "Enter" key or move the mouse cursor over the "register" button and press (click) its keys (Fig. 1, 2), data about users of computer devices 1 and 2 through the Internet goes to a remote server 3.

Data on the location of users of computer devices 1 and 2 are presented in the form of geo-points (geographical coordinates - latitude and longitude values) and are stored in the database of remote server 1.

When a user requests a computer device 1 for transportation, carried out using a dialog box (not shown in the figures, because it can have a diverse view), with which a user of a computer device 1 sends a request for transportation and movement to a remote server 3 object from the specified departure point to the specified destination with an indication of their location, the functioning of the system begins. For convenience and speed of data processing, the transportation request dialog box may also contain additional information: country, city and address. The web application of the remote server 1 searches for a match by country, locality and address and determines the corresponding geographic coordinates of the geo-points of departure and destination.

For the convenience of dialogue with the user of the computer device 1, it is advisable to use an electronic digital card. Knowing the coordinates of the geo-points from the database of the remote server 3, after the request for transportation to the user of the computer device 1 from the remote server via the Internet, an image of the corresponding electronic digital card is sent to this computer device 1 (Fig. 4). --> On an electronic digital map, the user indicates the marker 4 of the departure point and marker 5 of the destination, the restriction of the area of the object and the size of this area (area of restriction), data on the time interval for the transportation (sending the object). In addition, the following may additionally be indicated: object - passenger or cargo, date (by default it is accepted as existing on the present day), name of the object of transportation, size of the object, direction (one way, round-trip, for a route of more than two geo- points you can create directions in a circle, along a broken line, etc.), the frequency of the route (without repeating, every day, every week, every month, every year).

Additionally, with the help of marker 6, an intermediate destination can be shown, in which you want to pick up some cargo or put another passenger in the vehicle.

The restriction 7 of the location area of the object can be regulated by the user of the computer device 1, which sent the request for transportation.

Marker 4 (departure point) is usually located within the restriction 7 of the location of the object, the size of this area can be limited by a circle with a center coinciding with the location of the departure point of the object (if the departure point is not the address of the place of residence, for example, you need to transport the goods from the store or deliver the passenger at any address). Also, the departure point can be located directly at the indicated location (address of residence) of the user of the computer device 1, which sent the transportation request. In special cases, for example, with a settlement extended in one direction, restriction 7 can be implemented in the form of an ellipse, square, polygon, or other geometric shapes.

In addition, the location of the departure point and destination can be the same, and the user of the computer device 1 in his request for transportation with marker 6 indicates at least the location of one intermediate destination, for example, where you need to take an extra passenger on a trip. --> By default, each geo-point is assigned a specific radius of action, for example, 3 km. The radius of restriction 7 of the object location area for each geo-point in the route can be changed. To do this, click on the image of the geo-point with a computer mouse, and using the control lines 8 (sliders), change the radius of the geo-point (Fig. 4).

After the user indicates the computer device 1 tokens 4, 5 of the restriction 7 of the location of the object and its size, the time interval of the transportation and the sending of these data via the Internet to the remote server 3, its operation is as follows (Fig. 5).

As described previously, in block 30, the input and registration of users of computer devices 1, 2 and the assignment of unique identification numbers (ID) are carried out. Data on users of computer devices 1, 2 are stored in database 31. For users of computer devices 1, the name, location (geo-point coordinates), and communication means are stored. In this case, the user of the computer device 1 can contact the remote server 3 for the first time and immediately make a request for transportation after registration. For users of computer devices 2, the name, location (coordinates of geo-points), transportation time (daily, round-the-clock, one-time), transportation area, type of transport, means of communication with them are saved.

After entering a request for transportation to block 32 and then entering into block 33 data on the departure and destination points (coordinates of their geo-points), time interval, restriction 7 of the location area of the object with its radius R, block 34 searches the database of users who satisfy conditions of block 33. If the database 31 does not contain data on routes in which the radii of the circles of restriction 7 of the geo-point action area do not intersect with the data of the transportation range of users of computer devices 2 and which do not coincide in time, then b approx 35 comparisons provide information with the release of "No", which goes to the unit 36 for guiding the user to the computer device 1 reports the inability to transport the data provided in the request. The user can increase the size of the restriction 7 area --> location of the object or change the time interval of departure and repeat your request for transportation.

If the database 31 has data on routes whose radius of a circle is limited to 7, the areas where their objects intersect from the action of geo-points (geo-point, the user of computer device 2 is inside constraint 7) and which correspond to a time interval, then the comparison unit 35 provides information from the exit "Yes." This information is supplied to block 37 for compiling data of a list of users of computer devices 2 carrying out transportation (transportation). Next, block 38 directs the user of the computer device 1 data about the list of users of computer devices 2, carrying out transportation. If only one organization or individual carrying out transportation (transportation) is located in restriction 7, only one column may be in the list.

Thus, the user of the computer device 1 is informed about the carriers closest to the point of departure of the object, which reduces the delivery time and, accordingly, the cost of transportation.

The data of the list of users performing the transportation (transportation) is transmitted to the user of the computer device 1, for example, in the form of an image of a dialog box (Fig. 6), in which, in addition to the type of car and departure time, other additional data can be shown: year of manufacture of the car, driver class (driving experience, category), etc. When a user selects a computer device 1 of one nominee from the list and clicks (by clicking on the corresponding “Select” button), the user of computer device 1 can be directly connected (go to e-mail or website) with the user of computer device 2, or he can contact with him on a regular channel or cell phone.

In addition, the request data for the transportation of a computer device 1 by a user and moving an object from a specified departure point to a specified destination with an indication of their location via the Internet

from a remote server 3 can be additionally sent by block 39 (Fig. 5) to users of computer devices 2, transporting --> the points of which are inside the restriction 7 of the location area of the object indicated in the request for transportation. The users of computer devices 2 are sent information about the point of departure and destination, about the time interval for the transportation, about the means of communication with the user of the computer device 1.

Similarly, the task is solved for users of computer devices 2, transporting goods or passengers. For this option, the operation of the remote server 3 is as follows (Fig. 6).

In block 30, the input and registration of users of computer devices 1, 2 and the assignment of IDs to them are carried out. Data on users of computer devices 1, 2 are stored in the database 31.

The request for transportation from the user of the computer device 1 is entered into block 40 and then entered into the block 41 data about the points of departure and destination (coordinates of their geo-points), the time interval, additionally enter data on the type of object for transportation (passengers or cargo), however, the restriction 7 of the location area of the object with its radius R may not be implemented (but may be introduced, as is further explained using Fig. 9).

A request is made from the user of the computer device 2 for transportation to block 42 and then input to block 43 data on the movement of the vehicle from a given departure point to a specified destination, indicating their location, restricting the location of the object for transportation and the size of this area, data about type of object and time interval for transportation.

The data of the transportation request and the transportation request are sent to the database 31 of the remote server 3 in the future (deferred) time mode or directly in real time to block 44 (however, this data is still entered into the database 31 of the remote server 3).

Block 44 searches for users who meet the conditions of blocks 41 and 43. If the geo-point of the request for transportation is outside the database 31 about routes in which, for example, it is outside the radius of the circle of restriction 7 of the location area of the object (action of the geo-point) of the point --> if the vehicle is sent to the user of the computer device 2 or the request data does not satisfy the time intervals, the comparison unit 45 provides information from the No output, which is sent to the unit 46 to send a message about the impossibility of transportation to the user of the computer device 2 with the data specified in the request. The user of the computer device 2 can increase the size of the restriction 7 of the location area of the object or change the interval of time of departure and repeat your request for transportation.

If the database 31 has data on routes in which the restriction 7 (circle radius) of the object location area for the vehicle departure point covers geo-points of the location data specified in the request for transportation of computer device users 1, and this data corresponds to a time interval, then block 45 of the comparison represents information from the output "Yes". This information is sent to block 47 for compiling data of a list of users in need of transportation. Next, block 48 directs the user of the computer device 2 data about the list of users of computer devices 1 in need of transportation. If there is only one user carrying out transportation in clause 7 of the departure point, only one column may be in the list.

Thus, users of computer devices 2 are informed about users in need of transportation closest to the point of departure of the vehicle.

The data of the list of users in need of transportation is transmitted to the user of the computer device 2, for example, in the form of an image of a dialog box (Fig. 8), which indicates the type of object and departure time from the location of the transportation customer. Other additional data may also be shown: the weight of the cargo, its dimensions, number of passengers, etc.

When a user selects a computer device 2 (Fig. 8) one nominee from the list and clicks (by clicking on the corresponding “Select” button), a direct connection between the user of computer device 2 (switching to e-mail) and the user of the computer --> device 2, or he can contact him on a regular channel or cell phone.

In addition, the data of the request for transportation by the user of the computer device 2 and moving the object from the departure point to the destination, indicating their location via the Internet from the remote server 3, can be additionally sent by block 49 (Fig. 7) to users of computer devices 1 in need of transportation . Information about the point of departure and destination, the time of arrival of the vehicle to the location of the object, the means of communication with the user of the computer device 2 is sent to users of computer devices 1.

It is advisable for users of computer devices 2 carrying out transportation to determine the points of departure and destination farthest from each other, as well as use marker 6 to indicate an intermediate

destination (Fig. 4) or several such points. As a result, he can create an optimized route, which allows moving various passengers and objects along the route (Fig. 8).

In addition, in block 41 (Fig. 7) when requesting transportation it is also advisable to indicate data on the restriction of the area of the location of the object of the destination point and destination when requesting transportation, and in block 43 both the restriction of the area of the location of the object of the destination point and the restriction of the area the location of the destination object (Fig. 4). In this case, it is possible to carry out the transportation of two (several) passengers or two (several) cargoes with only one transport, for example, from the possible two along the accompanying route (Fig. 9).

Let it be necessary to carry out transportation from city A to city B. One object from point C of departure of city A is defined for delivery to destination D of city B, and another object from point E of departure of city A to point F of destination of city B (shown by a dashed line) . If the restrictions are 7 areas --> location of objects intersect in city A and city B, and the time of departure of objects in city A occurs at the necessary time intervals, then one-time delivery of two objects at once is possible, for example, along the route C - E - D - F (shown in Fig. 9 by arrows) . It is also possible to deliver several objects at once, for example, with yet another additional restriction 7, the intersection of the restrictions of some areas and the coincidence of the corresponding time intervals (in Fig. 9, for ease of reading, the drawing is not shown).

Specialists understand that the above examples of embodiments of the claimed method of exchanging data in a computer network for automobile transport can be applied in other forms: rail, river, air transportation. So, for example, when the consumer designates the computer device 1 as the departure point from the railway station, indicates the destination and time of departure, the computer device 2 can inform the applicant the schedule of the railway trains in the specified time interval, the type of train, its comfort, type of car, availability or inability to travel. If delivery to the destination from several stations is acceptable, then the consumer has the opportunity to get a comparative description of travel time and travel comfort for different carriers. In the same way, when traveling by air and indicating various airports, applicants for flights can receive data on the date and schedule of flights, the type of airliners, availability of seats, the possibility of delivery to the destination by plane or helicopter, etc. Computer users --> devices 2 can collect all the information they need about consumers who need their services.

Industrial applicability

The most successfully claimed method of data exchange in a computer network (options) is industrially applicable to provide users of computer devices - consumers, both in need of transportation and providing transportation services for various objects, with the necessary information about possible travel options, providing various types of transportation services, optimization moving objects in real and future time.

## Claims

1. The method of exchanging data on a computer network, which consists in the fact that through the Internet on a remote server register data on users of computer devices connected to the Internet, indicating the location of users, data on the possibility of transport, status, type of vehicle , and data on the means of communication with them, store the mentioned data in the server database, assigning identification numbers to users of computer devices, if the computer user has the building sends a request to the remote server for transportation and movement of the object from the specified departure point to the specified destination, indicating their location, then from the remote server via the Internet they send a request to this computer device to limit the location of the object and the size of this area to meet the requirements to the potential carrier, as well as data on the time interval for the transportation, after the user indicates the computer device limits of the location of the object and its size, the time interval for transporting and sending this data via the Internet to a remote server, that database selects information on the location of users of computer devices engaged in transportation and located in the location specified by the user of the computer device using identification numbers object - inside its size, status, type of vehicle and data on the means of communication with them, and a remote server om the Internet transmits a list of the whereabouts of users of computer devices engaged in transportation and within the specified by the user of the computer device restrictions on the location of the object, status, type of vehicle and data on the means of communication with users of computer devices engaged in transportation, to the computer device of the user who sent the

request transportation.
2. The method according to p. 1, characterized in that the request for transportation of the computer device by the user and moving the object from the specified departure point to the specified destination, indicating their location --> via the Internet, from a remote server they are sent to users of computer devices engaged in transportation and located within the specified limitation of the location of the object, while users of computer devices engaged in transportation are sent data on the time interval for transportation, means of communication with the user of the computer device that sent to remote server mentioned transportation request.
3, The method according to claim 1, characterized in that after the request for transportation of the computer device from the user is sent from the remote server via the Internet, the image of the electronic digital card is sent to the computer device on which the user indicates the markers of the departure and destination points, restriction the area of the object and the size of this area, as well as data on the time interval for the transportation.
4. The method according to p. 3, characterized in that the image of an electronic digital card with the instructions of the user of the computer device that made the transportation request, the remote server sends to users of computer devices engaged in transportation via the Internet.
5. The method according to p. 1, characterized in that the remote server accumulates in its database information on requests for transportation from several users of computer devices about the movement of objects from a specified departure point to a specified destination with an indication of their location, this data in the form the list via the Internet are sent to users of computer devices engaged in transportation and located within the restrictions specified in the request areas of the location of the object, while users of the computer For transportation devices, data is sent about the time interval for transportation, the means of communication with users of computer devices that have sent the said transportation requests to a remote server.
6. The method according to p. 1, characterized in that the size of the mentioned restrictions on the location of the object is regulated by the user of the computer device that sent the request for transportation. -->
7. The method according to p. 1, characterized in that the departure point is located within the boundaries of the area of the object, the size of this area is limited by a circle with a center coinciding with the location of the point of departure.
8. The method according to p. 1, characterized in that the point of departure is located directly at the specified location of the user of the computer device that sent the request for transportation.
9. The method according to p. 1, characterized in that the location of the departure point and destination coincides, and the user of the computer device in his request for transportation indicates at least the location of one intermediate destination.
10. A method of exchanging data on a computer network, which consists in the fact that through the Internet on a remote server register data on users of computer devices connected to the Internet, indicating the location of users, data on the possibility of transportation, and data on communications with users of computer devices, and for users of computer devices in need of transportation, data is recorded about the type of object intended for transportation, paragraph departure, destination, departure time interval and save the mentioned data in the server database, assigning identification numbers to users of computer devices if the user of the computer device carrying out the transport sends the transportation request via the Internet to the remote server indicating the movement of the vehicle from the specified departure point to a specified destination with an indication of their location, then from a remote server via the Int network Rnet sends to this computer device a request to limit the location area of the object for transportation and the size of this area, as well as data about the type of object and the time interval for the transportation, after the user indicates the computer device that is carrying out the transportation, data about the type of object, about restricting the area of the object and its sizes, about the time interval for the implementation of transportation and departure --> of this data via the Internet to a remote server, that one selects from its database data on the location of objects of users of computer devices in need of transportation and located in the specified restriction of the location of the object - inside its size, type of object and data on the means of communication with users of computer devices in need of transportation, and a remote server via the Internet transmits a list of the locations of objects of computer users ernyh devices needing to carry and are within said limit location area object to the user computer device, performing transport, information about the

type of the object and the means of communication data from the user computer devices needing transport.
1 1. The method according to p. 10, characterized in that the data of the request for transportation carried out by the user of the computer device and the movement of the vehicle from a given departure point to a specified destination with an indication of their location via the Internet from a remote server is sent to users of computer devices in need transportation and inside the specified in the request restrictions on the area of the object's location, while users of computer devices in need of trans ortirovke forwarded data on the time interval of the transportation, communications with the user computer device, who sent to a remote server, said request for transport.
12. The method according to p. 10, characterized in that after the request for transportation from the user of the computer device from a remote server via the Internet is sent to this computer device, an image of an electronic digital card on which the user indicates the markers of the vehicle departure point and destination, the limitation of the area of the location of the object for transportation and the size of this area, and also indicates data on the time interval for the implementation of transportation. -->
13. The method according to p. 12, characterized in that the image of the electronic digital card with the indicated instructions of the user of the computer device that made the transportation request, the remote server sends users of computer devices that need to be transported via the Internet.
14. The method according to p. 10, characterized in that the remote server accumulates in its database information on requests for transportation from several users of computer devices about moving a vehicle from a given departure point to a given destination with an indication of their location, this data in the form of the list via the Internet are sent to users of computer devices in need of transportation and located within the restrictions specified in the request areas of the location of objects, while users of computer devices in need of transportation are sent data on the time interval for transportation, data on the means of communication with users of computer devices that have sent these transportation requests to a remote server.
15. The method according to p. 10, characterized in that the dimensions of the said restrictions on the location of the object are regulated by the user of the computer device that sent the request for transportation.
16. The method according to p. 10, characterized in that the point of departure is located inside the restriction of the area of the object, the size of this area is limited by a circle with a center coinciding with the location of the point of departure of the vehicle.
17. The method according to p. 10, characterized in that the point of departure is located directly at the specified location of the user of the computer device that sent the transportation request.
18. The method according to p. 10, characterized in that the location of the departure point and destination coincides, and the user of the computer device in his transportation request indicates at least the location of one intermediate destination. -->
19. Method no. 10, characterized in that for the transportation of associated objects, the user of the computer device carrying out the transportation, additionally indicates the limitation of the area of the location of the object between the point of departure and destination.
20. The method according to p. 10, characterized in that for the transportation of associated objects, the user of the computer device carrying out the transportation, further indicates the restriction of the area of the object at the destination, and the user of the computer device in need of transportation - the restriction of the area of the object at the point of departure and restriction of the location area of the object at the destination, and when crossing the restrictions at the points of departure of the location area of the user's object of a computer device carrying out transportation, with the restriction of the location area of the user object of the computer device in need of transportation, and when crossing the restrictions at the destination point of the location area of the user object of the computer device in need of transportation, with the restriction of the area of the location of the user object of the computer device in need of transportation, transportation of the two mentioned objects from their points of departure to points of destination Acquisitions.

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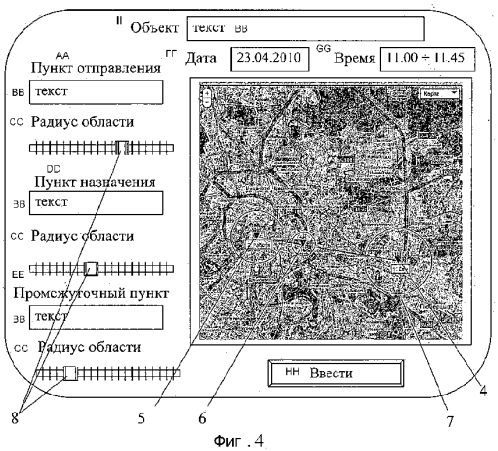
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**(54) Title:** METHOD FOR DATA INTERCHANGE IN A COMPUTER NETWORK (VARIANTS)

**(54) Название изобретения** : СПОСОБ ОБМЕНА ДАННЫМИ В КОМПЬЮТЕРНОЙ СЕТИ (ВАРИАНТЫ)




Фиг. 4

AA Starting point
BB text
CC Range radius
DD Destination point
EE Intermediate point
FF Date
GG Time
HH Enter
II Object

**(57) Abstract:** In accordance with a first variant, the method comprises: a computer user (CU) sending a request to a remote server (RS) for transfer and movement of an object (O) from a starting point to a destination point, stating the locations of said points; limiting the range for the position of O and the dimensions of this range and the transfer time period. The RS selects from a database, on the basis of identification numbers, data relating to the locations of the CUs performing the transfer. The RS transmits, over the Internet, a record of the locations of the CUs performing the transfer and located within said limitation of the range for the position of O, the status, the type of vehicle and data relating to means for communicating with the CUs performing the transfer. In accordance with a second variant, the method comprises recording data relating to the type of O intended for transportation, relating to the starting point, relating to the destination point and relating to the transmission time period. The CU of the vehicle determines and specifies the limitation of the range for the position of O at the starting point thereof and the transmission time period.

**(57) Реферат** :

/продолжение на следующей странице /

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Textron Specialized Vehicles Inc., Exh. 1002, p. 163

По первому варианту способ включает направление пользователем компьютерного устройства (ПКУ) на удаленный сервер (УС) запроса о перевозке и перемещении объекта (О) из пункта отправления в пункт назначения с указанием их местонахождения, ограничение области расположения О и ее размеров и интервала времени осуществления перевозки. УС из базы данных выбирает по идентификационным номерам данные о местонахождении ПКУ, осуществляющих перевозки. УС посредством сети Интернет передает список о местонахождении ПКУ, осуществляющих перевозки и находящиеся внутри указанного ограничения области расположения О, статусе, типе транспортного средства и данные о средствах связи с ПКУ, осуществляющих перевозки. По второму варианту способ включает регистрацию данных о типе О, предназначенного для транспортировки, о пункте отправления, о пункте назначения, об интервале времени отправления. ПКУ транспортного средства определяет и указывает ограничение области расположения О в пункте его отправления и временной интервал отправления.

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# СПОСОБ ОБМЕНА ДАННЫМИ В КОМПЬЮТЕРНОЙ СЕТИ (ВАРИАНТЫ )

## Область техники

Изобретение относится к вычислительной технике и может быть использовано в технологиях информационного поиска и связи пользователей компьютерных устройств , осуществляемой через сеть Интернет .

## Предшествующий уровень техники

Известен метод социальной организации сети , в котором вычислительные устройства , например , компьютеры потребителей , передают информацию о них на вебсайт , на котором они регистрируются , причем каждое вычислительное устройство создает профиль потребителя , который включает информацию о потребителе , при этом профиль потребителя связан с его идентификатором .. Контроль идентификаторов потребителей связан с устройствами потребителей , которые зарегистрированы в вебсайт . Вебсайт определяет действительное (виртуальное ) место . Загруженные устройства потребителей охарактеризованы в действительном (виртуальном ) месте , служа веб-страницам вычислительных устройств существующих потребителей через сеть . Причем веб-страница существующего потребителя включает изображение потребителя , связанное с существующими изображениями потребителя и других существующих потребителей . Определяю !, соответствует ли профиль потребителя , связанный с существующим потребителем , профилям потребителей , связанным с другими существующими потребителями согласно соответствию критерию намерения . В ответ на соответствующее намерение связывается изображение существующего потребителя с другими существующими потребителями , имеющими профили , которые соответствуют профилю потребителя согласно соответствующим критериям и назначению признака к изображениям других существующих потребителей . И обеспечивается необходимая информация профиля существующего потребителя , отобранного из других существующих потребителей соответствия через связанное изображение . (US, 7522058).

В этом способе организуют социальную сеть при помощи связи вычислительных устройств различных потребителей (через преимущественно сеть Интернет ) с учетом намерений самих потребителей .

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Ограничением этого технического решения является то, что построение социальной сети с учетом только намерений потребителей не позволяет быстро обработать огромный массив информации о них , а реализующая этот метод система требует использования очень мощного сервера .

Известен также другой компьютерный способ построения социальной сети , включающий построение социальной сети от множества несоизмеримых , гетерогенных источников данных , причем по крайней мере одно из упомянутого множества несоизмеримых , гетерогенных источников данных включает произведенный источник данных пользователя . Идентифицируют множество узлов и редактирований , определяя признаки узлов и редактирований , основанных на множестве несоизмеримых , гетерогенных источников данных . При этом множество несоизмеримых , гетерогенных источников данных включает комбинацию произведенного источника данных пользователя и по крайней мере одно лицо , не использующее своего права источника данных . Признаки включают в себя по крайней мере один детерминированный признак , вероятностный признак или динамический признак . Строят математическую модель принятия решения , основанную на множестве узлов и редактирований и определенных признаков оговоренного множества узлов и редактирований . Далее определяют признаки в оговоренных узлах и редактированиях и определенных признаков оговоренного множества узлов и редактирований во втором пункте во времени , перестраивая упомянутую математическую модель принятия решения , основанную на множестве узлов и редактирований , и определенных признаков множества узлов и редактирований в упомянутом втором пункте . Причем произведенный источник данных пользователя включает , по крайней мере , один источник данных обзора , анализ и диагностирование преград сотрудничества и рисков между множеством узлов социальной сети . При этом признаки определения узлов и редактирований во втором пункте включают сбор данных от множества несоизмеримых , гетерогенных источников данных , а множество несоизмеримых , гетерогенных источников данных включают , по крайней мере , одно из данных обзора , социальных вычислительных данных и комбинации этого . (US, 7512628).

Способ является достаточно сложным и не может обеспечить достаточно быструю связь между пользователями компьютерных устройств .

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Известен также способ , основанный на сети Интернет , для организации сети среди людей с подобными интересами . (US, 6745178).

Этот способ включает следующие шаги : принятие первого заявления вопроса от первого пользователя ; хранение первого пункта информации , связанной с первым вопросом ; принятие второго вопроса для второго пользователя ; хранение второго пункта информации , связанной со вторым вопросом ; вычисление меры подобия первого вопроса и второго вопроса при использовании первого пункта информации и второго пункта информации , производство списка ответов в союзе первого пункта информации и второго пункта информации ; производство ряда различия для каждого ответа в списке ; формирование суммы набора условий различия подсчета ; сравнение меры подобия пороговому критерию подобия ; в случае если мера подобия выполняет пороговый критерий подобия , сообщают первому пользователю второго пользователя ; принятие запроса от первого пользователя , который приглашает второго пользователя , чтобы участвовать на сессии чата ; отправление запроса второму пользователю ; принятие согласия от второго пользователя , чтобы разговаривать ; и устанавливают сессию чата между первым пользователем и вторым пользователем .

Ограничением этого способа являются его небольшие функциональные возможности и достаточно длительное время для определения людей с подобными интересами .

Известны также электронные интерактивные карты , которые позволяют потребителю выбрать пункт отправления и пункт назначения и составить маршрут от пункта направления к пункту назначения , например , с учетом принятого по улицам города направления движения и действующих развязок между улицами . (http://www.moscowmap.ru/), (http://maps.yandex.ru/).

В этом способе оценки маршрута движения с помощью электронных интерактивных карт можно определить общую длину пути , среднее время пути , заторы («пробки ») на дорогах или показать обратный маршрут из пункта назначения в пункт отправления .

Ограничением этого способа является невозможность осуществления перевозки другими лицами или различными видами транспорта без предварительного нахождения перевозчика . При нахождении оптимизированного

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маршрута по электронным интерактивным картам обычно автовладелец далее естественным путем осуществляет перемещение по найденному по карте маршруту движения .

Раскрытие изобретения

В основу настоящего изобретения поставлена задача создания способа обмена данными в компьютерной сети , который позволяет ускорить процесс обработки данных и расширить функциональные возможности соединения потребителей с подобными интересами - преимущественно связанными с перевозками различных объектов , обеспечивая возможность потребителя оперативно изменять его интересы в режиме реального или будущего времени и, таким образом , улучшить технико - эксплуатационные возможности способа при обмене такими данными .

Для решения поставленной задачи с достижением указанного технического результата первый вариант осуществления способа обмена данными в компьютерной сети заключается в том , что посредством сети Интернет на удаленном сервере регистрируют данные о пользователях компьютерных устройств , подсоединенных к сети Интернет , с указанием данных о местонахождении пользователей , данных о возможности осуществления перевозок , статусе , типе транспортного средства , и данных о средствах связи с ними , сохраняют упомянутые данные в базе данных сервера , присваивая пользователям компьютерных устройств идентификационные номера , если пользователь компьютерного устройства направляет на удаленный сервер запрос о перевозке и перемещении объекта из заданного им пункта отправления в заданный пункт назначения с указанием их местонахождения , то с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство запрос на ограничение области расположения объекта и размеры этого ограничения для удовлетворения требований к потенциальному перевозчику , а также данные об интервале времени осуществления перевозки , после указания пользователем компьютерного устройства ограничения области расположения объекта и ее размеров , интервале времени осуществления перевозки и отправления этих данных посредством сети Интернет на удаленный сервер , тот из своей базы данных выбирает по идентификационным номерам данные о местонахождении пользователей компьютерных устройств , осуществляющих перевозки и находящиеся в указанном пользователем компьютерного устройства

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ограничении области расположения объекта - внутри ее размеров , статусе , типе транспортного средства и данных о средствах связи с ними , и удаленный сервер посредством сети Интернет передает список о местонахождении пользователей компьютерных устройств , осуществляющих перевозки и находящиеся внутри указанного пользователем компьютерного устройства ограничении области расположения объекта , статусе , типе транспортного средства и данных о средствах связи с пользователями компьютерных устройств , осуществляющих перевозки , компьютерному устройству пользователя , направившему запрос о перевозке .

Возможны дополнительные варианты осуществления способа по первому варианту , в которых целесообразно , чтобы :

- данные запроса о перевозке пользователем компьютерного устройства и перемещении объекта из заданного им пункта отправления в заданный пункт назначения с указанием их местонахождения посредством сети Интернет с удаленного сервера направляли пользователям компьютерных устройств , осуществляющих перевозки и находящиеся внутри указанном в запросе ограничении области расположения объекта , при этом пользователям компьютерных устройств , осуществляющих перевозки , направляются данные об интервале времени осуществления перевозки , средствах связи с пользователем компьютерного устройства , направившего на удаленный сервер упомянутый запрос о перевозке ;

- после осуществления запроса о перевозке от пользователя компьютерного устройства , с удаленного сервера посредством сети Интернет направляли бы на данное компьютерное устройство изображение электронной цифровой карты , на которой пользователь указывает маркеры пункта отправления и пункта назначения , ограничение области расположения объекта и размеры этой области , а также указывает данные об интервале времени осуществления перевозки ;

- изображение электронной цифровой карты с упомянутыми указаниями пользователя компьютерного устройства , сделавшего запрос о перевозке , удаленный сервер посредством сети Интернет направлял бы пользователям компьютерных устройств , осуществляющих перевозки ;

- удаленный сервер накапливал бы в своей базе данных сведения по запросам о перевозке от нескольких пользователей компьютерных устройств о перемещении объектов из заданного ими пункта отправления в заданный пункт назначения с

указанием их местонахождения , эти данные в виде списка посредством сети Интернет направляются пользователям компьютерных устройств , осуществляющих перевозки и находящихся внутри указанных в запросах ограничениях областей расположения объекта , при этом пользователям компьютерных устройств , осуществляющих перевозки , направляются данные об интервале времени осуществления перевозок , средствах связи с пользователями компьютерных устройств , направивших на удаленный сервер упомянутые запросы о перевозках ;

- размеры упомянутого ограничения области расположения объекта регулировал пользователь компьютерного устройства , направившего запрос о перевозке ;

- пункт отправления располагали бы внутри ограничения области расположения объекта , размеры этой области ограничены окружностью с центром , совпадающим с местонахождением пункта отправления ;

- пункт отправления был бы расположен непосредственно в указанном местонахождении пользователя компьютерного устройства , направившего запрос о перевозке ;

- местоположение пункта отправления и пункта назначения совпадали бы , а пользователь компьютерного устройства в своем запросе о перевозке указывал бы, по меньшей мере , местоположение одного промежуточного пункта назначения .

Для решения поставленной задачи с достижением указанного технического результата другой вариант осуществления способа обмена данными в компьютерной сети заключается в том , что посредством сети Интернет на удаленном сервере регистрируют данные о пользователях компьютерных устройств , подсоединенных к сети Интернет , с указанием данных о местонахождении пользователей , данных о возможности осуществления транспортировки и данных о средствах связи с пользователями компьютерных устройств , а для пользователей компьютерных устройств , нуждающихся в транспортировке , регистрируют данные о типе объекта , предназначенного для транспортировки , сохраняют упомянутые данные в базе данных сервера , присваивая пользователям компьютерных устройств идентификационные номера , если пользователь компьютерного устройства , осуществляющий транспортировку , посредством сети Интернет направляет запрос на транспортировку к удаленному серверу с указанием о перемещении

транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения , то с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство запрос на ограничение области расположения объекта для транспортировки и размеры этой области (площади ограничения ), а также об интервале времени осуществления транспортировки (интервала времени подачи транспорта к пункту отправления ), после указания пользователем компьютерного устройства , осуществляющего транспортировку , ограничения области расположения объекта и ее размеров , интервала времени осуществления транспортировки и отправления этих данных посредством сети Интернет на удаленный сервер , тот из своей базы данных выбирает по идентификационным номерам данные о местонахождении объектов пользователей компьютерных устройств , нуждающихся в транспортировках и находящихся в указанном ограничении области расположения объекта - внутри ее размеров , типе объекта и данных о средствах связи с пользователями компьютерных устройств , нуждающихся в транспортировках , и удаленный сервер посредством сети Интернет передает список о местонахождении объектов пользователей компьютерных устройств , нуждающихся в транспортировках и находящихся внутри указанного ограничения области расположения объекта пользователю компьютерного устройства , осуществляющего транспортировку , данные о типе объекта и данные о средствах связи с компьютерными устройствами пользователей , нуждающихся в транспортировках .

Возможны дополнительные варианты осуществления способа по второму варианту , в которых целесообразно , чтобы :

- данные запроса на транспортировку , осуществляемой пользователем компьютерного устройства и перемещении транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения посредством сети Интернет с удаленного сервера направляли бы пользователям компьютерных устройств , нуждающихся в транспортировке и находящихся внутри указанного в запросе ограничения области расположения объекта , при этом пользователям компьютерных устройств , нуждающихся в транспортировке , направляются данные об интервале времени осуществления транспортировки ,

средствах связи с пользователем компьютерного устройства , направившего на удаленный сервер упомянутый запрос на транспортировку ;

- после осуществления запроса на транспортировку от пользователя компьютерного устройства с удаленного сервера посредством сети Интернет направляли бы на данное компьютерное устройство изображение электронной цифровой карты , на которой пользователь указывает маркеры пункта отправления транспортного средства и пункта назначения , ограничение области расположения объекта для транспортировки и размеры этой области , а также указывает данные об интервале времени осуществления транспортировки ;

- изображение электронной цифровой карты с упомянутыми указаниями пользователя компьютерного устройства , сделавшего запрос на транспортировку , удаленный сервер посредством сети Интернет направляли бы пользователям компьютерных устройств , нуждающихся в транспортировке объектов ;

- удаленный сервер накапливал бы в своей базе данных сведения по запросам на транспортировку от нескольких пользователей компьютерных устройств о перемещении транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения , эти данные в виде списка посредством сети Интернет направляются пользователям компьютерных устройств , нуждающихся в транспортировке и находящихся внутри указанных в запросах ограничениях областей расположения объекта , при этом пользователям компьютерных устройств , нуждающихся в транспортировке , направляются данные об интервале времени осуществления транспортировок , данные о средствах связи с пользователями компьютерных устройств , направивших на удаленный сервер упомянутые запросы на транспортировку ;

- размеры упомянутого ограничения области расположения объекта регулировал бы пользователь компьютерного устройства , направившего запрос на транспортировку ;

- пункт отправления располагали бы внутри ограничения области расположения объекта , размеры этой области ограничены окружностью с центром , совпадающим с местонахождением пункта отправления транспортного средства ;

- пункт отправления располагали бы непосредственно в указанном местонахождении пользователя компьютерного устройства , направившего запрос на транспортировку ;

- местоположение пункта отправления и пункта назначения совпадало бы, а пользователь компьютерного устройства в своем запросе на транспортировку указывал бы, по меньшей мере, местоположение одного промежуточного пункта назначения ;

- для транспортировки попутных объектов пользователь компьютерного устройства , осуществляющего транспортировку , ограничение области расположения объекта дополнительно указывал между пунктом отправления и пунктом назначения ;

- для транспортировки попутных объектов пользователь компьютерного устройства , осуществляющего транспортировку , дополнительно указывал ограничение области расположения объекта в пункте назначения , а пользователь компьютерного устройства , нуждающегося в транспортировке - ограничение области расположения объекта в пункте отправления и ограничение области расположения объекта в пункте назначения , а при пересечении ограничения в пунктах отправления области расположения объекта пользователя компьютерного устройства , осуществляющего транспортировку , с ограничением области расположения объекта пользователя компьютерного устройства , нуждающегося в транспортировке , и при пересечении ограничения в пунктах назначения области расположения объекта пользователя компьютерного устройства , осуществляющего транспортировку , с ограничением области расположения объекта пользователя компьютерного устройства , нуждающегося в транспортировке , осуществляли бы транспортировку двух упомянутых объектов из их пунктов отправления в пункты назначения .

Указанные преимущества , а также особенности настоящего изобретения поясняются лучшими вариантами его выполнения со ссылками на прилагаемые фигуры .

## Краткий перечень чертежей

Фиг . 1 изображает типовую функциональную схему взаимодействия компьютерных устройств через сеть Интернет с удаленным сервером ;

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Фиг . 2 - возможный вид изображения диалогового окна на мониторе компьютерного устройства пользователя , нуждающегося в перевозке , для регистрации этого пользователя ;

Фиг . 3 - возможный вид изображения диалогового окна на мониторе компьютерного устройства пользователя , обеспечивающего перевозку или транспортировку объекта , для регистрации этого пользователя ;

Фиг . 4 - возможный вид изображения диалогового окна на мониторе компьютерного устройства пользователя , нуждающегося в перевозке , для указания им маркеров пункта отправления и пункта назначения , ограничения области расположения объекта и размеров этой области для удовлетворения условий к потенциальному перевозчику ;

Фиг . 5 - обобщенная блок -схема алгоритма функционирования удаленного сервера для пользователей компьютерных устройств , нуждающихся в перевозке ;

Фиг . 6 - возможный вид изображения диалогового окна на мониторе компьютерного устройства пользователя , нуждающегося в перевозке , по первому варианту выполнения изобретения ;

Фиг . 7 - обобщенная блок -схема алгоритма функционирования удаленного сервера для пользователей компьютерных устройств , осуществляющих транспортировку ;

Фиг . 8 - возможный вид изображения диалогового окна на мониторе компьютерного устройства пользователя , осуществляющего транспортировку объектов , по второму варианту выполнения изобретения ;

Фиг . 9 - иллюстрация принципа перевозки для пользователей компьютерных устройств с сопутствующими маршрутами .

Лучшие варианты осуществления изобретения

Под компьютерными устройствами 1 и 2 в настоящем изобретении понимаются вычислительные устройства , обладающие способностью к связи с удаленным сервером 3 при помощи сети Интернет (фиг . 1). Они могут быть автономными устройствами , типа настольного компьютера или ноутбука , или это могут быть устройства коммуникаций , типа сотового телефона , электронного органайзера , приемоответчика , портативной радиостанции или другого мобильного устройства , которое может общаться (обмениваться данными ) через сеть .

Удаленный сервер 3 сохраняет в своей базе данных сведения о пользователях компьютерных устройств 1 в количестве от m до M, которые нуждаются в перевозке, и сведения о пользователях компьютерных устройств 2 в количестве от n до N, которые являются потенциальными перевозчиками. Общее число компьютерных устройств может постоянно изменяться по мере регистрации пользователей. Компьютерные устройства 1, 2 и удаленный сервер 3 соединены двусторонними связями с сетью Интернет. Двусторонние связи могут быть любым доступным методом доступа к Интернету - dial-up, коаксиальный кабель, оптоволокно, Wi-Fi, спутник и сотовые телефоны.

Первое клиентское приложение компьютерного устройства 1 и второе клиентское приложение компьютерного устройства 2 взаимодействуют с веб приложением удаленного сервера 3 через протокол передачи данных, соответственно, который взаимодействует с системой управления базами данных через любой возможный интерфейс доступа к данным. Протоколы передачи данных компьютерных устройств 1 и 2 могут быть, например, протоколом http. Интерфейс доступа к данным зависит от используемого языка программирования, на котором написано веб приложение. Для java-приложений (джава) - это будет JDBC (Java DataBase Connectivity — соединение с базами данных на джава), для PHP (ПиЭйчПи, препроцессор гипертекста) - PDO (ПиДиОу, интерфейс доступа к базам данных). Для осуществления заявленного способа может быть использована любая система управления базой данных (СУБД), например, MySQL, Oracle или PostgreSQL.

Под объектами для перевозки или транспортировки в настоящем изобретении понимаются всевозможные материальные объекты: люди, различные предметы и даже, например, животные.

Для практической реализации заявленного способа пользователь обязательно должен зарегистрироваться в веб приложении удаленного сервера 3. Регистрация пользователей компьютерных устройств может осуществляться с помощью диалоговых окон (фиг. 2, 3), которые могут иметь разнообразный вид. Причем в базе данных удаленного сервера 3 пользователи компьютерных устройств 1 и 2 в зависимости от существа запроса и указанных данных подразделяются на пользователей, нуждающихся в перевозке, например, при указании на фиг. 2 в разделе диалогового окна «Тип транспортного средства» текста - «нет» или

осуществляющих перевозку (транспортировку ) объектов (фиг . 3). На фигуре 3 показан пример окна для регистрации организации , обеспечивающей транспортировку . Но такого же типа окно может быть использовано для регистрации физических лиц в качестве транспортировщиков , т.е. осуществляющих перевозку объектов . В разделе статуса «Организация » указывается наименование фирмы . В разделе «Ареал перевозок » указывается их диапазон , например , по району , по городу , по городу и пригороду , междугородние , международные и т.п.

При нажатии клавиши «Enter» или наведении курсора компьютерной мыши на кнопку «зарегистрировать » и нажатии (клика ) ее клавиши (фиг . 1, 2) данные о пользователях компьютерных устройств 1 и 2 через сеть Интернет поступают на удаленный сервер 3.

Данные о местонахождении пользователей компьютерных устройств 1 и 2 представляются в виде гео -точек (географических координат - значений широты и долготы ) и запоминаются в базе данных удаленного сервера 1.

При запросе каким -либо пользователем компьютерного устройства 1 перевозки , осуществляемого с помощью диалогового окна (на фигурах не показанного , т.к. оно может иметь многообразный вид ), с помощью которого пользователь компьютерного устройства 1 направляет на удаленный сервер 3 запрос о перевозке и перемещении объекта из заданного им пункта отправления в заданный пункт назначения с указанием их местонахождения , начинается функционирование системы . Для удобства и быстроты обработки данных диалоговое окно запроса о перевозке также может содержать дополнительные сведения : страну , населенный пункт и адрес . Веб приложение удаленного сервера 1 производит поиск совпадения по стране , населенному пункту и адресу и определяет соответствующие географические координаты гео -точек пункта отправления и пункта назначения .

Для удобства ведения диалога с пользователем компьютерного устройства 1 целесообразно использовать электронную цифровую карту . Зная координаты гео - точек из базы данных удаленного сервера 3 после осуществления запроса о перевозке к пользователю компьютерного устройства 1 с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство 1 изображение соответствующей электронной цифровой карты (фиг . 4).

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На электронной цифровой карте пользователь указывает маркер 4 пункта отправления и маркер 5 пункта назначения, ограничение области расположения объекта и размеры этой области (площадь ограничения), данные об интервале времени осуществления перевозки (отправки объекта). Кроме того, дополнительно могут быть указаны: объект - пассажир или груз, дата (по умолчанию принимается как существующая в настоящие сутки), наименование предмета перевозки, размеры предмета, направление (в одну сторону, туда-обратно, для маршрута более чем двух гео-точек можно создавать направления по кругу, по ломаной линии и т.п.), периодичность маршрута (без повторения, каждый день, каждую неделю, каждый месяц, каждый год).

Дополнительно с помощью маркера 6 может быть показан промежуточный пункт назначения, в котором требуется забрать какой-либо груз или посадить в транспортное средство другого пассажира.

Ограничение 7 области расположения объекта может регулироваться пользователем компьютерного устройства 1, направившего запрос о перевозке.

Маркер 4 (пункт отправления) обычно располагают внутри ограничения 7 области расположения объекта, размеры этой области могут быть ограничены окружностью с центром, совпадающим с местонахождением пункта отправления объекта (если пункт отправления не является адресом местожительства, например, нужно перевезти груз из магазина или доставить пассажира по какому-либо адресу). Также пункт отправления может быть расположен непосредственно в указанном местонахождении (адресе местожительства) пользователя компьютерного устройства 1, направившего запрос о перевозке. В специальных случаях, например, при протяженном в одном направлении населенном пункте ограничение 7 может быть исполнено в виде эллипса, квадрата, многоугольника или других геометрических фигур.

Кроме того, местоположение пункта отправления и пункта назначения может совпадать, а пользователь компьютерного устройства 1 в своем запросе о перевозке маркером 6 указывает, по меньшей мере, местоположение одного промежуточного пункта назначения, например, в котором надо взять в поездку дополнительного пассажира.

По умолчанию каждой гео-точке присваивается определенный радиус действия, например, 3 км. Радиус ограничения 7 области расположения объекта для каждой гео-точки в маршруте можно изменить. Для этого необходимо кликнуть компьютерной мышью на изображение гео-точки, и с помощью линеек регулирования 8 (ползунков), изменить радиус действия гео-точки (Фиг. 4).

После указания пользователем компьютерного устройства 1 маркеров 4, 5 ограничения 7 области расположения объекта и ее размеров, интервала времени осуществления перевозки и отправления этих данных посредством сети Интернет на удаленный сервер 3 его работа осуществляется следующим образом (фиг. 5).

Как описывалось ранее, в блоке 30 осуществляется ввод и регистрация пользователей компьютерных устройств 1, 2 и присвоение им уникальных идентификационных номеров (ИН). Данные о пользователях компьютерных устройств 1, 2 сохраняются в базе данных 31. Для пользователей компьютерных устройств 1 сохраняются наименование, местонахождение (координаты гео-точки), средства связи. При этом пользователь компьютерного устройства 1 может обратиться на удаленный сервер 3 в первый раз и сразу сделать после регистрации запрос о перевозке. Для пользователей компьютерных устройств 2 сохраняются наименование, местонахождение (координаты гео-точек), время перевозок (ежедневно, круглосуточно, одноразово), ареал перевозок, тип транспорта, средства связи с ними.

После ввода запроса о перевозке в блок 32 и последующего ввода в блок 33 данных о пунктах отправления и назначения (координат их гео-точек), интервала времени, ограничения 7 области расположения объекта с ее радиусом R блоком 34 осуществляется поиск в базе данных пользователей, удовлетворяющих условиям блока 33. Если в базе данных 31 нет данных о маршрутах, в которых радиусы окружностей ограничения 7 области действия гео-точек не пересекаются с данными ареала перевозок пользователей компьютерных устройств 2 и которые не совпадают по времени, то блок 35 сравнения представляет информацию с выхода «Нет», которая поступает на блок 36 для направления пользователю компьютерного устройства 1 сообщения о невозможности перевозки с указанными в запросе данными. Пользователь может увеличить размеры ограничения 7 области

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расположения объекта или изменить интервал времени отправления и повторить свой запрос о перевозке .

Если в базе данных 31 есть данные о маршрутах , радиус окружности ограничения 7 области расположения объектов которых от действия гео-точек пересекаются (гео-точка , пользователя компьютерного устройства 2 находится внутри ограничения 7) и которые соответствуют интервалу времени , то блок 35 сравнения представляет информацию с выхода «Да». Эта информация поступает в блок 37 для составления данных списка пользователей компьютерных устройств 2, осуществляющих перевозку (транспортировку ). Далее , блоком 38 производится направление пользователю компьютерного устройства 1 данных о списке пользователей компьютерных устройств 2, осуществляющих перевозку . В случае нахождения в ограничении 7 только одной организации или физического лица , осуществляющего перевозку (транспортировку ), в списке может находиться только одна графа .

Таким образом , пользователю компьютерного устройства 1 сообщаются данные о перевозчиках , ближайших к пункту отправления объекта , что сокращает время доставки и, соответственно , стоимость перевозки .

Данные списка пользователей , осуществляющих перевозку (транспортировку ) передаются пользователю компьютерного устройства 1, например , в виде изображения диалогового окна (фиг . 6), в котором кроме типа автомобиля и времени отправления могут быть показаны и иные дополнительные данные : год выпуска автомобиля , классность шофера (стаж вождения , категория ) и т.п. При выборе пользователем компьютерного устройства 1 одного номинанта из списка и нажатии (кликом мышью на соответствующую клавишу «Выбор ») может быть осуществлена непосредственная связь пользователя компьютерного устройства 1 (переход на e-mail или сайт ) с пользователем компьютерного устройства 2, или тот может связаться с ним по обычному канальному или сотовому телефону .

Кроме того , данные запроса о перевозке пользователем компьютерного устройства 1 и перемещении объекта из заданного им пункта отправления в заданный пункт назначения с указанием их местонахождения посредством сети Интернет с удаленного сервера 3 могут быть дополнительно направлены блоком 39 (фиг . 5) пользователям компьютерных устройств 2, осуществляющих перевозки , гео-

точки которых находятся внутри указанном в запросе о перевозке ограничении 7 области расположения объекта . Пользователям компьютерных устройств 2 направляются данные о пункте отправления и пункте назначения , об интервале времени осуществления перевозки , о средствах связи с пользователем компьютерного устройства 1.

Аналогично решается поставленная задача для пользователей компьютерных устройств 2, осуществляющих транспортировку грузов или пассажиров . Для этого варианта работа удаленного сервера 3 осуществляется следующим образом (фиг . 6).

В блоке 30 осуществляется ввод и регистрация пользователей компьютерных устройств 1, 2 и присвоение им ИН. Данные о пользователях компьютерных устройств 1, 2 сохраняются в базе данных 31.

Осуществляется ввод запроса о перевозке от пользователя компьютерного устройства 1 в блок 40 и последующий ввод в блок 41 данных о пунктах отправления и назначения (координат их гео-точек ), интервала времени , дополнительно вводятся данные о типе объекта для перевозки (пассажиры или груз ), при этом ограничение 7 области расположения объекта с ее радиусом R может и не осуществляться (но может быть и введено , как это далее поясняется с помощью фиг . 9).

Осуществляется ввод запроса от пользователя компьютерного устройства 2 на транспортировку в блок 42 и последующего ввод в блок 43 данных о перемещении транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения , ограничение области расположения объекта для транспортировки и размеры этой области , данные о типе объекта и интервале времени осуществления транспортировки .

Данные запроса о перевозке и запроса на транспортировку поступают в базу данных 31 удаленного сервера 3 в режиме будущего (отложенного ) времени или непосредственно в режиме реального времени на блок 44, (однако эти данные все равно вносятся в базу данных 31 удаленного сервера 3).

Блоком 44 осуществляется поиск пользователей , удовлетворяющих условиям блоков 41 и 43. Если гео-точка запроса о перевозке находится вне базы данных 31 о маршрутах , в которых , например , она находится вне радиуса окружности ограничения 7 области расположения объекта (действия гео-точки ) пункта

отправления транспортного средства для пользователя компьютерного устройства 2 или данные запросов не удовлетворяют интервалам времени, то блок 45 сравнения представляет информацию с выхода «Нет», которая поступает на блок 46 для направления к пользователю компьютерного устройства 2 сообщения о невозможности транспортировки с указанными в запросе данными. Пользователь компьютерного устройства 2 может увеличить размеры ограничения 7 области расположения объекта или изменить интервал времени отправления и повторить свой запрос на транспортировку.

Если в базе данных 31 есть данные о маршрутах, в которых ограничение 7 (радиус окружности) области расположения объектов для пункта отправления транспортного средства охватывает гео-точки данных местоположений, указанных в запросе о перевозке пользователей компьютерных устройств 1, и эти данные соответствуют интервалу времени, то блок 45 сравнения представляет информацию с выхода «Да». Эта информация поступает в блок 47 для составления данных списка пользователей, нуждающихся в перевозках. Далее, блоком 48 производится направление пользователю компьютерного устройства 2 данных о списке пользователей компьютерных устройств 1, нуждающихся в перевозках. В случае нахождения в ограничении 7 пункта отправления только одного пользователя, осуществляющего перевозку, в списке может находиться только одна графа.

Таким образом, пользователям компьютерных устройств 2 сообщаются данные о пользователях, нуждающихся в перевозках, ближайших к пункту отправления транспортного средства.

Данные списка пользователей, нуждающихся в перевозках передаются пользователю компьютерного устройства 2, например, в виде изображения диалогового окна (фиг. 8), в котором указывается тип объекта и время отправления от пункта местонахождения заказчика перевозки. Также могут быть показаны и иные дополнительные данные: вес груза, его размеры, количество пассажиров и т.п.

При выборе пользователем компьютерного устройства 2 (фиг. 8) одного номинанта из списка и нажатии (кликом мышью на соответствующую клавишу «Выбор») может быть осуществлена непосредственная связь пользователя компьютерного устройства 2 (переход на e-mail) с пользователем компьютерного

устройства 2, или он может связаться с ним по обычному канальному или сотовому телефону .

Кроме того , данные запроса на транспортировку пользователем компьютерного устройства 2 и перемещении объекта из пункта отправления в пункт назначения с указанием их местонахождения посредством сети Интернет с удаленного сервера 3 могут быть дополнительно направлены блоком 49 (фиг . 7) пользователям компьютерных устройств 1, нуждающихся в перевозке . Пользователям компьютерных устройств 1 направляются данные о пункте отправления и пункте назначения , времени прибытия транспортного средства к местонахождению объекта , средствах связи с пользователем компьютерного устройства 2.

Пользователям компьютерных устройств 2, осуществляющих транспортировку , при определении ими наиболее удаленных друг от друга пунктов отправления и назначения целесообразно также использовать маркер 6 для указания промежуточного пункта назначения (фиг . 4) или нескольких таких пунктов . В результате он может создать оптимизированный маршрут , который позволяет по пути следования осуществить перемещение различных пассажиров и предметов (фиг . 8).

Кроме того , в блоке 41 (фиг . 7) при запросе о перевозке целесообразно также указывать данные об ограничении области расположения объекта пункта оправления и пункта назначения при запросе о перевозке , а в блоке 43 как ограничение области расположения объекта пункта оправления , так и ограничение области расположения объекта пункта назначения (фиг . 4). В этом случае можно осуществить перевозку двух (нескольких ) пассажиров или двух (нескольких ) грузов только одним транспортом , например , из возможных двух по сопутствующему маршруту (фиг . 9).

Пусть необходимо осуществить перевозку из города A в город B. Один объект из пункта C отправления города A определен для доставки в пункт D назначения города B, а другой объект из пункта E отправления города A - в пункт F назначения города B (показано пунктирной линией ). Если ограничения 7 областей

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расположения объектов пересекаются в городе A и городе B, и время отправления объектов в городе A происходит в необходимых интервалах времени, то возможна одноразовая доставка сразу двух объектов, например, по маршруту C - E - D - F (на фиг. 9 показано стрелками). Также возможна доставка сразу нескольких объектов, например, при еще другом дополнительном ограничении 7, пересечении ограничений каких-либо областей и совпадении соответствующих временных интервалов (на фиг. 9 для простоты чтения чертежа не показано).

Специалистам понятно, что приведенные выше примеры вариантов осуществления заявленного способа обмена данными в компьютерной сети для автомобильного транспорта могут быть применены и в других его видах: железнодорожном, речном, при авиаперевозках.

Так, например, при обозначении потребителем компьютерного устройства 1 пункта отправления от железнодорожного вокзала, указания пункта назначения и времени отправления, компьютерное устройство 2 может сообщать заявителю расписание железнодорожных поездов в указанном им интервале времени, тип поезда, его комфортабельность, тип вагона, наличие свободных мест или невозможность поездки. Если допустима доставка до пункта назначения от нескольких вокзалов, то потребитель имеет возможность получить сравнительную характеристику времени в пути и комфортабельности поездки для различных перевозчиков. Точно так же при авиаперевозках и указании различных аэропортов заявители о перелетах могут получить данные о дате и расписании полетов, типе авиалайнеров, наличии свободных мест, возможности доставки до пункта назначения самолетом или вертолетом и т.п. Пользователи же компьютерных

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устройств 2 могут собрать всю необходимую им информацию о потребителях , нуждающихся в их услугах .

Промышленная применимость

Наиболее успешно заявленный способ обмена данными в компьютерной сети (варианты ) промышленно применим для обеспечения пользователей компьютерных устройств - потребителей , как нуждающихся в перевозке , так и предоставляющих услуги транспортирования различных объектов , необходимой информацией о возможных вариантах совершения поездок , предоставления различных видов транспортных услуг , оптимизации перемещения объектов в режиме реального и будущего времени .

ФОРМУЛА ИЗОБРЕТЕНИЯ

1. Способ обмена данными в компьютерной сети, заключающийся в том, что посредством сети Интернет на удаленном сервере регистрируют данные о пользователях компьютерных устройств, подсоединенных к сети Интернет, с указанием данных о местонахождении пользователей, данных о возможности осуществления перевозок, статусе, типе транспортного средства, и данные о средствах связи с ними, сохраняют упомянутые данные в базе данных сервера, присваивая пользователям компьютерных устройств идентификационные номера, если пользователь компьютерного устройства направляет на удаленный сервер запрос о перевозке и перемещении объекта из заданного им пункта отправления в заданный пункт назначения с указанием их местонахождения, то с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство запрос на ограничение области расположения объекта и размеры этой области для удовлетворения требований к потенциальному перевозчику, а также данные об интервале времени осуществления перевозки, после указания пользователем компьютерного устройства ограничения области расположения объекта и ее размеров, интервала времени осуществления перевозки и отправления этих данных посредством сети Интернет на удаленный сервер, тот из своей базы данных выбирает по идентификационным номерам данные о местонахождении пользователей компьютерных устройств, осуществляющих перевозки и находящиеся в указанном пользователем компьютерного устройства ограничении области расположения объекта - внутри ее размеров, статусе, типе транспортного средства и данные о средствах связи с ними, и удаленный сервер посредством сети Интернет передает список о местонахождении пользователей компьютерных устройств, осуществляющих перевозки и находящиеся внутри указанного пользователем компьютерного устройства ограничения области расположения объекта, статусе, типе транспортного средства и данных о средствах связи с пользователями компьютерных устройств, осуществляющих перевозки, компьютерному устройству пользователя, направившему запрос о перевозке.

2. Способ по п. 1, отличающийся тем, что данные запроса о перевозке пользователем компьютерного устройства и перемещении объекта из заданного им пункта отправления в заданный пункт назначения с указанием их местонахождения

посредством сети Интернет с удаленного сервера направляют пользователям компьютерных устройств, осуществляющих перевозки и находящихся внутри указанного в запросе ограничении области расположения объекта, при этом пользователям компьютерных устройств, осуществляющих перевозки, направляются данные об интервале времени осуществления перевозки, средствах связи с пользователем компьютерного устройства, направившего на удаленный сервер упомянутый запрос о перевозке.

3. Способ по п. 1, отличающийся тем, что после осуществления запроса о перевозке от пользователя компьютерного устройства, с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство изображение электронной цифровой карты, на которой пользователь указывает маркеры пункта отправления и пункта назначения, ограничение области расположения объекта и размеры этой области, а также данные об интервале времени осуществления перевозки.

4. Способ по п. 3, отличающийся тем, что изображение электронной цифровой карты с указаниями пользователя компьютерного устройства, сделавшего запрос о перевозке, удаленный сервер посредством сети Интернет направляет пользователям компьютерных устройств, осуществляющих перевозки.

5. Способ по п. 1, отличающийся тем, что удаленный сервер накапливает в своей базе данных сведения по запросам о перевозке от нескольких пользователей компьютерных устройств о перемещении объектов из заданного ими пункта отправления в заданный пункт назначения с указанием их местонахождения, эти данные в виде списка посредством сети Интернет направляются пользователям компьютерных устройств, осуществляющих перевозки и находящихся внутри указанных в запросах ограничениях областей расположения объекта, при этом пользователям компьютерных устройств, осуществляющих перевозки, направляются данные об интервале времени осуществления перевозок, средствах связи с пользователями компьютерных устройств, направивших на удаленный сервер упомянутые запросы о перевозках.

6. Способ по п. 1, отличающийся тем, что размеры упомянутого ограничения области расположения объекта регулирует пользователь компьютерного устройства, направившего запрос о перевозке.

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7. Способ по п. 1, отличающийся тем, что пункт отправления располагают внутри ограничения области расположения объекта, размеры этой области ограничены окружностью с центром, совпадающим с местонахождением пункта отправления.

8. Способ по п. 1, отличающийся тем, что пункт отправления расположен непосредственно в указанном местонахождении пользователя компьютерного устройства, направившего запрос о перевозке.

9. Способ по п. 1, отличающийся тем, что местоположение пункта отправления и пункта назначения совпадает, а пользователь компьютерного устройства в своем запросе о перевозке указывает, по меньшей мере, местоположение одного промежуточного пункта назначения.

10. Способ обмена данными в компьютерной сети, заключающийся в том, что посредством сети Интернет на удаленном сервере регистрируют данные о пользователях компьютерных устройств, подсоединенных к сети Интернет, с указанием данных о местонахождении пользователей, данных о возможности осуществления транспортировки, и данных о средствах связи с пользователями компьютерных устройств, а для пользователей компьютерных устройств, нуждающихся в транспортировке, регистрируют данные о типе объекта, предназначенного для транспортировки, пункте отправления, пункте назначения, интервал времени отправления и сохраняют упомянутые данные в базе данных сервера, присваивая пользователям компьютерных устройств идентификационные номера, если пользователь компьютерного устройства, осуществляющий транспортировку, посредством сети Интернет направляет запрос на транспортировку к удаленному серверу с указанием о перемещении транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения, то с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство запрос на ограничение области расположения объекта для транспортировки и размеры этой области, а также данные о типе объекта и интервал времени осуществления транспортировки, после указания пользователем компьютерного устройства, осуществляющего транспортировку, данных о типе объекта, об ограничении области расположения объекта и ее размеров, об интервале времени осуществления транспортировки и отправления

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этих данных посредством сети Интернет на удаленный сервер, тот из своей базы данных выбирает по идентификационным номерам данные о местонахождении объектов пользователей компьютерных устройств, нуждающихся в транспортировках и находящихся в указанном ограничении области расположения объекта - внутри ее размеров, типе объекта и данных о средствах связи с пользователями компьютерных устройств, нуждающихся в транспортировках, и удаленный сервер посредством сети Интернет передает список о местонахождении объектов пользователей компьютерных устройств, нуждающихся в транспортировках и находящихся внутри указанного ограничения области расположения объекта пользователю компьютерного устройства, осуществляющего транспортировку, данные о типе объекта и данные о средствах связи с компьютерными устройствами пользователей, нуждающихся в транспортировках.

11. Способ по п. 10, отличающийся тем, что данные запроса на транспортировку, осуществляемой пользователем компьютерного устройства и перемещении транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения посредством сети Интернет с удаленного сервера направляют пользователям компьютерных устройств, нуждающихся в транспортировке и находящихся внутри указанного в запросе ограничения области расположения объекта, при этом пользователям компьютерных устройств, нуждающихся в транспортировке, направляются данные об интервале времени осуществления транспортировки, средствах связи с пользователем компьютерного устройства, направившего на удаленный сервер упомянутый запрос на транспортировку.

12. Способ по п. 10, отличающийся тем, что после осуществления запроса на транспортировку от пользователя компьютерного устройства с удаленного сервера посредством сети Интернет направляют на данное компьютерное устройство изображение электронной цифровой карты, на которой пользователь указывает маркеры пункта отправления транспортного средства и пункта назначения, ограничение области расположения объекта для транспортировки и размеры этой области, а также указывает данные об интервале времени осуществления транспортировки.

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13. Способ по п. 12, отличающийся тем, что изображение электронной цифровой карты с упомянутыми указаниями пользователя компьютерного устройства, сделавшего запрос на транспортировку, удаленный сервер посредством сети Интернет направляет пользователям компьютерьгх устройств, нуждающихся в транспортировке объектов.

14. Способ по п. 10, отличающийся тем, что удаленный сервер накапливает в своей базе данных сведения по запросам на транспортировку от нескольких пользователей компьютерных устройств о перемещении транспортного средства из заданного пункта отправления в заданный пункт назначения с указанием их местонахождения, эти данные в виде списка посредством сети Интернет направляются пользователям компьютерных устройств, нуждающихся в транспортировке и находящихся внутри указанных в запросах ограничениях областей расположения объектов, при этом пользователям компьютерных устройств, нуждающихся в транспортировке, направляются данные об интервале времени осуществления транспортировок, данные о средствах связи с пользователями компьютерных устройств, направивших на удаленный сервер упомянутые запросы на транспортировку.

15. Способ по п. 10, отличающийся тем, что размеры упомянутого ограничения области расположения объекта регулирует пользователь компьютерного устройства, направившего запрос на транспортировку.

16. Способ по п. 10, отличающийся тем, что пункт отправления располагают внутри ограничения области расположения объекта, размеры этой области ограничены окружностью с центром, совпадающим с местонахождением пункта отправления транспортного средства.

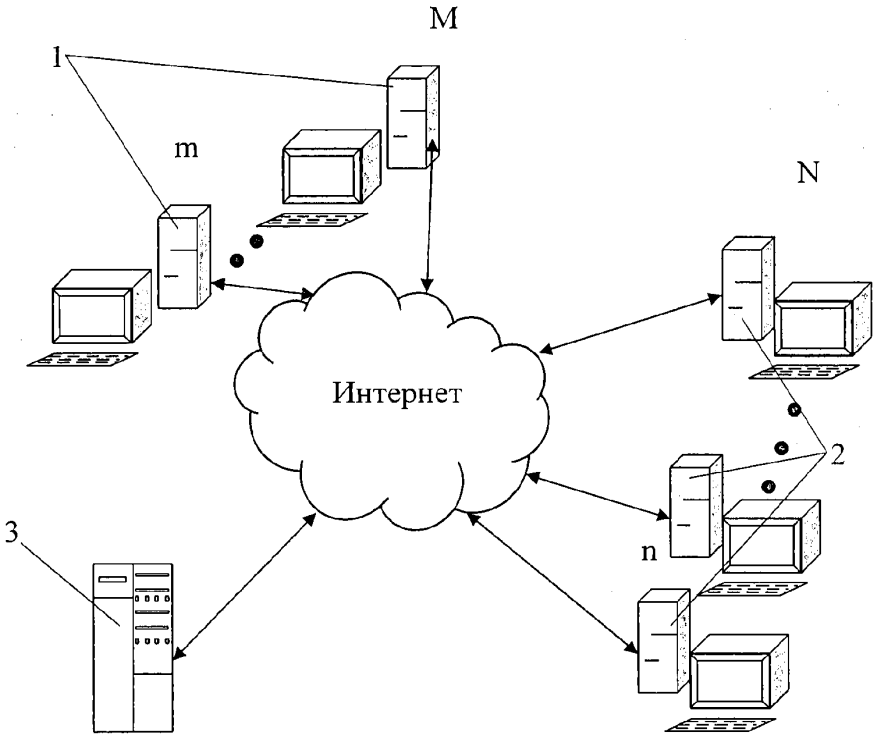
17. Способ по п. 10, отличающийся тем, что пункт отправления расположен непосредственно в указанном местонахождении пользователя компьютерного устройства, направившего запрос на транспортировку.

18. Способ по п. 10, отличающийся тем, что местоположение пункта отправления и пункта назначения совпадает, а пользователь компьютерного устройства в своем запросе на транспортировку указывает, по меньшей мере, местоположение одного промежуточного пункта назначения.

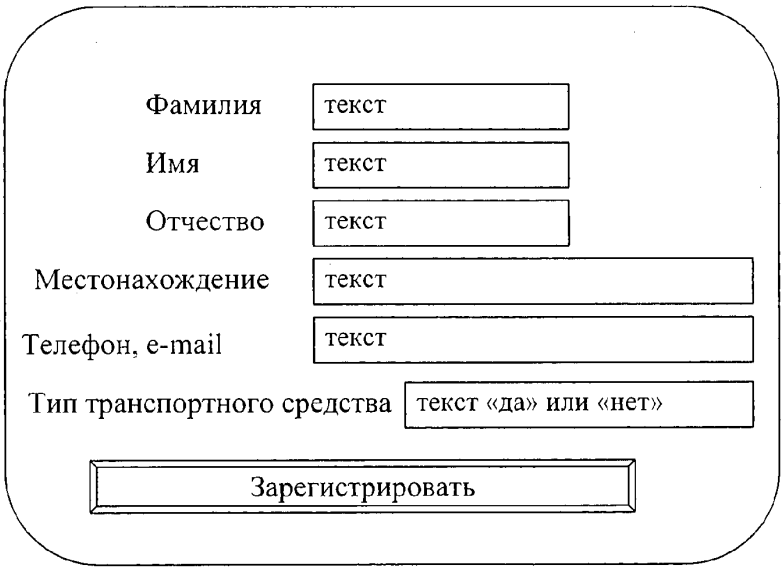
19. Способ по п. 10, отличающийся тем, что для транспортировки попутных объектов пользователь компьютерного устройства, осуществляющего транспортировку, ограничение области расположения объекта дополнительно указывает между пунктом отправления и пунктом назначения.

20. Способ по п. 10, отличающийся тем, что для транспортировки попутных объектов пользователь компьютерного устройства, осуществляющего транспортировку, дополнительно указывает ограничение области расположения объекта в пункте назначения, а пользователь компьютерного устройства, нуждающегося в транспортировке - ограничение области расположения объекта в пункте отправления и ограничение области расположения объекта в пункте назначения, а при пересечении ограничения в пунктах отправления области расположения объекта пользователя компьютерного устройства, осуществляющего транспортировку, с ограничением области расположения объекта пользователя компьютерного устройства, нуждающегося в транспортировке, и при пересечении ограничения в пунктах назначения области расположения объекта пользователя компьютерного устройства, осуществляющего транспортировку, с ограничением области расположения объекта пользователя компьютерного устройства, нуждающегося в транспортировке, осуществляют транспортировку двух упомянутых объектов из их пунктов отправления в пункты назначения.

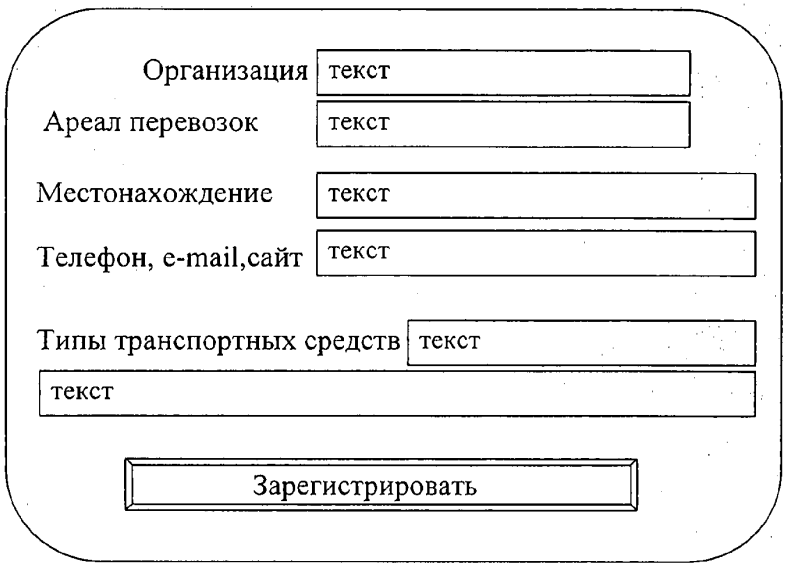
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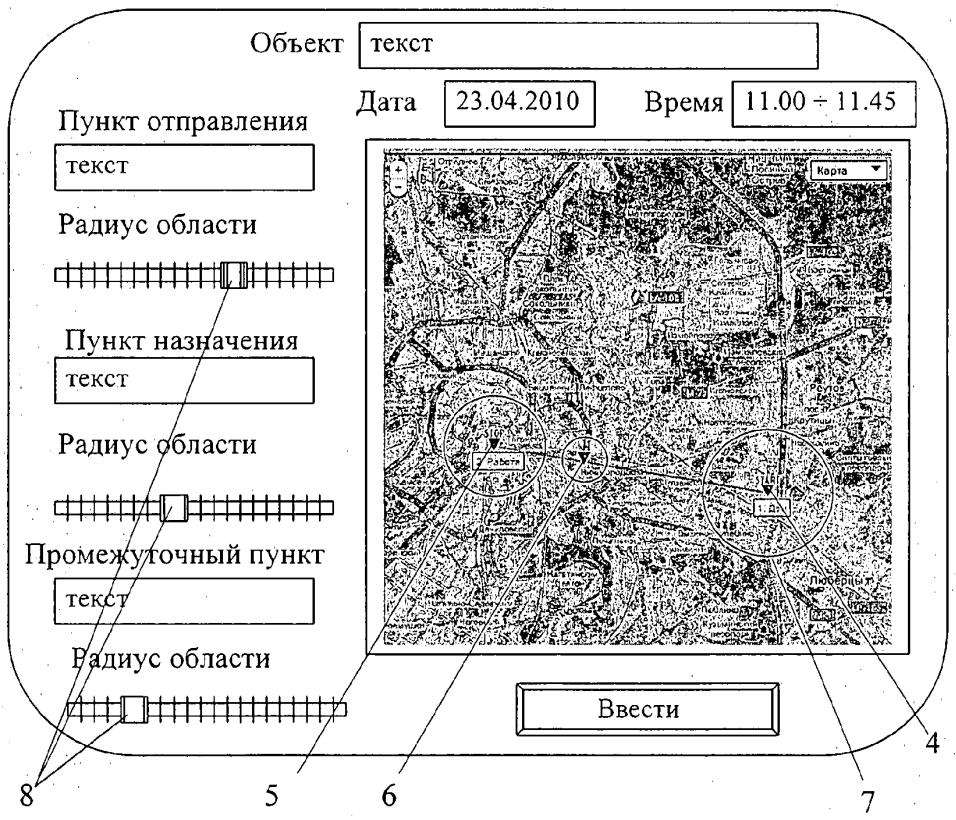
Фиг. 1


Фамилия
текст
Имя
текст
Отчество
текст
Местонахождение
текст
Телефон, e-mail
текст
Тип транспортного средства
текст «да» или «нет»
Зарегистрировать

Фиг. 2


Организация
текст
Ареал перевозок
текст
Местонахождение
текст
Телефон, e-mail,сайт
текст
Типы транспортных средств
текст
текст
Зарегистрировать

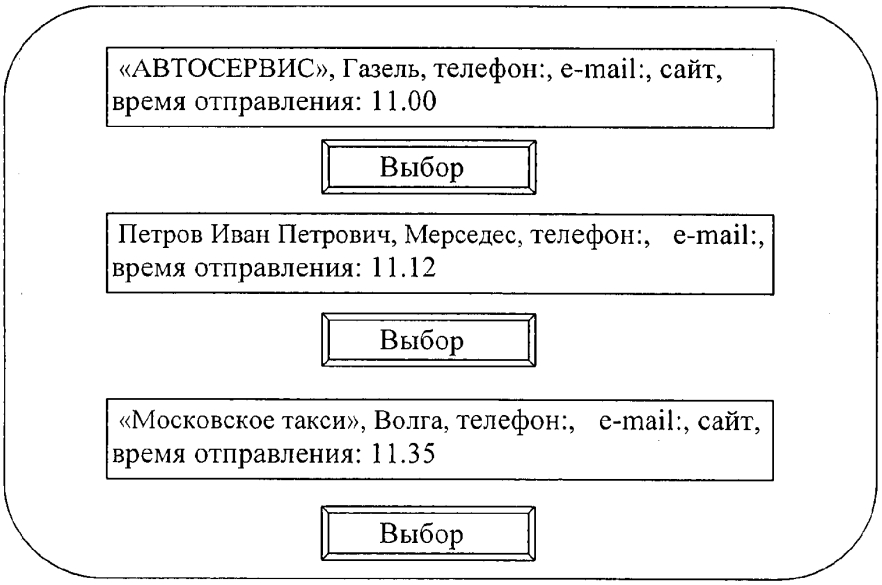
Фиг. 3


Объект
текст
Дата
23.04.2010
Время
11.00 ÷ 11.45
Пункт отправления
текст
Радиус области
Пункт назначения
текст
Радиус области
Промежуточный пункт
текст
Радиус области
Карта
Ввести
8
5
6
7
4

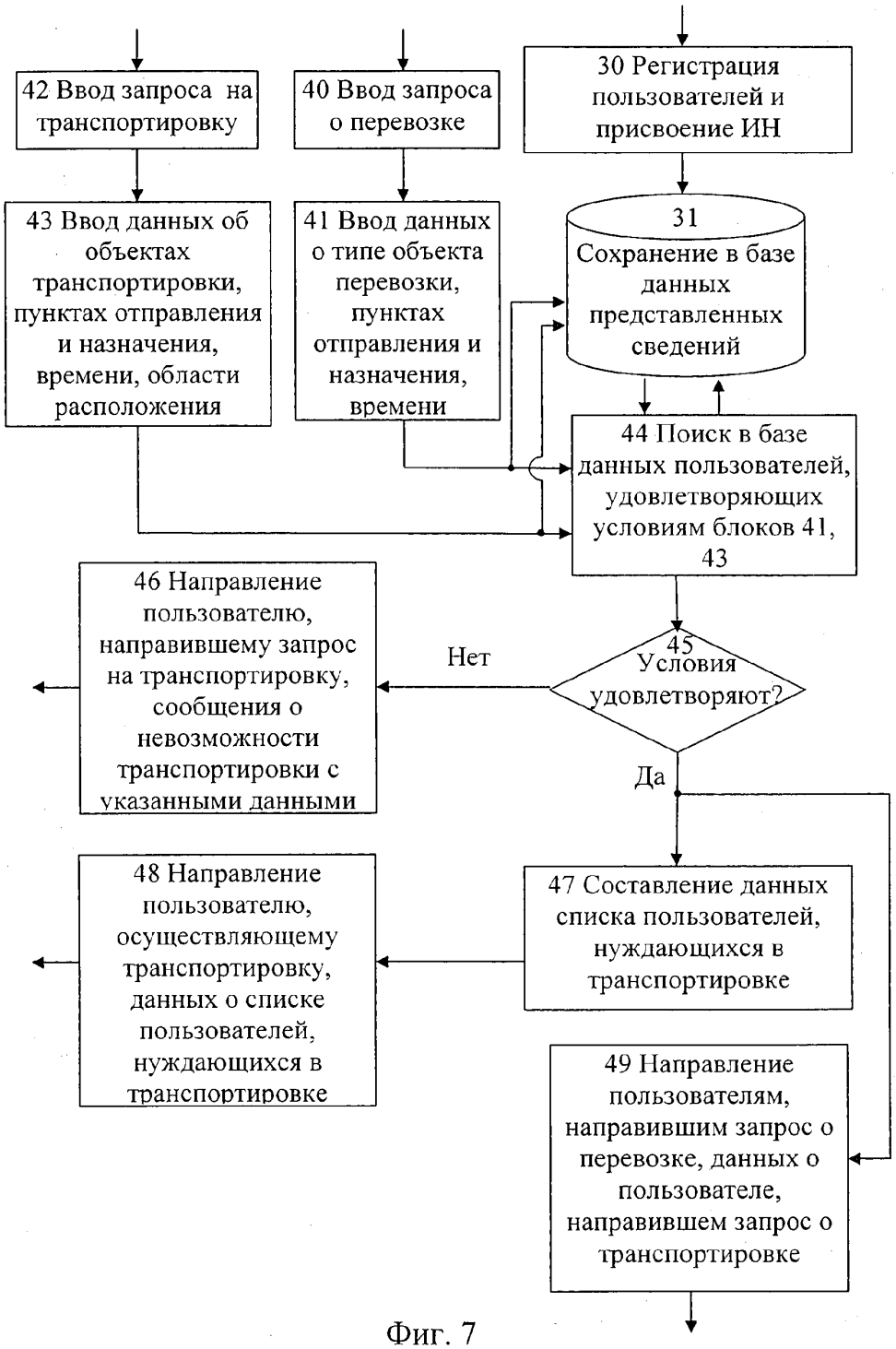
Фиг. 4


32 Ввод запроса о перевозке
30 Регистрация пользователей и присвоение ИН
33 Ввод данных о пунктах отправления и назначения, времени, ограничения области расположения объекта
31 Сохранение в базе данных представленных сведений
34 Поиск в базе данных пользователей, удовлетворяющих условиям блока 33
35 Условия удовлетворяют?
Нет
36 Направление пользователю сообщения о невозможности перевозки с указанными данными
Да
37 Составление данных списка пользователей, осуществляющих перевозку
38 Направление пользователю данных о списке пользователей, осуществляющих перевозку
39 Направление пользователям, осуществляющим перевозки, данных о пользователе, направившему запрос о перевозке

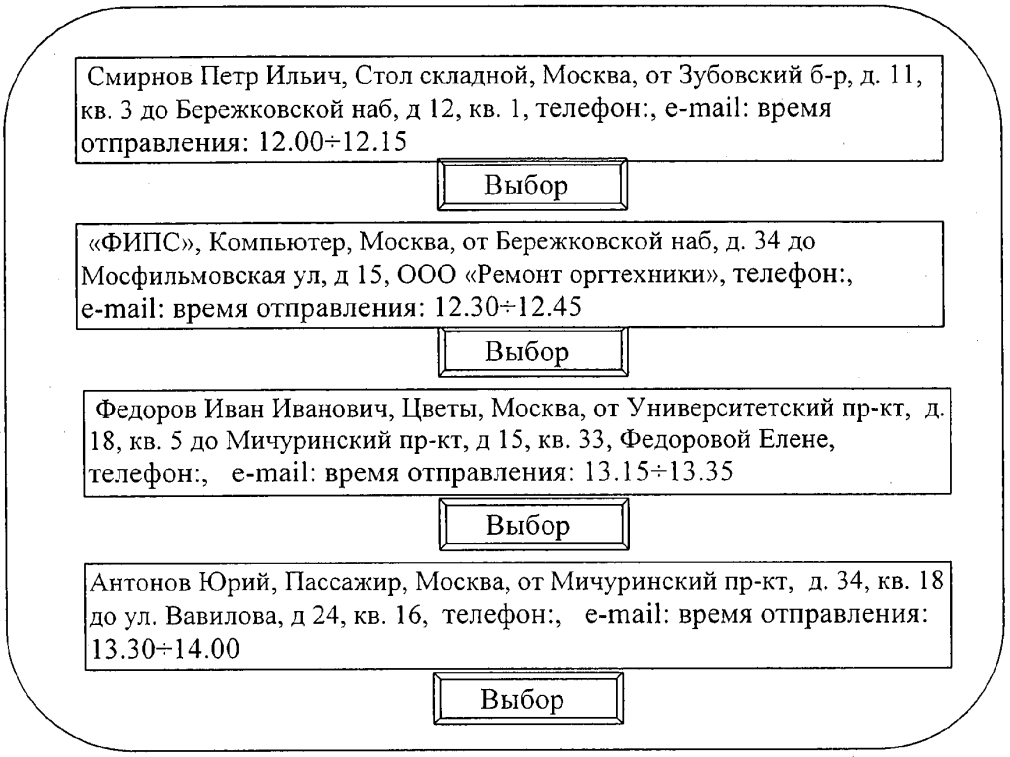
Фиг. 5


«АВТОСЕРВИС», Газель, телефон:, e-mail:, сайт, время отправления: 11.00
Выбор
Петров Иван Петрович, Мерседес, телефон:, e-mail:, время отправления: 11.12
Выбор
«Московское такси», Волга, телефон:, e-mail:, сайт, время отправления: 11.35
Выбор

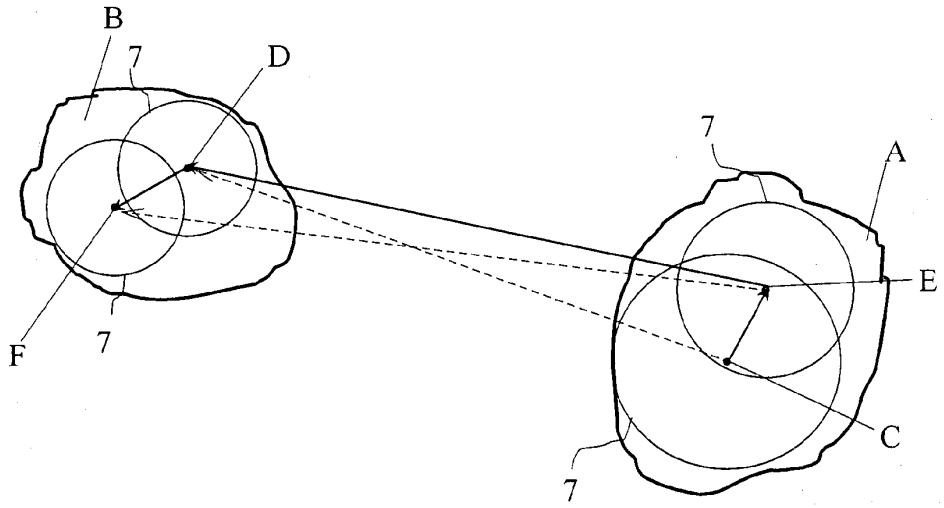
Фиг. 6


42 Ввод запроса на транспортировку
40 Ввод запроса о перевозке
30 Регистрация пользователей и присвоение ИН
43 Ввод данных об объектах транспортировки, пунктах отправления и назначения, времени, области расположения
41 Ввод данных о типе объекта перевозки, пунктах отправления и назначения, времени
31 Сохранение в базе данных представленных сведений
44 Поиск в базе данных пользователей, удовлетворяющих условиям блоков 41, 43
45 Условия удовлетворяют?
Нет
Да
46 Направление пользователю, направившему запрос на транспортировку, сообщения о невозможности транспортировки с указанными данными
47 Составление данных списка пользователей, нуждающихся в транспортировке
48 Направление пользователю, осуществляющему транспортировку, данных о списке пользователей, нуждающихся в транспортировке
49 Направление пользователям, направившим запрос о перевозке, данных о пользователе, направившем запрос о транспортировке

Фиг. 7


Смирнов Петр Ильич, Стол складной, Москва, от Зубовский б-р, д. 11, кв. 3 до Бережковской наб, д 12, кв. 1, телефон:, e-mail: время отправления: 12.00÷12.15
Выбор
«ФИПС», Компьютер, Москва, от Бережковской наб, д. 34 до Мосфильмовская ул, д 15, ООО «Ремонт оргтехники», телефон:, e-mail: время отправления: 12.30÷12.45
Выбор
Федоров Иван Иванович, Цветы, Москва, от Университетский пр-кт, д. 18, кв. 5 до Мичуринский пр-кт, д 15, кв. 33, Федоровой Елене, телефон:, e-mail: время отправления: 13.15÷13.35
Выбор
Антонов Юрий, Пассажир, Москва, от Мичуринский пр-кт, д. 34, кв. 18 до ул. Вавилова, д 24, кв. 16, телефон:, e-mail: время отправления: 13.30÷14.00
Выбор

Фиг. 8


B
7
D
7
A
E
F
7
C
7

Фиг. 9

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 201 0/000324

A. CLASSIFICATION OF SUBJECT MATTER

G06F 17/30 (2006.01); G06Q 50/00 (2006.01); H04H 60/76 (2008.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F 13/00, 13/14, 15/00, 15/16, 17/00, 17/30, 17/40, 17/60, G06Q 50/00, H04H 60/00, 60/76, 60/81, 60/82

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

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

PAJ, Esp@senet, DWPI, PCT Online, USPTO DB, CIPO (Canada PO), SIPO DB, RUPAT, RUABRU, RUABEN, RUPAT-OLD RUABU1

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | RU 2268486 C2 (DZHIDZHI21 KO. LTD.) 20.01.2006, p. 5, lines 17-19, p. 13, lines 4-10, points 1, 10 of the claims | 1-20 |
| Y | EA 010642 B1 (BEREKELYA ANATOLY ALEKSANDROVICH) 30.10.2008 | 1-20 |
| A | US 6014634 A (SUPERMARKETS ONLINE, INC.) 11.01.2000 | 1-20 |
| A | RU 2237279 C2 (OOO "VTS-DV") 27.09.2004 | 1-20 |

☐ Further documents are listed in the continuation of Box C.

D See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 15 February 2011 (15.02.2011) | 17 March 2011 (17.03.2011) |
| Name and mailing address of the ISA/ RU | Authorized officer |
| Facsimile No. | Telephone No. |

Form PCT/ISA/210 (second sheet) (July 1998)

# ОТЧЕТ О МЕЖДУНАРОДНОМ ПОИСКЕ

Международная заявка № PCTVRU 2010/000324

А. КЛАССИФИКАЦИЯ ПРЕДМЕТА ИЗОБРЕТЕНИЕ : ***G06F 17/30*** *(2006.01)*
***G06Q 50/00*** *(2006.01)*
Согласно Международной патентной классификации МПК Н ***04***Н ***60/76*** *(2008.01)*

В. ОБЛАСТЬ ПОИСКА :

Проверенный минимум документации (система классификации с индексами классификации ):
G06F 13/00, 13/14, 15/00, 15/16, 17/00, 17/30, 17/40, 17/60, G06Q 50/00, Н04Н 60/00, 60/76, 60/81, 60/82

Другая проверенная документация в той мере, в какой она включена в поисковые подборки :

Электронная база данных, использовавшаяся при поиске (название базы и, если возможно, используемые поисковые
PAJ, Esp@cenet, DWPI, PCT Online, USPTO DB, CIPO (Canada PO), SIPO DB, RUPAT, RUABRU, RUABEN, RUPAT-OLD, RUABU 1

С. ДОКУМЕНТЫ, СЧИТАЮЩИЕСЯ РЕЛЕВАНТНЫМИ :

| Категория * | Цитируемые документы с указанием, где это возможно, релевантных частей | Относится к пункту № |
|---|---|---|
| Y | RU 2268486 C2 (ДЖИДЖИ 21 КО., ЛТД.) 20.01.2006, с. 5, строки 17-19, с. 13, строки 4-10, п.п. 1, 10 формулы | 1-20 |
| Y | ЕА 010642 В1 (БЕРЕКЕЛЯ АНАТОЛИЙ АЛЕКСАНДРОВИЧ ) 30.10.2008 | 1-20 |
| A | US 6014634 A (SUPERMARKETS ONLINE, INC.) 11.01.2000 | 1-20 |
| A | RU 2237279 C2 (ООО "ВТС-ДВ") 27.09.2004 | 1-20 |

☐ Последующие документы указаны в продолжении графы С. ☐ Данные о патентах-аналогах указаны в приложении

* Особые категории ссылочных документов :

A документ, определяющий общий уровень техники и не считающийся особо релевантным

E более ранняя заявка или патент, но опубликованная на дату международной подачи или после нее

L документ, подвергающий сомнению притязание (я) на приоритет, или который приводится с целью установления даты публикации другого ссылочного документа, а также в других целях (как указано)

O документ, относящийся к устному раскрытию, использованию,

P документ, опубликованный до даты международной подачи, но после даты испрашиваемого приоритета

T более поздний документ, опубликованный после даты международной подачи или приоритета, но приведенный для понимания принципа или теории, на которых основывается изобретение

X документ, имеющий наиболее близкое отношение к предмету поиска; заявленное изобретение не обладает новизной или изобретательским уровнем, в сравнении с документом, взятым в отдельности

Y документ, имеющий наиболее близкое отношение к предмету поиска; заявленное изобретение не обладает изобретательским уровнем, когда документ взят в сочетании с одним или несколькими документами той же категории, такая комбинация документов очевидна для специалиста

& документ, являющийся патентом-аналогом

| Дата действительного завершения международного поиска : | Дата отправки настоящего отчета о международном поиске : |
|---|---|
| 15 февраля 2011 (15.02.2011) | 17 марта 2011 (17.03.2011) |

| Наименование и адрес ISA/RU | Уполномоченное лицо : |
|---|---|
| ФГУ ФИПС<br>РФ, 123995, Москва, Г-59, ГСП-5, Бережковская наб., 30, 1<br>Факс :(499) 243-3337 | И. Кряжев<br>Телефон № (499) 240-25-91 |

Форма PCT/ISA/210 (второй лист )(июль 2009)

Textron Specialized Vehicles Inc., Exh. 1002, p. 198

# SYSTEM AND METHOD OF RESTRICTED ACCESS AREAS PROTECTING FROM OF PEDESTRIANS AND/OR GENERALLY WITHOUT A CABIN VEHICLES PENETRATION, WITH PERMISSIBLE ACCESS FOR THE VEHICLES WITH CABIN, INCLUDING VEHICLES OF CABRIOLET TYPE WITH RAISED ROOFS


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## Abstract

FIELD: protective devices.
SUBSTANCE: invention relates to device and method for preventing penetration of the violators into restricted access areas for pedestrians and vehicles. Power supply provides electrical power, with corresponding the intended use voltage and current, for supports (14), which may be electrical materials in the shell, from which flexible conductors (13) with a charge are protruding. They can be located protruding from the lower supports in the ground or from the supports on one or both side and/or top structures sides, setting the restricted access area (10) entry/exit points boundaries, and having the sizes and shapes, which are most suitable for the particular purpose. This system allows to prevent access by the pedestrian and/or generally without a cabin vehicles to the vehicles with a cabin authorized access area (10), including of cabriolet type with a raised roof vehicles, simultaneously or immediately before or after the passage of the authorized vehicle (-s), preventing penetration, intrusion, armed attacks, etc. in the restricted access area (10).
EFFECT: this system allows to prevent access by the pedestrian and/or generally without a cabin vehicles to the vehicles with a cabin authorized access zone.
6 cl, 3 dwg


## Description

FIELD OF TECHNOLOGY

[0001] The present patent application relates to a device and method for preventing intruders from entering restricted access places for pedestrians and vehicles in general without a cabin, with permitted access for vehicles with a closed or partially open cabin, including vehicles of the type convertible with a raised roof.

BACKGROUND

[0002] The protection of buildings, structures, factories, houses, land holdings, military installations, mansions or other restricted areas is generally an increasing and difficult task.

[0003] It has been confirmed that the use of barbed wire fences and barriers is not enough to deter a wave of penetration, armed attacks and intrusions even into military facilities, including cases of theft of weapons and the deaths of people who felt protected from such events.

[0004] Attraction of cameras, even night vision cameras, supplying electric charge to existing fences, installation of sirens, as well as protection with other means currently available, along with an increase in surveillance personnel, was implemented as a way to reduce the risk of intrusions, which always had small results of limited volume.

[0005] The risk of managing access to restricted areas increases during entry and exit of authorized persons. Numerous armed attacks occur at a time when previously blocked access is granted to local residents, guests, suppliers and other authorized persons, attackers take advantage of temporarily terminating access protection to such limited places, thereby making unauthorized entry with armed attacks and intrusions.

[0006] This vulnerability is significantly increased in the case of access by authorized persons by means of vehicles. In fact, there are numerous recorded cases in which persons carrying out an attack take action when vehicles carrying authorized persons are allowed to enter or leave, in general, after some preliminary identification has been made.

[0007] In fact, news is published almost daily, for example, in print and / or broadcast, about such incidents, most often indicating that such criminal events occur when the gates in such restricted areas are open to allow passage authorized vehicles entering or leaving.

[0008] the Prevention of such incidents requires the involvement of a large number of people prepared for such unforeseen incidents, as well as other means, thereby causing the use of significant resources and structures, which entails high costs.

TECHNICAL PROBLEM

[0009] Thus, there is an urgent need for security so that, in general or in particular, restricted areas are accessible only to authorized persons using vehicles with a closed or partially open cab, without the possibility of unauthorized entry of one or more persons on foot and / or in vehicles without a cab, even with strong armament, simultaneously with the vehicle or immediately before or after it.

[0010] There is also a concomitant need for the means used in a potential solution to this problem to be relatively inexpensive.

[0011] There is also a concomitant need for the means used in a potential solution to this problem to be relatively simple.

[0012] There is also an important need for the devices used to solve this problem to work continuously under all weather conditions.

[0013] It is also essential that the physical resources used are capable of efficient operation in the event of a breakdown or shutdown of an electric power source.

[0014] There is also a significant need for the means used to work in a similar manner during the day and night.

SUMMARY OF THE INVENTION

[0015] The present invention has been developed based on the concept of a Faraday cage, which explains that energy loaded into a conductive structure, such as a closed or partially open cabin of a wide range of motorized vehicles, is distributed through it from the outside.

[0016] Important applications include protecting homes, buildings, living quarters, and stadiums that use lightning rods and a grid that diverts electricity to the ground, thereby preventing potential damage to such structures caused by atmospheric discharges. This type of protection is better known as SPDA (English - "Atmospheric Discharge Protection System" - "System of protection against atmospheric discharges").

[0017] Another important application of the Faraday cage concept is to use frames in which electrical

equipment is placed to prevent electromagnetic interactions of one device with another.

SUMMARY OF THE INVENTION

[0018] The present invention was developed to prevent unauthorized entry of intruders - also at risk at the time of entry and / or exit of authorized persons transported in vehicles with closed or partially open cabs (cars, trucks, buses, vans, utility vehicles) , three-wheeled vehicles with a closed or partially open cabin, etc.) - into the space and / or from the restricted access space.

[0019] The searches conducted for specific topics did not reveal any previous decisions.

[0020] The devices in accordance with the present invention in a simplified form are depicted in the accompanying drawings, in which:

[0021] figure 1 shows a vehicle with a closed cabin, approaching a place of limited access;

[0022] figure 2 shows various types of conductors mounted on supports, all of which are used in the present invention; and

[0023] Figure 3 corresponds to a combined view and an exploded view of the conductors and supports used in the present invention with respect to penetration into a restricted access area.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention relates to devices and corresponding methods used to prevent unauthorized persons from entering and / or leaving restricted areas and / or immediately and / or immediately before or after the movement of authorized persons' entrance and / or exit, transported in vehicles with a closed or partially open cabin; or anytime.

[0025] The following definitions are used in this patent application:

[0026] a) restricted access zone 10 - refers to enclosed surfaces 100, i.e. defining a closed zone, of any size and shape, or open from one or more sides, with or without buildings in it; they can be either public or private, with entry and / or exit permitted only to certain persons transported in vehicles; that is, it is intended to prevent unauthorized persons and / or vehicles without cabs from entering on foot, i.e. to prevent intrusions, intrusions, armed attacks, etc .; in the present invention, for its functioning and / or application it is not required that the restricted access zones be limited by fixed protective structures, such as walls, fences, etc., it is possible that it was only a closed land plot; or open on one or more sides; with structures in it or without them;

[0027] b) entry / exit movement - the action of entering / leaving the restricted area;

[0028] c) entrance / exit 11 - the place where the entrance / exit movement of authorized persons carried in vehicles with a closed or partially open cabin occurs through temporary, intentional deactivation of physical obstacles (gates, barriers, etc.) when their availability; physical obstacles can be made in the form of a single product (for example, a gate) or two products that provide the ability to enter or exit when the vehicle is removed, while maintaining the localization of space 10 relative to the outer space;

[0029] d) vehicles with a closed or partially open cabin 12 - refers to vehicles equipped with an enclosed space or enclosure where authorized persons may be located; such as, for example, in the case of passenger cars, vans, buses, three-wheeled vehicles with a closed or partially open cabin, trucks and utility vehicles (without people in the container), tractors with a closed or partially open cabin; with the exception of motorcycles, vehicles without a hull, such as tractors without a cab, three-wheeled vehicles without a cab and the like;

[0030] e) conductors 13 are flexible electrically conductive elements having a core 131 made of plastic or other materials that:

[0031] e1) in the absence of an external force 132 arbitrarily remain in the initial physical position or physical readiness position;

[0032] e2) have physical properties of flexibility, thereby providing the ability to move from the ready position or the starting position and bending or folding them under the action of an external force 132, then returning to its original position when the action of the external force 132 is terminated; and

[0033] e3) are coated with metal (s) layer (s) 133 or other conductive metal materials (such as copper, aluminum, etc.) or other non-metallic electrically conductive materials that allow electric current to pass; and

g) supports 14: holders made of:

g1) an insulating material having resistance, or a material having resistance, having dielectrics 141 that contain electrically conductive materials that extend completely through it; or

g2) a non-insulating material having resistance, containing electrically conductive materials in the shell,

passing completely through it; or
g3) conductive materials in the shell,
which are located in the ground and / or side and / or upper structures defining the boundaries of the places of entry / exit 11 and from which the conductors 13 protrude; and which make it possible to transfer electric current from a power source - which may be a public network or auxiliary and / or alternative sources, such as generators, uninterruptible power supplies, etc. - conductors 13, which then receive power.
[0035] For the implementation of the present invention, restricted access zones 10 are surrounded at all their boundaries 100, or only at entry / exit points 11 with supports 14 provided with conductors 13, all of which are connected in series or parallel to a power source.
[0036] In an embodiment of the present invention, the conductors 13 are the same, linear and have a length, typically in the range of 1 to 3 meters, which may extend beyond these values to ensure that the configurations are more suitable for a particular location.
[0037] In another embodiment of the present invention, all conductors 13 are curved.
[0038] In another embodiment of the present invention, all conductors 13 are made in accordance with a zigzag pattern.
[0039] In another embodiment, the conductors 13 have a different shape, including the shape of tree conductors.
[0040] In another embodiment, the conductors 13 have various shapes and sizes, including the shape and dimensions of tree-shaped conductors.
[0041] In an embodiment of the present invention, the supports 14 are made of a continuous insulating base such as porcelain, ceramic, non-conductive plastic, etc. - made at intervals of 5 to 20 centimeters - or other more suitable distances, according to specific circumstances - in places 142, where the conductors 13 protrude, are properly insulated, including from contact with the ground, and with a seal to prevent water or other elements. Inside them passes an electric cable connected to each of the output conductors 13.
[0042] In an embodiment of the present invention, the supports 14 are comprised of a continuous non-insulating base — for example, metal or other conductive material, etc. - an electric cable in a sheath, made at intervals of 5 to 20 centimeters - or other more suitable distances, according to specific circumstances - in places 142, where the conductors 13 protrude, are properly insulated, including from contact with the ground, and with the seal, preventing the ingress of water or other elements. Inside them passes an electric cable connected to each of the output conductors 13.
[0043] In another embodiment, the supports 14 are comprised of an insulating electric cable spaced from 5 to 20 centimeters apart — or other more suitable distances, according to specific circumstances — at locations 142 where the conductors 13 protrude are properly insulated, including from contact with the ground, and with a seal that prevents the ingress of water or other elements.
[0043] In another embodiment, non-insulating supports 14 are located at the entry / exit points (11) of the restricted access area (10), and may be grounded.
[0044] In another embodiment of the present invention, a set of supports 14 that define entry / exit points 11 is located in the structures — see FIG. 3 - made on the one hand (or A, or B, or C, or D) of the entrance (11).
[0045] In another embodiment of the present invention, supports 14 are located in structures — see FIG. 3 - made from two sides (A and B, A and C, A and D, B and C, B and D, etc.) of input 11.
[0046] In other embodiments of the present invention, supports 14 may be located simultaneously on three or all sides — see FIG. 3:
[0047] a) in the upper portion D and on both sides B and C of the inlet 11, for example; or
[0048] b) on land A, on both sides B and C and on the upper portion D of entry 11.
[0049] For each of these options, the conductors 13 may have a shape that is considered most suitable for constructing a stretched mesh surface.
[0050] The present invention operates as described below:
[0051] when one or more vehicles are approaching entry / exit points 11 in restricted area 10,
[0052] a) if there is a physical obstacle in the input / output 11, containing a gate, a barrier, a movable fence, etc .:
[0053] a1) as soon as authorized persons transported in vehicles with a closed or partially open cabin are visually or otherwise recognized and the entrance is allowed, the physical obstacle of entry / exit 11 is removed, or by moving it up, sliding to one side or otherwise removing it thus, leaving the conductors 13

exposed and lying in the path of the vehicle (s) entering (leaving) or leaving (them). In some embodiments, the same result can be achieved using remote control. Such conductors have an electric charge, since they are connected to supports 14 connected to a power source, and have sufficient uniformity and flexibility to bend from one side to the other when in contact with transports (and) by means (s) entering or leaving zone 10 and / or from restricted area 10;
[0054] a2) when the vehicle (s) are passing through the network of conductors 13, an attempt of any offender (s) to take advantage of the possibility of penetration of the vehicle (s), either simultaneously, or before or after them when the physical obstacle to the entrance / exit of restricted area 10 is currently deactivated, the trespassers will receive an electrical discharge that will neutralize them, thereby preventing penetration. Authorized persons transported in the vehicle (s) will not be subjected to anything;
[0055] b) if there is no physical obstacle in the entrance / exit 11 (containing a gate, a barrier, a moving fence, etc.):
[0056] b1) everything happens the same as in step (a2), but in this case, without the stage of recognizing authorized persons or activating by remote control from the vehicle (s).
[0057] In other words, the invention will function both with and without physical obstruction. In fact, such a physical obstacle is only convenient for preventing incidents with random persons, children, animals, blind people, etc., which might inadvertently wish to enter restricted area 10. In fact, it is an element that is not relevant to the present invention.
[0058] It should be noted that even if the intruder (s), trying to neutralize the effect of the present invention, wear shoes made of rubber or other insulating materials, they will not be able to avoid getting an electric discharge when touching any of the flexible conductors 13.
[0059] In an embodiment, such conductors 13 are powered by low voltage and high current.
[0060] In another embodiment, such conductors 13 may be powered by voltage and current, in accordance with features suitable for the particular application.
[0061] After the vehicle (s) have entered or exited, the conductors 13 will return from their curved positions to their original position. Such as a substantially vertical or nearly vertical position, but depending on the particular suitable location, it may be any other position. It can even be a horizontal position when the conductors 13 are, for example, on the wall not on the upper section, but on the side section, together with other conductors on the upper section or not.
[0062] In embodiments where applicable, an obstacle to enter / exit 11 may return to the closed position, thereby preventing movement as a whole. Appropriate activation can be performed by specialized personnel or by remote control.
[0063] The present invention has been described with respect to its general aspects. The description should not be construed as limiting. A person skilled in the art will be able to easily adapt new devices or circuits that will not fall outside the scope of the relevant scope when applying the spirit of the invention.
[0064] Thus, the specific components, structures, steps, or features of the embodiments described herein can be combined in any suitable manner into one or more separate embodiments.
[0065] Therefore, it is assumed that the scope of the described embodiments is not limited to the specific forms of the above described embodiments, but is determined by the correct interpretation of the paragraphs of the following claims.

## Claims

1. The system of protection of restricted access zones from penetrations of pedestrians and / or vehicles in general without a cabin, with authorized access for vehicles with a cabin, including vehicles of the type of convertible with a raised roof, characterized in that it contains:
a) conductors (13), consisting of electrically conductive flexible elements with a core (131) of plastic or other materials, which in the absence of external force (132) arbitrarily remain in their original position or at rest; which have been given the properties of flexibility, providing the possibility of their movement from a state of rest or initial position and their bending or folding under the influence of any external force (132), then returning to their original position when the action of the external force (132) is terminated; and which are coated with a conductive layer (133) or conductive layers (133), such as copper, aluminum, etc., or other

conductive materials that allow electric current to pass through;
b) supports (14), which are supports made of insulating material with resistance or with dielectrics (141), moreover, it can be electric cables in a sheath, located on the ground and / or in side and / or upper structures that define places (11) of the entry / exit and from which the conductors (13) protrude; and providing the possibility of the passage of electric current from the power source (15) to the conductors (13); and
c) a power source, which may be a public network or auxiliary sources, such as generators, uninterruptible power supplies, etc., supplying electric current to supports (14) and conductors (13); and preferably, but not necessarily:
d) two support rails (14) with grounded conductors (13) located in front of and behind the supports (14), discharging the residual electricity of the vehicle after it passes through them.
2. The system for protecting restricted areas from penetration by pedestrians and / or vehicles in general without a cab, with authorized access for vehicles with a cab, including vehicles of the type of convertible with a raised roof, according to claim 1, characterized in that
conductors (13) can be the same, linear, have a length, usually in the range from 1 to 3 meters, and can go beyond these values in the most appropriate way for a particular place; all conductors are curved; or all conductors have a zigzag shape and / or various shapes; or various shapes and sizes.
3. The system for protecting restricted areas from penetration by pedestrians and / or vehicles in general without a cabin, with permitted access for vehicles with a cabin, including vehicles of the type of convertible with a raised roof, according to claim 1, characterized in that
the supports (14) are made of a non-insulating base, for example metal or other conductive material, each in the range from 5 to 20 cm or at other more suitable distances, depending on the specific circumstances, at the places (142) of the output of the conductor (13), insulated properly in a manner that has a seal to prevent ingress of water or other elements; and through which an electric cable with a sheath passes, connected in an isolated manner to each of the protruding conductors (13).
4. The system for protecting restricted areas from penetration by pedestrians and / or vehicles in general without a cab, with authorized access for vehicles with a cab, including vehicles of the type of convertible with a raised roof, according to claim 1, characterized in that
the supports (14) are located in the places (11) of the entrance / exit of the restricted access zone (10) and can be buried in the ground; and / or structures (142) made on one side or on both sides of the entrance (11); and / or located hanging from the upper structures; and / or located simultaneously on the ground, on both sides of the entrance (11) and hanging from the upper structure.
5. The system for protecting restricted areas from penetration by pedestrians and / or vehicles in general without a cabin, with permitted access for vehicles with a cabin, including vehicles of the type of convertible with a raised roof, according to claim 1, characterized in that
it can be performed without supports (14), replaced by a conductive cable in a sheath in which conductors (13) are directly enclosed, insulated from leakage of electric current, and / or ingress of water, and / or other external factors.
6. A method for protecting restricted access areas from penetration by pedestrians and / or vehicles in general without a cabin, with permitted access for vehicles with a cabin, including vehicles such as a convertible with a raised roof, according to claim 1, characterized in that includes the following steps:
a) the environment of restricted access zones (10) from the inside along the entire length of their borders (100) or only in places (11) of the entrance / exit, supports (14) equipped with conductors (13), all of which are connected in series or in parallel with the source ( 15) nutrition;
b) when one or more vehicles approach the places (11) of entry / exit of zone (10) of restricted access, if there is a physical obstacle with the vehicle or vehicles hidden, in the place (11) of entry / exit containing a gate, a barrier , mobile fence, etc., pending recognition, by visual or other means, of authorized persons transported in vehicles with a closed or partially open cabin, including vehicles such as a convertible with a raised roof, and permission to access; or launching a remote control available in a vehicle or vehicles;
b1) waiting for the physical obstacle to be removed from the place (11) of entry / exit by moving upwards or by sliding, or in any other way, leaving the conductors (13) in the path of an entering or leaving vehicle or vehicles;
b2) getting into restricted access area (10);

c) getting into restricted access zone (10), passing through conductors (13), if there is no physical obstacle in the place (11) of entry / exit containing a gate, a barrier, etc., a moving fence, etc.

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*G08B 15/00* (2006.01)
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ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

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## (54) СИСТЕМА И СПОСОБ ЗАЩИТЫ ЗОН ОГРАНИЧЕННОГО ДОСТУПА ОТ ПРОНИКНОВЕНИЙ ПЕШЕХОДОВ И/ИЛИ ТРАНСПОРТНЫХ СРЕДСТВ В ЦЕЛОМ БЕЗ КАБИНЫ, С РАЗРЕШЕННЫМ ДОСТУПОМ ДЛЯ ТРАНСПОРТНЫХ СРЕДСТВ С КАБИНОЙ, В ТОМ ЧИСЛЕ ТРАНСПОРТНЫХ СРЕДСТВ ТИПА КАБРИОЛЕТ С ПОДНЯТОЙ КРЫШЕЙ

(57) Реферат:

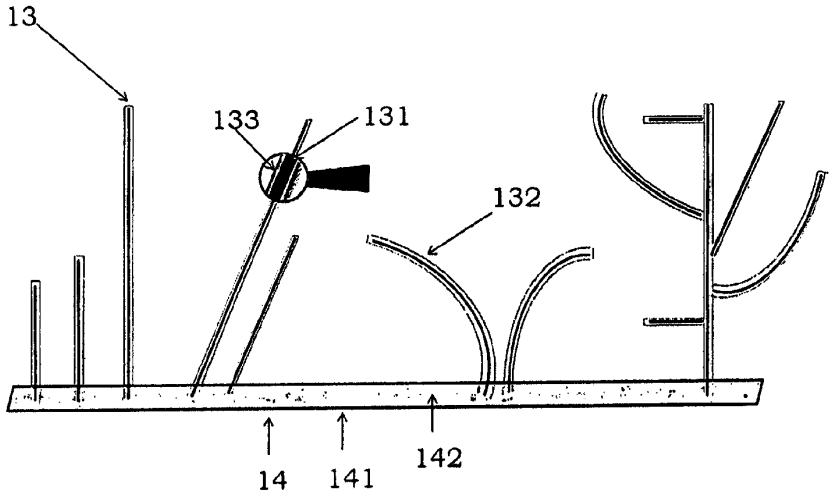
Изобретение относится к устройству и способу предотвращения проникновения нарушителей в места ограниченного доступа для пешеходов и транспортных средств. Источник питания обеспечивает электрическое питание, с соответствующим напряжением и током для запланированного использования, для опор (14), которые могут представлять собой электрические материалы в оболочке, из которых выступают гибкие проводники (13) с зарядом. Они могут быть расположены выступающими из нижних опор в земле или из опор с одной или обеих сторон боковых и/или верхних конструкций, задающих границы мест входа/выхода в зону (10) ограниченного доступа, и обладающих размерами и формами, которые наиболее подходят для конкретного назначения. Данная система обеспечивает возможность предотвращения получения доступа пешеходом и/или транспортными средствами в целом без кабины к зоне (10), с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, одновременно или непосредственно перед или после прохождения авторизованного (ых) транспортного(ых) средства(средств),

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предотвращая проникновения, вторжения, вооруженные нападения и т.д. в зоне (10) ограниченного доступа. 2 н. и 4 з.п. ф-лы, 3 ил.




Фиг. 2

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### (54) SYSTEM AND METHOD OF RESTRICTED ACCESS AREAS PROTECTING FROM OF PEDESTRIANS AND/OR GENERALLY WITHOUT A CABIN VEHICLES PENETRATION, WITH PERMISSIBLE ACCESS FOR THE VEHICLES WITH CABIN, INCLUDING VEHICLES OF CABRIOLET TYPE WITH RAISED ROOFS

(57) Abstract:

FIELD: protective devices.

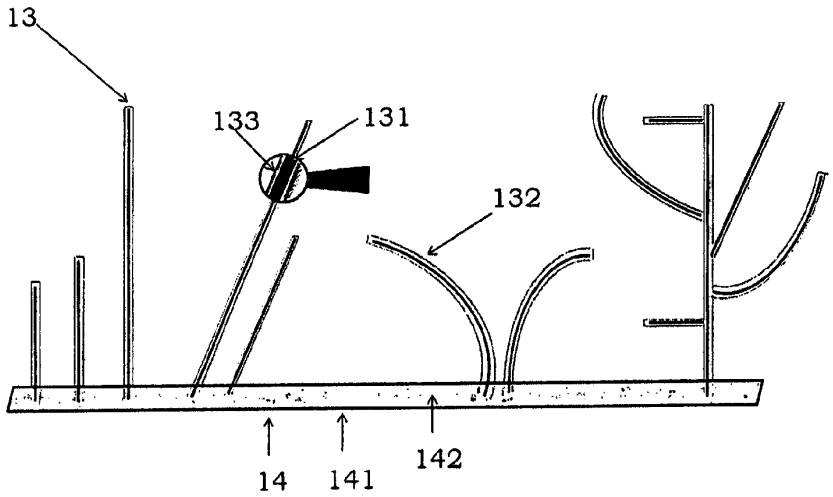
SUBSTANCE: invention relates to device and method for preventing penetration of the violators into restricted access areas for pedestrians and vehicles. Power supply provides electrical power, with corresponding the intended use voltage and current, for supports (14), which may be electrical materials in the shell, from which flexible conductors (13) with a charge are protruding. They can be located protruding from the lower supports in the ground or from the supports on one or both side and/or top structures sides, setting the restricted access area (10) entry/exit points boundaries, and having the sizes and shapes, which are most suitable for the particular purpose. This system allows to prevent access by the pedestrian and/or generally without a cabin vehicles to the vehicles with a cabin authorized access area (10), including of cabriolet type with a raised roof vehicles, simultaneously or immediately before or after the passage of the authorized vehicle (-s), preventing penetration, intrusion, armed attacks, etc. in the restricted access area (10).

EFFECT: this system allows to prevent access by the pedestrian and/or generally without a cabin vehicles to the vehicles with a cabin authorized access zone.

6 cl, 3 dwg



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Фиг. 2

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## ОБЛАСТЬ ТЕХНИКИ

[0001] Настоящая заявка на патент на изобретение относится к устройству и способу предотвращения проникновения нарушителей в места ограниченного доступа для пешеходов и транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с закрытой или частично открытой кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей.

## УРОВЕНЬ ТЕХНИКИ

[0002] Защита зданий, конструкций, заводов, домов, земельных владений, военных объектов, особняков или других зон ограниченного доступа в целом представляет собой возрастающую и трудноразрешимую задачу.

[0003] Было подтверждено, что использование решеток и ограждений из колючей проволоки не достаточно для удержания волны проникновений, вооруженных нападений и вторжений даже в объекты вооруженных сил, в том числе случаев с кражей оружия и гибелью людей, которые чувствовали себя защищенными от таких событий.

[0004] Привлечение камер, даже камер ночного видения, подведение электрического заряда к имеющимся ограждениям, установка сирен, а также защита другими средствами, доступными в настоящее время, наряду с увеличением персонала наблюдения, было реализовано, как способ снижения риска вторжений, что всегда имело малые результаты ограниченного объема.

[0005] Риск при управлении доступа к местам ограниченного доступа увеличивается во время входа и выхода авторизованных лиц. Многочисленные вооруженные нападения случаются в тот момент, когда ранее заблокированный доступ предоставляется местным жителям, гостям, поставщикам и другим авторизованным лицам, злоумышленники пользуются преимуществом временного прекращения защиты доступа в такие ограниченные места, осуществляя тем самым несанкционированное проникновение с совершением вооруженных нападений и вторжений.

[0006] Такая уязвимость существенным образом увеличивается в случае осуществления доступа авторизованными лицами с помощью транспортных средств. В действительности, существуют многочисленные зафиксированные случаи, при которых лица, осуществляющие нападение, предпринимают действия тогда, когда транспортным средствам, перевозящим авторизованных лиц, допускается въезд или выезд, в целом после их некоторой предварительной идентификации.

[0007] В действительности, практически ежедневно публикуются новости, например, в печатных изданиях и/или широком вещании, о подобных происшествиях, чаще всего с указанием на то, что такие преступные события происходят, когда ворота в таких местах ограниченного доступа открыты для обеспечения прохождения авторизованных въезжающих или выезжающих транспортных средств.

[0008] Предотвращение таких происшествий требует привлечения большого числа лиц, подготовленных к таким непредвиденным случаям, а также других средств, обуславливая тем самым использование значительных ресурсов и структур, что влечет за собой высокие затраты.

## ТЕХНИЧЕСКАЯ ЗАДАЧА

[0009] Таким образом, существует острая необходимость в отношении безопасности того, чтобы, в целом или в частности, зоны ограниченного доступа были доступны только лишь авторизованным лицам с использованием транспортных средств с закрытой или частично открытой кабиной, без возможности осуществления несанкционированного проникновения одного или более лиц пешком и/или на транспортных средствах без кабины, даже с сильным вооружением, одновременно с транспортным средством или



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непосредственно перед или после него.

[0010] Также имеет место сопутствующая необходимость в том, чтобы средства, используемые в потенциальном решении данной проблемы, были относительно недорогими.

[0011] Также имеет место сопутствующая необходимость в том, чтобы средства, используемые в потенциальном решении данной проблемы, были относительно простыми.

[0012] Также имеет место важная необходимость в том, чтобы устройства, используемые для решения данной проблемы, работали непрерывно при любых погодных условиях.

[0013] Также существенно, чтобы используемые физические ресурсы были выполнены с возможностью эффективной работы в случае поломки или выключения источника электроэнергии.

[0014] Также имеет место существенная необходимость в том, чтобы используемые средства могли работать подобным образом в дневное и в ночное время суток.

## РАСКРЫТИЕ СУЩНОСТИ ИЗОБРЕТЕНИЯ

[0015] Настоящее изобретение было разработано на основе концепции клетки Фарадея, которой объясняется то, что энергия, загруженная в проводящую конструкцию, такую как закрытая или частично открытая кабина широкого ряда моторизированных транспортных средств, распространяется по ней снаружи.

[0016] В число важных вариантов применения входит защита домов, строений, жилых помещений и стадионов, в которых используются громоотводы и сетка, которая отводит электроэнергию в землю, предотвращая тем самым потенциальное повреждение таких конструкций, обуславливаемое атмосферными разрядами. Данный вид защиты больше известен как SPDA (англ. - «Atmospheric Discharge Protection System» - «Система защиты от атмосферных разрядов»).

[0017] Другой важный вариант применения концепции клетки Фарадея заключается в использовании каркасов, в которые помещается электрическое оборудование с целью предотвращения электромагнитных взаимодействий одного устройства с другими.

## КРАТКОЕ ОПИСАНИЕ ИЗОБРЕТЕНИЯ

[0018] Настоящее изобретение было разработано с целью предотвращения несанкционированного проникновения нарушителей - также в подверженное риску время входа и/или выхода авторизованных лиц, перевозимых в транспортных средствах с закрытой или частично открытой кабиной (автомобилях, грузовиках, автобусах, фургонах, транспортных средств коммунальных предприятий, трехколесных транспортных средств с закрытой или частично открытой кабиной и т.д.) - в пространство и/или из пространства ограниченного доступа.

[0019] Поиски, проведенные в отношении конкретных тем, не выявил каких-либо предшествующих решений.

[0020] Устройства в соответствии с настоящим изобретением в упрощенном виде изображены на сопроводительных чертежах, на которых:

[0021] на фигуре 1 изображено транспортное средство с закрытой кабиной, приближающееся к месту ограниченного доступа;

[0022] на фигуре 2 изображены различные виды проводников, установленных на опорах, при этом все они используются в настоящем изобретении; и

[0023] Фигура 3 соответствует комбинированному виду и изображению в разобранном виде проводников и опор, используемых в настоящем изобретении, применительно к проникновению в место ограниченного доступа.



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ОСУЩЕСТВЛЕНИЕ ИЗОБРЕТЕНИЯ

[0024] Настоящее изобретение относится к устройствам и соответствующим способам, применяемым с целью предотвращения входа и/или выхода неавторизованных лиц в зоны и/или из зон ограниченного доступа, одновременно и/или непосредственно перед или после движения входа и/или выхода авторизованных лиц, перевозимых в транспортных средствах с закрытой или частично открытой кабиной; или в любое время.

[0025] В настоящей заявке на патент на изобретение используются следующие определения:

[0026] а) зоны 10 ограниченного доступа - относится к замкнутым поверхностям 100, т.е. определяющим закрытую зону, любого размера и формы, или открытую с одной или более сторон, со строениями в ней или без них; они могут быть как общественными, так и частными, причем вход и/или выход разрешен только лишь некоторым лицам, перевозимым в транспортных средствах; то есть она предназначена для предотвращения пешего проникновения неавторизованных лиц и/или транспортных средств без кабины, т.е. для предотвращения проникновений, вторжений, вооруженных нападений и т.д.; в настоящем изобретении для его функционирования и/или применения не требуется, чтобы зоны ограниченного доступа были ограничены неподвижными защитными сооружениями, такими как стены, заборы и т.д., возможно, чтобы она представляла собой лишь закрытый земельный участок; или открытый с одной или более сторон; с сооружениями в ней или без них;

[0027] б) движение входа/выхода - действие вхождения/покидания зоны ограниченного доступа;

[0028] в) вход/выход 11 - место, где происходит движение входа/выхода авторизованных лиц, перевозимых в транспортных средствах с закрытой или частично открытой кабиной, посредством временной, намеренной деактивации физических препятствий (ворот, шлагбаумов и т.д.) при их наличии; физические препятствия могут быть выполнены в форме единого изделия (например, ворота) или двух изделий, которые обеспечивают возможность входа или выхода при удалении транспортного средства, сохраняя локализацию пространства 10 относительно наружного пространства;

[0029] г) транспортные средства с закрытой или частично открытой кабиной 12 - относится к транспортным средствам, снабженным закрытым пространством или корпусом, где могут находиться авторизованные лица; таким как, например, в случаях пассажирских автомобилей, фургонов, автобусов, трехколесных транспортных средств с закрытой или частично открытой кабиной, грузовиков и транспортных средств коммунальных предприятий (без людей в контейнере), тракторов с закрытой или частично открытой кабиной; за исключением мотоциклов, транспортных средств без корпуса, таких как трактора без кабины, трехколесные транспортные средства без кабины и тому подобное;

[0030] е) проводники 13 - гибкие электропроводящие элементы, имеющие сердцевину 131, выполненную из пластика или других материалов, которые:

[0031] е1) в отсутствие внешней силы 132 произвольно остаются в исходном физическом положении или физическом положении готовности;

[0032] е2) имеют физические свойства гибкости, обеспечивая тем самым возможность перемещения из положения готовности или исходного положения и их изгибания или сворачивания под действием внешней силы 132, возвращаясь после этого в исходное положение, когда действие внешней силы 132 прекращено; и

[0033] е3) покрыты металлическим(и) слоем(ями) 133 или другими проводящими



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металлическими материалами (такими как медь, алюминий и т.д.) или другими неметаллическими электропроводящими материалами, которые обеспечивают возможность пропускания электрического тока; и

ж) опоры 14: держатели, выполненные из:

ж1) изолирующего материала, обладающего сопротивлением, или материала, обладающего сопротивлением, имеющего диэлектрики 141, которые содержат электропроводящие материалы, проходящие полностью через него; или

ж2) неизолирующего материала, обладающего сопротивлением, содержащего электропроводящие материалы в оболочке, проходящие полностью через него; или

ж3) электропроводящих материалов в оболочке,

которые расположены в земле и/или боковых и/или верхних конструкциях, определяющих границы мест входа/выхода 11 и из которых выступают проводники 13; и которые обеспечивают возможность передачи электрического тока из источника питания - который может представлять собой сеть общего пользования или вспомогательные и/или альтернативные источники, такие как генераторы, источники бесперебойного питания, и т.д. - проводникам 13, которые после этого получают питание.

[0035] Для осуществления настоящего изобретения, зоны 10 ограниченного доступа окружены по всем их границам 100 или только в местах 11 входа/выхода опорами 14, снабженными проводниками 13, при этом все они соединены последовательно или параллельно с источником питания.

[0036] В варианте реализации настоящего изобретения проводники 13 являются одинаковыми, линейными и имеют длину, как правило, в диапазоне от 1 до 3 метров, которая может выходить за пределы данных значений, для обеспечения того, чтобы конфигурации были более подходящими для конкретного места.

[0037] В другом варианте реализации настоящего изобретения все проводники 13 являются изогнутыми.

[0038] В другом варианте реализации настоящего изобретения все проводники 13 выполнены в соответствии с зигзагообразным шаблоном.

[0039] В другом варианте реализации проводники 13 имеют различную форму, в том числе форму древовидных проводников.

[0040] В другом варианте реализации проводники 13 имеют различную форму и размеры, в том числе форму и размеры древовидных проводников.

[0041] В варианте реализации настоящего изобретения опоры 14 выполнены из непрерывной изолирующей основы - например, фарфора, керамики, непроводящего пластика и т.д. - выполненные с интервалами от 5 до 20 сантиметров - или другими более подходящими расстояниями, согласно конкретным обстоятельствам - в местах 142, где проводники 13 выступают, надлежащим образом изолированы, в том числе от контакта с землей, и с уплотнением, предотвращающим попадание воды или других элементов. Внутри них проходит электрический кабель, соединенный с каждым из выходящих проводников 13.

[0042] В варианте реализации настоящего изобретения опоры 14 состоят из непрерывной неизолирующей основы - например, металла или другого проводящего материала, и т.д. - электрического кабеля в оболочке, выполненного с интервалами от 5 до 20 сантиметров - или другими более подходящими расстояниями, согласно конкретным обстоятельствам - в местах 142, где проводники 13 выступают, надлежащим образом изолированы, в том числе от контакта с землей, и с уплотнением, предотвращающим попадание воды или других элементов. Внутри них проходит



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электрический кабель, соединенный с каждым из выходящих проводников 13.

[0043] В другом варианте реализации опоры 14 состоят из изолирующего электрического кабеля, выполненного с интервалами от 5 до 20 сантиметров - или другими более подходящими расстояниями, согласно конкретным обстоятельствам - в местах 142, где проводники 13 выступают, надлежащим образом изолированы, в том числе от контакта с землей, и с уплотнением, предотвращающим попадание воды или других элементов.

[0043] В другом варианте реализации неизолирующие опоры 14 расположены в местах (11) входа/выхода зоны (10) ограниченного доступа, и могут быть заземлены.

[0044] В другом варианте реализации настоящего изобретения набор опор 14, которые ограничивают места 11 входа/выхода, расположен в конструкциях - см. фиг. 3 - выполненных с одной стороны (или A, или B, или C, или D) входа (11).

[0045] В другом варианте реализации настоящего изобретения опоры 14 расположены в конструкциях - см. фиг. 3 - выполненных с двух сторон (A и B, A и C, A и D, B и C, B и D, и т.д.) входа 11.

[0046] В других вариантах реализации настоящего изобретения опоры 14 могут быть расположены одновременно с трех или всех сторон - см. фиг. 3:

[0047] а) на верхнем участке D и с обеих сторон B и C входа 11, например; или

[0048] б) на земле A, с обеих сторон B и C и на верхнем участке D входа 11.

[0049] Для каждого из данных вариантов, проводники 13 могут иметь форму, считающуюся наиболее подходящей для того, чтобы сконструировать натянутую сеточную поверхность.

[0050] Настоящее изобретение функционирует так, как описано ниже:

[0051] когда одно или более транспортных средств приближаются к местам 11 входа/выхода в зоне 10 ограниченного доступа,

[0052] а) если имеет место физическое препятствие во входе/выходе 11, содержащее ворота, шлагбаум, подвижное заграждение и т.д.:

[0053] а1) как только авторизованные лица, перевозимые в транспортных средствах с закрытой или частично открытой кабиной, визуально или иным образом распознаны и вход разрешен, физическое препятствие входа/выхода 11 удаляется, или путем его перемещения вверх, его скольжения вбок или удаления иным образом, оставляя проводники 13 выставленными и лежащими на пути въезжающего(их) или выезжающего (их) транспортного(ых) средства(средств). В некоторых вариантах реализации тот же результат может быть достигнут с использованием дистанционного управления. Такие проводники имеют электрический заряд, поскольку они присоединены к опорам 14, соединенным с источником питания, и обладают достаточной однородностью и гибкостью для изгибания от одной стороны к другой при контакте с транспортым(и) средством(ами), въезжающими или выезжающими в зону 10 и/или из зоны 10 ограниченного доступа;

[0054] а2) при прохождении транспортного(ых) средства (средств) через сетку проводников 13, попытка любого(ых) нарушителя(ей) воспользоваться преимуществом возможности проникновения транспортного(ых) средства(средств), или одновременно, или перед или после них, когда физическое препятствие входа/выхода зоны 10 ограниченного доступа в данный момент деактивировано, приведет к тому, что нарушители получат электрический разряд, который их обезвредит, тем самым предотвратив проникновение. Авторизованные лица, перевозимые в транспортном(ых) средстве(ах), не будут ничему подвергнуты;

[0055] б) если во входе/выходе 11 отсутствует какое-либо физическое препятствие



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(содержащее ворота, шлагбаум, подвижное заграждение и т.д.):

[0056] б1) все происходит так же, как и на этапе (а2), но в данном случае без этапа распознавания авторизованных лиц или активации с помощью дистанционного управления из транспортного(ых) средства (средств).

[0057] Иными словами, изобретение будет функционировать как при наличии физического препятствия, так и без него. В действительности, такое физическое препятствие является удобным только лишь для предотвращения инцидентов со случайными лицами, детьми, животными, слепыми людьми и т.д., которые непреднамеренно могут пожелать попасть в зону 10 ограниченного доступа. Фактически, оно представляет собой элемент, который не относится к настоящему изобретению.

[0058] Следует отметить, что даже если нарушитель(и), пытающиеся нейтрализовать действие настоящего изобретения, одевают обувь, выполненную из резиновых или других изолирующих материалов, они не смогут избежать получения электрического разряда при прикосновении к любому из гибких проводников 13.

[0059] В варианте реализации такие проводники 13 получают питание от низкого напряжения и высокого тока.

[0060] В другом варианте реализации такие проводники 13 могут получать питание от напряжения и тока, в соответствии с особенностями, подходящими для соответствующего конкретного случая применения.

[0061] После движения въезда или выезда транспортного(ых) средства(средств), проводники 13 возвратятся из своих изогнутых положений в свое исходное положение. Такое как, по существу, вертикальное или почти вертикальное положение, но в зависимости от конкретного подходящего места оно может представлять собой любое другое положение. Оно может представлять собой даже горизонтальное положение, когда проводники 13 находятся, например, на стене не на верхнем участке, а на боковом участке, вместе с другими проводниками на верхнем участке или нет.

[0062] В вариантах реализации, где это применимо, препятствие для входа/выхода 11 может возвращаться в закрытое положение, предотвращая тем самым движение в целом. Соответствующая активация может быть выполнена специализированным персоналом или путем дистанционного управления.

[0063] Настоящее изобретение было описано в отношении его общих аспектов. Описание не следует толковать в качестве ограничения. Специалист в данной области техники сможет легко приспособить новые устройства или схемы, которые не будут выходит за рамки соответствующего объема при применении замысла изобретения.

[0064] Таким образом, конкретные компоненты, конструкции, этапы или признаки описанных в настоящем документе вариантов реализации могут быть скомбинированы любым подходящим образом в один или более отдельных вариантов реализации.

[0065] Следовательно, предполагается, что объем описанных вариантов реализации не ограничен конкретными формами вышеописанного варианта реализации, а определяется правильным толкованием пунктов нижеследующей формулы изобретения.

## (57) Формула изобретения

1. Система защиты зон ограниченного доступа от проникновений пешеходов и/или транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, характеризующаяся тем, что содержит:

а) проводники (13), состоящие из электропроводящих гибких элементов с сердцевиной (131) из пластика или других материалов, которые в отсутствие внешней силы (132)



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произвольно остаются в исходном положении или в состоянии покоя; которым приданы свойства гибкости, обеспечивая возможность их перемещения из состояния покоя или исходного положения и их изгибания или сворачивания под действием какой-либо внешней силы (132), возвращаясь после этого в исходное положение, когда действие внешней силы (132) прекращено; и которые покрыты проводящим слоем (133) или проводящими слоями (133), такими как медь, алюминий и т.д., или другими проводящими материалами, которые обеспечивают возможность пропускания электрического тока;

б) опоры (14), представляющие собой опоры, выполненные из изолирующего материала с сопротивлением или с диэлектриками (141), причем он может представлять собой электрические кабели в оболочке, расположенные на земле и/или в боковых и/или верхних конструкциях, которые определяют места (11) входа/выхода и из которых выступают проводники (13); и обеспечивающие возможность прохождения электрического тока от источника (15) питания к проводникам (13); и

в) источник питания, который может представлять собой сеть общего пользования или вспомогательные источники, такие как генераторы, источники бесперебойного питания и т.д., подводящий электрический ток к опорам (14) и проводникам (13); и предпочтительно, но не обязательно:

г) две опорные рейки (14) с заземленными проводниками (13), расположенные перед и за опорами (14), разряжающие остаточное электричество транспортного средства после его прохождения через них.

2. Система защиты зон ограниченного доступа от проникновений пешеходов и/или транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, по п. 1, характеризующаяся тем, что

проводники (13) могут быть одинаковыми, линейными, иметь длину, как правило, находящуюся в диапазоне от 1 до 3 метров, и могут выходить за пределы данных значений наиболее подходящим образом для конкретного места; все проводники имеют изогнутую форму; или все проводники имеют зигзагообразную форму и/или различные формы; или различные формы и размеры.

3. Система защиты зон ограниченного доступа от проникновений пешеходов и/или транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, по п. 1, характеризующаяся тем, что

опоры (14) выполнены из неизолирующей основы, например металла или другого проводящего материала, каждая в интервале от 5 до 20 см или на других более подходящих расстояниях, в зависимости от конкретных обстоятельств, в местах (142) выхода проводника (13), изолированного должным образом и имеющего уплотнение для предотвращения попадания воды или других элементов; и через которые проходит электрический кабель с оболочкой, соединенный изолированным образом с каждым из выступающих проводников (13).

4. Система защиты зон ограниченного доступа от проникновений пешеходов и/или транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, по п. 1, характеризующаяся тем, что

опоры (14) расположены в местах (11) входа/выхода зоны (10) ограниченного доступа и могут быть зарыты в землю; и/или конструкциях (142), выполненных с одной стороны или с обеих сторон места (11) входа; и/или расположены свисающими с верхних конструкций; и/или расположены одновременно на земле, с обеих сторон места (11)



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входа и свисающими с верхней конструкции.

5. Система защиты зон ограниченного доступа от проникновений пешеходов и/или транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, по п. 1, характеризующаяся тем, что

она может быть выполнена без опор (14), замененных проводящим кабелем в оболочке, в который непосредственно заключены проводники (13), снабженные изоляцией от утечки электрического тока, и/или попадания воды, и/или других внешних факторов.

6. Способ защиты зон ограниченного доступа от проникновений пешеходов и/или транспортных средств в целом без кабины, с разрешенным доступом для транспортных средств с кабиной, в том числе транспортных средств типа кабриолет с поднятой крышей, по п. 1, характеризующийся тем, что он включает следующие этапы:

а) окружение зон (10) ограниченного доступа изнутри по всей длине их границ (100) или только в местах (11) входа/выхода, опор (14), снабженных проводниками (13), все из которых соединены последовательно или параллельно с источником (15) питания;

б) при приближении одного или более транспортных средств к местам (11) входа/выхода зоны (10) ограниченного доступа, если имеется физическое препятствие, с укрытием транспортного средства или транспортных средств, в месте (11) входа/выхода, содержащее ворота, шлагбаум, подвижное заграждение и т.д., ожидание распознания, визуальными или другими средствами, авторизованных лиц, перевозимых в транспортных средствах с закрытой или частично открытой кабиной, в том числе транспортных средствах типа кабриолет с поднятой крышей, и разрешения на доступ; или запуск дистанционного управления, доступного в транспортном средстве или транспортных средствах;

б1) ожидание удаления физического препятствия места (11) входа/выхода движением вверх или скольжением, или иным способом, оставляя проводники (13) на пути въезжающего или выезжающего транспортного средства или транспортных средств;

б2) попадание в зону (10) ограниченного доступа;

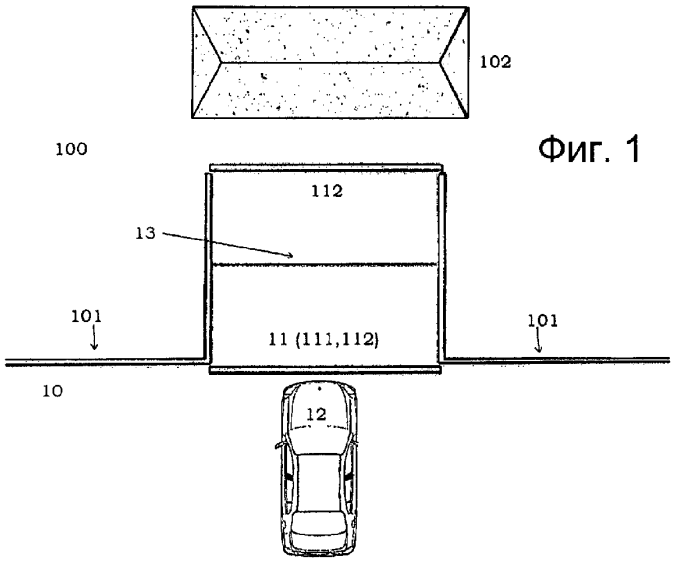
в) попадание в зону (10) ограниченного доступа, проходя через проводники (13), если в месте (11) входа/выхода отсутствует физическое препятствие, содержащее ворота, шлагбаум и т.д., подвижное заграждение и т.д.



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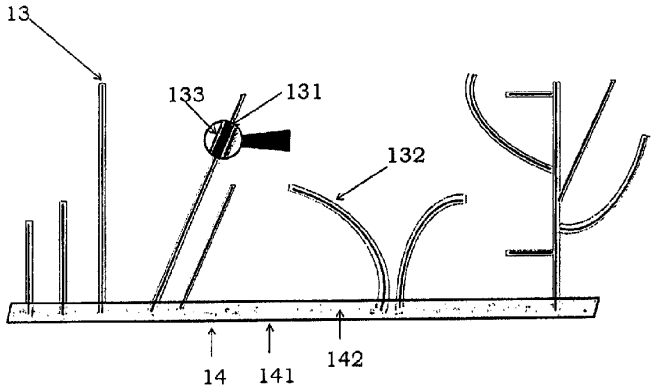
1






Фиг. 1

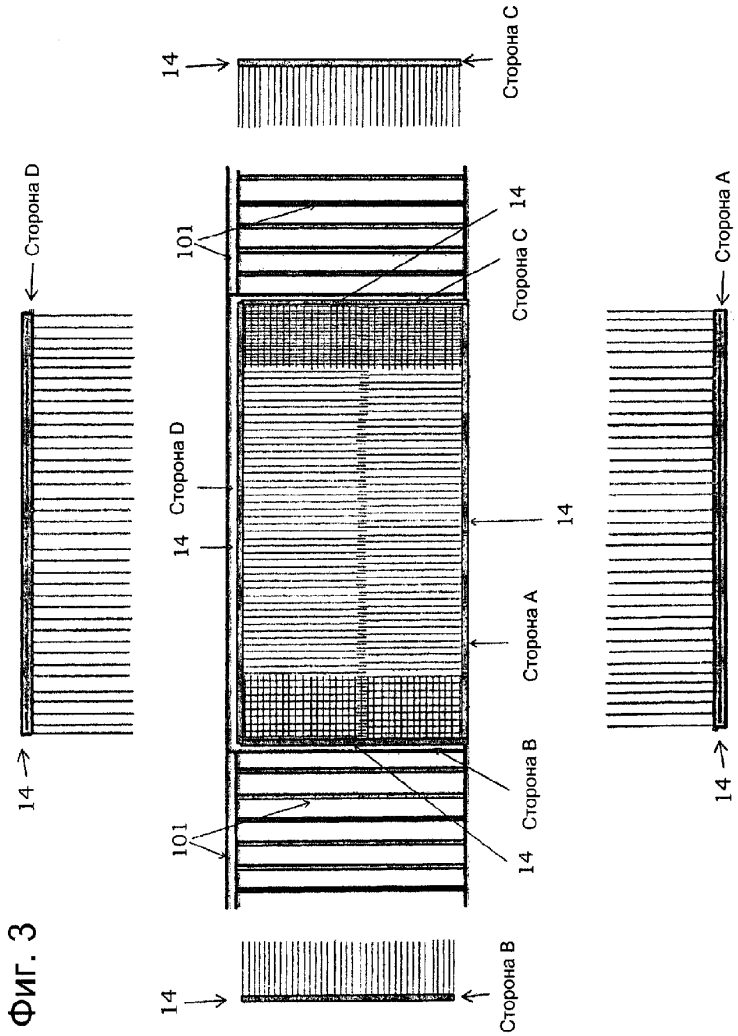
Фиг. 2




2



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Фиг. 3



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# TRAVELING CONTROLLER FOR VEHICLE

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**Abstract**

<P>PROBLEM TO BE SOLVED: To surely secure safety, and to improve conveyance efficiency and operation efficiency by enabling a vehicle to quickly avoid a vehicle(operation vehicle, low speed vehicle, defective vehicle or the like) which disturbs high speed traveling while preventing the interference of mutual vehicles in facing traffic. <P>SOLUTION: An off-limits region 60 is prepared based on the location information of an manned vehicle 20 on one of both-lanes 51 and 52, and a by-pass course 72 is prepared based on the information of the off-limits region 60. The information of the by-pass course 72 is taught to each unmanned vehicle 10 and 11 and manned vehicles 20 and so on. Then, the unmanned vehicle 11 of an opposite side lane 52 in the off-limits region 60 is blocked at a block position 61B based on the location information of the unmanned vehicle 10 and the unmanned vehicle 11 traveling face to face via the off-limits region 60 and the unmanned vehicle 10 traveling in a lane 51 at the off-limits region 60 side is given a traveling permission command on a by-pass course 72. Then, the unmanned vehicle 10 travels on the by-pass course 72. <P>COPYRIGHT: (C)2007,JPO&INPIT

**Description**

TECHNICAL-FIELD

According to the present invention, each unmanned vehicle provided with a traveling control means for traveling the host vehicle along the traveling course according to the taught traveling course data is caused to face-to-face on a traveling path having an adjacent round-trip lane. The present invention relates to a vehicle travel control device.

BACKGROUND-ART

When carrying out earth and sand transport work at a wide-area work site such as a quarry site, mining, etc. An unmanned vehicle traveling system that operates an unmanned vehicle instead of a dump truck has been introduced. In order to manage the operation of multiple unmanned dump trucks, a monitoring station is set up as a ground station, and an unmanned vehicle traveling system is constructed so that these multiple unmanned dump trucks can be managed and monitored by this monitoring station. Has been.

However, it is practically impossible to make all the vehicles traveling on the work site unmanned vehicles. That is, in the work site, it is necessary to run manned vehicles such as a grader, a water truck, a wheel loader, an escalator, a trailer, an operator pickup vehicle, and a measurement vehicle in addition to an unmanned dump truck.

At the work site, as shown in FIG. 1, the traveling path R connecting the excavation site A and the processing facility B is provided with reciprocating lanes Ra and Rb adjacent to each other, and set in advance to the respective lanes Ra and Rb. Each vehicle T1, T2 is autonomous on the basis of the travel course data (course data) and the vehicle travel data (travel data; vehicle position, speed, etc.) obtained using a position measurement system such as GPS. Guided traveling is performed, and the vehicles T1 and T2 travel on the reciprocal lanes Ra and Rb, respectively.

Here, for example, it is assumed that a manned motor grader T3 is performing road works on one of the round-trip lanes, for example, the lane Ra. Road construction is performed at a low speed or in a stopped state, and hinders high-speed travel for the rear vehicle T1 traveling on the same lane Ra, leading to a decrease in conveyance efficiency and work efficiency.

Here, if each of the vehicles T1 and T2 traveling in a face-to-face manner is a manned vehicle, the operators on board communicate directly with each other so that the vehicle T1 passes over the grader T3 and faces the own vehicle T1. By traveling along the detour course Ca that passes through the lane Rb, high-speed traveling can be continued while preventing interference between vehicles.

Further, even if the vehicle T1 that is going to pass the grader T3 through the detour course Ca is a manned vehicle and the facing vehicle T2 is an unmanned vehicle, the operator of the manned vehicle T1 will be on the facing side. Since it is possible to travel on the detour course Ca while paying attention to the movement of the vehicle T2, it is possible to continue high-speed travel while preventing interference between the vehicles.

Furthermore, the operator of the manned vehicle T1 identifies the movement of the grader T3 to be overtaken and, if necessary, obtains the overtaking permission from the operator of the grader T3 through a radio or the like. It is possible to pass the vehicle without interfering with the grader T3 while preventing the vehicle from protruding to the opposite lane Rb due to turning.

However, when the vehicle T1 passing the grader T3 through the detour course Ca is an unmanned vehicle (when the facing vehicle T2 is an unmanned or manned vehicle), the unmanned vehicle T1 itself has no Since there is no ability to travel along the detour course Ca while looking at the movement of the facing vehicle T2 or the ability to obtain overtaking permission from the operator, there is no interference between vehicles unless some control is added. It is impossible to continue high-speed driving while preventing this. Furthermore, since the unmanned vehicle T1 itself does not have the ability to overtake the grader T3 along the detour course Ca while identifying the movement of the grader T3 to be overtaken, the grader T3 must be added without any control. During overtaking, there is a risk of interference with the grader T3 due to the sudden behavior of the grader T3 (for example, when the vehicle moves over the opposite lane Rb to make a turn).

In the following Patent Document 1, for the purpose of preventing interference between vehicles, the distance when moving at the maximum speed from the current position is set as the radius for each vehicle based on the current position and the maximum vehicle speed of each vehicle. Is described as a possible

existence area, and when the existence possible areas interfere with each other, it is determined that the corresponding vehicles may interfere with each other, and one vehicle is decelerated or stopped. Yes.

Further, in Patent Document 2 below, when an unmanned vehicle and a manned vehicle travel in a fleet in the same traveling direction, the manned vehicle and a rear unmanned vehicle are used for the purpose of preventing interference caused by the vehicles traveling in the same direction. An invention is described in which the unmanned vehicle behind is decelerated or stopped when approaching until the distance to the vehicle becomes equal to or less than a predetermined distance.

Further, in Patent Document 3 below, for the purpose of preventing interference between the vehicle and an obstacle on the road, the vehicle is equipped with an obstacle sensor such as a video camera, and when the obstacle is detected on the road by the obstacle sensor, An invention is described in which a detour course for avoiding an obstacle and making a detour based on detection information of the obstacle sensor is created, and the vehicle is driven along the detour course.

[1] JP 2000-339029 A [2] JP-A-9-231500 [3] Japanese Patent Laid-Open No. 11-242520

DISCLOSURE

TECH-PROBLEM

According to the invention described in Patent Document 1, when one vehicle approaches, one vehicle is decelerated or stopped, so that interference between the vehicles can be reliably prevented.

However, if the present invention is applied to a situation in which the vehicle T1 is driven along the detour course Ca and overtakes the grader T3 as shown in FIG. 1, the vehicle T1 approaches the grader T3 while overtaking. Then, the vehicle T1 is decelerated or stopped, and overtaking itself becomes impossible. Moreover, in this invention, the cooperation of the vehicles which run face-to-face is not taken into consideration at all. For this reason, a situation is also created in which the vehicle T1 traveling in the facing lane Rb along the detour course Ca approaches the vehicle T2 traveling in the opposite lane Rb. In this case, when the vehicle T1 approaches the vehicle T2, the vehicle T1 decelerates or stops, and even though it is possible to prevent interference between vehicles that face each other, overtaking itself may be impossible. is there.

In addition, the invention described in Patent Document 2 assumes only a case where a plurality of vehicles travel fleet in the same traveling direction, and does not assume any situation of facing traveling. Therefore, as shown in FIG. 1, if the present invention is applied to a situation where the vehicle T1 is driven along the detour course Ca and overtakes the grader T3, the vehicle T1 is close to a predetermined distance in order to overtake the grader T3. At that time, the vehicle T1 is decelerated or stopped, and the overtaking itself becomes impossible.

In the first place, the invention described in Patent Document 3 assumes only the case of avoiding an obstacle on the traveling road, and does not take into account any vehicle that travels face-to-face. Therefore, as shown in FIG. 1, even if the vehicle T1 can travel along the detour course Ca and pass the grader T3, the vehicle T1 may interfere with the vehicle T2 that faces the vehicle. The invention described in Patent Document 3 is to create a detour course Ca based on the detection information of the obstacle sensor, and does not take into consideration the future behavior of the grader T3 that is an obstacle. For this reason, while the vehicle T1 is overtaking the grader T3, there is a possibility that the grader T3 may interfere with the grader T3 due to the sudden behavior of the grader T3 (for example, when the vehicle T1 protrudes to the opposite lane Rb for turning). Moreover, although it cannot be seen with an obstacle sensor such as a place that is slippery due to rain or the like, it cannot cope with something that should be avoided.

Further, the traveling road R such as a mine is an unpaved road, and an obstacle that hinders the traveling of the vehicle T1, such as a windrow, is formed on the road surface by the grader T3 cutting the road surface. For this reason, in some cases, there is a possibility that problems such as getting on the windrow when the vehicle T1 passes the grader T3 may occur.

As described above, all of the conventional technologies cannot prevent the vehicles from interfering with

each other, but cannot pass at high speed, or even if the vehicles can be overtaken, the interference between vehicles is unavoidable. It was not satisfying both.

The present invention has been made in view of such a situation, and when a vehicle travels face-to-face, while preventing the vehicles from interfering with each other, the vehicle (work vehicle, low speed) that hinders high-speed travel for a vehicle traveling behind. An object of the present invention is to improve transport efficiency and work efficiency while reliably ensuring safety by detouring vehicles, broken vehicles, etc.) at high speed.
TECH-SOLUTION

The first invention is
Driving control of a vehicle, in which an unmanned vehicle provided with a driving control means for driving the host vehicle along the driving course according to the taught driving course data is face-to-face driven on a driving path having an adjacent round-trip lane. A device,
On the basis of the position information of the vehicle on either lane of the round-trip lane, a restricted entry area creating means for creating a restricted entry area surrounding the vehicle,
A detour course creation means for creating a detour course that returns to the lane of the host vehicle through the facing lane while avoiding the off-limit area based on the off-limit area,
Detour course teaching means for teaching each vehicle of detour course information;
A detour course is provided for unmanned vehicles traveling in the lane in the restricted area, while blocking the vehicle in the facing lane in the restricted area, based on the position information of each vehicle that faces the restricted area. A travel permission command output means for giving a travel permission command for permitting traveling, and
The driving control means for the unmanned vehicle to which the driving permission command is given is characterized in that it controls to drive the own vehicle along the detour course according to the data of the detour course taught.

The second invention is
In the vehicle travel control device of the first invention,
An input means for inputting the position information of the vehicle existing in the restricted area is provided,
The off-limit area creating means creates the off-limit area based on the input vehicle position information.

The third invention is
In the vehicle travel control device of the first invention,
The detour course creation means, the detour course teaching means, and the travel permission command output means are provided in a monitoring station that monitors the travel of the vehicle,
The monitoring station and each vehicle are provided with transmission / reception means for transmitting and receiving information between the monitoring station and the vehicle,
The detour course information is sent from the monitoring station to each vehicle,
A travel permission command is transmitted from the monitoring station to an unmanned vehicle traveling in the lane on the off-limits area side.

The fourth invention is
In the vehicle travel control device of the second invention,
The input means is provided in a manned or unmanned vehicle existing in a restricted area,
The detour course creation means, the detour course teaching means, and the travel permission command output means are provided in a monitoring station that monitors the travel of the vehicle,
The monitoring station and each vehicle are provided with transmission / reception means for transmitting and receiving information between the monitoring station and the vehicle,
Information on restricted areas is sent to the monitoring station from manned or unmanned vehicles in restricted areas,
The detour course information is sent from the monitoring station to each vehicle,
A travel permission command is transmitted from the monitoring station to an unmanned vehicle traveling in

the lane on the off-limits area side.

The fifth invention
In the vehicle travel control device of the first invention,
The off-limit area is an area where the vehicle works, an area where the vehicle travels at a low speed, or an area where a faulty vehicle exists.

The sixth invention
In the vehicle travel control device of the first invention,
Vehicles that are in restricted areas are manned vehicles,
A travel permission command is given to an unmanned vehicle traveling in a lane on the off-limit area side on condition that a permission command permitting traveling on a detour course is received from the manned vehicle.

According to the first invention, as shown in FIG. 4, the off-limit area 60 is created based on the position information 60 </ b> A, 60 </ b> B of the manned vehicle 20 in either one of the round-trip lanes 51, 52 (lane 51). Then, the detour course 72 is created based on the information of the restricted entry area 60. Information on this detour course 72 is taught to each unmanned vehicle 10, 11 and manned vehicle 20. Then, based on the position information of the unmanned vehicle 10 and the unmanned vehicle 11 that travel face-to-face across the restricted entry area 60, the unmanned vehicle 11 in the facing lane 52 of the restricted entry area 60 is blocked at the block position 61B, and the entry prohibited. A travel permission command is given to the detour course 72 for the unmanned vehicle 10 traveling in the lane 51 on the region 60 side, and the unmanned vehicle 10 travels on the detour course 72. Therefore, according to the present invention, when the unmanned vehicle 10 and the unmanned vehicle 11 travel face-to-face, it is possible to reliably prevent the vehicles from interfering with each other, and at the same time, the rear vehicle 10 such as a low-speed vehicle has an obstacle to high-speed travel. Thus, the manned vehicle 20 can be detoured at high speed, and the transportation efficiency and work efficiency are improved while ensuring safety.

According to the second invention, as shown in FIGS. 4A and 4B, the position information of the start point 60A and the end point 60 of the work range of the manned vehicle 20 existing in the restricted entry area 60 is input from the input means. The And as shown in FIG.4 (c), the entry prohibition area | region 60 is produced based on the positional information on the start point 60A and the end point 60B of the input work range.

According to the third invention, as shown in FIG. 2, the information about the detour course 72 is transmitted from the monitoring station 40 to the vehicles 10, 11,..., 20 by radio communication S1, S2, S3. A travel permission command for permitting travel on the detour course 72 is transmitted from the 40 to the unmanned vehicle 10 traveling on the lane 51 on the off-limit area 60 side by wireless communication S1.

According to the fourth aspect of the present invention, as shown in FIG. 2, information on the restricted area 60 (start point 60A of the work range) is transmitted from the manned vehicle 20 existing in the restricted area 60 to the monitoring station 40 by wireless communication S3. , Position information of the end point 60B) is transmitted from the monitoring station 40 to each of the vehicles 10, 11,..., 20 through the wireless communication S1, S2, and S3. A traveling permission command for permitting traveling on the detour course 72 is transmitted to the unmanned vehicle 10 traveling on the lane 51 on the prohibited area 60 side by wireless communication S1.

According to the fifth invention, as shown in FIG. 4, FIG. 7 or FIG. 11, the restricted entry area 60 is an area where the manned vehicle 20 is working, an area where the manned vehicle 20 travels at a low speed, or an unmanned vehicle 12 is at a low speed. It is created as a region where the vehicle runs. Further, the entry prohibition area 60 can be created as an area where a faulty vehicle exists.

According to the sixth invention, as shown in FIG. 4, the vehicle existing in the restricted entry area 60 is a

manned vehicle 20, and receives a permission instruction permitting traveling on the detour course 72 from the manned vehicle 20. On this condition, a travel permission command is given to the unmanned vehicle 10 traveling in the lane 51 on the off-limits area 60 side. Thereby, since the permission command is given from the manned vehicle 20 at the time when there is no possibility of protruding from the entry prohibition area 60, it is possible to reliably avoid the manned vehicle 20 from interfering with the unmanned vehicle 10.

BEST-MODE

Hereinafter, the present invention will be described in detail with reference to the drawings illustrating embodiments.

FIG. 2 shows an embodiment in which the vehicle travel control device according to the present invention is employed in an unmanned vehicle travel system in a mine. Moreover, in the unmanned vehicle traveling system of the present embodiment, a dump truck is assumed as the unmanned vehicle.

As shown in FIG. 2, the traveling road 50 connecting the mine excavation site 50A and the processing facility 50B is provided with reciprocating lanes 51 and 52 adjacent to each other, and the lanes 51 and 52 are preset. Each unmanned vehicle 10 based on the data (course data) of the travel courses 70 and 71 and the data (travel data; vehicle position, speed, etc.) relating to the travel of the vehicle obtained by using a position measurement system such as GPS. , 11 ... are autonomously guided. FIG. 2 shows a case where the unmanned vehicles 10 and 11 are traveling face-to-face along the traveling courses 70 and 71 on the round-trip lanes 51 and 52, respectively. The unmanned vehicle is a vehicle that operates without an operator boarding.

Further, each manned vehicle 20... A manned vehicle is a vehicle on which an operator is boarded. FIG. 2 shows a case where the manned motor grader 20 is performing road construction in one lane 51 of the traveling road 50.

The road construction is performed at a low speed or in a stopped state with a work range between the start point 60A and the end point 60B. In addition, the manned vehicle 20 may run backward in the lane 51 between the start point 60A and the end point 60B. For this reason, it becomes an obstacle to high-speed traveling for a vehicle (unmanned vehicle 10) traveling behind. Moreover, the mine traveling path 50 is an unpaved road, and the grader 20 performs a cutting operation on the road surface so that obstacles such as windrows that interfere with the traveling of the unmanned vehicles 10, 11... Are formed on the road surface. . For this reason, as will be described later, an area that is wider than the work range connecting the start point 60A and the end point 60B and in which a windrow is to be formed is set as the off-limit area 60. Furthermore, as will be described later, an area wider than the entry prohibition area 60 is set as a safety ensuring area 61 in order to prevent interference between the vehicles 10 and 11 traveling facing each other. Further, as will be described later, a detour course 72 deviating from the scheduled course 70 of the unmanned vehicle 10 traveling behind is created on the basis of the entry prohibition area 60 and the safety ensuring area 61. The detour course 72 is a traveling course formed in the safety ensuring area 61 and is a course that returns to the lane 51 of the host vehicle 10 through the facing lane 52 while avoiding the restricted entry area 60.

The mine is provided with a monitoring station 40 that manages and monitors a plurality of unmanned vehicles 10, 11... And a plurality of manned vehicles 20.

The unmanned vehicles 10, 11... Are equipped with a position measuring device 1 that measures the position of the vehicle and a communication device 2 that transmits and receives data to and from the monitoring station 40 by wireless communication. The manned vehicles 20 are equipped with a position measuring device 31 that measures the position of the vehicle and a communication device 32 that transmits and receives data to and from the monitoring station 40 by wireless communication. The position measuring devices 1 and 31 can use a position measuring system such as GPS.

The monitoring station 40 is equipped with a communication device 42 that transmits / receives data to / from the unmanned vehicles 10, 11,.

Data is transmitted and received between the unmanned vehicle 10 and the monitoring station 40 by wireless communication S1, and data is transmitted and received between the unmanned vehicle 11 and the monitoring station 40 by wireless communication S2, and the manned vehicle 12 and the monitoring station are transmitted. 40, data is transmitted and received by wireless communication S3.

FIGS. 3A, 3B, and 3C are block diagrams showing configurations of apparatuses mounted on the manned vehicle 20 (grader), the monitoring station 40, and the unmanned vehicles 10 and 11, respectively.

First, the configuration of the unmanned vehicles 10 and 11 will be described. Since the devices mounted on the unmanned vehicles 10 and 11 are the same, the configuration of the unmanned vehicle 10 will be described as a representative.

As shown in FIG. 3C, the unmanned vehicle 10 includes the position measurement device 1, the communication device 2, the operation data sharing device 3, the manned vehicle mixed running controller 4, and the control device 5. It is installed.

The operation data sharing device 3 is data necessary for the operation of the own vehicle 10 such as data of the restricted entry region 60, the safety ensuring region 61, and the detour course 72 given from the monitoring station 40 via the communication device 2. Operation data shared between the vehicles 10, 11,..., 20... And the monitoring station 40 is stored, and a travel permission command for permitting the own vehicle 10 to travel on the detour course 72 based on these operation data. Is output to the control device 5 to control the traveling of the host vehicle 10 so as not to interfere with other unmanned vehicles 11 traveling face-to-face.

The manned vehicle mixed running controller 4 is configured such that the own vehicle 10 is mixed with the manned vehicle 20..., Such as the current position data of the manned vehicle 20... And the data of the travel permission command of the detour course 72 given from the monitoring station 40 via the communication device 2. Thus, data necessary for traveling on the traveling path 50 is stored, and based on these data and the current position data of the host vehicle 10 measured by the position measuring device 1, the host vehicle 10 The vehicle travels 72 and outputs a travel permission command permitting access to the restricted entry area 60 where the manned vehicle 20 exists to the control device 5 so that the host vehicle 10 travels so as not to interfere with the manned vehicles 20. It is to be controlled.

The control device 5 sequentially travels while receiving the course data from the operation data sharing device 3 and the travel continuation permission from the manned vehicle mixed travel controller 4. The travel data sharing device 3 receives the course that the unmanned vehicle operation management device 48 of the monitoring station 40 puts in the operation data sharing device 43. For example, when running on the detour course, the unmanned vehicle operation management device 48 of the monitoring station 40 operates the detour course 72 and the detour course 72 on and after the detour course 72 until the switching point of the travel course 70 with the detour course 72. Put in. The operation data sharing device 43 distributes a traveling course to each manned vehicle 20 and unmanned vehicles 10 and 11 via a communication device. The control device 5 travels like a course 70, a course 72, and a course 70 in accordance with the contents of this instruction.

4D, when the position of 61B is blocked, the unmanned vehicle operation management device 48 of the monitoring station 40 sends a stop request to the unmanned vehicle 11 at the position of 61B to the operation data sharing device 43. Put in. The unmanned vehicle 11 receives this via the operation data sharing device 43 and transmits it to the control device 5. If the control device 5 determines that the stop at the command position is impossible, the control device 5 passes as it is. During this time, the unmanned vehicle operation management device 48 of the monitoring station 40 waits without issuing a travel instruction of the detour course 72 to the unmanned vehicle 10. In addition, when the control device 5 of the unmanned vehicle 11 determines that it can be stopped, the control device 5 enters data indicating that the travel schedule of the course 71 after 61B is canceled into the operation data sharing device 3. The unmanned vehicle operation management device 48 of the monitoring station 40 receives the operation data sharing device 43, and inputs a travel instruction of the detour course 72 to the unmanned vehicle 10 into the operation data sharing device 43.

The course data of the scheduled traveling course 70 is obtained by a teaching operation or the like performed prior to actual traveling. The course data consists of data on the position of each point on the planned traveling course and the designated traveling direction. However, when the course data of the detour course 72 is taught to the host vehicle 10 via the monitoring station 40 and the travel permission command for the detour course 72 is input to the control device 5, the control device 5 The traveling of the host vehicle 10 is controlled so as to travel from the course 70 and travel on the detour course 72. That is, the control device 5 compares the current position of the host vehicle 10 measured by the position measurement device 1 with the position of the next point on the traveling course 70 (or the detour course 72), and Compare the specified traveling direction at the point with the current traveling direction, and adjust the steering angle and brake so that the amount of positional deviation from the target point and the amount

of deviation in the traveling direction from the specified direction at the target point are minimized. Then, the traveling of the host vehicle 10 is controlled by adjusting the speed stage of the transmission, the engine speed, and the like.

Next, the configuration of the manned vehicles 20 will be described. In addition, since the apparatus mounted in each manned vehicle 20 ... is the same, the structure of one manned vehicle 20 of them will be described as a representative.

As shown in FIG. 3A, the manned vehicle 20 includes the position measurement device 31, the communication device 32, the operation data sharing device 33, a manned vehicle mixed running controller 34, and a restricted area controller 35. An input device 36 and a display device 37 are mounted.

The operation data sharing device 33 is provided with the data of the restricted entry area 60 and the detour course 72 given from the monitoring station 40 through the communication device 32, and the detour given from the monitoring station 40 to the unmanned vehicles 10, 11. Data necessary for the operation of the host vehicle 20, such as data for a travel permission command for the course 72, which is stored in the operation data shared among all the vehicles 10, 11,. Based on these operation data, a display command for displaying the entry prohibition area 60, the safety ensuring area 61, the detour course 72, the position of the vehicle permitted to travel, etc. is output to the display device 37, and the manned vehicle or the unmanned vehicle is displayed. Is not to interfere with other unmanned vehicles 10, 11,.

The input device 36 is composed of a keyboard or the like, inputs the position data of the start point 60A and the end point 60B of the working range of the host vehicle 20, and permits the unmanned vehicles 10 and 11 to travel the detour course 72. This is a device that inputs the data of the work, and when the work is further completed, inputs the data of the work completion notification.

The manned vehicle mixed running controller 34 receives the data of the driving permission command for permitting the traveling of the detour course 72 inputted from the input device 36 of the own vehicle 20 or the data of the command for requesting the driving permission from the monitoring station 40. 32 so as not to interfere with the unmanned vehicles 10, 11,...

The entry prohibition area controller 35 uses the position data of the start points 60A and 60B of the work range input from the input device 36 of the host vehicle 20 in order to cause the monitoring station 40 to create the entry prohibition area 60 and the safety ensuring area 61. When the work end notification is input from the input device 36, the work end notification is sent to the communication device so that the monitoring prohibition area 60, the safety ensuring region 61, and the detour course 72 are deleted by the monitoring station 40. 32.

Based on the input display command, the display device 37 measures the position prohibition area 60, the safety ensuring area 61, the detour course 72, the position of the vehicle permitted to travel, and the like of the host vehicle 20 measured by the position measurement device 31. The current position is displayed on the display screen.

Next, the configuration of the monitoring station 40 will be described. The data input operation in the monitoring station 40 is performed by an operator on the monitoring station 40 side.

As shown in FIG. 3 (b), the monitoring station 40 includes a course generation device 41, a communication device 42, an operation data sharing device 43, a manned vehicle mixed running controller 44, a restricted access area controller 45, and an input device. 46, a display device 47, and an unmanned vehicle operation management device 48 are mounted.

The off-limit area controller 45 creates a off-limit area 60 and a safety area 61 based on the position data of the start points 60A and 60B of the work range of the manned vehicle 20 input via the communication device 42. Is output to the operation data sharing device 43, and on the basis of the work end notification input via the communication device 42, the entry prohibition area deletion for deleting the entry prohibition area 60, the safety ensuring area 61, and the detour course 72 is deleted. The command is output to the operation data sharing device 43.

The manned vehicle mixed running controller 44 receives data necessary when the manned vehicle 20 travels along the traveling path 50 in a mixed manner with the unmanned vehicles 10, 11..., Such as data of a travel permission command input via the communication device 42. The travel permission command data is stored and output to the unmanned vehicle operation management device 48.

The operation data sharing device 43 includes an entry prohibition area 60, a safety ensuring area 61, data of the detour course 72, data of a travel permission command of the detour course 72 to be given to the

unmanned vehicles 10, 11,. 61. Data necessary for the operation of each vehicle, such as data of an entry prohibition area deletion command for deleting the detour course 72, is output to the communication device 32 and taught to all the vehicles 10, 11,. is there. Thereby, the storage data of the operation data sharing device 43 of the monitoring station 40 becomes operation data shared among all the vehicles 10, 11.

The unmanned vehicle operation management device 48 is a device that manages the operation of the unmanned vehicles 10, 11..., And causes the course generation device 41 to create a detour course 72 based on the entry prohibition area 60 and the safety ensuring area 61. The created detour course 72 is stored in the operation data sharing device 43. Further, the unmanned vehicle operation management device 48 is based on the stored data of the operation data sharing device 43 and the travel permission command obtained via the manned vehicle mixed running controller 34, and the unmanned vehicle 11 and the manned vehicle 20 on which the unmanned vehicle 10 travels face-to-face. A travel permission command for traveling the detour course 72 safely without interference with the travel data sharing device 43 is generated. In addition, the unmanned vehicle operation management device 48 uses the entry prohibition region deletion command stored in the operation data sharing device 43 and the entry prohibited region 60, the safety ensuring region 61, and the detour course 72 stored in the operation data sharing device 43. Along with deleting the data, a command for prohibiting the unmanned vehicles 10, 11... From entering the deleted detour course 72 is output to the operation data sharing device 43.

The input device 46 is provided in order to define a restricted entry area, like the input device 36 of the manned vehicle 20. However, since the monitoring station 40 is not a direct worker, the restricted entry area is defined by inputting position data of the start point 60A and end point 60B of the range, manned or unmanned faulty vehicles, and entering the existence area. It is set as a prohibited section, set as a restricted entry area by drawing a figure, and the like. Further, when it is determined that it is safe even if the unmanned vehicles 10 and 11 travel in the defined entry prohibition area, the input device 46 receives data of entry prohibition area deletion notification. Further, similarly to the manned vehicle 20, the unmanned vehicles 10 and 11 may be configured not to pass the detour course 72 unless the monitoring station 40 permits passage.

Based on the display command, the display device 47 displays on the display screen the entry prohibition area 60, the safety ensuring area 61, the detour course 72, the position of the vehicle permitted to travel, and the like to monitor the operation of all the vehicles. Is provided.

(First embodiment; detour when manned vehicle is working)

Hereinafter, the processing procedure of the embodiment will be described with reference to the drawing showing the traveling path 50 shown in FIGS. 4A, 4B, 4C, and 4D and the flowchart shown in FIG.

In the present embodiment, it is assumed that the manned vehicle 20 on the traveling road 50 performs work such as road construction.

First, before starting the work in the mine, the map data of the traveling path 50 is input in advance from the input device 46 of the monitoring station 40 and stored in the operation data sharing device 43. This map data includes data indicating the topography such as the position of the shoulder of the traveling road 50. The map data of the traveling path 50 is transmitted to all the unmanned vehicles 10, 11,... Via the communication device 42 of the monitoring station 40 by wireless communication S1, S2,. And stored in the operation data sharing device 3. Further, the map data is transmitted to all manned vehicles 20 through wireless communication S3 through the communication device 42 of the monitoring station 40, received by the communication device 32 of the manned vehicle 20 through the operation data sharing device. 33.

Prior to the start of work in the mine, an unmanned vehicle or manned vehicle is used to teach the traveling courses 70, 71, etc. on which the unmanned vehicles 10, 11,. In the management device 48, data of traveling courses 70, 71... Scheduled to be shared by the unmanned vehicles 10, 11,.

The control device 5 of each unmanned vehicle 10, 11 controls the own vehicle 10, 11 to travel along the traveling course 70, 71 according to the course data of the traveling course 70, 71 of the own vehicle (step 101). .

On the display screen of the display device 37 of the manned vehicle 20, based on the map data stored in the operation data sharing device 33 and the data of the current position measured by the position measuring device 31, FIGS. As shown, the position of the host vehicle 20 on the travel path 50 is displayed together with the travel path 50.

When the operator of the manned vehicle 20 intends to perform the road construction work, the lane 51 of

the own vehicle on the travel path 50 is viewed as shown in FIGS. 4A and 4B while looking at the display screen of the display device 37. Among them, the data of the start point 60A and the end point 60B of the work range in which road construction is to be performed (information on the entry prohibition area 60 of the lane 51 of the host vehicle 20) is sequentially input by the input device 36. In this case, when the manned vehicle 20 is actually run and each time the manned vehicle 20 is positioned at the start point 60A and the end point 60B of the work range, the “start point” and the “end point” are specified and input. The position measured by the position measuring device 31 is stored in the restricted entry area controller 35. The restricted area controller 35 outputs the position data of the start point 60A and the end point 60B of the work range of the host vehicle 20 to the communication device 32. In response to this, the communication device 32 transmits the position data of the start point 60A and the end point 60B to the communication device 42 of the monitoring station 40 by wireless communication S3 (step 102).

In the communication device 42 of the monitoring station 40, the position data of the start point 60 </ b> A and the end point 60 </ b> B of the work range of the manned vehicle 20 is received and sent to the off-limit area controller 45. The off-limit area controller 45 is an area wider than the work range connecting the start point 60A and the end point 60B based on the position data of the start points 60A and 60B of the work range of the manned vehicle 20, as shown in FIG. Thus, an area where an obstacle such as a windrow will be formed is created as a restricted entry area 60 with a margin on the lane 51 side where the manned vehicle 20 exists. A region wider than the restricted entry region 60 is created as the safety ensuring region 61 across both lanes 51 and 52. The entry prohibition area 60 is an area where all unmanned vehicles 10, 11... Are prohibited from entering. The safety ensuring area 61 is an area around the entry prohibition area 60 and is an area that allows the driving of the unmanned vehicle to which the driving permission is given.

The created data of the restricted entry area 60 and the safety ensuring area 61 are sent to the operation data sharing device 43.

The unmanned vehicle operation management device 48 causes the course generation device 41 to create a detour course 72 based on the data in the entry prohibition area 60 and the safety ensuring area 61 stored in the operation data sharing apparatus 43.

The detour course 72 is a travel course that is out of the planned travel course 70 of the unmanned vehicle (unmanned vehicle 10) that travels behind the manned vehicle 20 in the lane 51 on the off-limit area 60 side. The point 72B of the facing lane 52 (the point corresponding to the entrance of the prohibiting region 60) and the point 72C of the facing lane 52 (no entry) so as to avoid the restricted entry region 60 at the entrance point 72A. It is a course that returns to the lane 51 on the off-limits area 60 side and returns to the traveling course 70 of the host vehicle 10 at an exit point 72D in the safety ensuring area 61. The detour course 72 is created in the safety ensuring area 61. Data of block positions 61A and 61B is created. As shown in FIG. 4 (d), when the travel permission is not obtained, the block position 61A (lane 51 side) corresponding to the entrance point 72A of the safety ensuring area 61, the safety ensuring area, for ensuring safety. The unmanned vehicles 10 and 11 are each on standby at a block position 61B (lane 52 side) corresponding to the exit point 71D of 61.

The detour course 72 includes body data such as inner and outer wheel differences of the unmanned vehicle 10 traveling on the course 72, map data of the travel path 50 (such as the shoulder position of the travel path 50), a no-entry area 60, and a safety ensuring area 61. In consideration of the position data, the unmanned vehicle 10 is set so as not to deviate from the shoulder of the traveling path 50 and the unmanned vehicle 10 does not interfere with the manned vehicle 20 in the off-limit area 60. In FIG. 4 (c), from the traveling lane 51 to the facing lane from the entrance point 72 </ b> A of the safety ensuring region 61 to the point 72 </ b> B of the facing lane 52 corresponding to the entrance of the restricted entry region 60. The lane change to 52 is performed, and from the point 72C of the facing lane 52 corresponding to the exit of the restricted area 60 to the exit point 72D of the safety ensuring region 61, the original lane 52 The case where the detour course 72 is created so that the lane change to the driving lane 51 is performed is illustrated. In the case of the front-steer unmanned vehicle 10 in which the front wheels are steered, the vehicle moves away from the driving lane 51 with a small curvature ra, shifts to the facing lane 52 with a large curvature rb, and leaves the facing lane 52 with a small curvature rc. It is desirable to create a detour course 72 of a route that returns to the travel lane 51 with a large curvature rd.

The unmanned vehicle operation management device 48 of the monitoring station 40 sends the data of the

detour course 72 and the data of the block positions 61A and 61B thus created to the operation data sharing device 43.

In this way, the operation data sharing device 43 stores data of the entry prohibition area 60, the safety ensuring area 61, the detour course 72, and the block positions 61A and 61B. The operation data sharing device 43 outputs data such as the detour course 72 to the communication device 42. In response to this, the communication device 42 transmits data such as the detour course 72 to the communication device 2 of the unmanned vehicles 10 and 11 by wireless communication S1 and S2, and also to the communication device 32 of the manned vehicle 20 by wireless communication S3. Send. As a result, the operation data sharing device 3 of the unmanned vehicles 10 and 11 and the operation data sharing device 33 of the manned vehicle 20 store data such as the detour course 72, and the shared data such as the detour course 72 is stored in all the vehicles 10, 11 ..., 20 ... (step 103).

On the display screen of the display device 37 of the manned vehicle 20, as shown in FIG. 4D, the current prohibition area 60, the safety ensuring area 61, and the detour course 72 are presently measured by the position measuring device. Displayed with position. Thereby, the operator of the manned vehicle 20 can recognize that the unmanned vehicle 10 may pass through the vicinity of the area 60 where the own vehicle 20 is working through the detour course 72.

The current position of the own vehicle 20... Measured by the position measuring device 31 of each manned vehicle 20... Is sequentially transmitted to the monitoring station 40 via the communication device 32 by wireless communication S3. It is received by the device 42 and sent to the manned vehicle mixed running controller 44 of the own station 40. The manned vehicle mixed running controller 44 of the monitoring station 40 outputs the current position of each manned vehicle 20 to the communication device 42 of the own station 40. As a result, the current positions of the manned vehicles 20 are transmitted to the unmanned vehicles 10, 11 by wireless communication S1, S2 by the communication device 42 of the monitoring station 40, and received by the communication device 2 of the unmanned vehicles 10, 11. And sent to the manned vehicle mixed running controller 4 of the own vehicle 10, 11.

Further, the current positions of the own vehicles 10 and 11 measured by the position measuring device 1 of the unmanned vehicles 10 and 11 are sequentially transmitted from the communication device 2 to the monitoring station 40 through wireless communication S1 and S2, and the monitoring station 40 Are transmitted to the unmanned vehicle operation management device 48 of the local station 40.

The unmanned vehicle operation management device 48 of the monitoring station 40 travels on the lane 51 on the off-limits area 60 side by comparing the position of the unmanned vehicle 10 traveling on the lane 51 on the off-limit area 60 side with the block position 61A. It is predicted and determined whether or not the unmanned vehicle 10 may pass through the restricted entry area 60.

As a result, if it is predicted that the unmanned vehicle 10 may pass through the off-limit area 60, a command requesting permission for the unmanned vehicle 10 to travel on the detour course 72 is issued. It is sent to the mixed running controller 44. In response to this, the manned vehicle mixed running controller 44 outputs a command for permission to travel to the communication device 42 of the own station 40. As a result, a command for permission to travel is transmitted to the communication device 32 of the manned vehicle 20 that has entered the information on the restricted entry area 60, that is, the data of the start point 60A and the end point 60B, in the wireless communication S3 (step S30). 104).

In the communication device 32 of the manned vehicle 20, a command requesting permission to travel is received and sent to the manned vehicle mixed running controller 34 of the host vehicle 20. The manned vehicle mixed running controller 34 outputs a command requesting permission to travel to the display device 37 as a display command. As a result, the display screen of the display device 37 of the manned vehicle 20 displays “travel permission requested”.

The operator of the manned vehicle 20 looks at the display of “A request for travel permission” displayed on the display screen of the display device 37, and, for example, as shown in FIG. If there is no problem of interfering with the unmanned vehicle 10 in the area D beyond the prohibited area 60, the request for travel permission is approved, and a travel permission command is input by the input device 36. In addition, even if the operator of the manned vehicle 20 does not request the travel permission from the monitoring station 40 and the display screen of the display device 37 does not indicate that the travel permission is requested, the operator 20 sees the entry prohibition area 60 as well. If there is no problem of interfering with the unmanned vehicle 10, the travel permission can be approved and a travel permission command can be independently

input from the input device 36.

The travel permission command input by the input device 36 is sent to the manned vehicle mixed travel controller 34 of the host vehicle 20. The manned vehicle mixed running controller 34 outputs a travel permission command to the communication device 32 of the host vehicle 20. In response to this, a travel permission command is transmitted from the communication device 32 of the manned vehicle 20 to the monitoring station 40 by wireless communication S3 (step 105).

The travel permission command is received by the communication device 42 of the monitoring station 40, sent to the manned vehicle mixed running controller 44 of the own station 40, and further output to the unmanned vehicle operation management device 48.

In the unmanned vehicle operation management device 48, the unmanned vehicle 10 traveling in the lane 51 on the entry prohibited area 60 side is based on the travel permission command and the position information of each unmanned vehicle 10, 11 that faces the entry prohibited area 60. On the other hand, it is determined whether or not a travel permission command for allowing the detour course 72 to travel is to be given.

That is, even if the travel permission command is obtained from the manned vehicle 20, if the unmanned vehicle 11 traveling in the facing lane 52 of the unmanned vehicle 10 is approaching the off-limit area 60, the unmanned vehicle 10 is This is because the detour course 72 should not be entered.

In the unmanned vehicle operation management device 48, the block positions 61A and 61B are compared with the current positions of the unmanned vehicles 10 and 11, respectively, to determine whether or not the unmanned vehicles 10 and 11 are approaching the restricted entry area 60. Judgment is made sequentially.

If the unmanned vehicles 10 and 11 approach the off-limit area 60 without obtaining permission to travel from the manned vehicle 20, there is a possibility that the manned vehicle 20 may work outside the off-limit area 60. A stop command for stopping the unmanned vehicle 10 traveling in the lane 51 on the prohibited area 60 side at the block position 61A is given, and interference is also prevented for the unmanned vehicle 11 traveling in the facing lane 52. Therefore, a stop command is given to stop at the block position 61B of the facing lane 52.

When the travel permission is obtained from the manned vehicle 20, a stop command for stopping the unmanned vehicle 11 traveling in the facing lane 52 at the block position 61A is given, and then the restricted area 60 side lane 51 The unmanned vehicle 10 is given a travel permission command for permitting traveling on the detour course 72.

However, when the travel permission is obtained from the manned vehicle 20, the unmanned vehicle 11 in the facing lane 52 precedes the off-limit region 60 side than the unmanned vehicle 10 traveling in the lane 51 on the off-limit region 60 side. In the case of approaching, giving priority to the unmanned vehicle 11 in the facing lane 52 approaching the entry prohibition area 60 in advance and passing the side of the safety ensuring area 61, A stop command is given to the unmanned vehicle 10 traveling in the lane 51 on the off-limit area 60 so as to stop at the block position 61A. The system may be configured such that the unmanned vehicle 11 in the facing lane 52 passes the maneuvered vehicle 20 to obtain the passage permission even when the unmanned vehicle 11 passes through the vicinity of the restricted entry area 60. When the unmanned vehicle 11 traveling in the facing lane 52 passes the side of the safety ensuring area 61, the unmanned vehicle 10 in the off-limit area 60 side lane 51 is permitted to travel on the detour course 72. A travel permission command is given.

The unmanned vehicle operation management device 48 sends the generated travel permission command (or stop command) to the operation data sharing device 43. The operation data sharing device 43 outputs a travel permission command (or a stop command) to the communication device 42 of the own station 40. As a result, a travel permission command (or stop command) is transmitted from the communication device 42 of the monitoring station 40 to the unmanned vehicle 10 through the wireless communication S1. Similarly, a command to permit traveling or a stop command is given to the unmanned vehicle 11 in the facing lane 52.

The communication device 2 of the unmanned vehicle 10 receives a travel permission command (or a stop command). The communication device 2 sends a travel permission command (or stop command) to the operation data sharing device 3 of the host vehicle 10.

On the other hand, in the manned vehicle mixed running controller 4 of the unmanned vehicle 10, the own vehicle 10 runs on the detour course 72 based on the position data of each manned vehicle 20... Separately from the travel permission command given from the monitoring station 40. A travel permission command for

permitting the vehicle is generated. That is, even if a travel permission command is obtained from the monitoring station 40, the manned vehicles 20 may approach the unmanned vehicle 10 and interfere with the unmanned vehicle 10 due to careless behavior of the manned vehicles 20. In some cases, running should not be allowed.

As described above, the manpowered vehicle mixed controller 4 may generate a travel permission command, and the same processing may be performed in the following procedures 1) to 6). This is done in order to avoid an increase in the amount of calculation in the controller of the unmanned vehicle when the number of manned vehicles increases, and there is no room in the processing capacity.

1) The possibility of interference between the course and the own vehicle position is calculated by the manned vehicle mixed running controller 34 in each manned vehicle.

2) The manned vehicle mixed running controller 34 of the manned vehicle sends a speed limit to a nearby unmanned vehicle and a running continuation permission with a time limit (running permission for short distance control) to the monitoring station 40.

3) The manned vehicle mixed running controller 44 of the monitoring station 40 issues a time-limited running permission (running permission for long-distance control) between a manned vehicle and an unmanned vehicle at a sufficiently separated position.

4) The manned vehicle mixed running controller 44 of the monitoring station 40 combines the driving permission for the short distance control of 2) and the driving permission for the long distance control of 3) to the manned vehicle mixed running controller 4 of the unmanned vehicles 10 and 11. send.

5) The manned vehicle mixed running controller 4 of the unmanned vehicles 10 and 11 continues to run according to the travel permission for the long distance control and the travel permission for the short distance control.

6) If the next continuation permission is expired and there is no next continuation permission, the unmanned vehicle stops.

The control device 5 of the unmanned vehicle 10 inquires of the travel data sharing device 3 of the host vehicle 10 about the travel permission command and inquires of the manned vehicle mixed running controller 4 of the host vehicle 10 about the travel permission command. On condition that the travel permission command is output from both the operation data sharing device 3 and the manned vehicle mixed travel controller 4, the control device 5 controls the host vehicle 10 to travel on the detour course 72.

However, when the travel permission command is not output from either the operation data sharing device 3 or the manned vehicle mixed travel controller 4, the control device 5 causes the host vehicle 10 to reach the block position 61A in response to the stop command. Then, control is performed so as to stop, or if the own vehicle 10 is already traveling on the detour course 72, it is decelerated or stopped depending on the situation. As described above, the control device 5 travels the detour course 72 while always inquiring the permission to continue traveling to the manned vehicle mixed travel controller 4 as well as the travel permission command obtained from the monitoring station 40 via the operation data sharing device 3. (Step 106).

The processes in steps 104 to 106 described above are repeatedly executed unless a command to delete the restricted entry area 60 is output from the manned vehicle 20. The same processing is performed for other unmanned vehicles that run further from behind the unmanned vehicle 10.

When the road construction by the manned vehicle 20 is completed, work completion notification data is input from the input device 36. The work end notification is input to the entry prohibition area controller 35 of the host vehicle 20, and the entry prohibition area controller 35 outputs the work end notification to the communication device 32 of the host vehicle 20. In response to this, a work end notification is transmitted from the communication device 32 to the monitoring station 40 by wireless communication S3.

The communication device 42 of the monitoring station 40 receives the work end notification, and sends this work end notification to the entry prohibition area controller 45 of the own station 40. The restricted area controller 45 sends out a restricted area deletion command to the operation data sharing device 43 of the local station 40.

The unmanned operation management device 48 receives the input of the prohibited entry region deletion command to the operation data sharing device 43, and after the entry of the prohibited entry region deletion command, the new unmanned vehicle enters the detour course 72. A command for prohibiting new entry is output to the operation data sharing device 43, and the data of the entry prohibition area 60, the safety

ensuring area 61, and the detour course 72 stored in the operation data sharing apparatus 43 are deleted. However, if the unmanned vehicle is already traveling on the bypass course 72 at the time when the entry prohibition area deletion command is input, after waiting for the unmanned vehicle 10 to pass the bypass course 72, the entry prohibition area Data such as 60 is deleted (step 107).

In the embodiment described above, the operator of the manned vehicle 20 inputs the data of the start points 60A and 60B of the work range at the start of work such as road construction, and at the end of the work, the operator sends the work end notification data. Although input is performed from the input device 36 of the host vehicle 20, this input operation may be performed at any location. For example, the operator on the monitoring station 40 side displays the display screen of the display device 47 of the host station 40. The same data may be input from the input device 46 while watching.

In the above-described embodiment, the monitoring station 40 is interposed, and data is transmitted from the monitoring station 40 to the unmanned vehicles 10, 11,..., And data is transmitted from the monitoring station 40 to the manned vehicles 20. However, the data is transmitted directly from the unmanned vehicles 10, 11 ... to the manned vehicles 20, ... without the monitoring station 40, or from the manned vehicles 20, ... to the unmanned vehicles 10, 11 ... The data may be transmitted directly. That is, the manned vehicle 20 may be provided with the function of the monitoring station 40 to directly transmit and receive data to and from the unmanned vehicle.

(Second embodiment; detour when manned vehicle is traveling at low speed)

6 (a), (b), (c), FIG. 7, (a), (b), (c), FIG. The processing procedure of the embodiment will be described with reference to the flowchart shown in FIG.

6 (a), 6 (b), and 6 (c) correspond to FIGS. 3 (a), 3 (b), and 3 (c), respectively. The same reference numerals as those in FIG. The description is omitted.

However, as shown in FIG. 6A, the manned vehicle 20 is provided with an overtaking controller 35 ′ instead of the restricted entry area controller 35.

Further, the monitoring station 40 is not provided with the input device 46 and the display device 47 shown in FIG. 3B, and is provided with an overtaking controller 45 ′ instead of the restricted area controller 45.

The configuration of the unmanned vehicles 10 and 11 is the same as that shown in FIG.

In the present embodiment, it is assumed that the manned vehicle 20 on the travel path 50 is traveling at a low speed. In the present embodiment, the detour course 72 for overtaking the low-speed manned vehicle 20 is created in the same manner as the detour course 72 of the first embodiment described above.

First, similarly to Step 101 of the first embodiment, the map data of the travel path 50 is stored in the operation data sharing device 43 in advance prior to the start of work in the mine. The map data of the traveling path 50 is transmitted to all the unmanned vehicles 10, 11,... Via the communication device 42 of the monitoring station 40 by wireless communication S1, S2,. And stored in the operation data sharing device 3. Further, the map data is transmitted to all manned vehicles 20 through wireless communication S3 through the communication device 42 of the monitoring station 40, received by the communication device 32 of the manned vehicle 20 through the operation data sharing device. 33.

Prior to the start of work in the mine, an unmanned vehicle or manned vehicle is used to teach the traveling courses 70, 71, etc. on which the unmanned vehicles 10, 11,. In the management device 48, data of traveling courses 70, 71,... Scheduled to be shared by the unmanned vehicles 10, 11,. The control device 5 of each unmanned vehicle 10, 11 controls the own vehicle 10, 11 to travel along the traveling course 70, 71 according to the course data of the traveling course 70, 71 of the own vehicle (step 201). .

The current position of the own vehicle 20... Measured by the position measuring device 31 of each manned vehicle 20... Is sequentially transmitted to the monitoring station 40 via the communication device 32 by wireless communication S3. It is received by the device 42 and sent to the operation data sharing device 33 of its own station 40. The operation data sharing device 33 of the monitoring station 40 outputs the current position of each manned vehicle 20 to the communication device 42 of the own station 40. As a result, the current positions of the manned vehicles 20 are transmitted to the unmanned vehicles 10, 11 by wireless communication S1, S2 by the communication device 42 of the monitoring station 40, and received by the communication device 2 of the unmanned vehicles 10, 11. And sent to the manned vehicle mixed running controller 4 of the own vehicle 10, 11.

Further, the current positions of the own vehicles 10 and 11 measured by the position measuring device 1

of the unmanned vehicles 10 and 11 are sequentially transmitted from the communication device 2 to the monitoring station 40 through wireless communication S1 and S2, and the monitoring station 40 Are transmitted to the operation data sharing device 43 of the local station 40.

The unmanned vehicle operation management device 48 of the monitoring station 40 is based on the position data of each unmanned vehicle 10, 11... And the position data of each manned vehicle 20 stored in the operation data sharing device 43. Whether the unmanned vehicle 10 may catch up with the low-speed manned vehicle 20 traveling in the same lane 51 by comparing each position of the vehicle 10 and the manned vehicle 20 or a position change (speed) per unit time. Predict and judge.

As a result, if it is predicted that the unmanned vehicle 10 may catch up with the manned vehicle 20 traveling on the same lane 51, the travel permission that the unmanned vehicle 10 may pass the manned vehicle 20 is granted. Is sent to the overtaking controller 45 ′ of the own station 40. In response to this, the overtaking controller 45 ′ outputs a command for permission to travel to the communication device 42 of the local station 40. As a result, a command for permission to travel is transmitted to the communication device 32 of the manned vehicle 20 that may be caught up by the unmanned vehicle 10 in the wireless communication S3 (step 202).

In the communication device 32 of the manned vehicle 20, a command for permission to travel is received and sent to the overtaking controller 35 ′ of the host vehicle 20. The overtaking controller 35 'outputs a command requesting permission to travel to the display device 37 as a display command. As a result, the display of the display device 37 of the manned vehicle 20 displays “travel permission (passing permission) requested”.

The operator of the manned vehicle 20 looks at the display of “there is a request for travel permission” displayed on the display screen of the display device 37, so that the own vehicle 20 shifts to high speed traveling, turns, and so on. If there is no problem such as interference with the unmanned vehicle 10 behind the vehicle, the request for travel permission is approved and a travel permission command is input by the input device 36. In addition, even if the operator of the manned vehicle 20 does not request the travel permission from the monitoring station 40 and the display screen of the display device 37 does not indicate that the travel permission is requested, the own vehicle 20 can also travel at high speed. If there is no problem such as shifting, it is possible to approve the travel permission and voluntarily input a travel permission command from the input device 36.

The travel permission command input by the input device 36 is sent to the overtaking controller 35 ′ of the host vehicle 20. The overtaking controller 35 ′ outputs a travel permission command to the communication device 32 of the host vehicle 20. In response to this, a travel permission command is transmitted from the communication device 32 of the manned vehicle 20 to the monitoring station 40 by wireless communication S3.

The travel permission command is received by the communication device 42 of the monitoring station 40, sent to the overtaking controller 45 ′ of the own station 40, and further output to the unmanned vehicle operation management device 48.

The unmanned vehicle operation management device 48 determines whether or not a travel permission command is input from the overtaking controller 45 '(whether or not the manned vehicle 20 is permitted to pass) (step 203).

As a result of this determination, if a driving permission command is input from the overtaking controller 45 'and it is determined that the manned vehicle 20 is permitting overtaking (determination YES in step 203), then the low speed A safe block position 61B that can avoid interference when the unmanned vehicle 10 travels on the detour course 72 based on the position information of the unmanned vehicle 11 that faces the unmanned vehicle 10 across the manned vehicle 20 The process to stop at. That is, even if a travel permission (passing permission) command is obtained from the manned vehicle 20, if the unmanned vehicle 11 traveling in the facing lane 52 of the unmanned vehicle 10 is approaching the manned vehicle 20, This is because the vehicle 10 should not enter the detour course 72 (step 204).

The facing side lane block process for stopping the unmanned vehicle 11 traveling in the facing side lane 52 at the block position 61B is shown in FIG.

That is, in the overtaking controller 45 ′, as shown in FIG. 7B, the unmanned vehicle 10 is changed to the manned vehicle based on the position data of the unmanned vehicle 10 and the position data of the manned vehicle 20 stored in the operation data sharing device 43. A predicted overtaking distance L required to overtake 20 is calculated. Then, based on the predicted overtaking distance L, a no entry area 60 is created. The off-limit area 60 is an area where the manned vehicle 20 can travel while the unmanned vehicle 10 passes the manned vehicle 20, and, like the off-limit area 60 of the first embodiment, the unmanned vehicle 10 This is an area where entry of the unmanned vehicle 10 is prohibited when the vehicle is detouring. Then, based on the restricted entry area 60, a block position 61B for stopping the unmanned vehicle 11 in the facing lane 52 is created in the same manner as in the first embodiment. The block position 61 </ b> B is set to a position where the unmanned vehicle 10 does not interfere with the unmanned vehicle 11 in the facing lane 52 when the unmanned vehicle 10 travels around the restricted entry area 60.

The predicted overtaking distance L is the slope of the traveling path 50, the difference between the maximum vehicle speeds of the unmanned vehicle 10 and the manned vehicle 20, the current speed of the unmanned vehicle 10 and the manned vehicle 20, the distance required to change lanes, the safety margin, and the processing delay margin. And so on.

However, the entry prohibition area 60 is sequentially updated as follows. That is, the lane change start position is recalculated as needed along with the position of the unmanned vehicle 10. Further, the block position 61B of the facing lane 52 is recalculated in accordance with the movement of the manned vehicle 20 and the change in the traveling speed, and is also recalculated when the processing delay margin is used up.

As shown in FIGS. 7B and 7C, when the manned vehicle 20 is moving to the left in the figure, the entry prohibition area 60 and the block position 61B are sequentially moved to the left in the figure. Become.

The unmanned vehicle operation management device 48 of the monitoring station 40 sends the data of the entry prohibition area 60 and the data of the block position 61B thus created to the operation data sharing device 43.

In this way, the operation data sharing device 43 stores the data of the restricted entry area 60 and the block position 61B. The operation data sharing device 43 outputs data such as the block position 61B to the communication device 32. In response to this, the communication device 32 transmits data such as the block position 61B to the communication device 42 of the unmanned vehicles 10 and 11 by wireless communication S1 and S2, and transmits the data to the manned vehicle 20 by wireless communication S3. As a result, data such as the block position 61B is stored in the operation data sharing device 3 of the unmanned vehicles 10 and 11 and the operation data sharing device 33 of the manned vehicle 20.

After the block position 61B is created, transmission of the travel permission command for the section including the block position 61B is stopped from the communication device 42 of the monitoring station 40 to each unmanned vehicle traveling in the facing lane 52. (Step 301).

The following steps 302 to 308 are performed in consideration of the case where the travel permission command for the section including the block position 61B is already output from the monitoring station 40 to the unmanned vehicle.

That is, the unmanned vehicle operation management device 48 determines whether or not there is an unmanned vehicle scheduled to pass through the block position 61B (step 302). As a result, when there is an unmanned vehicle (for example, unmanned vehicle 11) scheduled to pass through the block position 61B, a stop request command is generated so as to stop at the block position 61B.

The unmanned vehicle operation management device 48 outputs the generated stop request command to the communication device 42 of the own station 40 via the operation data sharing device 43 of the own station 40. As a result, a stop request command is transmitted from the communication device 42 of the monitoring station 40 to the unmanned vehicle 11 in the facing lane 52 by wireless communication S2 (step 303).

In the communication device 2 of the unmanned vehicle 11, a stop request command is received. The communication device 2 sends a stop request command to the control device 5 via the operation data

sharing device 3 of the host vehicle 11. When receiving the stop request command, the control device 5 of the unmanned vehicle 11 compares the block position 61B stored in the operation data sharing device 3 with the current position of the own vehicle 11 measured by the position measurement device 1, It is determined whether or not the block can be stopped at the block position 61B (step 304). As a result, if the vehicle can be stopped at the block position 61B (YES at step 304), the control device 5 controls the travel so that the host vehicle 11 stops at the block position 61B (step 305), Data indicating that the vehicle can be stopped at the position 61B is transmitted to the monitoring station 40 via the communication device 2 (step 306), and the facing-side lane block process is completed. On the other hand, when it is determined that the block cannot be stopped at the block position 61B (NO in Step 304), data indicating that the block cannot be stopped at the block position 61B is sent to the monitoring station 40 via the communication device 2. (Step 307), and the control device 5 controls the traveling of the host vehicle 11 so that the section including the block position 61B is passed as it is. When it is confirmed that the host vehicle 11 has passed the side of the off-limits area 60 and has reached a position where it does not interfere with the unmanned vehicle 10 that attempts to bypass the off-limit area 60 (step 308), the facing lane block process is performed. Complete.
The monitoring station 40 that has received the stop impossible notification in step 307 inputs it to the overtaking controller 45 ′, and the overtaking controller 45 ′ predicts the passing completion position of the manned vehicle 20 and the unmanned vehicle 11, and based on this predicts the unmanned vehicle 11. You may comprise so that it may block beforehand, calculating the entry prohibition area | region for overtaking after passing, and the block position of the succeeding vehicle of the unmanned vehicle 11. FIG.

If it is determined in step 302 that there is no unmanned vehicle that is scheduled to pass the block position 61B (determination NO in step 302), the facing lane block process is completed.

The facing lane block process is performed as described above (step 204), and when the facing lane block process is completed (YES in step 205), the unmanned vehicle operation management device 48 is stored in the operation data sharing device 43. The course generation device 41 creates the detour course 72 based on the data of the entry prohibition area 60 and the block position 61B.

The detour course 72 is a travel course that deviates from the planned travel course 70 of the unmanned vehicle (unmanned vehicle 10) that travels behind the manned vehicle 20 in the lane 51 on the off-limits area 60 side, similar to the detour course 72 described above. In this case, the course returns to the traveling course 70 of the host vehicle 10 at a point corresponding to the block position 61B through the facing lane 52 so as to avoid the restricted entry area 60.

The unmanned vehicle operation management device 48 of the monitoring station 40 sends the data of the detour course 72 created in this way to the operation data sharing device 43.

In this way, the operation data sharing device 43 stores the data of the detour course 72. The operation data sharing device 43 outputs the data of the detour course 72 to the communication device 32. In response to this, the communication device 32 transmits the data of the detour course 72 to the communication device 42 of the unmanned vehicles 10 and 11 by the wireless communication S1 and S2, and transmits the data to the manned vehicle 20 by the wireless communication S3. Thereby, the data of the detour course 72 is stored in the operation data sharing device 3 of the unmanned vehicles 10, 11 and the operation data sharing device 33 of the manned vehicle 20, and the shared data of the detour course 72 is stored in all the vehicles 10, 11,. 20 ... will be taught.

On the display screen of the display device 37 of the manned vehicle 20, the restricted entry area 60, the block position 61B, and the detour course 72 are displayed together with the current position of the host vehicle 20 measured by the position measurement device. Thereby, the operator of the manned vehicle 20 can recognize that the unmanned vehicle 10 may pass the own vehicle 20 through the detour course 72 (step 206).

The unmanned vehicle operation management device 48 of the monitoring station 40 again asks the manned vehicle 20 for permission that the unmanned vehicle 10 may start traveling on the detour course 72 when the detour course 72 is created. The command is sent to the overtaking controller 45 ′ of the own station 40. In response to this, the overtaking controller 45 ′ outputs a command for permission to start driving to the communication device 42 of the own station 40. Thereby, the instruction |

command which requests | requires driving | running | working start permission is transmitted with respect to the communication apparatus 32 of the manned vehicle 20 overtaken by the detour course 72 by radio | wireless communication S3.

In the communication device 32 of the manned vehicle 20, a command requesting permission to start traveling is received and sent to the overtaking controller 35 ′ of the host vehicle 20. The overtaking controller 35 'outputs a command requesting permission to start traveling to the display device 37 as a display command. As a result, the display screen of the display device 37 of the manned vehicle 20 displays “A request for permission to start traveling (passing start permission) for the detour course 72”.

When the operator of the manned vehicle 20 sees the display of “There is a request for permission to start driving the detour course 72” displayed on the display screen of the display device 37, the own vehicle 20 shifts to high speed driving, or FIG. If there is no problem such as interfering with the unmanned vehicle 10 behind in the area D as seen in the facing lane 52 for turning or the like, the request for permission to start traveling is approved, and the input device 36 Enter the permission to start driving.

The travel start permission command input by the input device 36 is sent to the overtaking controller 35 ′ of the host vehicle 20. The overtaking controller 35 ′ outputs a travel start permission command to the communication device 32 of the host vehicle 20. In response to this, a travel start permission command is transmitted from the communication device 32 of the manned vehicle 20 to the monitoring station 40 by wireless communication S3.

The travel start permission command is received by the communication device 42 of the monitoring station 40, sent to the passing controller 45 ′ of the own station 40, and further output to the unmanned vehicle operation management device 48.

The unmanned vehicle operation management device 48 determines whether or not a travel start permission command is input from the overtaking controller 45 ′ (whether or not the manned vehicle 20 is permitted to start traveling on the detour course 72). As a result of this determination, when a driving start permission command is input from the overtaking controller 45 ′ and it is determined that the manned vehicle 20 is permitted to start driving on the detour course 72, the unmanned vehicle operation management device 48. Sends a travel permission command for allowing the unmanned vehicle 10 to travel on the detour course 72 to the operation data sharing device 43. The operation data sharing device 43 outputs a travel permission command to the communication device 42 of the own station 40.

In addition, when the travel start permission command is not obtained from the manned vehicle 20, the unmanned operation management device 48 of the monitoring station 40 may change the entry prohibited area 60, the block position 61B, and the detour course 72 at any time according to the position of the manned vehicle. Wait for permission while updating the schedule data.

In addition, when an overtaking prohibition input is explicitly received from a manned vehicle, or when it is determined that overtaking is impossible due to a change in a situation such as a traveling speed of a manned vehicle or a position of an oncoming vehicle, an unmanned vehicle operation management device of the monitoring station 40 48 deletes the planned entry data of the restricted entry area 60, the block position 61B, and the detour course 72 stored in the operation data sharing device 43.

When a travel start permission command is obtained from the manned vehicle 20 and a travel permission command is generated by the monitoring station 40 accordingly, the communication device 42 of the monitoring station 40 travels to the unmanned vehicle 10 by wireless communication S1. A permission command is sent. In addition, the communication device 42 of the monitoring station 40 transmits a running permission notification that the unmanned vehicle 10 has been allowed to travel to the manned vehicle 20 by wireless communication S3.

The communication device 2 of the unmanned vehicle 10 receives the travel permission command. The communication device 2 sends a travel permission command to the operation data sharing device 3 of the

host vehicle 10.

On the other hand, in the manned vehicle mixed running controller 4 of the unmanned vehicle 10, the own vehicle 10 runs on the detour course 72 based on the position data of each manned vehicle 20... Separately from the travel permission command given from the monitoring station 40. A travel permission command for permitting the vehicle is generated. That is, even if a travel permission command is obtained from the monitoring station 40, travel should not be permitted if there is a possibility of interference with the unmanned vehicle 10 due to careless behavior of each manned vehicle 20. It is. Moreover, you may comprise so that this process may be performed by the manned vehicle mixed running controller 34 of the manned vehicle 20 like 1st Example.

The control device 5 of the unmanned vehicle 10 inquires of the travel data sharing device 3 of the host vehicle 10 about the travel permission command and inquires of the manned vehicle mixed running controller 4 of the host vehicle 10 about the travel permission command. On condition that the travel permission command is output from both the operation data sharing device 3 and the manned vehicle mixed travel controller 4, the control device 5 controls the host vehicle 10 to travel on the detour course 72.

However, when the travel permission command is not output from either the operation data sharing device 3 or the manned vehicle mixed running controller 4, the control device 5 does not pass the low speed manned vehicle 20 according to the situation. The travel of the host vehicle 10 is controlled so as to decelerate or stop. As described above, the control device 5 travels the detour course 72 while always inquiring the permission to continue traveling to the manned vehicle mixed travel controller 4 as well as the travel permission command obtained from the monitoring station 40 via the operation data sharing device 3. Continue.

On the other hand, the communication device 32 of the manned vehicle 20 receives the notification that the unmanned vehicle 10 is permitted to travel, and sends it to the overtaking controller 35 ′ of the host vehicle 20. The overtaking controller 35 ′ outputs a running permission notification to the display device 37 as a display command. As a result, the display screen of the display device 37 of the manned vehicle 20 displays “Un allowed to drive the unmanned vehicle 10 (passing)”, and warns the operator that the driver is overtaking. This warning causes the host vehicle 20 to shift to a high speed or to interfere with the unmanned vehicle 10 behind in the region D (FIG. 7D) as seen from the facing lane 52 in order to make a turn or the like. Attention can be drawn so as not to cause (step 207).

The unmanned operation management device 48 determines whether or not the unmanned vehicle 10 has finished traveling on the detour course 72. When it is determined that the unmanned vehicle 10 has finished traveling on the detour course 72, the unmanned operation management device 48 of the monitoring station 40 determines that the no entry area 60, the block position 61B, the detour course stored in the operation data sharing device 43. 72 data is deleted.

In the second embodiment, data is transmitted from the monitoring station 40 to the unmanned vehicles 10, 11... Via the monitoring station 40, or data is transmitted from the monitoring station 40 to the manned vehicles 20. However, without intervention of the monitoring station 40, data is transmitted directly from the unmanned vehicles 10, 11 ... to the manned vehicles 20, or from the manned vehicles 20 ... to the unmanned vehicles 10, 11 ... Alternatively, the data may be directly transmitted. That is, the low-speed manned vehicle 20 may be provided with the function of the monitoring station 40 to directly transmit / receive data to / from the unmanned vehicle.

(Third embodiment; detour when unmanned vehicle is traveling at low speed)

Hereinafter, the processing of the embodiment will be described with reference to the configuration diagrams shown in FIGS. 10A, 10B, and 10C and the traveling path 50 shown in FIGS. 11A, 11B, and 11C. The procedure of will be described.

The present embodiment is an embodiment in which the manned vehicle 20 traveling at a low speed in the second embodiment is replaced with the unmanned vehicle 12 traveling at a low speed, and the description overlapping the second embodiment is omitted. To do.

FIGS. 10A, 10B, and 10C correspond to FIGS. 6A, 6B, and 6C, respectively. The same reference numerals as those in FIG.

The configuration of the unmanned vehicles 10 and 11 is the same as the configuration of FIG. 6C of the

second embodiment, as shown in FIG.

The configuration of the low-speed unmanned vehicle 12 to be overtaken is the same as the configuration of the other unmanned vehicles 10 and 11 (FIG. 10C), as shown in FIG.

The monitoring station 40 is the same as the configuration of FIG. 6B except that the manned vehicle mixed running controller 44 shown in the configuration of FIG. 6B of the second embodiment is not provided.

In this embodiment, it is assumed that the unmanned vehicle 12 on the travel path 50 is traveling at a low speed. In the present embodiment, as in the second embodiment, a detour course 72 for overtaking the low-speed unmanned vehicle 12 is created.

That is, as shown in FIG. 11A, when the monitoring station 40 determines that there is a possibility that the unmanned vehicle 10 may catch up with the unmanned vehicle 12 traveling in the same lane 51 at a low speed, FIG. As shown in FIG. 4, the block position 61B is created in the facing lane 52, and the entry prohibition area 60 is created so that the unmanned vehicle 11 traveling in the facing lane 52 stops at the block position 61B. A stop command is given to the unmanned vehicle 11. The off-limit area 60 is created based on the data of the traveling course 73 on which the unmanned vehicle 12 is scheduled to travel.

If it is confirmed that the unmanned vehicle 11 in the facing lane 52 is surely stopped at the block position 61B, the detour course 72 is created, and the low-speed unmanned vehicle 12 decelerates along the traveling course 73. To give a running command to run.

When the detour course 72 is created, the monitoring station 40 gives a travel permission command to the unmanned vehicle 10 and causes the detour course 72 to travel as shown in FIG.

When the monitoring station 40 determines that the unmanned vehicle 10 has finished traveling on the detour course 72, the monitoring station 40 deletes the data of the block position 61B of the facing lane 52 and the detour course 72.

In the above description of each embodiment, the case where the vehicle in the facing lane 52 is the unmanned vehicle 11 has been described. However, the vehicle in the facing lane 52 may be a manned vehicle.

In the above embodiments, the case where the vehicle to be overtaken is a work vehicle or a low-speed vehicle has been described. However, as the vehicle to be overtaken, an unmanned vehicle that travels behind has an obstacle to high-speed running. As long as the vehicle is equipped with a vehicle, it may be a malfunctioning vehicle.

As described above, according to the embodiment, the position information of the manned vehicle 20 (or the unmanned vehicle 12) in either one of the round-trip lanes 51 and 52 (the start point 60A, the end point 60B of the work range, or the traveling course 73). On the basis of the data), a detour course 72 is created on the basis of the information on the off-limit area 60, and the information on the detour course 72 is used for each unmanned vehicle 10, 11, 12,. The unmanned vehicle 11 in the facing lane 52 of the restricted entry area 60 is taught on the basis of the positional information of the unmanned vehicle 10 and the unmanned vehicle 11 (or manned vehicle) that teach the vehicles 20. Alternatively, the maneuvering vehicle 10 is blocked at the block position 61B, and the unmanned vehicle 10 traveling on the lane 51 on the off-limits area 60 side is given a travel permission command to bypass the course. And so as to travel 2. For this reason, when the unmanned vehicle 10 and the unmanned vehicle 11 (or manned vehicle) are faced to each other, it is possible to reliably prevent the vehicles from interfering with each other, and at the same time, the unmanned vehicle 10 behind the low-speed vehicle or the like hinders high-speed travel. The manned vehicle 20 (or the unmanned vehicle 12) can be detoured at high speed, and transport efficiency and work efficiency are improved while ensuring safety.

Explanation of symbols

10, 11, 12 Unmanned vehicle 20 Manned vehicle 40 Monitoring station 50 Traveling road 51, 52 Lane 60 No entry area 61A, 61B Block position 70, 71, 73 Traveling course 72 Detour course

**Claims**

Driving control of a vehicle, in which an unmanned vehicle provided with a driving control means for driving the host vehicle along the driving course according to the taught driving course data is face-to-face driven on

a driving path having an adjacent round-trip lane. A device,
On the basis of the position information of the vehicle on either lane of the round-trip lane, a restricted entry area creating means for creating a restricted entry area surrounding the vehicle,
A detour course creation means for creating a detour course that returns to the lane of the host vehicle through the facing lane while avoiding the off-limit area based on the off-limit area,
Detour course teaching means for teaching each vehicle of detour course information;
A detour course is provided for unmanned vehicles traveling in the lane in the restricted area, while blocking the vehicle in the facing lane in the restricted area, based on the position information of each vehicle that faces the restricted area. A travel permission command output means for giving a travel permission command for permitting traveling, and
A travel control device for a vehicle, characterized in that the travel control means for the unmanned vehicle to which the travel permission command is given controls the travel of the own vehicle along the bypass course according to the data of the bypass course taught.
The vehicle travel control apparatus according to claim 1,
An input means for inputting the position information of the vehicle existing in the restricted area is provided,
The entry prohibition area creating means creates an entry prohibition area based on the inputted vehicle position information.
The vehicle travel control apparatus according to claim 1,
The detour course creation means, the detour course teaching means, and the travel permission command output means are provided in a monitoring station that monitors the travel of the vehicle,
The monitoring station and each vehicle are provided with transmission / reception means for transmitting and receiving information between the monitoring station and the vehicle,
The detour course information is sent from the monitoring station to each vehicle,
A vehicle travel control device, characterized in that a travel permission command is transmitted from a monitoring station to an unmanned vehicle traveling in a lane on an off-limit area side.
The vehicle travel control apparatus according to claim 2,
The input means is provided in a manned or unmanned vehicle existing in a restricted area,
The detour course creation means, the detour course teaching means, and the travel permission command output means are provided in a monitoring station that monitors the travel of the vehicle,
The monitoring station and each vehicle are provided with transmission / reception means for transmitting and receiving information between the monitoring station and the vehicle,
Information on restricted areas is sent to the monitoring station from manned or unmanned vehicles in restricted areas,
The detour course information is sent from the monitoring station to each vehicle,
A vehicle travel control device, characterized in that a travel permission command is transmitted from a monitoring station to an unmanned vehicle traveling in a lane on an off-limit area side.
The vehicle travel control apparatus according to claim 1,
The entry prohibition area is an area where the vehicle is working, an area where the vehicle runs at a low speed, or an area where a faulty vehicle is present.
The vehicle travel control apparatus according to claim 1,
Vehicles that are in restricted areas are manned vehicles,
A vehicle permission command is given to an unmanned vehicle traveling in a lane on the off-limit area on condition that a permission command permitting traveling on a detour course is received from the manned vehicle. Travel control device.

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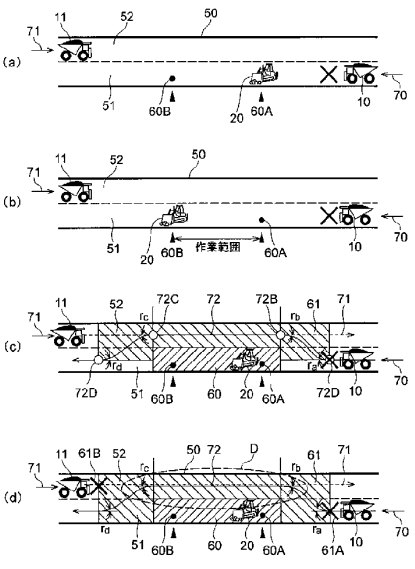
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最終頁に続く

(54)【発明の名称】車両の走行制御装置

(57)【要約】
【課題】　車両を対面走行させるに際して、車両同士の干渉を防止しつつも、高速走行に支障のある車両（作業車両、低速車両、故障車両等）を高速で迂回するようにして、安全を確実に保障しつつ、搬送効率、作業効率を向上させる。
【解決手段】　往復車線５１、５２のうちいずれか一方の車線の有人車両２０の位置情報に基づいて、立入禁止領域６０が作成され、この立入禁止領域６０の情報に基づいて、迂回コース７２が作成される。この迂回コース７２の情報は各無人車両１０、１１、有人車両２０…に教示される。そして、立入禁止領域６０を挟んで対面走行する無人車両１０、無人車両１１の位置情報に基づいて、立入禁止領域６０の対面側車線５２の無人車両１１をブロック位置６１Ｂでブロックしつつ、立入禁止領域６０側の車線５１を走行する無人車両１０に対して、迂回コース７２に対して走行許可指令が与えられ、無人車両１０は、迂回コース７２を走行する。
【選択図】　図４




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【特許請求の範囲】
【請求項１】
教示された走行コースのデータにしたがい当該走行コースに沿って自車両を走行させる走行制御手段が備えられた無人車両を、隣接する往復の車線を備えた走行路において対面走行させる、車両の走行制御装置であって、
往復車線のうちいずれか一方の車線の車両の位置情報に基づいて、当該車両を囲む立入禁止領域を作成する立入禁止領域作成手段と、
立入禁止領域に基づいて、当該立入禁止領域を回避して対面側の車線を通り自車両の車線に戻る迂回コースを作成する迂回コース作成手段と、
迂回コースの情報を各車両に教示する迂回コース教示手段と、
立入禁止領域を挟んで対面走行する各車両の位置情報に基づいて、立入禁止領域の対面側車線の車両をブロックしつつ、立入禁止領域側の車線を走行する無人車両に対して、迂回コースを走行させることを許可する走行許可指令を与える走行許可指令出力手段と
が備えられ、
走行許可指令が与えられた無人車両の走行制御手段は、教示された迂回コースのデータにしたがい当該迂回コースに沿って自車両を走行させる制御を行うこと
を特徴とする車両の走行制御装置。
【請求項２】
請求項１記載の車両の走行制御装置において、
立入禁止領域に存在する車両の位置情報を入力する入力手段が設けられ、
立入禁止領域作成手段は、入力された車両位置情報に基づいて、立入禁止領域を作成するものであること
を特徴とする車両の走行制御装置。
【請求項３】
請求項１記載の車両の走行制御装置において、
迂回コース作成手段と、迂回コース教示手段と、走行許可指令出力手段は、車両の走行を監視する監視局に設けられ、
監視局と各車両には、監視局と車両との間で相互に情報を送受信する送受信手段が設けられ、
監視局から各車両に対して、迂回コースの情報が送信され、
監視局から立入禁止領域側の車線を走行する無人車両に対して、走行許可指令が送信されること
を特徴とする車両の走行制御装置。
【請求項４】
請求項２記載の車両の走行制御装置において、
入力手段は、立入禁止領域に存在する有人または無人の車両に設けられ、
迂回コース作成手段と、迂回コース教示手段と、走行許可指令出力手段は、車両の走行を監視する監視局に設けられ、
監視局と各車両には、監視局と車両との間で相互に情報を送受信する送受信手段が設けられ、
立入禁止領域に存在する有人または無人の車両から監視局に対して、立入禁止領域の情報が送信され、
監視局から各車両に対して、迂回コースの情報が送信され、
監視局から立入禁止領域側の車線を走行する無人車両に対して、走行許可指令が送信されること
を特徴とする車両の走行制御装置。
【請求項５】
請求項１記載の車両の走行制御装置において、
立入禁止領域は、車両が作業を行う領域または車両が低速で走行する領域または故障している車両が存在する領域であること

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を特徴とする車両の走行制御装置。
【請求項６】
請求項１記載の車両の走行制御装置において、
立入禁止領域に存在する車両は、有人車両であって、
当該有人車両から、迂回コースを走行することを許諾する許諾指令を受け取ることを条件に、走行許可指令を、立入禁止領域側の車線を走行する無人車両に対して与えること
を特徴とする車両の走行制御装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、教示された走行コースのデータにしたがい当該走行コースに沿って自車両を走行させる走行制御手段が備えられた各無人車両を、隣接する往復の車線を備えた走行路において対面走行させる、車両の走行制御装置に関する。
【背景技術】
【０００２】
採石現場、鉱山などの広域の作業現場で土砂運搬作業を行うに際して、作業者の疲労による事故の回避、省人化、作業時間の延長による生産性の向上を図るべく、有人の車両（オフロードダンプトラック）の代わりに無人の車両を稼動させるという無人車両走行システムが導入されている。複数の無人ダンプトラックを運行管理するために、地上局として監視局を設営して、この監視局により、これら複数の無人ダンプトラックを統括して管理、監視するように、無人車両走行システムが構築されている。
【０００３】
しかし、作業現場を走行する車両のすべてを無人車両とすることは、実際上は不可能である。すなわち、作業現場では、無人のダンプトラック以外に、グレーダ、散水車、ホイールローダ、エスカベータ、トレーラ、オペレータ送迎車、計測用車両などの有人車両を走行させる必要がある。
【０００４】
作業現場では、図１に示すように、掘削現場Ａと処理施設Ｂとを繋ぐ走行路Ｒに、互いに隣接する往復の車線Ｒａ、Ｒｂが設けられており、それぞれの車線Ｒａ、Ｒｂに予め設定した走行コースのデータ（コースデータ）と、ＧＰＳ等の位置計測システムを利用して得られる車両の走行に関するデータ（走行データ；車両位置、速度等）とに基づいて、各車両Ｔ1、Ｔ2が自律誘導走行され、車両Ｔ1、Ｔ2がそれぞれ往復車線Ｒａ、Ｒｂ上を対面走行する。
【０００５】
ここで、たとえば往復車線のうちいずれか一方の車線、たとえば車線Ｒａ上で、有人のモータグレーダＴ3が、道路工事を行っていたとする。道路工事は、低速若しくは停止状態で行われ、同じ車線Ｒａを走行する後方の車両Ｔ1にとって高速走行の妨げとなり、搬送効率、作業効率の低下を招く。
【０００６】
ここで、仮に、対面走行する各車両Ｔ1、Ｔ2が有人車両同士である場合には、搭乗するオペレータ同士で直接コミュニケーションをとって、車両Ｔ1が、グレーダＴ3を追い越して自車両Ｔ1にとって対面側の車線Ｒｂを通るような迂回コースＣａに沿って走行することにより、車両同士の干渉を防止しつつ高速走行を続行することができる。
【０００７】
また、仮に、迂回コースＣａを通ってグレーダＴ3を追い越そうとする車両Ｔ1が有人車両であって、対面側の車両Ｔ2が無人車両である場合にも、有人車両Ｔ1のオペレータが対面側の車両Ｔ2の動きに注意しながら迂回コースＣａを走行することができるため、車両同士の干渉を防止しつつ高速走行を続行することができる。
【０００８】
さらには、有人車両Ｔ1のオペレータは、追い越そうとするグレーダＴ3の動きをみきわ

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め、必要に応じて無線機などを通してグレーダＴ3のオペレータからの追い越し許可を得るため、グレーダＴ3の突然の挙動（たとえば転回のために対向車線Ｒbにはみ出した場合など）を防ぎつつ、グレーダＴ3と干渉することなく追い越しを行うことができる。

【０００９】

しかし、迂回コースＣaを通ってグレーダＴ3を追い越そうとする車両Ｔ1が無人車両である場合（対面側の車両Ｔ2が、無人または有人の車両である場合）には、無人車両Ｔ1自体には、対面側の車両Ｔ2の動きをみきわめつつ迂回コースＣaに沿って対面側を走行するという能力やオペレータから追い越し許可を得る能力が備わっていないため、何らかの制御を付加しなければ、車両同士の干渉を防止しつつ高速走行を続行することは不可能である。さらには、無人車両Ｔ1自体には、追い越そうとするグレーダＴ3の動きをみきわめつつ迂回コースＣaに沿ってグレーダＴ3を追い越すという能力が備わっていないため、何らかの制御を付加しなければ、グレーダＴ3を追い越し中に、グレーダＴ3の突然の挙動（たとえば転回を行うために対向車線Ｒbにはみ出した場合など）によって、グレーダＴ3と干渉するおそれが生じる。

【００１０】

下記特許文献１には、車両同士の干渉防止を目的として、各車両の現在の位置と車両最大速度とに基づいて、各車両毎に、現在位置から最大速度で移動した場合の距離を半径とする円を、存在可能エリアとして求め、存在可能エリア同士が干渉する場合に、対応する車両同士が干渉する可能性があると判定して、一方の車両を減速若しくは停止させるという発明が記載されている。

【００１１】

また、下記特許文献２には、同一走行方向に、無人車両と有人車両とがフリート走行する場合に、これら同一方向を走行する車両同士の接近による干渉防止を目的として、有人車両と後方の無人車両との距離が所定距離以下になるまで接近すると、後方の無人車両を減速若しくは停止させるという発明が記載されている。

【００１２】

また、下記特許文献３には、車両と走行路上の障害物との干渉防止を目的として、車両にビデオカメラ等の障害物センサを搭載し、障害物センサによって走行路上で障害物を検出すると、障害物センサの検出情報に基づいて、障害物を避けて迂回するための迂回コースを作成し、この迂回コースに沿って車両を走行させるという発明が記載されている。

【特許文献１】特開２０００－３３９０２９号

【特許文献２】特開平９－２３１５００号公報

【特許文献３】特開平１１－２４２５２０号公報

【発明の開示】

【発明が解決しようとする課題】

【００１３】

特許文献１記載の発明によれば、車両同士が近接した場合に、一方の車両を減速または停止させているため、車両同士の干渉を確実に防止することができる。

【００１４】

しかし、図１のように、車両Ｔ1を迂回コースＣaに沿って走行させてグレーダＴ3を追い越すような状況に、この発明を適用したとすると、車両Ｔ1が追い越し中にグレーダＴ3に近接することで、車両Ｔ1が減速または停止することになってしまい、追い越し自体が不可能になる。また、この発明では、対面走行する車両同士の連携は、何ら考慮されていない。このため、迂回コースＣaに沿って対面側車線Ｒbを走行中の車両Ｔ1が、同じ車線Ｒbを反対側に走行する車両Ｔ2に近接してしまう状況も生み出される。この場合には、車両Ｔ1が車両Ｔ2に近接することで車両Ｔ1が減速または停止することになってしまい、対面通行する車両同士の干渉は防止できても、追い越し自体が不可能になるおそれがある。

【００１５】

また、特許文献２記載の発明は、そもそも、同一走行方向に、複数の車両がフリート走行する場合のみを想定しており、対面走行する状況は、何ら想定されていない。このため

Textron Specialized Vehicles Inc., Exh. 1002, p. 244

図１のように、車両Ｔ1を迂回コースＣaに沿って走行させてグレーダＴ3を追い越すような状況に、この発明を適用したとすると、車両Ｔ1がグレーダＴ3に追い越すために所定距離まで近接した時点で、車両Ｔ1が減速または停止することになってしまい、追い越し自体が不可能になる。

【００１６】

また、特許文献３記載の発明は、そもそも、走行路上の障害物を回避する場合のみを想定しており、対面走行する車両のことは、何ら考慮されていない。このため図１のように、車両Ｔ1を迂回コースＣaに沿って走行させてグレーダＴ3を追い越すことはできても、車両Ｔ1が、対面走行する車両Ｔ2と干渉してしまうおそれがある。また、特許文献３記載の発明は、障害物センサの検出情報に基づいて迂回コースＣaを作成するというものであり、障害物であるグレーダＴ3の将来の挙動までは何ら考慮されていない。このため車両Ｔ1がグレーダＴ3を追い越し中に、グレーダＴ3の突然の挙動（たとえば転回を行うために対向車線Ｒbにはみ出した場合など）によって、グレーダＴ3と干渉するおそれが生じる。また、雨などにより滑りやすくなっている場所など、障害物センサでは見ることができないが、回避すべきものがあった場合にも対処できない。

【００１７】

また、鉱山などの走行路Ｒは、未舗装道路であり、グレーダＴ3が路面の切削作業を行うことでウインドローなど、車両Ｔ1の走行にとって支障のある障害物が路面に形成される。このため、場合によっては、車両Ｔ1がグレーダＴ3を追い越す際にウインドローに乗り上げるなどの問題が発生するおそれがある。

【００１８】

以上のように従来技術は、いずれも、車両同士の干渉は防止できても高速での追い越しが不可能であるか、あるいは、追い越しが可能であっても車両同士の干渉は避けられないというものであり、両方を満足させるものではなかった。

【００１９】

本発明は、こうした実状に鑑みてなされたものであり、車両を対面走行させるに際して、車両同士の干渉を防止しつつも、後方を走行する車両にとって高速走行に支障のある車両（作業車両、低速車両、故障車両等）を高速で迂回するようにして、安全を確実に保障しつつ、搬送効率、作業効率を向上させることを解決課題とするものである。

【課題を解決するための手段】

【００２０】

第１発明は、

教示された走行コースのデータにしたがい当該走行コースに沿って自車両を走行させる走行制御手段が備えられた無人車両を、隣接する往復の車線を備えた走行路において対面走行させる、車両の走行制御装置であって、

往復車線のうちいずれか一方の車線の車両の位置情報に基づいて、当該車両を囲む立入禁止領域を作成する立入禁止領域作成手段と、

立入禁止領域に基づいて、当該立入禁止領域を回避して対面側の車線を通り自車両の車線に戻る迂回コースを作成する迂回コース作成手段と、

迂回コースの情報を各車両に教示する迂回コース教示手段と、

立入禁止領域を挟んで対面走行する各車両の位置情報に基づいて、立入禁止領域の対面側車線の車両をブロックしつつ、立入禁止領域側の車線を走行する無人車両に対して、迂回コースを走行させることを許可する走行許可指令を与える走行許可指令出力手段と

が備えられ、

走行許可指令が与えられた無人車両の走行制御手段は、教示された迂回コースのデータにしたがい当該迂回コースに沿って自車両を走行させる制御を行うこと

を特徴とする。

【００２１】

第２発明は、

第１発明の車両の走行制御装置において、

Textron Specialized Vehicles Inc., Exh. 1002, p. 245

立入禁止領域に存在する車両の位置情報を入力する入力手段が設けられ、
立入禁止領域作成手段は、入力された車両位置情報に基づいて、立入禁止領域を作成するものであること
を特徴とする。

【００２２】

第３発明は、
第１発明の車両の走行制御装置において、
迂回コース作成手段と、迂回コース教示手段と、走行許可指令出力手段は、車両の走行を監視する監視局に設けられ、
監視局と各車両には、監視局と車両との間で相互に情報を送受信する送受信手段が設けられ、
監視局から各車両に対して、迂回コースの情報が送信され、
監視局から立入禁止領域側の車線を走行する無人車両に対して、走行許可指令が送信されること
を特徴とする。

【００２３】

第４発明は、
第２発明の車両の走行制御装置において、
入力手段は、立入禁止領域に存在する有人または無人の車両に設けられ、
迂回コース作成手段と、迂回コース教示手段と、走行許可指令出力手段は、車両の走行を監視する監視局に設けられ、
監視局と各車両には、監視局と車両との間で相互に情報を送受信する送受信手段が設けられ、
立入禁止領域に存在する有人または無人の車両から監視局に対して、立入禁止領域の情報が送信され、
監視局から各車両に対して、迂回コースの情報が送信され、
監視局から立入禁止領域側の車線を走行する無人車両に対して、走行許可指令が送信されること
を特徴とする。

【００２４】

第５発明は、
第１発明の車両の走行制御装置において、
立入禁止領域は、車両が作業を行う領域または車両が低速で走行する領域または故障している車両が存在する領域であること
を特徴とする。

【００２５】

第６発明は、
第１発明の車両の走行制御装置において、
立入禁止領域に存在する車両は、有人車両であって、
当該有人車両から、迂回コースを走行することを許諾する許諾指令を受け取ることを条件に、走行許可指令を、立入禁止領域側の車線を走行する無人車両に対して与えること
を特徴とする。

【００２６】

第１発明によれば、図４に示すように、往復車線５１、５２のうちいずれか一方の車線（車線５１）の有人車両２０の位置情報６０Ａ、６０Ｂに基づいて、立入禁止領域６０が作成され、この立入禁止領域６０の情報に基づいて、迂回コース７２が作成される。この迂回コース７２の情報は各無人車両１０、１１、有人車両２０…に教示される。そして、立入禁止領域６０を挟んで対面走行する無人車両１０、無人車両１１の位置情報に基づいて、立入禁止領域６０の対面側車線５２の無人車両１１をブロック位置６１Ｂでブロックしつつ、立入禁止領域６０側の車線５１を走行する無人車両１０に対して、迂回コース７

Textron Specialized Vehicles Inc., Exh. 1002, p. 246

２に対して走行許可指令が与えられ、無人車両１０は、迂回コース７２を走行する。このため、本発明によれば、無人車両１０、無人車両１１を対面走行させるに際して、車両同士の干渉を確実に防止することができると同時に、低速車両などの後方の車両１０にとって高速走行に支障のある有人車両２０を高速で迂回することができ、安全を確実に保障しながらも、搬送効率、作業効率が向上する。

【００２７】

第２発明によれば、図４（ａ）、（ｂ）に示すように、立入禁止領域６０に存在する有人車両２０の作業範囲の始点６０Ａ、終点６０の位置情報が、入力手段から入力される。そして、図４（ｃ）に示すように、入力された作業範囲の始点６０Ａ、終点６０Ｂの位置情報に基づいて、立入禁止領域６０が作成される。

【００２８】

第３発明によれば、図２に示すように、監視局４０から各車両１０、１１…、２０に対して、無線通信Ｓ1、Ｓ2、Ｓ3にて迂回コース７２の情報が送信され、監視局４０から立入禁止領域６０側の車線５１を走行する無人車両１０に対して、無線通信Ｓ1にて、迂回コース７２の走行を許可する走行許可指令が送信される。

【００２９】

第４発明によれば、図２に示すように、立入禁止領域６０に存在する有人車両２０から監視局４０に対して、無線通信Ｓ3にて、立入禁止領域６０の情報（作業範囲の始点６０Ａ、終点６０Ｂの位置情報）が送信され、監視局４０から各車両１０、１１…、２０に対して、無線通信Ｓ1、Ｓ2、Ｓ3にて迂回コース７２の情報が送信され、監視局４０から立入禁止領域６０側の車線５１を走行する無人車両１０に対して、無線通信Ｓ1にて、迂回コース７２の走行を許可する走行許可指令が送信される。

【００３０】

第５発明によれば、図４あるいは図７あるいは図１１に示すように、立入禁止領域６０は、有人車両２０が作業を行う領域あるいは有人車両２０が低速で走行する領域あるいは無人車両１２が低速で走行する領域であるものとして作成される。また、立入禁止領域６０を、故障している車両が存在する領域であるものとして作成することもできる。

【００３１】

第６発明によれば、図４に示すように、立入禁止領域６０に存在する車両は、有人車両２０であって、有人車両２０から、迂回コース７２を走行することを許諾する許諾指令を受け取ることを条件に、走行許可指令が、立入禁止領域６０側の車線５１を走行する無人車両１０に対して与えられる。これにより、立入禁止領域６０をはみでる可能性がなくなった時点で有人車両２０から許諾指令が与えられるため、有人車両２０が無人車両１０と干渉してしまうことを確実に回避することができる。

【発明を実施するための最良の形態】

【００３２】

以下、実施例を示す図面に基づいて、本発明を詳細に説明する。

【００３３】

図２は、本発明に係る車両の走行制御装置を、鉱山での無人車両走行システムに採用した一実施例を示している。また、本実施例の無人車両走行システムでは、無人車両としてダンプトラックを想定している。

【００３４】

同図２に示すように、鉱山の掘削現場５０Ａと処理施設５０Ｂとを繋ぐ走行路５０には、互いに隣接する往復の車線５１、５２が設けられており、それぞれの車線５１、５２に予設定した走行コース７０、７１のデータ（コースデータ）と、ＧＰＳ等の位置計測システムを利用して得られる車両の走行に関するデータ（走行データ；車両位置、速度等）とに基づいて、各無人車両１０、１１…が自律誘導走行される。図２では、無人車両１０、１１がそれぞれ、往復車線５１、５２上を、走行コース７０、７１に沿って対面走行している場合を示している。なお、無人車両とは、オペレータが搭乗しないで稼動する車両のことである。

Textron Specialized Vehicles Inc., Exh. 1002, p. 247

【００３５】
また、走行路５０には、各有人車両２０…が存在している。なお、有人車両とは、オペレータが搭乗している車両のことである。図２では、有人のモータグレーダ２０が、走行路５０の一方の車線５１において道路工事を行っている場合を示している。
【００３６】
道路工事は、始点６０Ａ、終点６０Ｂ間を作業範囲として、低速若しくは停止状態で行われる。また有人車両２０は、これら始点６０Ａ、終点６０Ｂ間で車線５１を逆走することもある。このため後方を走行する車両（無人車両１０）にとって高速走行の障害となる。しかも、鉱山の走行路５０は、未舗装道路であり、グレーダ２０が路面の切削作業を行うことでウインドローなど、無人車両１０、１１…の走行にとって支障のある障害物が路面に形成される。このため、後述するように、始点６０Ａと終点６０Ｂを結ぶ作業範囲よりも広い領域であって、ウインドローが形成されるであろう領域が立入禁止領域６０として設定される。さらに、後述するように、立入禁止領域６０よりも広い領域が、対面走行する車両１０、１１同士の干渉を防止するために、安全確保領域６１として設定される。また、後述するように、立入禁止領域６０と安全確保領域６１に基づいて、後方を走行する無人車両１０の予定コース７０から外れた迂回コース７２が作成される。迂回コース７２とは、安全確保領域６１内において形成される走行コースであって、立入禁止領域６０を回避して対面側の車線５２を通り自車両１０の車線５１に戻るコースのことである。
【００３７】
鉱山には、広域作業現場内の複数の無人車両１０、１１…および複数の有人車両２０…を管理、監視する監視局４０が設けられている。
【００３８】
無人車両１０、１１…には、自己の車両位置を計測する位置計測装置１、監視局４０との間でデータを無線通信にて送受信する通信装置２が搭載されている。また、有人車両２０…には、自己の車両位置を計測する位置計測装置３１、監視局４０との間でデータを無線通信にて送受信する通信装置３２が搭載されている。位置計測装置１、３１は、ＧＰＳ等の位置計測システムを利用することができる。
【００３９】
監視局４０には、無人車両１０、１１…および有人車両２０との間でデータを無線通信にて送受信する通信装置４２が搭載されている。
【００４０】
無人車両１０と監視局４０との間は、無線通信Ｓ1にてデータが送受信され、無人車両１１と監視局４０との間は、無線通信Ｓ2にてデータが送受信され、有人車両１２と監視局４０との間は、無線通信Ｓ3にてデータが送受信される。
【００４１】
図３（ａ）、（ｂ）、（ｃ）はそれぞれ有人車両２０（グレーダ）、監視局４０、無人車両１０、１１に搭載される装置の構成をブロック図にて示している。
【００４２】
まず、無人車両１０、１１の構成について説明する。なお、無人車両１０、１１に搭載される装置は同じであるので、無人車両１０の構成を代表させて説明する。
【００４３】
図３（ｃ）に示すように、無人車両１０には、前述の位置計測装置１と、前述の通信装置２と、運行データ共有装置３と、有人車混走コントローラ４と、制御装置５とが搭載されている。
【００４４】
運行データ共有装置３は、監視局４０から通信装置２を介して与えられる立入禁止領域６０、安全確保領域６１、迂回コース７２のデータなど、自己車両１０の運行に必要なデータであって、全車両１０、１１…、２０…および監視局４０間で共有している運行データを記憶しており、これら運行データに基づいて、自己車両１０が迂回コース７２を走行することを許可する走行許可指令を制御装置５に出力して、対面走行している他の無人車

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両１１と干渉しないように自車両１０の走行を制御させるものである。

【００４５】

有人車混走コントローラ４は、有人車両２０…の現在位置のデータ、監視局４０から通信装置２を介して与えられる迂回コース７２の走行許可指令のデータなど、自己車両１０が有人車両２０…と混走して走行路５０を走行する際に必要となるデータを記憶しており、これらデータと位置計測装置１で計測される自車両１０の現在位置のデータに基づいて、自己車両１０が、迂回コース７２を走行して、有人車両２０が存在する立入禁止領域６０に接近することを許可する走行許可指令を制御装置５に出力して、有人車両２０…と干渉しないように自車両１０の走行を制御させるものである。

【００４６】

制御装置５は、逐次、運行データ共有装置３からコースデータを、有人車混走コントローラ４から走行継続許可を受け取りながら走行する。走行コースは、監視局４０の無人車運行管理装置４８が運行データ共有装置４３に入れるものを、運行データ共有装置３が受け取る。例えば迂回コースを走る場合、監視局４０の無人車運行管理装置４８は、走行コース７０の迂回コース７２との切り替え点まで、迂回コース７２、走行コース７０の迂回コース７２以降を運行データ共有装置４３に入れる。運行データ共有装置４３は、通信装置を介して、各有人車両２０や無人車両１０、１１への走行コースを配信する。制御装置５は、この指示内容に従い、コース７０、コース７２、コース７０のように走行する。

【００４７】

また、図４（ｄ）のように、６１Ｂの位置をブロックする場合、監視局４０の無人車運行管理装置４８は、無人車両１１への６１Ｂの位置での停止要求を運行データ共有装置４３に入れる。無人車両１１は、運行データ共有装置４３を介してこれを受け取り、制御装置５へと伝達する。制御装置５は指令位置での停止は不能と判断すると、そのまま通過する。この間、監視局４０の無人車運行管理装置４８は、無人車両１０への迂回コース７２の走行指示を出さずに待つ。また、無人車両１１の制御装置５は、停止可能と判断すると、「６１Ｂ以降のコース７１の走行予定をとりやめる」旨のデータを運行データ共有装置３へ入れる。監視局４０の無人車運行管理装置４８は、運行データ共有装置４３を介して受け取り、無人車両１０への迂回コース７２の走行指示を運行データ共有装置４３に入れる。

【００４８】

なお、予定走行コース７０のコースデータは、実際の走行に先だって実施されるティーチング作業等によって得られる。コースデータは、予定走行コース上の各地点の位置、指定進行方向のデータからなる。ただし、迂回コース７２のコースデータが監視局４０を介して自車両１０に教示され、制御装置５に、その迂回コース７２の走行許可指令が入力されている場合には、制御装置５は、走行コース７０から外れて迂回コース７２を走行させるように自車両１０の走行を制御する。すなわち、制御装置５は、位置計測装置１で計測される自車両１０の現在位置と、走行コース７０（あるいは迂回コース７２）の上のつぎに進行すべき地点の位置とを比較するとともに、同地点における指定進行方向と、現在の進行方向とを比較して、目標とする地点に対する位置ずれ量、目標とする地点における指定方向からの進行方向ずれ量が最小となるように、ステアリング角度、ブレーキ、トランスミッションの速度段、エンジン回転数などを調整して、自車両１０の走行を制御する。

【００４９】

つぎに、有人車両２０…の構成について説明する。なお、各有人車両２０…に搭載される装置は同じであるので、そのうちの１台の有人車両２０の構成を代表させて説明する。

【００５０】

図３（ａ）に示すように、有人車両２０には、前述の位置計測装置３１と、前述の通信装置３２と、運行データ共有装置３３と、有人車混走コントローラ３４と、立入禁止領域コントローラ３５と、入力装置３６と、表示装置３７とが搭載されている。

【００５１】

運行データ共有装置３３は、監視局４０から通信装置３２を介して与えられる立入禁止

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領域６０および迂回コース７２のデータ、監視局４０から通信装置３２を介して無人車両１０、１１…に与えられる迂回コース７２の走行許可指令のデータなど、自己車両２０の運行に必要なデータであって、全車両１０、１１…、２０…および監視局４０間で共有している運行データを記憶しており、これら運行データに基づいて、立入禁止領域６０、安全確保領域６１、迂回コース７２、走行許可された車両の位置などを表示させるための表示指令を表示装置３７に出力して、有人車両あるいは無人車両が他の無人車両１０、１１…と干渉しないようにするものである。

【００５２】

入力装置３６は、キーボード等で構成され、自車両２０の作業範囲の始点６０Ａ、終点６０Ｂの位置データを入力するとともに、無人車両１０、１１が迂回コース７２を走行することを許諾する走行許諾指令のデータを入力し、さらに作業が終了した場合には作業終了通知のデータを入力する装置である。

【００５３】

有人車混走コントローラ３４は、自車両２０の入力装置３６より入力された迂回コース７２の走行を許諾するための走行許諾指令のデータあるいは監視局４０からの走行許諾を求める指令のデータを、通信装置３２との間で入出力して、無人車両１０、１１…と干渉しないようにするものである。

【００５４】

立入禁止領域コントローラ３５は、立入禁止領域６０、安全確保領域６１を監視局４０で作成させるために、自車両２０の入力装置３６より入力された作業範囲の始点６０Ａ、６０Ｂの位置データを通信装置３２に出力するとともに、作業終了通知が入力装置３６から入力された場合に、立入禁止領域６０、安全確保領域６１、迂回コース７２を監視局４０で削除させるために、作業終了通知を、通信装置３２に出力するものである。

【００５５】

表示装置３７は、入力された表示指令に基づいて、立入禁止領域６０、安全確保領域６１、迂回コース７２、走行許可された車両の位置などを、位置計測装置３１で計測される自車両２０の現在位置とともに、表示画面上に表示するものである。

【００５６】

つぎに、監視局４０の構成について説明する。監視局４０におけるデータの入力操作は、監視局４０側のオペレータによって行われる。

【００５７】

図３（ｂ）に示すように、監視局４０には、コース生成装置４１と、通信装置４２と、運行データ共有装置４３と、有人車混走コントローラ４４と、立入禁止領域コントローラ４５と、入力装置４６と、表示装置４７と、無人車運行管理装置４８が搭載されている。

【００５８】

立入禁止領域コントローラ４５は、通信装置４２を介して入力された有人車両２０の作業範囲の始点６０Ａ、６０Ｂの位置データに基づいて、立入禁止領域６０、安全確保領域６１を作成し、これら各データを、運行データ共有装置４３に出力するとともに、通信装置４２を介して入力された作業終了通知に基づいて、立入禁止領域６０、安全確保領域６１、迂回コース７２を削除するための立入禁止領域削除指令を、運行データ共有装置４３に出力するものである。

【００５９】

有人車混走コントローラ４４は、通信装置４２を介して入力された走行許諾指令のデータなど、有人車両２０が無人車両１０、１１…と混走して走行路５０を走行する際に必要となるデータを記憶し、走行許諾指令のデータを、無人車運行管理装置４８に出力する。

【００６０】

運行データ共有装置４３は、立入禁止領域６０、安全確保領域６１、迂回コース７２のデータ、無人車両１０、１１…に与えるべき迂回コース７２の走行許可指令のデータ、立入禁止領域６０、安全確保領域６１、迂回コース７２を削除するための立入禁止領域削除指令のデータなど、各車両の運行に必要なデータを通信装置３２に出力して、全車両１０

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、１１…、２０…に教示するものである。これにより監視局４０の運行データ共有装置４３の記憶データは、全車両１０、１１…、２０…および監視局４０間で共有する運行データとなる。

【００６１】

無人車運行管理装置４８は、無人車両１０、１１…の運行を管理する装置であり、立入禁止領域６０、安全確保領域６１に基づいて迂回コース７２をコース生成装置４１で作成させる。作成された迂回コース７２は、運行データ共有装置４３に記憶される。また無人車運行管理装置４８は、運行データ共有装置４３の記憶データと有人車混走コントローラ３４を介して得られる走行許諾指令とに基づいて、無人車両１０が対面走行する無人車両１１や有人車両２０と干渉することなく安全に迂回コース７２を走行させるための走行許可指令を生成して、運行データ共有装置４３に出力する。また無人車運行管理装置４８は、運行データ共有装置４３に記憶された立入禁止領域削除指令に基づいて、運行データ共有装置４３に記憶された立入禁止領域６０、安全確保領域６１、迂回コース７２のデータを削除するとともに、削除された迂回コース７２に無人車両１０、１１…が進入することを禁止する指令を運行データ共有装置４３に出力する。

【００６２】

入力装置４６は、有人車両２０の入力装置３６と同様に立入禁止領域の定義を行うために設けられている。ただし、監視局４０は直接の作業者ではないため、立入禁止領域の定義は、範囲の始点６０Ａ、終点６０Ｂの位置データの入力、有人または無人の故障車両を指定して、その存在領域を立入禁止区間として設定、図形を描いて立入禁止領域として設定などとなる。さらに、入力装置４６には、定義した立入禁止領域を無人車両１０、１１が走行しても安全となったと判断した場合には立入禁止領域削除通知のデータが入力される。また、有人車両２０と同様に、監視局４０から通過許諾がなければ、無人車両１０、１１が迂回コース７２を通過できないように構成してもよい。

【００６３】

表示装置４７は、表示指令に基づいて、立入禁止領域６０、安全確保領域６１、迂回コース７２、走行許可された車両の位置などを表示画面上に表示して、全車両の運行を監視するために設けられている。

【００６４】

（第１実施例；有人車が作業を行っている場合の迂回）

以下、図４（ａ）、（ｂ）、（ｃ）、（ｄ）に示す走行路５０を示す図、図５に示すフローチャートを併せ参照して実施例の処理の手順について説明する。

【００６５】

本実施例では、走行路５０上の有人車両２０が道路工事などの作業を行う場合を想定している。

【００６６】

まず、鉱山における作業開始に先だって予め走行路５０の地図データが監視局４０の入力装置４６から入力されて運行データ共有装置４３に記憶される。この地図データは、走行路５０の路肩の位置などの地形を示すデータを含む。走行路５０の地図データは、監視局４０の通信装置４２を介して全ての無人車両１０、１１…に対して無線通信Ｓ1、Ｓ2…にて送信され、無人車両１０、１１…の通信装置2で受信され、運行データ共有装置3に記憶される。また、地図データは、監視局４０の通信装置４２を介して全ての有人車両２０…に対して無線通信Ｓ3…にて送信され、有人車両２０…の通信装置３２で受信され、運行データ共有装置３３に記憶される。

【００６７】

なお、鉱山における作業開始に先だって、無人車両、あるいは、有人車両で、無人車両１０、１１…が走行する予定の走行コース７０、７１…を教示する作業が行われ、監視局４０の無人車運行管理装置４８に、無人車両１０、１１…で共用する予定の走行コース７０，７１…のデータが記憶されておかれる。

【００６８】

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各無人車両１０、１１の制御装置５は、自車の走行コース７０、７１のコースデータに従い走行コース７０、７１に沿って自車両１０、１１を走行させるように制御している（ステップ１０１）。

【００６９】

有人車両２０の表示装置３７の表示画面には、運行データ共有装置３３に記憶された地図データと位置計測装置３１で計測された現在位置のデータに基づいて、図４（ａ）、（ｂ）に示すように、走行路５０とともに、走行路５０上の自車２０の位置が表示される。

【００７０】

有人車両２０のオペレータが、道路工事の作業を行おうとするときには、表示装置３７の表示画面をみながら、図４（ａ）、（ｂ）に示すように、走行路５０の自車の車線５１のうちで、道路工事を行おうとする作業範囲の始点６０Ａ、終点６０Ｂのデータ（自車２０の車線５１の立入禁止領域６０の情報）を入力装置３６によって順次入力する。この場合、有人車両２０を、実際に走行させて、有人車両２０が作業範囲の始点６０Ａ、終点６０Ｂに位置する毎に、「始点」、「終点」と指定して入力すると、その入力時点において位置計測装置３１で計測された位置が、立入禁止領域コントローラ３５に記憶される。立入禁止領域コントローラ３５は、自車２０の作業範囲の始点６０Ａ、終点６０Ｂの位置データを、通信装置３２に出力する。これを受けて通信装置３２は、始点６０Ａ、終点６０Ｂの位置データを無線通信Ｓ3にて監視局４０の通信装置４２に送信する（ステップ１０２）。

【００７１】

監視局４０の通信装置４２では、有人車両２０の作業範囲の始点６０Ａ、終点６０Ｂの位置データが受信され、立入禁止領域コントローラ４５に送出する。立入禁止領域コントローラ４５では、有人車両２０の作業範囲の始点６０Ａ、６０Ｂの位置データに基づいて、図４（ｃ）に示すように、始点６０Ａと終点６０Ｂを結ぶ作業範囲よりも広い領域であって、ウインドローなどの障害物が形成されるであろう領域が、有人車両２０が存在する車線５１側に、マージンをとって立入禁止領域６０として作成される。また、立入禁止領域６０よりも広い領域が、両車線５１、５２にまたがって、安全確保領域６１として作成される。立入禁止領域６０は、全ての無人車両１０、１１…が立ち入ることが禁止される領域のことである。安全確保領域６１は、立入禁止領域６０の周囲の領域であり、走行許可が与えられた無人車両の走行を許容する領域である。

【００７２】

作成された立入禁止領域６０、安全確保領域６１のデータは、運行データ共有装置４３に送出される。

【００７３】

無人車運行管理装置４８は、運行データ共有装置４３に記憶された立入禁止領域６０、安全確保領域６１のデータに基づいて、迂回コース７２をコース生成装置４１で作成させる。

【００７４】

迂回コース７２は、立入禁止領域６０側の車線５１にあって有人車両２０の後方を走行する無人車両（無人車両１０）の予定走行コース７０から外れた走行コースであって、安全確保領域６１の入口地点７２Ａで走行コース７０から外れ、立入禁止領域６０を回避するように、対面側車線５２の地点７２Ｂ（立入禁止領域６０の入口に対応する地点）、対面側車線５２の地点７２Ｃ（立入禁止領域６０の出口に対応する地点）を通って、立入禁止領域６０側の車線５１に戻り、安全確保領域６１の出口地点７２Ｄで自車１０の走行コース７０に復帰するコースのことである。迂回コース７２は、安全確保領域６１内において作成される。またブロック位置６１Ａ、６１Ｂのデータが作成される。図４（ｄ）に示すように、走行許可が得られていない場合には、安全確保のために、安全確保領域６１の入口地点７２Ａに相当するブロック位置６１Ａ（車線５１側）、安全確保領域６１の出口地点７１Ｄに相当するブロック位置６１Ｂ（車線５２側）で無人車両１０、１１がそれぞれ待機されることになる。

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【００７５】
迂回コース７２は、同コース７２を走行する無人車両１０の内輪差、外輪差などの車体データ、走行路５０の地図データ（走行路５０の路肩位置等）、立入禁止領域６０、安全確保領域６１の位置データを考慮し、無人車両１０が走行路５０の路肩から外れたり、無人車両１０が立入禁止領域６０内の有人車両２０と干渉したりしないように設定される。なお、図４（ｃ）では、安全確保領域６１の入口地点７２Ａから、立入禁止領域６０の入口に対応する対面側車線５２の地点７２Ｂに進行するまでの間に、走行車線５１から対面側車線５２へのレーン変更が行われ、立入禁止領域６０の出口に対応する対面側車線５２の地点７２Ｃから、安全確保領域６１の出口地点７２Ｄに進行するまでの間に、対面側車線５２から元の走行車線５１へのレーン変更が行われるように迂回コース７２が作成される場合を例示している。前輪がステアリング操作される前輪ステアの無人車両１０の場合、小さな曲率ｒaで走行車線５１から離れ、大きな曲率ｒbで対面側車線５２に移行し、また、小さな曲率ｒcで対面側車線５２から離れ、大きな曲率ｒdで走行車線５１に戻るような経路の迂回コース７２を作成することが望ましい。
【００７６】
監視局４０の無人車運行管理装置４８は、こうして作成された迂回コース７２のデータ、ブロック位置６１Ａ、６１Ｂのデータを、運行データ共有装置４３に送出する。
【００７７】
こうして運行データ共有装置４３には、立入禁止領域６０、安全確保領域６１、迂回コース７２、ブロック位置６１Ａ、６１Ｂのデータが記憶される。運行データ共有装置４３は、これら迂回コース７２等のデータを通信装置４２に出力する。これを受けて通信装置４２は、迂回コース７２等のデータを無線通信Ｓ1、Ｓ2にて無人車両１０、１１の通信装置2に送信するとともに、無線通信Ｓ3にて有人車両２０の通信装置３２に送信する。これにより、無人車両１０、１１の運行データ共有装置3、有人車両２０の運行データ共有装置３３には、迂回コース７２等のデータが記憶されて、迂回コース７２等の共有データが全車両１０、１１…、２０…に教示されることになる（ステップ１０３）。
【００７８】
有人車両２０の表示装置３７の表示画面には、図４（ｄ）に示すように、立入禁止領域６０、安全確保領域６１、迂回コース７２が、位置計測装置で計測された自車両２０の現在位置とともに、表示される。これにより有人車両２０のオペレータは、無人車両１０が迂回コース７２を通って自車両２０が作業している領域６０の近傍を通過する可能性があることを認識することができる。
【００７９】
各有人車両２０…の位置計測装置３１で計測される自車両２０…の現在位置は、逐次、通信装置３２を介して無線通信Ｓ3にて、監視局４０に送信されて、監視局４０の通信装置４２で受信され、自局４０の有人車混走コントローラ４４に送られる。監視局４０の有人車混走コントローラ４４は、各有人車両２０…の現在位置を自局４０の通信装置４２に出力する。これにより各有人車両２０…の現在位置は、監視局４０の通信装置４２によって無線通信Ｓ1、Ｓ2にて各無人車両１０、１１…に送信され、各無人車両１０、１１の通信装置２で受信され、自車両１０、１１…の有人車混走コントローラ４に送られる。
【００８０】
また、無人車両１０、１１の位置計測装置１で計測される自車両１０、１１の現在位置は、逐次、通信装置２から無線通信Ｓ1、Ｓ2にて、監視局４０に送信され、監視局４０の通信装置４２で受信され、自局４０の無人車運行管理装置４８に送られる。
【００８１】
監視局４０の無人車運行管理装置４８は、立入禁止領域６０側の車線５１を走行する無人車両１０の位置と、ブロック位置６１Ａとを対比して、立入禁止領域６０側の車線５１を走行する無人車両１０が、立入禁止領域６０を通過する可能性があるか否かを予測し判定する。
【００８２】

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この結果、無人車両１０が立入禁止領域６０を通過する可能性があると予測した場合には、同無人車両１０が迂回コース７２を走行することの許諾を求める指令を、自局４０の有人車混走コントローラ４４に送出する。有人車混走コントローラ４４は、これを受けて、走行許諾を求める指令を、自局４０の通信装置４２に対して出力する。これにより、走行許諾を求める指令は、無線通信Ｓ3にて、その立入禁止領域６０の情報、つまり始点６０Ａ、終点６０Ｂのデータを入力した有人車両２０の通信装置３２に対して送信される（ステップ１０４）。

【００８３】

有人車両２０の通信装置３２では、走行許諾を求める指令が受信され、自車両２０の有人車混走コントローラ３４に送出される。有人車混走コントローラ３４は、走行許諾を求める指令を、表示指令として表示装置３７に出力する。これにより有人車両２０の表示装置３７の表示画面には、「走行許諾の求めあり」の表示がなされる。

【００８４】

有人車両２０のオペレータは、表示装置３７の表示画面に表示された「走行許諾の求めあり」の表示をみて、たとえば図４（ｄ）に示すように、自車両２０が転回等のために立入禁止領域６０をはみでて域Ｄで無人車両１０と干渉するという問題がなければ、走行許諾の求めを承認して、入力装置３６によって、走行許諾の指令を入力する。また、有人車両２０のオペレータは、監視局４０から走行許諾の求めがなく、表示装置３７の表示画面に、走行許諾を求める旨の表示がなされていない場合でも、同じく立入禁止領域６０をはみでて無人車両１０と干渉するという問題がなければ、走行許諾を承認して、自主的に入力装置３６から、走行許諾の指令を入力することができる。

【００８５】

入力装置３６によって入力された走行許諾の指令は、自車両２０の有人車混走コントローラ３４に送られる。有人車混走コントローラ３４は、自車両２０の通信装置３２に走行許諾指令を出力する。これを受けて有人車両２０の通信装置３２から、走行許諾指令が無線通信Ｓ3にて、監視局４０に送信される（ステップ１０５）。

【００８６】

走行許諾指令は、監視局４０の通信装置４２で受信されて、自局４０の有人車混走コントローラ４４に送出され、さらに無人車運行管理装置４８に出力される。

【００８７】

無人車運行管理装置４８では、走行許諾指令と、立入禁止領域６０を挟んで対面走行する各無人車両１０、１１の位置情報に基づいて、立入禁止領域６０側の車線５１を走行する無人車両１０に対して、迂回コース７２を走行させることを許可する走行許可指令を与えるべきか否かが判断される。

【００８８】

すなわち、有人車両２０から走行許諾指令が得られても、無人車両１０の対面側車線５２を走行している無人車両１１が、立入禁止領域６０に接近している場合には、無人車両１０を迂回コース７２に進入させるべきではないからである。

【００８９】

無人車運行管理装置４８では、ブロック位置６１Ａ、６１Ｂと、無人車両１０、１１の現在位置とをそれぞれ対比して、無人車両１０、１１が立入禁止領域６０に接近中であるか否かを、逐次、判定している。

【００９０】

有人車両２０から走行許諾が得られないまま、無人車両１０、１１が立入禁止領域６０に接近した場合には、有人車両２０が立入禁止領域６０をはみ出て作業を行う可能性があるため、立入禁止領域６０側の車線５１を走行する無人車両１０に対して、ブロック位置６１Ａで停止させるための停止指令を与えるとともに、対面側車線５２を走行する無人車両１１に対しても、干渉を防止するために、対面側車線５２のブロック位置６１Ｂで停止するように停止指令を与える。

【００９１】

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有人車両２０から走行許諾が得られた場合には、対面側車線５２を走行している無人車両１１をブロック位置６１Ａで停止させるための停止指令を与えた上で、立入禁止領域６０側車線５１の無人車両１０に対して、迂回コース７２を走行を許可する走行許可指令を与える。

【００９２】

ただし、有人車両２０から走行許諾が得られたときに、立入禁止領域６０側の車線５１を走行する無人車両１０よりも、対面側車線５２の無人車両１１の方が立入禁止領域６０側に先行して接近していた場合には、先行して立入禁止領域６０に接近している対面側車線５２の無人車両１１を優先させて、安全確保領域６１の側方を通過させる許可を与えるとともに、立入禁止領域６０側車線５１を走行している無人車両１０に対しては、ブロック位置６１Ａで停止するように停止指令を与えるようにする。対面側車線５２の無人車両１１の方が立入禁止領域６０付近を通過する際にも、有人車両２０から通過許可を求めるようにシステムを構成してもよい。そして、対面側車線５２を走行する無人車両１１が、安全確保領域６１の側方を過ぎた時点で、立入禁止領域６０側車線５１の無人車両１０に対して、迂回コース７２の走行を許可する走行許可指令を与える。

【００９３】

無人車運行管理装置４８は、生成された走行許可指令（あるいは停止指令）を運行データ共有装置４３に送出する。運行データ共有装置４３は、走行許可指令（あるいは停止指令）を自局４０の通信装置４２に出力する。これにより監視局４０の通信装置４２から、無線通信Ｓ1にて、無人車両１０に対して走行許可指令（あるいは停止指令）が送信される。なお、同様に対面側車線５２の無人車両１１に対しても走行を許可する指令若しくは停止指令が与えられる。

【００９４】

無人車両１０の通信装置２では、走行許可指令（あるいは停止指令）が受信される。通信装置２は、走行許可指令（あるいは停止指令）を、自車両１０の運行データ共有装置３に送出する。

【００９５】

一方、無人車両１０の有人車混走コントローラ４では、監視局４０から与えられる走行許可指令とは別に、各有人車両２０…の位置データに基づいて、自己車両１０が、迂回コース７２を走行することを許可する走行許可指令を生成している。すなわち、監視局４０から走行許可指令が得られていても、各有人車２０…の不用意な行動によって、有人車両２０…が無人車両１０に接近して無人車両１０に干渉する可能性がある場合には、走行を許可すべきではないからである。

【００９６】

なお、上述のように有人車混走コントローラ４で、走行許可指令を生成してもよく、また以下の手順１）～６）で同様の処理を行ってもよい。このようにするのは、有人車両の数が増えた場合に無人車両のコントローラ内部での計算量が増大して演算処理能力に余裕がなくなることを回避するため。

【００９７】

１）各有人車両内の有人車混走コントローラ３４でコースと自己車両位置の干渉可能性を計算する。

【００９８】

２）有人車両の有人車混走コントローラ３４は、近傍の無人車両への速度制限と期限付き走行継続許可（近距離コントロール用の走行許可）を監視局４０に送る。

【００９９】

３）監視局４０の有人車混走コントローラ４４は、充分に離れた位置の有人車と無人車間の期限付き走行許可（遠距離コントロール用の走行許可）を出す。

【０１００】

４）監視局４０の有人車混走コントローラ４４は、２）の近距離コントロール用の走行許可と３）の遠距離コントロール用の走行許可を総合し、無人車両１０、１１の有人車混走

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コントローラ４へ送る。

【０１０１】

５）無人車両１０、１１の有人車混走コントローラ４は、遠距離コントロール用の走行許可と、近距離コントロール用の走行許可に従って走行継続する。

【０１０２】

６）走行継続許可の期限が切れても、次の走行継続許可がない場合、無人車両は停止する。

【０１０３】

無人車両１０の制御装置５は、自車両１０の運行データ共有装置３に対して、走行許可指令を問い合わせるとともに、自車両１０の有人車混走コントローラ４に対して走行許可指令を問い合わせる。運行データ共有装置３および有人車混走コントローラ４の両方から走行許可指令が出力されることを条件に、制御装置５は、自車両１０が迂回コース７２を走行するように制御する。

【０１０４】

しかし、運行データ共有装置３、有人車混走コントローラ４のいずれか一方から走行許可指令が出力されていない場合には、制御装置５は、停止指令に応じて、自車両１０がブロック位置６１Ａに達したら停止するように、あるいは、自車両１０がすでに迂回コース７２を走行中であれば、状況に応じて減速若しくは停止するように、制御する。このように制御装置５は、監視局４０から運行データ共有装置３を介して得られる走行許可指令のみならず、常に、有人車混走コントローラ４に走行継続の許可を問い合わせながら、迂回コース７２の走行を継続する（ステップ１０６）。

【０１０５】

上述したステップ１０４～１０６の処理は、有人車両２０から、立入禁止領域６０を削除する旨の指令が出力されていない限り、繰り返し実行される。無人車両１０の更に後方から走行してく他の無人車両に対しても同様の処理が行われる。

【０１０６】

有人車両２０による道路工事が終了すると、作業終了通知のデータが入力装置３６から入力される。作業終了通知は、自車両２０の立入禁止領域コントローラ３５に入力され、立入禁止領域コントローラ３５は、作業終了通知を、自車両２０の通信装置３２に出力する。これを受けて、通信装置３２から、作業終了通知が、無線通信Ｓ3にて、監視局４０に送信される。

【０１０７】

監視局４０の通信装置４２では、作業終了通知が受信され、この作業終了通知は、自局４０の立入禁止領域コントローラ４５に送出する。立入禁止領域コントローラ４５は、自局４０の運行データ共有装置４３に対して、立入禁止領域削除指令を送出する。

【０１０８】

無人運行管理装置４８は、運行データ共有装置４３に、立入禁止領域削除指令が入力されたことを受けて、立入禁止領域削除指令が入力された時点以後に、新規の無人車両が迂回コース７２に新たに進入することを禁止する指令を、運行データ共有装置４３に出力するとともに、運行データ共有装置４３に記憶された立入禁止領域６０、安全確保領域６１、迂回コース７２のデータを削除する。ただし、立入禁止領域削除指令が入力された時点で既に、無人車両が迂回コース７２を走行中である場合には、その無人車両１０が迂回コース７２を通過するのを待ってから、立入禁止領域６０等のデータを削除する（ステップ１０７）。

【０１０９】

なお、上述した実施例では、有人車両２０のオペレータが、道路工事等の作業開始時に、作業範囲の始点６０Ａ、６０Ｂのデータを入力し、作業終了時に、同オペレータが作業終了通知のデータを、自車両２０の入力装置３６から入力するようにしているが、この入力操作は、いかなる場所で行ってもよく、たとえば、監視局４０側のオペレータが、自局４０の表示装置４７の表示画面をみながら入力装置４６から同様のデータを入力してもよ

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い。

【０１１０】

また、上述した実施例では、監視局４０を介在させて、監視局４０から無人車両１０、１１…に対してデータを送信したり、監視局４０から有人車両２０…に対してデータを送信するようにしているが、監視局４０を介在させることなく、無人車両１０、１１…から有人車両２０…に対してデータを直接、送信したり、有人車両２０…から無人車両１０、１１…に対してデータを直接、送信するように構成してもよい。すなわち、有人車両２０に、監視局４０の機能をもたせて、無人車両と直接相互にデータを送受信してもよい。

【０１１１】

（第２実施例；有人車が低速で走行している場合の迂回）

以下、図６（ａ）、（ｂ）、（ｃ）に示す構成図、図７（ａ）、（ｂ）、（ｃ）、（ｄ）に示す走行路５０を示す図、図８、図９に示すフローチャートを併せ参照して実施例の処理の手順について説明する。

【０１１２】

図６（ａ）、（ｂ）、（ｃ）はそれぞれ、図３（ａ）、（ｂ）、（ｃ）に対応する図であり、図６と同じ符合は同じ構成要素であるとして、適宜、説明を省略する。

【０１１３】

ただし、図６（ａ）に示すように、有人車両２０には、立入禁止領域コントローラ３５の代わりに、追い越しコントローラ３５′が設けられている。

【０１１４】

また、監視局４０には、図３（ｂ）に示す入力装置４６、表示装置４７は設けられておらず、立入禁止領域コントローラ４５の代わりに、追い越しコントローラ４５′が設けられている。

【０１１５】

無人車両１０、１１の構成は、図３（ｃ）に示すものと同じである。

【０１１６】

本実施例では、走行路５０上の有人車両２０が低速で走行している場合を想定している。本実施例では、前述した第１実施例の迂回コース７２と同様に、低速の有人車両２０を追い越すための迂回コース７２が作成される。

【０１１７】

まず、第１実施例のステップ１０１と同様に、鉱山における作業開始に先だって予め走行路５０の地図データが運行データ共有装置４３に記憶される。走行路５０の地図データは、監視局４０の通信装置４２を介して全ての無人車両１０、１１…に対して無線通信Ｓ1、Ｓ2…にて送信され、無人車両１０、１１…の通信装置２で受信され、運行データ共有装置３に記憶される。また、地図データは、監視局４０の通信装置４２を介して全ての有人車両２０…に対して無線通信Ｓ3…にて送信され、有人車両２０…の通信装置３２で受信され、運行データ共有装置３３に記憶される。

【０１１８】

なお、鉱山における作業開始に先だって、無人車両、あるいは、有人車両で、無人車両１０、１１…が走行する予定の走行コース７０、７１…を教示する作業が行われ、監視局４０の無人車運行管理装置４８に、無人車両１０、１１…で共用する予定の走行コース７０、７１…のデータが記憶されておかれる。各無人車両１０、１１の制御装置５は、自車の走行コース７０、７１のコースデータに従い走行コース７０、７１に沿って自車両１０、１１を走行させるように制御している（ステップ２０１）。

【０１１９】

各有人車両２０…の位置計測装置３１で計測される自車両２０…の現在位置は、逐次、通信装置３２を介して無線通信Ｓ3にて、監視局４０に送信されて、監視局４０の通信装置４２で受信され、自局４０の運行データ共有装置３３に送られる。監視局４０の運行データ共有装置３３は、各有人車両２０…の現在位置を自局４０の通信装置４２に出力する。これにより各有人車両２０…の現在位置は、監視局４０の通信装置４２によって無線通

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信Ｓ1、Ｓ2にて各無人車両１０、１１…に送信され、各無人車両１０、１１の通信装置２で受信され、自車両１０、１１…の有人車混走コントローラ４に送られる。

【０１２０】

また、無人車両１０、１１の位置計測装置１で計測される自車両１０、１１の現在位置は、逐次、通信装置２から無線通信Ｓ1、Ｓ2にて、監視局４０に送信され、監視局４０の通信装置４２で受信され、自局４０の運行データ共有装置４３に送られる。

【０１２１】

監視局４０の無人車運行管理装置４８は、運行データ共有装置４３に記憶された各無人車両１０、１１…の位置データ、各有人車両２０の位置データに基づいて、同じ車線５１を走行する無人車両１０、有人車両２０の各位置あるいは単位時間当たりの位置変化（速度）を対比して、無人車両１０が、同じ車線５１を走行する低速の有人車両２０に追いつく可能性があるか否かを予測し判定する。

【０１２２】

この結果、無人車両１０が同じ車線５１を走行する有人車両２０に追いつく可能性があると予測した場合には、同無人車両１０が有人車両２０を追い越してもよいとの走行許諾を有人車両２０に対して求める指令を、自局４０の追い越しコントローラ４５′に送出する。追い越しコントローラ４５′は、これを受けて、走行許諾を求める指令を、自局４０の通信装置４２に対して出力する。これにより、走行許諾を求める指令は、無線通信Ｓ３にて、その無人車両１０に追いつかれる可能性のある有人車両２０の通信装置３２に対して送信される（ステップ２０２）。

【０１２３】

有人車両２０の通信装置３２では、走行許諾を求める指令が受信され、自車両２０の追い越しコントローラ３５′に送出される。追い越しコントローラ３５′は、走行許諾を求める指令を、表示指令として表示装置３７に出力する。これにより有人車両２０の表示装置３７の表示画面には、「走行許諾（追い越し許諾）の求めあり」の表示がなされる。

【０１２４】

有人車両２０のオペレータは、表示装置３７の表示画面に表示された「走行許諾の求めあり」の表示をみて、自車両２０が高速走行に移行したり、転回等を行うために対面側車線５２にはみでて後方の無人車両１０と干渉するなどの問題がなければ、走行許諾の求めを承認して、入力装置３６によって、走行許諾の指令を入力する。また、有人車両２０のオペレータは、監視局４０から走行許諾の求めがなく、表示装置３７の表示画面に、走行許諾を求める旨の表示がなされていない場合でも、同じく自車両２０が高速走行に移行する等の問題がなければ、走行許諾を承認して、自主的に入力装置３６から、走行許諾の指令を入力することができる。

【０１２５】

入力装置３６によって入力された走行許諾の指令は、自車両２０の追い越しコントローラ３５′に送られる。追い越しコントローラ３５′は、自車両２０の通信装置３２に走行許諾指令を出力する。これを受けて有人車両２０の通信装置３２から、走行許諾指令が無線通信Ｓ3にて、監視局４０に送信される。

【０１２６】

走行許諾指令は、監視局４０の通信装置４２で受信されて、自局４０の追い越しコントローラ４５′に送出され、さらに無人車運行管理装置４８に出力される。

【０１２７】

無人車運行管理装置４８では、追い越しコントローラ４５′から走行許諾指令が入力されているか否か（有人車両２０は追い越しを許諾中であるか否か）を判断している（ステップ２０３）。

【０１２８】

この判断の結果、追い越しコントローラ４５′から走行許諾指令が入力されており、有人車両２０が追い越しを許諾中であるという判断がなされた場合には（ステップ２０３の判断ＹＥＳ）、つぎに、低速の有人車両２０を挟んで、無人車両１０に対して対面走行し

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ている無人車両１１の位置情報に基づいて、無人車両１０が迂回コース７２を走行する際に、干渉を回避できる安全なブロック位置６１Ｂで停止させる処理を行う。すなわち、有人車両２０から走行許諾（追い越し許諾）指令が得られても、無人車両１０の対面側車線５２を走行している無人車両１１が、有人車両２０に接近している場合には、無人車両１０を迂回コース７２に進入させるべきではないからである（ステップ２０４）。

【０１２９】

対面側車線５２を走行する無人車両１１をブロック位置６１Ｂで停止させる対面側車線ブロック処理は、図９に示される。

【０１３０】

すなわち、追い越しコントローラ４５′では、運行データ共有装置４３に記憶された無人車両１０の位置データおよび有人車両２０の位置データに基づいて、図７（ｂ）に示すように、無人車両１０が有人車両２０を追い越すのに必要な予測追い越し距離Ｌが演算される。そして、この予測追い越し距離Ｌに基づいて、立入禁止領域６０が作成される。立入禁止領域６０は、無人車両１０が有人車両２０を追い越し中に有人車両２０が走行し得る領域であって、第１実施例の立入禁止領域６０と同様に、無人車両１０が有人車両２０を迂回して走行しているときに無人車両１０の立入が禁止される領域である。そして、立入禁止領域６０に基づいて、対面側車線５２の無人車両１１を停止させるためのブロック位置６１Ｂが第１実施例と同様に作成される。ブロック位置６１Ｂは、無人車両１０が立入禁止領域６０を迂回して走行したときに対面側車線５２の無人車両１１と干渉しないような位置に設定される。

【０１３１】

予測追い越し距離Ｌは、走行路５０の斜度、無人車両１０と有人車両２０の最高車速の差、無人車両１０と有人車両２０の現在の速度、車線変更に要する距離、安全マージン、処理遅れマージン等に基づいて演算される。

【０１３２】

ただし、立入禁止領域６０は、つぎのようにして逐次更新される。すなわち、車線変更開始位置は、無人車両１０の位置に伴い、随時再計算される。また、対面側車線５２のブロック位置６１Ｂは、有人車両２０の移動や走行速度の変化等に伴い再計算され、処理遅れマージンを使い切った場合にも、再計算される。

【０１３３】

図７（ｂ）、（ｃ）に示すように、有人車両２０が図中左方に移動中の場合には、立入禁止領域６０、ブロック位置６１Ｂは、図中左方に逐次移動することになる。

【０１３４】

監視局４０の無人車運行管理装置４８は、こうして作成された立入禁止領域６０のデータ、ブロック位置６１Ｂのデータを、運行データ共有装置４３に送出する。

【０１３５】

こうして運行データ共有装置４３には、立入禁止領域６０、ブロック位置６１Ｂのデータが記憶される。運行データ共有装置４３は、これらブロック位置６１Ｂ等のデータを通信装置３２に出力する。これを受けて通信装置３２は、ブロック位置６１Ｂ等のデータを無線通信Ｓ1、Ｓ2にて無人車両１０、１１の通信装置４２に送信するとともに、無線通信Ｓ3にて有人車両２０に送信する。これにより、無人車両１０、１１の運行データ共有装置3、有人車両２０の運行データ共有装置３３に、ブロック位置６１Ｂ等のデータが記憶されることになる。

【０１３６】

ブロック位置６１Ｂが作成されると、以後、監視局４０の通信装置４２から、対面側車線５２を走行する各無人車両に対して、ブロック位置６１Ｂを含む区間の走行許可指令の送信が停止される（ステップ３０１）。

【０１３７】

以下のステップ３０２～３０８の処理は、監視局４０から無人車両に対してブロック位置６１Ｂを含む区間の走行許可指令が既に出力されている場合を考慮してなされる。

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【０１３８】
すなわち、無人車運行管理装置４８は、ブロック位置６１Ｂを通過する予定の無人車両が存在するか否かを判断する（ステップ３０２）。この結果、ブロック位置６１Ｂを通過する予定の無人車両（たとえば無人車両１１）が存在した場合には、ブロック位置６１Ｂで停止するように停止要求指令を生成する。
【０１３９】
無人車運行管理装置４８は、生成された停止要求指令を自局４０の運行データ共有装置４３を介して自局４０の通信装置４２に出力する。これにより監視局４０の通信装置４２から、無線通信S2にて、対面側車線５２の無人車両１１に対して停止要求指令が送信される（ステップ３０３）。
【０１４０】
無人車両１１の通信装置２では、停止要求指令が受信される。通信装置２は、停止要求指令を、自車両１１の運行データ共有装置３を介して制御装置５に送出する。無人車両１１の制御装置５は、停止要求指令を受け取ると、運行データ共有装置３に記憶されたブロック位置６１Ｂと、位置計測装置１で計測される自己車両１１の現在位置とを対比して、ブロック位置６１Ｂで停止可能であるか否かを判断する（ステップ３０４）。この結果、ブロック位置６１Ｂで停止可能である場合には（ステップ３０４の判断ＹＥＳ）、制御装置５は、自車両１１がブロック位置６１Ｂで停止するように、走行を制御し（ステップ３０５）、ブロック位置６１Ｂで停止可能であることを示すデータを通信装置２を介して監視局４０に送信して（ステップ３０６）、対面側車線ブロック処理を完了させる。一方、ブロック位置６１Ｂで停止不可能であると判断された場合には（ステップ３０４の判断ＮＯ）、ブロック位置６１Ｂで停止不可能であることを示すデータを通信装置２を介して監視局４０に送信し（ステップ３０７）、制御装置５は、ブロック位置６１Ｂを含む区間をそのまま通過させるように、自車両１１の走行を制御する。自車両１１が、立入禁止領域６０の側方を通過し、立入禁止領域６０を迂回しようとする無人車両１０と干渉しない位置に達したことを確認すると（ステップ３０８）、対面側車線ブロック処理を完了させる。ステップ３０７で停止不能通知を受け取った監視局４０は、追い越しコントローラ４５′に入力し、追い越しコントローラ４５′は有人車両２０と無人車両１１のすれ違い完了位置を予測し、これをもとに無人車両１１通過後の追い越しのための立入禁止領域と、無人車両１１の後続車両のブロック位置を計算し、あらかじめブロックしておくように構成してもよい。
【０１４１】
ステップ３０２で、ブロック位置６１Ｂを通過する予定の無人車両が存在しないと判断された場合も（ステップ３０２の判断ＮＯ）、対面側車線ブロック処理を完了させる。
【０１４２】
以上のようにして対面側車線ブロック処理が行われ（ステップ２０４）、対面側車線ブロック処理が完了すると（ステップ２０５の判断ＹＥＳ）、無人車運行管理装置４８は、運行データ共有装置４３に記憶された立入禁止領域６０、ブロック位置６１Ｂのデータに基づいて、迂回コース７２をコース生成装置４１で作成させる。
【０１４３】
迂回コース７２は、前述の迂回コース７２と同様に、立入禁止領域６０側の車線５１にあって有人車両２０の後方を走行する無人車両（無人車両１０）の予定走行コース７０から外れた走行コースであって、立入禁止領域６０を回避するように、対面側車線５２を通って、ブロック位置６１Ｂに対応する地点で自車１０の走行コース７０に復帰するコースのことである。
【０１４４】
監視局４０の無人車運行管理装置４８は、こうして作成された迂回コース７２のデータを、運行データ共有装置４３に送出する。
【０１４５】
こうして運行データ共有装置４３には、迂回コース７２のデータが記憶される。運行デ

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ータ共有装置４３は、迂回コース７２のデータを通信装置３２に出力する。これを受けて通信装置３２は、迂回コース７２のデータを無線通信Ｓ1、Ｓ2にて無人車両１０、１１の通信装置４２に送信するとともに、無線通信Ｓ3にて有人車両２０に送信する。これにより、無人車両１０、１１の運行データ共有装置３、有人車両２０の運行データ共有装置３３に、迂回コース７２のデータが記憶されて、迂回コース７２の共有データが全車両１０、１１…、２０…に教示されることになる。

【０１４６】

有人車両２０の表示装置３７の表示画面には、立入禁止領域６０、ブロック位置６１Ｂ、迂回コース７２が、位置計測装置で計測された自車両２０の現在位置とともに、表示される。これにより有人車両２０のオペレータは、無人車両１０が迂回コース７２を通って自車両２０を追い越す可能性があることを認識することができる（ステップ２０６）

監視局４０の無人車運行管理装置４８は、迂回コース７２が作成されると、無人車両１０が迂回コース７２の走行を開始してもよいとの許諾を、再度、有人車両２０に対して求める指令を、自局４０の追い越しコントローラ４５′に送出する。追い越しコントローラ４５′は、これを受けて、走行開始許諾を求める指令を、自局４０の通信装置４２に対して出力する。これにより、走行開始許諾を求める指令は、無線通信Ｓ3にて、迂回コース７２によって追い越される有人車両２０の通信装置３２に対して送信される。

【０１４７】

有人車両２０の通信装置３２では、走行開始許諾を求める指令が受信され、自車両２０の追い越しコントローラ３５′に送出される。追い越しコントローラ３５′は、走行開始許諾を求める指令を、表示指令として表示装置３７に出力する。これにより有人車両２０の表示装置３７の表示画面には、「迂回コース７２の走行開始許諾（追い越し開始許諾）の求めあり」の表示がなされる。

【０１４８】

有人車両２０のオペレータは、表示装置３７の表示画面に表示された「迂回コース７２の走行開始許諾の求めあり」の表示をみて、自車両２０が高速走行に移行したり、図７（ｄ）に示すように転回等を行うために対面側車線５２にはみでて領域Ｄで後方の無人車両１０と干渉するなどの問題がなければ、走行開始許諾の求めを承認して、入力装置３６によって、走行開始許諾の指令を入力する。

【０１４９】

入力装置３６によって入力された走行開始許諾の指令は、自車両２０の追い越しコントローラ３５′に送られる。追い越しコントローラ３５′は、自車両２０の通信装置３２に走行開始許諾指令を出力する。これを受けて有人車両２０の通信装置３２から、走行開始許諾指令が無線通信Ｓ3にて、監視局４０に送信される。

【０１５０】

走行開始許諾指令は、監視局４０の通信装置４２で受信されて、自局４０の追い越しコントローラ４５′に送出され、さらに無人車運行管理装置４８に出力される。

【０１５１】

無人車運行管理装置４８では、追い越しコントローラ４５′から走行開始許諾指令が入力されているか否か（有人車両２０が迂回コース７２の走行開始を許諾中であるか否か）を判断している。この判断の結果、追い越しコントローラ４５′から走行開始許諾指令が入力されており、有人車両２０が迂回コース７２の走行開始を許諾中であるという判断がなされた場合には、無人車運行管理装置４８は、無人車両１０が迂回コース７２を走行することを許可する走行許可指令を運行データ共有装置４３に送出する。運行データ共有装置４３は、走行許可指令を自局４０の通信装置４２に出力する。

【０１５２】

なお、有人車両２０から走行開始許諾指令が得られない場合、監視局４０の無人運行管理装置４８は、有人車両の位置に応じて、随時、立入禁止領域６０、ブロック位置６１Ｂ、迂回コース７２の予定データを更新しながら、許諾を待つ。

【０１５３】

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また、明示的に有人車両から追い越し禁止入力を受けた場合や、有人車両の走行速度、対向車の位置など、状況の変化により追い越し不能と判断した場合は、監視局４０の無人車運行管理装置４８は、運行データ共有装置４３に記憶された立入禁止領域６０、ブロック位置６１Ｂ、迂回コース７２の予定データを削除する。

【０１５４】

有人車両２０より走行開始許諾指令が得られ、それに応じて監視局４０で走行許可指令が生成されると、監視局４０の通信装置４２から、無線通信Ｓ1にて、無人車両１０に対して走行許可指令が送信される。また、監視局４０の通信装置４２から、無線通信Ｓ3にて、有人車両２０に対して、無人車両１０に走行を許可した旨の走行許可中通知が送信される。

【０１５５】

無人車両１０の通信装置２では、走行許可指令が受信される。通信装置２は、走行許可指令を、自車両１０の運行データ共有装置３に送出する。

【０１５６】

一方、無人車両１０の有人車混走コントローラ４では、監視局４０から与えられる走行許可指令とは別に、各有人車両２０…の位置データに基づいて、自己車両１０が、迂回コース７２を走行することを許可する走行許可指令を生成している。すなわち、監視局４０から走行許可指令が得られていても、各有人車２０…の不用意な行動によって、無人車両１０に干渉する可能性がある場合には、走行を許可すべきではないからである。また、第１実施例のように、この処理を有人車両２０の有人車混走コントローラ３４で行うように構成してもよい。

【０１５７】

無人車両１０の制御装置５は、自車両１０の運行データ共有装置３に対して、走行許可指令を問い合わせるとともに、自車両１０の有人車混走コントローラ４に対して走行許可指令を問い合わせる。運行データ共有装置３および有人車混走コントローラ４の両方から走行許可指令が出力されることを条件に、制御装置５は、自車両１０が迂回コース７２を走行するように制御する。

【０１５８】

しかし、運行データ共有装置３、有人車混走コントローラ４のいずれか一方から走行許可指令が出力されていない場合には、制御装置５は、低速の有人車両２０を追い越さないように、状況に応じて減速若しくは停止するように、自車両１０の走行を制御する。このように制御装置５は、監視局４０から運行データ共有装置３を介して得られる走行許可指令のみならず、常に、有人車混走コントローラ４に走行継続の許可を問い合わせながら、迂回コース７２の走行を継続する。

【０１５９】

一方、有人車両２０の通信装置３２では、無人車両１０の走行が許可された旨の走行許可中通知が受信され、自車両２０の追い越しコントローラ３５′に送出される。追い越しコントローラ３５′は、走行許可中通知を、表示指令として表示装置３７に出力する。これにより有人車両２０の表示装置３７の表示画面には、「無人車両１０の走行許可中（追い越し中）」の表示がなされ、オペレータに対して、追い越し中であるとの警告がなされる。この警告によって、自車両２０が高速走行に移行したり、転回等を行うために対面側車線５２にはみでて領域Ｄ（図７（ｄ））にて後方の無人車両１０と干渉するなどの問題を引き起こさないように注意を喚起することができる（ステップ２０７）。

【０１６０】

なお、無人運行管理装置４８は、無人車両１０が迂回コース７２の走行を終えたか否かを判断している。無人車両１０が迂回コース７２の走行を終えたと判断された場合には、監視局４０の無人運行管理装置４８は、運行データ共有装置４３に記憶された立入禁止領域６０、ブロック位置６１Ｂ、迂回コース７２のデータを削除する。

【０１６１】

なお、この第２実施例では、監視局４０を介在させて、監視局４０から無人車両１０、

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１１…に対してデータを送信したり、監視局４０から有人車両２０…に対してデータを送信するようにしているが、監視局４０を介在させることなく、無人車両１０、１１…から有人車両２０…に対してデータを直接、送信したり、有人車両２０…から無人車両１０、１１…に対してデータを直接、送信するように構成してもよい。すなわち、低速の有人車両２０に、監視局４０の機能をもたせて、無人車両と直接相互にデータを送受信してもよい。

【０１６２】

（第３実施例；無人車両が低速で走行している場合の迂回）

以下、図１０（ａ）、（ｂ）、（ｃ）に示す構成図、図１１（ａ）、（ｂ）、（ｃ）に示す走行路５０を示す図を併せ参照して実施例の処理の手順について説明する。

【０１６３】

本実施例は、第２実施例における低速走行している有人車両２０を、低速走行している無人車両１２に置換した実施例であり、第２実施例と重複する説明は、省略して説明する。

【０１６４】

図１０（ａ）、（ｂ）、（ｃ）はそれぞれ、図６（ａ）、（ｂ）、（ｃ）に対応する図である。図６と同じ符合は同じ構成要素であるとして、適宜、説明を省略する。

【０１６５】

無人車両１０、１１の構成は、図１０（ｃ）に示すように、第２実施例の図６（ｃ）の構成と同じである。

【０１６６】

追い越される低速の無人車両１２の構成は、図１０（ａ）に示すように、他の無人車両１０、１１の構成（図１０（ｃ））と同じである。

【０１６７】

監視局４０には、第２実施例の図６（ｂ）の構成に示す有人車混走コントローラ４４は設けられていない他は、同図６（ｂ）の構成と同じである。

【０１６８】

本実施例では、走行路５０上の無人車両１２が低速で走行している場合を想定している。本実施例では、第２実施例と同様に、低速の無人車両１２を追い越すための迂回コース７２が作成される。

【０１６９】

すなわち、図１１（ａ）に示すように、監視局４０で、無人車両１０が同じ車線５１を低速で走行している無人車両１２に追いつく可能性があることを判断すると、図１１（ｂ）に示すように、対面側車線５２にブロック位置６１Ｂを作成するとともに、立入禁止領域６０を作成して、対面側車線５２を走行中の無人車両１１に対して、ブロック位置６１Ｂで停止するように停止指令を無人車両１１に対して与える。立入禁止領域６０は、無人車両１２が走行する予定の走行コース７３のデータに基づき作成される。

【０１７０】

対面側車線５２の無人車両１１がブロック位置６１Ｂで確実に停止することが確認されたならば、迂回コース７２を作成し、低速の無人車両１２に対しては、走行コース７３に沿って減速して走行させる旨の走行指令を与える。

【０１７１】

迂回コース７２が作成されると、監視局４０は、図１１（ｃ）に示すように、無人車両１０に対して走行許可の指令を与えて、迂回コース７２を走行させる。

【０１７２】

監視局４０は、無人車両１０が迂回コース７２の走行を終えたと判断すると、対面側車線５２のブロック位置６１Ｂ、迂回コース７２のデータを削除する。

【０１７３】

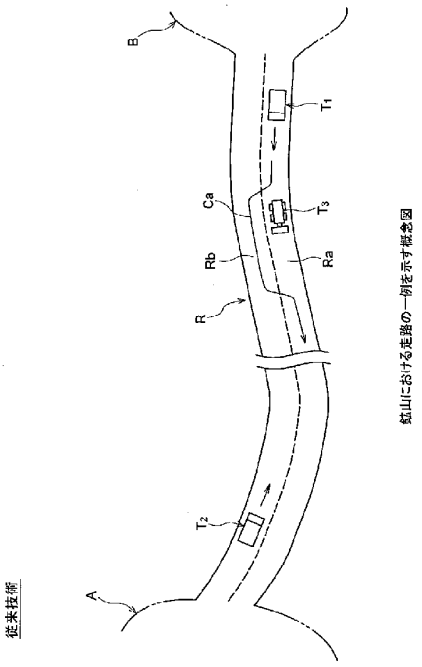
なお、以上の各実施例の説明では、対面側車線５２の車両が、無人車両１１である場合を想定して説明したが、対面側車線５２の車両は、有人車両であってもよい。

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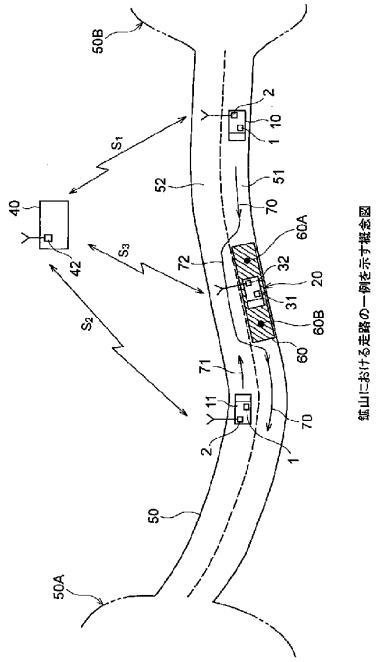
【０１７４】
また、以上の実施例では、追い越される車両が、作業車両である場合、あるいは低速車両である場合を想定して説明したが、追い越される車両としては、後方を走行する無人車両にとって高速走行に支障のある車両であればよく、故障した車両であってもよい。
【０１７５】
以上のように、実施例によれば、往復車線５１、５２のうちいずれか一方の車線５１の有人車両２０（あるいは無人車両１２）の位置情報（作業範囲の始点６０Ａ、終点６０Ｂあるいは走行コース７３のデータ）に基づいて、立入禁止領域６０を作成し、この立入禁止領域６０の情報に基づいて、迂回コース７２を作成し、この迂回コース７２の情報を各無人車両１０、１１、１２…有人車両２０…に教示し、立入禁止領域６０を挟んで対面走行する無人車両１０、無人車両１１（あるいは有人車両）の位置情報に基づいて、立入禁止領域６０の対面側車線５２の無人車両１１（あるいは有人車両）をブロック位置６１Ｂでブロックしつつ、立入禁止領域６０側の車線５１を走行する無人車両１０に対して、走行許可指令を与えて迂回コース７２を走行させるようにしている。このため、無人車両１０、無人車両１１（あるいは有人車両）を対面走行させるに際して、車両同士の干渉を確実に防止することができると同時に、低速車両などの後方の無人車両１０にとって高速走行に支障のある有人車両２０（あるいは無人車両１２）を高速で迂回することができ、安全を確実に保障しながらも、搬送効率、作業効率が向上する。
【図面の簡単な説明】
【０１７６】
【図１】図１は、従来技術の説明のために用いた図で、往復車線を有した走行路を車両が対面走行している様子を示す図である。
【図２】図２は、実施例の説明のために用いた図で、往復車線を有した走行路を車両が対面走行している様子を示す図である。
【図３】図３（ａ）、（ｂ）、（ｃ）は第１実施例の構成図である。
【図４】図４（ａ）、（ｂ）、（ｃ）、（ｄ）は第１実施例において迂回コースを作成する処理を説明する図である。
【図５】図５は第１実施例の処理手順を示すフローチャートである。
【図６】図６（ａ）、（ｂ）、（ｃ）は第２実施例の構成図である。
【図７】図７（ａ）、（ｂ）、（ｃ）、（ｄ）は第２実施例において迂回コースを作成する処理を説明する図である。
【図８】図８は第２実施例の処理手順を示すフローチャートである。
【図９】図９は第２実施例における対面側車線ブロック処理の手順を示すフローチャートである。
【図１０】図１０（ａ）、（ｂ）、（ｃ）は第３実施例の構成図である。
【図１１】図１１（ａ）、（ｂ）、（ｃ）は第３実施例において迂回コースを作成する処理を説明する図である。
【符号の説明】
【０１７７】
１０、１１、１２　無人車両　２０　有人車両　４０　監視局　５０　走行路　５１、５２　車線　６０　立入禁止領域　６１Ａ、６１Ｂ　ブロック位置　７０、７１、７３　走行コース　７２　迂回コース

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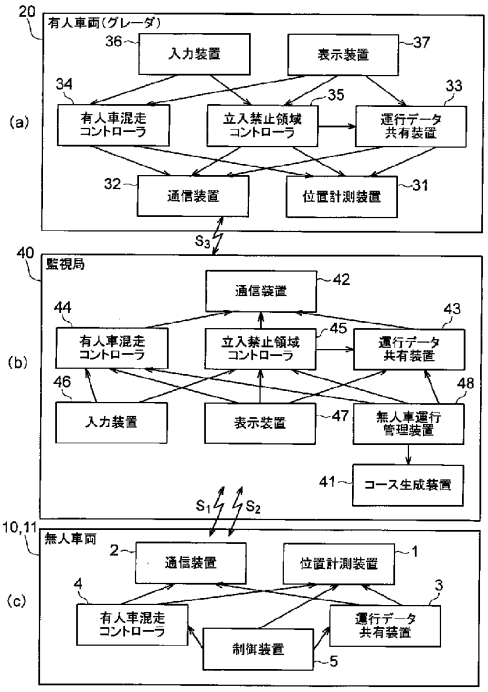
【図１】


従来技術
鉱山における走路の一例を示す概念図
A
B
R
Ra
Rb
Ca
T1
T2
T3

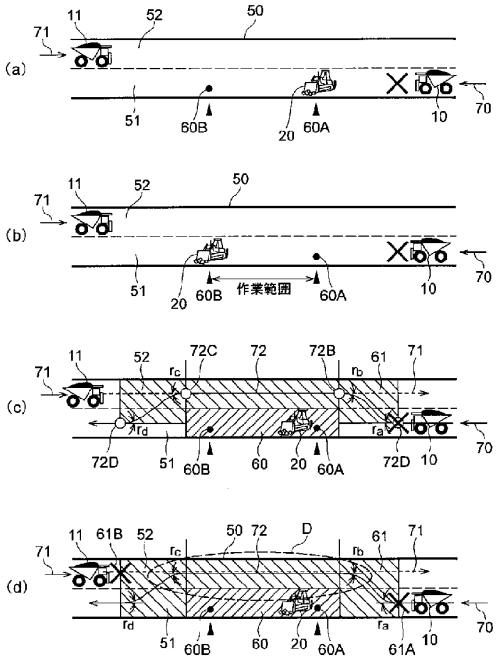
【図２】


鉱山における走路の一例を示す概念図
50A
50B
S1
S2
S3

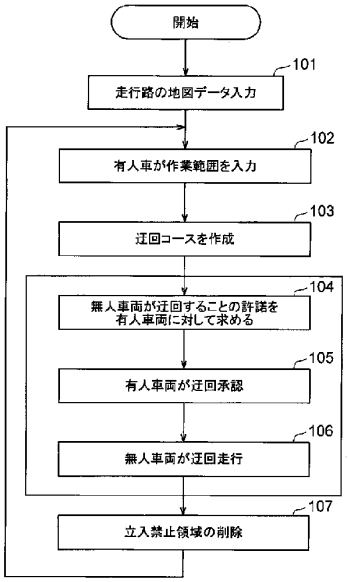
【図３】


有人車両(グレーダ)
入力装置
表示装置
有人車混走コントローラ
立入禁止領域コントローラ
運行データ共有装置
通信装置
位置計測装置
監視局
無人車運行管理装置
コース生成装置
無人車両
制御装置
(a)
(b)
(c)

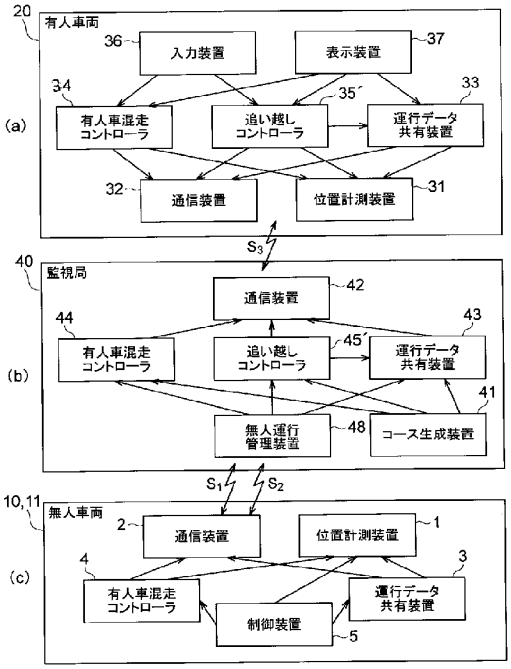
【図４】


(a)
(b)
(c)
(d)
作業範囲

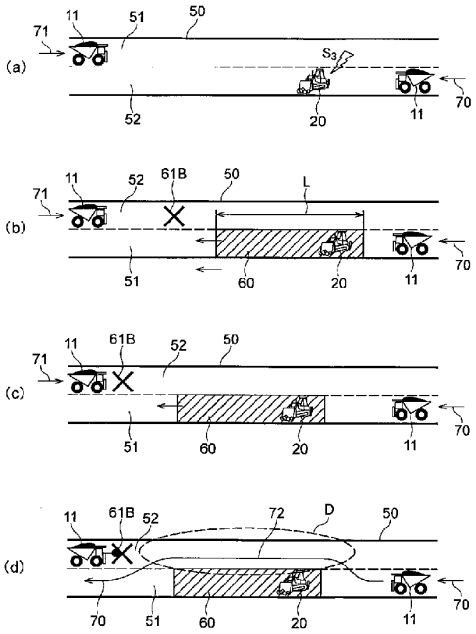
【図５】


開始
101
走行路の地図データ入力
102
有人車が作業範囲を入力
103
迂回コースを作成
104
無人車両が迂回することの許諾を有人車両に対して求める
105
有人車両が迂回承認
106
無人車両が迂回走行
107
立入禁止領域の削除

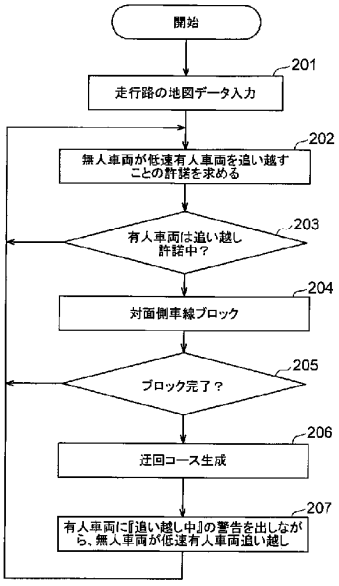
【図６】


20
有人車両
36
入力装置
37
表示装置
34
33
35
(a)
有人車混走コントローラ
追い越しコントローラ
運行データ共有装置
32
通信装置
位置計測装置
31
S3
40
監視局
通信装置
42
44
43
45
(b)
有人車混走コントローラ
追い越しコントローラ
運行データ共有装置
41
無人運行管理装置
48
コース生成装置
S1
S2
10,11
無人車両
2
通信装置
位置計測装置
1
4
3
(c)
有人車混走コントローラ
制御装置
運行データ共有装置
5

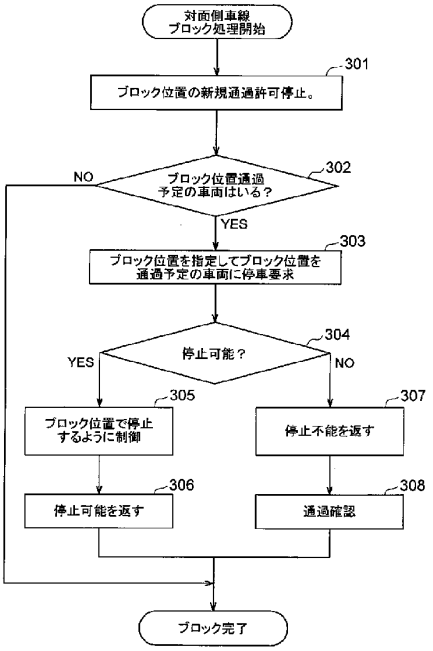
【図７】


(a)
71
11
51
50
S3
52
20
11
70
(b)
71
11
52
61B
50
L
51
60
20
11
70
(c)
71
11
61B
52
50
51
60
20
11
70
(d)
11
61B
52
72
D
50
70
51
60
20
11
70

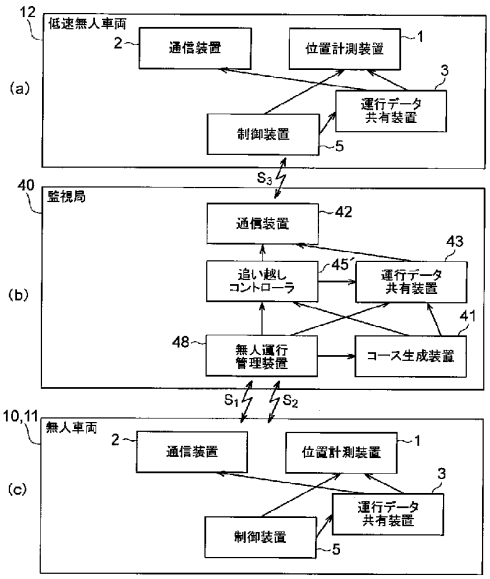
【図８】


開始
201
走行路の地図データ入力
202
無人車両が低速有人車両を追い越すことの許諾を求める
203
有人車両は追い越し許諾中？
204
対面側車線ブロック
205
ブロック完了？
206
迂回コース生成
207
有人車両に『追い越し中』の警告を出しながら、無人車両が低速有人車両追い越し

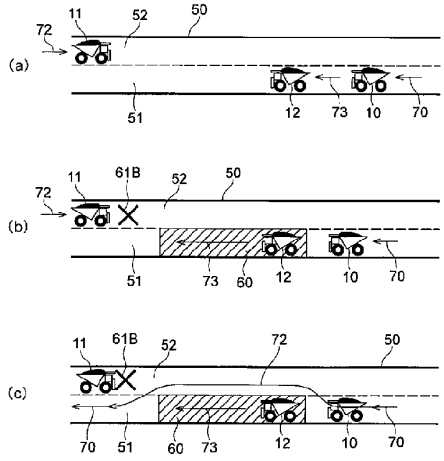
【図９】


対面側車線
ブロック処理開始
301
ブロック位置の新規通過許可停止。
302
ブロック位置通過
予定の車両はいる？
NO
YES
303
ブロック位置を指定してブロック位置を
通過予定の車両に停車要求
304
停止可能？
YES
NO
305
ブロック位置で停止
するように制御
306
停止可能を返す
307
停止不能を返す
308
通過確認
ブロック完了

【図１０】


12
低速無人車両
2
通信装置
位置計測装置
1
3
運行データ
共有装置
(a)
制御装置
5
S3
40
監視局
通信装置
42
43
追い越し
コントローラ
45
運行データ
共有装置
(b)
41
48
無人運行
管理装置
コース生成装置
S1
S2
10,11
無人車両
2
通信装置
位置計測装置
1
3
運行データ
共有装置
(c)
制御装置
5

【図１１】


(a)
11
52
50
72
51
12
73
10
70
(b)
11
61B
52
50
72
51
73
60
12
10
70
(c)
11
61B
52
72
50
70
51
60
73
12
10
70

フロントページの続き

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| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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| | **Attorney Docket Number** | 144604-8001.US00 |

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| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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Textron Specialized Vehicles Inc., Exh. 1002, p. 274

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

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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Textron Specialized Vehicles Inc., Exh. 1002, p. 275

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

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*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.



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## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| L1 | 6062 | ceas$3 WITH (control$4 command$3) WITH (car vehicle automobile) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/24 03:17 PM |
| L2 | 648541 | restrict$3 near6 (region area zone) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/24 03:17 PM |
| L3 | 294 | 1 AND 2 | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/24 03:18 PM |
| L4 | 167 | 3 AND @ad<"20150309" | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/24 03:18 PM |

## PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.



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## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| L1 | 604879 | restrict$3 near5 (area zone region strip) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 11:47 AM |
| L2 | 21148 | (vehicle car automobile) WITH 1 | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 11:48 AM |
| L3 | 21191 | (vehicle car automobile taxi) WITH 1 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 12:24 PM |
| L4 | 31386 | 1 WITH (point boundary border) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 12:25 PM |
| L5 | 2663 | 3 AND 4 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 12:25 PM |
| L6 | 2798 | point WITH (connect$3 path) WITH 1 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 12:26 PM |
| L7 | 308 | 5 AND 6 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, | OR | ON | ON | 2022/03/22 12:26 PM |



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| L8 | 137 | 7 AND @ad<"20150309" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 12:29 PM |
| L9 | 2816 | air near6 taxi | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:09 PM |
| L10 | 3 | 9 AND 5 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:09 PM |
| L11 | 19 | 9 AND 3 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:10 PM |
| L12 | 12232 | 1 WITH ("UAV" drone flight plane aircraft airbus) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:14 PM |
| L13 | 1503 | 12 AND 3 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:15 PM |
| L14 | 465 | 13 AND 4 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, | OR | ON | ON | 2022/03/22 01:16 PM |

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| | | | DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | | | | |
| L15 | 96 | 14 AND @ad<"20150309" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:16 PM |
| L16 | 79 | 15 NOT 8 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:16 PM |
| L17 | 151298 | (g08g5/006 g08g5/0004 g08g5/0013 g08g5/0021 g08g5/0026 g08g5/0052 g08g5/0069 g08g5/0082 b64c39/024 b64c2201/024 b64c2201/127 b64c2201/141 b64c2201/146 b64d47/08 g05d1/0214 g05d1/106 g05d1/101).cpc. | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:37 PM |
| L18 | 67 | 17 AND 7 | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/03/22 01:37 PM |

## PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Google

restriction region for ground vehicle

ALL NEWS IMAGES VIDEOS MAPS SHOPPING BOOKS SEARCH TOOLS

## [PDF] FAA Guide to Ground Vehicle Operations

www.faa.gov

› airports › media › ground_vehicle_guide_proof_final

FAA

Guide to Ground Vehicle Operations. Airport Basics. Taxiway Markings are Yellow. Taxiways are areas used by aircraft to get to and from the.

**People also ask**

Are non licensed vehicle roads part of the non-movement area?

What areas make up the AOA?

Which are required to be in all vehicles that operate on the airfield?

What separates a movement area from a non-movement area?

## AC 150/5210-20A - Ground Vehicle Operations to include Taxiing or ...

www.faa.gov

› airports › index.cfm › document.current › documentnumber

Apr 30, 2020 -

The AC now addresses aircraft being taxied by persons other than certificated pilots; adds a definition for Airport Operations Area; revises the ...

## 14 CFR § 139.329 - Pedestrians and ground vehicles. - Legal ...

www.law.cornell.edu

› ... › Subpart D - Operations

(a)

Limit access to movement areas and safety areas only to those pedestrians and ground vehicles necessary for airport operations;.



Textron Specialized Vehicles Inc., Exh. 1002, p. 283

[PDF] Ground Vehicle AOA Familarization Manual
assets.ctfassets.net › DFW_Operations_Aircraft_Non-Movement_Area...
Vehicles and/or persons that have a valid reason to enter or work in restricted areas such as Runways or Taxiways or their Safety and Protected Areas, Object ...

[PDF] Restricted Area
popodn.azureedge.net › pdfs › Restricted-Driving-PDX
Cockpit visibility prohibits the pilot from seeing under the nose or behind the aircraft and limits the pilot's ability to observe and avoid ground vehicles. 5.

[PDF] Ground Vehicle Operations in the Movement Area - ICAO
www.icao.int › NACC › Documents › Meetings › ACIW14
Inspectors Workshop for the Caribbean Region ... pedestrian/ground vehicle training program. FAA. Requirements ... Limit access to movement areas and.

[PDF] Runway Safety and Pedestrian -- Ground vehicles/ Public Protection
www.icao.int › NACC › Documents › Meetings › ACI
Eastern Region, Airports Division. Airport Operator Actions to Reduce the Potential for Pedestrian and Ground Vehicle. Deviations. •. Limit the number of.

[PDF] AOA Non-Movement Ground Vehicle Operation Rules & Regulations
www.flylawton.org › system › docs › original › LFSRAFORM004_D...
Owner–a person who holds the legal title of an aircraft or a motor vehicle. 1.3.25. Restricted Areas–areas of the airport posted to prohibit or limit entry ...


Textron Specialized Vehicles Inc., Exh. 1002, p. 284

### Online TDM Encyclopedia - Vehicle Restrictions

www.vtpi.org › tdm › tdm33

Some cities have Auto-Restricted Zones that limit automobile access, for example, to residents and commercial vehicles. These often have features of Car-Free ...

### [PDF] RAMP SAFETY & TRAFFIC REGULATIONS HANDBOOK - San Jose ...

www.flysanjose.com › sites › default › files › ALWO › Ramp_Rules

runways, taxiways, and areas in which both ground vehicles and aircraft frequently ... AIRPORT RESTRICTED AREA DRIVER PERMIT: Revocable permit issued by.

**People also ask**

Which of the following vehicles are required to be chocked when parked on the airfield?

Do you need permission from ATC to enter into the non-movement area?

Can you drive a car on a runway?

What does the acronym Nplas stand for?

**Related searches**

- Ground vehicle operations on airports
- Airport vehicle Regulations
- No drive zone airport
- Airport ground vehicles
- drivers must know the standard air traffic control (atc) phraseology
- Airport ground vehicle flight Radar


Textron Specialized Vehicles Inc., Exh. 1002, p. 285

Airport vehicle service Road markings

Airport vehicles names

Next >

**Alexandria, Virginia** - Based on your past activity - Update location

- Learn more

Sign in

Settings Privacy Terms



Textron Specialized Vehicles Inc., Exh. 1002, p. 286

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/523,847 | XU et al. |
| | Examiner | Art Unit |
| | MARY D CHEUNG | 3665 |

| CPC - Searched* | | |
|---|---|---|
| Symbol | Date | Examiner |
| G08G 5/006; G08G 5/0004; G08G 5/0013; G08G 5/0021; G08G 5/0026; G08G 5/0052; G08G 5/0069; G08G 5/0082; B64C 39/024; B64C 2201/024; B64C 2201/127; B64C 2201/141; B64C 2201/146; B64D 47/08; G05D 1/106; G05D 1/101 | 03/22/2022 | mc |

| 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 |
| EAST | 03/22/2022 | mc |
| CPC with text search | 03/22/2022 | mc |
| EAST | 03/24/2022 | mc |
| Google | 03/24/2022 | mc |

| Interference Search | | | |
|---|---|---|---|
| US Class/CPC Symbol | US Subclass/CPC Group | Date | Examiner |
| | | | |



Textron Specialized Vehicles Inc., Exh. 1002, p. 287

| Notice of References Cited | Application/Control No. 17/523,847 | Applicant(s)/Patent Under Reexamination XU et al. | |
|---|---|---|---|
| | Examiner MARY D CHEUNG | Art Unit 3665 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-20080183344-A1 | 07-2008 | Doyen; William G. | G08G5/0013 | 701/9 |
| * | B | US-20160253907-A1 | 09-2016 | Taveira; Michael Franco | G05D1/106 | 701/3 |
| * | C | US-20150241878-A1 | 08-2015 | Crombez; Dale Scott | B60W50/08 | 701/23 |
| * | D | US-20080025238-A1 | 01-2008 | McCown; Steven H. | G08B21/0261 | 370/308 |
| * | E | US-20140359724-A1 | 12-2014 | KUBISCH; Martin | H04L67/12 | 726/5 |
| * | F | US-20080174454-A1 | 07-2008 | Bitar; Elias | G01C23/00 | 340/975 |
| | G | | | | | |
| | H | | | | | |
| | I | | | | | |
| | J | | | | | |
| | K | | | | | |
| | L | | | | | |
| | M | | | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
| | N | WO-2011159182-A1 | 12-2011 | WO | MISOLIN Y V | G06Q10/08 |
| | O | JP-2007164280-A | 06-2007 | JP | KUROMOTO K | G01C21/005 |
| | P | RU-2657916-C1 | 06-2018 | RU | TARCISIO CADDAH M | G08B15/005 |
| | Q | CN-101826262-A | 09-2010 | CN | KIYOTAKA T | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 | 5063 |

25096 7590 03/29/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

| EXAMINER | |
|---|---|
| CHEUNG, MARY DA ZHI WANG | |
| **ART UNIT** | **PAPER NUMBER** |
| 3665 | |
| **NOTIFICATION DATE** | **DELIVERY MODE** |
| 03/29/2022 | 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):

patentprocurement@perkinscoie.com

| *Office Action Summary* | Application No. 17/523,847 | Applicant(s) XU et al. | |
|---|---|---|---|
| | Examiner MARY D CHEUNG | Art Unit 3665 | 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 3 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 3/11/22.

☐ 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) 1-30 is/are pending in the application.

5a) Of the above claim(s) 25-30 is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3 and 8-24 is/are rejected.

8) ☑ Claim(s) 4-7 is/are objected to.

9) ☐ Claim(s) _____ 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. 15/699,359.

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 3/11/22.

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

4) ☐ Other: _____.

## DETAILED ACTION

### *Status of Claims*

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA. This action is in response to the applicant's election filed on March 11, 2022. Claims 1-30 are pending. Claims 1-24 are elected without traverse, and claims 25-30 are withdrawn. Claims 1-24 are examined below.

### *Claim Rejections - 35 USC § 102*

2. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention.

4. Claims 1, 3, 8, 15 and 17-19 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Doyen et al., US 2008/0183344 A1.

As to claim 1, Doyen teaches a method for supporting a vehicle restriction region, comprising (abstract):

- Receiving, via one or more processors, two or more points associated with the restriction region (¶ 34-35, 53 and page 6 claim 5);
- Generating, via one or more processors, one or more restriction strips along with a boundary of the restriction region by connecting adjacent points of the two or more points, the one or more restriction strips defining at least a portion of the restriction region (¶ 34-35, 53 and page 6 claim 5); and
- Automatically causing a ground vehicle to undertake one or more response measures based on at least one of a location or a movement characteristic of the ground vehicle relative to the restriction region (¶ 24, 30-45, page 6 claim 8 and Fig. 1; e.g. alert message or egress from the restriction region).

As to claim 3, Doyen teaches wherein the two or more points correspond to coordinate information of the boundary (¶ 53).

As to claim 8, Doyen teaches Doyen teaches wherein the one or more restriction strips corresponding to one or more restriction lines that define the restriction region (¶ 53)

As to claim 15, Doyen teaches wherein the movement characteristic includes at least one of a velocity, an acceleration, a deceleration, a direction of travel, or a projected path of the ground vehicle (¶ 24, 33, 36, 38, 40, 56).

As to claim 17, Doyen teaches further comprising: determining which of the one or more response measures to cause the ground vehicle to undertake, based on the location or the movement characteristic of the ground vehicle relative to the restriction region (¶ 24, 36-45, 56 and Fig. 1).

As to claim 18, Doyen teaches wherein causing the ground vehicle to undertake the one or more response measures based on the location or the movement characteristic of the ground vehicle includes: calculating an estimated amount of time for the ground vehicle to approach the restriction region, or a time or distance for the ground vehicle to begin to experience a response measure (¶ 56).

As to claim 19, Doyen teaches wherein the one or more response measures includes at least one of: decelerating the ground vehicle; providing a safety measure to prevent the ground vehicle from entering the restriction region; changing a direction of the ground vehicle; adjusting a path of the ground vehicle; or providing an alert regarding the ground vehicle (¶ 24, 30-45 and Fig. 1).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 2, 9-14, 16, 21 and 23-24 are rejected under 35 U.S.C. 103 as being unpatentable over Doyen et al, US 2008/0183344 A1 in view of Taveira, US 2016/0253907 A1.

As to claim 2, Doyen teaches does not specifically teach wherein the two or more points are input by a user. However, Taveira teaches this matter (¶ 162-163; e.g. restriction boundary coordinates are controlled by federal government agency). It would have been obvious to one of ordinary skill in the art before the effective filing date of the

claimed invention to modify Doyen's invention by incorporating feature of the two or more points are input by a user as taught by Taveira for better control the restriction region.

As to claim 9, Doyen does not specifically teach wherein each of the one or more restriction strips is configured with a width that is larger than or equal to a minimum width. However, Taveira teaches this matter (¶ 70, 73; e.g. extended restriction area altitude profile 320a over the restriction area 320). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention by incorporating the extending the restriction strips as taught by Taveira for safer avoiding restricted region.

As to claim 10, Doyen in view of Taveira further teaches wherein the minimum width is defined to prevent the ground vehicle form encroaching in the restriction region (Doyen: ¶ 53).

As to claim 11, Doyen does not specifically teach wherein the boundary is a closed boundary and restriction region is a closed region. However, Taveira teaches this matter (Figs. 3A-3B). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention by incorporating the closed restricted area as taught by Taveira for safer managing the restricted area.

As to claim 12, Doyen in view of Taveira teaches wherein the one or more restriction strips have ends, and wherein an end of one restriction strip overlaps with an end of another restriction strip to enclose the restriction region (Taveira: Fig. 3A; see claim 11 above for motivation and obviousness to combine the references).

As to claim 13, Doyen in view of Taveira further teaches wherein the one or more response measures are undertaken only in an area outside the restriction region (Doyen: ¶ 37-43).

As to claim 14, Doyen does not specifically teach the boundary is an open boundary and the restriction region is an open region. However, Taveira teaches this matter (¶ 71-75 and Fig. 3B). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention by incorporating the opened restricted area as taught by Taveira for better managing the restricted area.

As to claim 16, Doyen in view of Taveira further teaches wherein causing the ground vehicle to undertake the one or more response includes (Doyen: ¶ 24, 30-43): calculating a distance between the location of the ground vehicle and the boundary of the restriction region; and determining whether to cause the ground vehicle to undertake the one or more response measures based at least in part on comparing the calculated distance to a distance threshold (Taveira: ¶ 70-71, 74; see claim 11 above for motivation and obviousness to combine the references).

As to claim 21, Doyen teaches causing the ground vehicle to undertake one or more response measures as discussed in claim 1 above. Doyen does not specifically teach causing the ground vehicle to undertake one or more response measures includes taking control away from a user of the ground vehicle. However, this matter is taught by Taveira as taking control away from a user of the vehicle (¶ 37; e.g. certain vehicle function is disabled). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention

by incorporating the feature of taking control away from a user as taught by Taveira for better the vehicles when approaching the restricted area.

As to claim 23, Doyen does not teach specifically teach the restriction region has an irregular shape. However, Taveira teaches this matter (¶ 76). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention by incorporating the irregular shaped restriction region as taught by Taveira for better managing the restricted region.

As to claim 24, Doyen teaches the restriction region corresponds to a man-made feature (¶ 53; e.g. geographic boundaries are defined by a range of altitude).

7. Claims 20 and 22 are rejected under 35 U.S.C. 103 as being unpatentable over Doyen et al, US 2008/0183344 A1 in view of Crombez et al., US 2015/0241878 A1.

As to claim 20, Doyen does not specifically teach the ground vehicle includes a housing configured to carry a person. However, Crombez teaches this matter (¶ 26, 29 and Fig. 2). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention by incorporating the ground vehicle feature as taught by Crombez for efficiently managing the transportation.

As to claim 22, Doyen does not specifically teach causing the ground vehicle to undertake one or more response measures includes ceasing to take commands from a user of the ground vehicle. However, Crombez teaches this matter (¶ 42, 53 and Fig. 2). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify Doyen's invention by incorporating the

ground vehicle feature as taught by Crombez for effectively managing the control of the vehicle.

***Allowable Subject Matter***

8. Claims 4-7 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Inquiry***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary Cheung whose telephone number is (571) 272-6705. The examiner can normally be reached on Monday, Tuesday and Thursday from 10:00 AM to 7:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christian Chace, can be reached on (571) 272-4190.

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).

The fax phone numbers for the organization where this application or proceedings is assigned are as follows:

(571) 273-8300 (Official Communications; including After Final Communications labeled “BOX AF”)

(571) 273-6705 (Draft Communications)

/MARY CHEUNG/
Primary Examiner, Art Unit 3665
March 24, 2022

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>17/523,847 | Filing Date<br>11/10/2021 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☑ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED - PART I

| FOR | (Column 1)<br>NUMBER FILED | (Column 2)<br>NUMBER EXTRA | | RATE ($) | FEE ($) |
|---|---|---|---|---|---|
| ☐ BASIC FEE<br>(37 CFR 1.16(a), (b), or (c)) | N/A | N/A | | N/A | |
| ☐ SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m)) | N/A | N/A | | N/A | |
| ☐ EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q)) | N/A | N/A | | N/A | |
| TOTAL CLAIMS<br>(37 CFR 1.16(i)) | minus 20 = | * | | x $100 = | |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h)) | minus 3 = | * | | x $480 = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | | TOTAL | |

## APPLICATION AS AMENDED - PART II

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | 03/11/2022 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * 30 | Minus | ** 30 | = 0 | | x $100 = | 0 |
| | Independent<br>(37 CFR 1.16(h)) | * 1 | Minus | *** 3 | = 0 | | x $480 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | 0 |

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * | Minus | ** | = | | x $0 = | |
| | Independent<br>(37 CFR 1.16(h)) | * | Minus | *** | = | | x $0 = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
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| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. | PSA |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". | /CHERYL A CLARK/ |
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This collection of information is required by 37 CFR 1.16. 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 12 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 45207825 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Anndreya Perez |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 11-MAR-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 14:53:47 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
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| 1 | | 2022_03_11_Response_to_Restriction_Requirement_144604 8001US00.PDF | 141990<br>36a5e865734394bae59fcdd818cf20a44e6f b333 | yes | 10 |

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| | **Document Description** | **Start** | **End** |
| | Response to Election / Restriction Filed | 1 | 1 |
| | Specification | 2 | 2 |
| | Claims | 3 | 8 |
| | Applicant Arguments/Remarks Made in an Amendment | 9 | 10 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 141990 | |

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**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.**

## REMARKS

In the above-referenced Office Action, the Examiner divided the claims into the following Groups:

I. Claims 1-24, drawn to supporting a vehicle restriction region comprising automatically causing a ground vehicle to undertake response measures based on a location or a movement characteristic of the ground vehicle relative to the restriction region, classified in G06G 5/006; and

II. Claims 25-30, drawn to restricting motion of a ground vehicle comprising automatically disabling the ground vehicle in response to the ground vehicle penetrating the restriction region, classified in G05B 2219/24127.

In response, the Applicant elects Group I (claims 1-24), without traverse. Non-elected claims 25-30 have been withdrawn without prejudice to requesting reconsideration of these claims upon an indication of an allowable generic claim, and without prejudice to pursuing these claims in a continuation, divisional, continuation-in-part, or other application. Accordingly, claims 1-24 are currently pending, with claims 25-30 withdrawn.

Please charge any underpayment or credit any overpayment to our Deposit Account No. 50-0665, under Order No. 144604-8001.US00 from which the undersigned is authorized to draw.

Dated: March 11, 2022

Respectfully submitted,

By _/John M. Wechkin/___
John Wechkin
Registration No.: 42,216

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Attorneys for Applicant



Textron Specialized Vehicles Inc., Exh. 1002, p. 303

## AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Original) A method for supporting a vehicle restriction region, comprising:

receiving, via one or more processors, two or more points associated with the restriction region;

generating, via the one or more processors, one or more restriction strips along a boundary of the restriction region by connecting adjacent points of the two or more points, the one or more restriction strips defining at least a portion of the restriction region; and

automatically causing a ground vehicle to undertake one or more response measures based on at least one of a location or a movement characteristic of the ground vehicle relative to the restriction region.

2. (Original) The method of claim 1, wherein the two or more points are input by a user.

3. (Original) The method of claim 1, wherein the two or more points correspond to coordinate information of the boundary.

4. (Original) The method of claim 1, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle.

5. (Original) The method of claim 4, wherein the first circle and the second circle are centered, respectively, at the adjacent points that are connected, to generate the at least one restriction strip.

6. (Original) The method of claim 4, wherein the first circle and the second circle have the same radius.

7. (Original) The method of claim 4, wherein a radius of the first circle or a radius of the second circle is defined based on a width of the at least one restriction strip.

8. (Original) The method of claim 1, wherein the one or more restriction strips correspond to one or more restriction lines that define the restriction region.

9. (Original) The method of claim 1, wherein each of the one or more restriction strips is configured with a width that is larger than or equal to a minimum width.

10. (Original) The method of claim 9, wherein the minimum width is defined to prevent the ground vehicle from encroaching in the restriction region.

11. (Original) The method of claim 1, wherein the boundary is a closed boundary and the restriction region is a closed region.

12. (Original) The method of claim 11, wherein the one or more restriction strips have ends, and wherein an end of one restriction strip overlaps with an end of another restriction strip to enclose the restriction region.

13. (Original) The method of claim 12, wherein the one or more response measures are undertaken only in an area outside the restriction region.

14. (Original) The method of claim 1, wherein the boundary is an open boundary and the restriction region is an open region.

15. (Original) The method of claim 1, wherein the movement characteristic includes at least one of a velocity, an acceleration, a deceleration, a direction of travel, or a projected path of the ground vehicle.

16. (Original) The method of claim 1, wherein causing the ground vehicle to undertake the one or more response measures includes:

calculating a distance between the location of the ground vehicle and the boundary of the restriction region; and

determining whether to cause the ground vehicle to undertake the one or more response measures based at least in part on comparing the calculated distance to a distance threshold.

17. (Original) The method of claim 1, further comprising:

determining which of the one or more response measures to cause the ground vehicle to undertake, based on the location or the movement characteristic of the ground vehicle relative to the restriction region.

18. (Original) The method of claim 1, wherein causing the ground vehicle to undertake the one or more response measures based on the location or the movement characteristic of the ground vehicle includes:

calculating an estimated amount of time for the ground vehicle to approach the restriction region, or a time or distance for the ground vehicle to begin to experience a response measure.

19. (Original) The method of claim 1, wherein the one or more response measures include at least one of:

decelerating the ground vehicle;

providing a safety measure to prevent the ground vehicle from entering the restriction region;

changing a direction of the ground vehicle;

adjusting a path of the ground vehicle; or

providing an alert regarding the ground vehicle .

20. (Original) The method of claim 1, wherein the ground vehicle includes a housing configured to carry a person.

21. (Original) The method of claim 1, wherein causing the ground vehicle to undertake one or more response measures includes taking control away from a user of the ground vehicle.

22. (Original) The method of claim 1, wherein causing the ground vehicle to undertake one or more response measures includes ceasing to take commands from a user of the ground vehicle.

23. (Original) The method of claim 1, wherein the restriction region has an irregular shape.

24. (Original) The method of claim 1, wherein the restriction region corresponds to a man-made feature.

25. (Withdrawn) A method for restricting motion of a ground vehicle, comprising:

receiving, via one or more processors, multiple points associated with an irregularly-shaped restriction region;

generating, via the one or more processors, a boundary around the restriction region, by forming restriction strips between neighboring points of the multiple points; and

automatically disabling the ground vehicle in response to the ground vehicle penetrating the restriction region, wherein:

the ground vehicle is configured to carry one or more persons;

the ground vehicle is electrically powered; and

the irregularly-shaped restriction region corresponds to a man-made feature.

26. (Withdrawn) The method of claim 25, further comprising taking control of the ground vehicle.

27. (Withdrawn) The method of claim 25, further comprises providing at least one of the one or more persons with limited time to take corrective action before taking control of the ground vehicle.

28. (Withdrawn) A system for restricting motion of a ground vehicle, comprising:

one or more processors having instructions that, when executed:

receive multiple points associated with an irregularly-shaped restriction region;

generate a boundary around the restriction region, by forming restriction strips between neighboring points of the multiple points; and

automatically disable the ground vehicle in response to the ground vehicle penetrating the restriction region, wherein:

the ground vehicle is configured to carry one or more persons;

the ground vehicle is electrically powered; and

the irregularly-shaped restriction region corresponds to a man-made feature.

29. (Withdrawn) The method of claim 28, wherein the instructions, when executed, take control of the ground vehicle.

30. (Withdrawn) The method of claim 28, wherein the instructions, when executed, provide at least one of the one or more persons with limited time to take corrective action before taking control of the ground vehicle.

## AMENDMENTS TO THE SPECIFICATION

Please amend the Title as follows:

POLYGON SHAPED ~~FLIGHT-~~VEHICLE RESTRICTION ZONES



Textron Specialized Vehicles Inc., Exh. 1002, p. 310

Docket No.: 144604-8001.US00
(PATENT)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:
Xinan Xu et al.

Application No.: 17/523,847 | Confirmation No.: 5063

Filed: November 10, 2021 | Art Unit: 3665

For: POLYGON SHAPED VEHICLE RESTRICTION ZONES (as amended) | Examiner: Mary Da Zhi Wang Cheung

**AMENDMENT AND RESPONSE TO RESTRICTION REQUIREMENT UNDER 37 CFR 1.142**

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

Dear Commissioner:

In response to the Restriction Requirement mailed on February 7, 2022, please amend the above-identified U.S. patent application as follows:

**INTRODUCTORY COMMENTS**

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** are reflected in the listing of claims which begins on page 3 of this paper.

**Remarks/Arguments** begin on page 9 of this paper.





Textron Specialized Vehicles Inc., Exh. 1002, p. 311

Docket No.: 144604-8001.US00
(PATENT)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of:
Xinan Xu et al.

| | |
|---|---|
| Application No.: 17/523,847 | Confirmation No.: 5063 |
| Filed: November 10, 2021 | Art Unit: 3665 |
| For: POLYGON SHAPED FLIGHT-RESTRICTION ZONES | Examiner: Mary Da Zhi Wang Cheung |

**TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT**

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

Commissioner:

Pursuant to 37 C.F.R §§ 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached Information Disclosure Statement by Applicant (PTO/SB/08). It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

This Information Disclosure Statement is filed before the mailing date of a first Office Action on the Merits as far as is known to the undersigned (37 C.F.R. § 1.97(b)(3)).

In accordance with 37 C.F.R. § 1.98(a)(2)(ii), Applicant has not submitted copies of U.S. patents and U.S. patent applications. Applicant submits herewith copies of foreign patents and non-patent literature in accordance with 37 C.F.R. § 1.98(a)(2), with the exception of those documents which are marked with a double asterisk (**) next to the

Cite No. in the attached form PTO/SB/08. In accordance with 37 C.F.R. § 1.98(d), those documents are not supplied because they were previously cited by or submitted to the Office in prior application numbers 16/810,631 filed March 5, 2020 and 15/699,359 filed September 8, 2017.

This Information Disclosure Statement is not to be construed as a representation that: (i) a search has been made; (ii) additional information that may be material to the examination of this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the cited information is, or is considered to be, material to patentability. In addition, Applicant does not admit that any enclosed item of information constitutes prior art to the subject invention and specifically reserves the right to demonstrate that any such reference is not prior art.

It is submitted that the Information Disclosure Statement is in compliance with 37 C.F.R §1.98 and the Examiner is respectfully requested to consider the listed references.

Please charge any underpayment or credit any overpayment to our Deposit Account No. 50-0665, under Order No. 144604-8001.US00 from which the undersigned is authorized to draw.

Dated: March 11, 2022

Respectfully submitted,

By _/John M. Wechkin/_
John Wechkin
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Fax: (206) 359-7198

Attorney for Applicant

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 45206136 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Pamela Baumgart |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 11-MAR-2022 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 13:11:00 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 2022_03_11_IDS_1446048001 US00.PDF | 711169<br>7fa7a04e3daaa2562d85496d5fc3dfbad1e2b6ca | yes | 12 |

| | Multipart Description/PDF files in .zip description | | | |
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| | **Document Description** | **Start** | **End** | |
| | Transmittal Letter | 1 | 2 | |
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| **Warnings:** | | | | |
| **Information:** | | | | |
| 2 | Non Patent Literature | 2021_11_02_NFOA_16810631.PDF<br>318238<br>5c26505d232fa336c77cd73cb38b49b43538d27c | no | 9 |
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| **Information:** | | | | |
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| | **Total Files Size (in bytes):** | 1764186 | | |

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**<u>New Applications Under 35 U.S.C. 111</u>**
**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.**
**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**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.**
**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**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.**

Based on PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | **Application Number** | 17/523,847 |
| | **Filing Date** | 2021-11-10 |
| | **First Named Inventor** | Xinan Xu |
| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
| | **Attorney Docket Number** | 144604-8001.US00 |

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| | **Art Unit** | 3665 |
| | **Examiner Name** | Mary Da Zhi Wang Cheung |
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*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.

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**PUBLICATION NOTICE**

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**Title:**POLYGON SHAPED FLIGHT-RESTRICTION ZONES

**Publication No.**US-2022-0068143-A1
**Publication Date:**03/03/2022

## 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.

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Application No: 17/523,847

Foreign Priority claimed: (●) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /MARY CHEUNG/ Examiner's Signature [ ] Initials

Title: POLYGON SHAPED FLIGHT-RESTRICTION ZONES

| FILING or 371(c) DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
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| 11/10/2021 | 701 | 3665 | 144604-8001.US00 |
| RULE | | | |

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**CONTINUING DATA**

This application is a CON of 16810631 03/05/2020

16810631 is a CON of 15699359 09/08/2017 PAT 10586463

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**IF REQUIRED, FOREIGN LICENSE GRANTED****

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| EXAMINER | |
|---|---|
| CHEUNG, MARY DA ZHI WANG | |
| **ART UNIT** | **PAPER NUMBER** |
| 3665 | |
| **NOTIFICATION DATE** | **DELIVERY MODE** |
| 02/07/2022 | 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):

patentprocurement@perkinscoie.com

| *Office Action Summary* | Application No. 17/523,847 | Applicant(s) XU et al. | |
|---|---|---|---|
| | Examiner MARY D CHEUNG | Art Unit 3665 | 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 11/10/2021.

☐ 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) 1-30 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) 1-30 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. 15/699,359.

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: _____.

## DETAILED ACTION

### *Status of Claims*

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA. This action is in response to the applicant's filing on November 10, 2021. Claims 1-30 are pending, and subject to restriction election.

### *Election/Restrictions*

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

I. Claims 1-24, drawn to supporting a vehicle restriction region comprising automatically causing a ground vehicle to undertake response measures based on a location or a movement characteristic of the ground vehicle relative to the restriction region, classified in G06G 5/006.

II. Claims 25-30, drawn to restricting motion of a ground vehicle comprising automatically disabling the ground vehicle in response to the ground vehicle penetrating the restriction region, classified in G05B 2219/24127.

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

Inventions I and II are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct if they do not overlap in scope and are not obvious variants, and if it is shown that at least one subcombination is separately usable. In the instant case, subcombination II has separate utility such as the disabling feature. See MPEP § 806.05(d).

4. The examiner has required restriction between subcombinations usable together. Where applicant elects a subcombination and claims thereto are subsequently found

allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

5. 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:

The inventions require a different field of search. For example, searching different classes/subclasses or electronic resources, or employing different search queries.

6. **Applicant is advised that the reply to this requirement to be complete must include (i) an election of an 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**.

7. 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.

8. 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.

9. 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).

***Inquiry***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary Cheung whose telephone number is (571) 272-6705. The examiner can normally be reached on Monday, Tuesday and Thursday from 10:00 AM to 7:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christian Chace, can be reached on (571) 272-4190.

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).

The fax phone numbers for the organization where this application or proceedings is assigned are as follows:

(571) 273-8300 (Official Communications; including After Final Communications labeled "BOX AF")

(571) 273-6705 (Draft Communications)

/MARY CHEUNG/
Primary Examiner, Art Unit 3665
February 1, 2022

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. |
|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 | 5063 |

25096 7590 01/04/2022

PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

| EXAMINER |
|---|
| CENTRAL, DOCKET |

| ART UNIT | PAPER NUMBER |
|---|---|
| 3665 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 01/04/2022 | 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):

patentprocurement@perkinscoie.com

| *Decision Granting Request for Prioritized Examination (Track I)* | **Application No.** 17/523,847 | **Applicant(s)** XU et al. | |
|---|---|---|---|
| | **Examiner** KIMBERLY A INABINET | **Art Unit** OPET | **AIA (FITF) Status** Yes |

1. THE REQUEST FILED 10 November 2021 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to KIMBERLY INABINET at (571) 272-4618. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

| /KIMBERLY A INABINET/<br>Paralegal Specialist, OPET | |
|---|---|

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 NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 |

**CONFIRMATION NO. 5063**

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

**POA ACCEPTANCE LETTER**

*OC000000130577377*

Date Mailed: 12/21/2021

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/16/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rmohamed/

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 44535145 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 16-DEC-2021 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 13:46:20 |
| **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 | Power of Attorney | POA8001US00.pdf | 3681137<br>dd5d7bd9c6939f3841c6c5bd5c789e47b109ed54 | no | 2 |

**Warnings:**

| Information: | |
|---|---|
| Total Files Size (in bytes): | 3681137 |

**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.**

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

# TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

| | |
|---|---|
| Application Number | 17/523,847 |
| Filing Date | November 10, 2021 |
| First Named Inventor | Xinan XU |
| Title | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| Art Unit | 3665 |
| Examiner Name | Not Yet Assigned |
| Attorney Docket Number | 144604-8001.US00 |

**SIGNATURE of Applicant or Patent Practitioner**

| | | | |
|---|---|---|---|
| Signature | /John M. Wechkin/ | Date (Optional) | |
| Name | John Wechkin | Registration Number | 42,216 |
| Title (if Applicant is a juristic entity) | Attorney of Record | | |
| Applicant Name (if Applicant is a juristic entity) | SZ DJI Technology Co., Ltd. | | |

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-18)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

# POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

| Application Number | Filing Date |
|---|---|
| | |

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 25096

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

**Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:**

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

| | | | | | |
|---|---|---|---|---|---|
| ☐ Firm or Individual Name | | | | | |
| Address | | | | | |
| City | | State | | Zip | |
| Country | | | | | |
| Telephone | | Email | | | |

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

SZ DJI Technology Co., Ltd.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

**SIGNATURE of Applicant for Patent**

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

| | | | |
|---|---|---|---|
| Signature | Wenhao ZHOU | Date (Optional) | 2021. 12. 10 |
| Name | Wenhao ZHOU | | |
| Title | IP Head | | |

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.191, 1.32, and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 44452737 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 07-DEC-2021 |
| **Filing Date:** | 10-NOV-2021 |
| **Time Stamp:** | 13:40:35 |
| **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 | Applicant Response to Pre-Exam Formalities Notice | Transmittal.pdf | 15857<br>9ca2e40316053c84c74670c7d9da1503ac0e19f4 | no | 1 |

**Warnings:**

| Information: | | | | | |
|---|---|---|---|---|---|
| 2 | Oath or Declaration filed | SubStatement.pdf | 290330<br>ae20e6600823e96df48d8a200e51a8fd6cae58dd | no | 2 |
| Warnings: | | | | | |
| Information: | | | | | |
| | | | Total Files Size (in bytes): | 306187 | |

**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.**

Docket No.: 144604-8001.US00
(PATENT)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:
Xinan Xu et al.

Application No.: 17/523,847 | Confirmation No.: 5063

Filed: November 10, 2021 | Art Unit: 3665

For: POLYGON SHAPED FLIGHT-RESTRICTION ZONES | Examiner: Not Yet Known

**RESPONSE TO INFORMATIONAL NOTICE TO APPLICANT**

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

Dear Commissioner:

In response to the Informational Notice to Applicant mailed November 26, 2021, Applicant submits herewith a Substitute Statement in Lieu of an Oath or Declaration for inventor Xi Chen. The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 50-0665, under Order No. 144604-8001.US00.

Dated: December 7, 2021

Respectfully submitted,

By __/John M. Wechkin/____
John Wechkin
Registration No.: 42,216
Perkins Coie LLP
P.O. Box 1247
Seattle, WA 98111-1247
Phone: (206) 359-3257
Fax: (206) 359-7198
Perkins Coie LLP

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 NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 17/523,847 | 11/10/2021 | | 2980 | 144604-8001.US00 | 30 | 3 |

**CONFIRMATION NO. 5063**

**FILING RECEIPT**

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

OC000000130011230

Date Mailed: 11/26/2021

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

**Please verify the accuracy of the data presented on this receipt.** If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

**Inventor(s)**

Xinan XU, Shenzhen, CHINA;
Yun YU, Shenzhen, CHINA;
Canlong LIN, Shenzhen, CHINA;
Xi CHEN, Shenzhen, CHINA;
Mingyu WANG, Shenzhen, CHINA;
Jianyu SONG, Shenzhen, CHINA;

**Applicant(s)**

SZ DJI TECHNOLOGY CO., LTD., Shenzhen, CHINA;

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This application is a CON of 16/810,631 03/05/2020
which is a CON of 15/699,359 09/08/2017 PAT 10586463
which is a CON of PCT/CN2015/098149 12/21/2015

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
CHINA PCT/CN2015/073915 03/09/2015 No Access Code Provided

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 11/23/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/523,847**

**Projected Publication Date:** 03/03/2022

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

POLYGON SHAPED FLIGHT-RESTRICTION ZONES

**Preliminary Class**

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

## LICENSE FOR FOREIGN FILING UNDER

## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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---

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## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/523,847

### APPLICATION AS FILED - PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY FEE($) |
|---|---|---|---|---|---|---|---|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | | | N/A | 320 |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | 700 |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | 800 |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 30 minus 20 = | * 10 | | | OR | x 100 = | 1000 |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 3 minus 3 = | * | | | | x 480 = | 0.00 |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | 0.00 |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | | | 0.00 |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | 2820 |

### APPLICATION AS AMENDED - PART II

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE($) | ADDITIONAL FEE($) | OR | RATE($) | ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 17/523,847 | 11/10/2021 | Xinan XU | 144604-8001.US00 |

**CONFIRMATION NO. 5063**

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

**INFORMAL NOTICE**

*OC000000130011252*

Date Mailed: 11/26/2021

## INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  Xi CHEN
- The substitute statement is signed by a person who is not identified as the applicant under 37 CFR 1.46 in an application data sheet (ADS). Only an applicant under 37 CFR 1.43, 1.45 or 1.46 may execute a substitute statement. See 37 CFR 1.64(a). An application data sheet in compliance with 37 CFR 1.76 identifying the person (i.e., assignee, obligated assignee, or person who otherwise shows sufficient proprietary interest) executing the substitute statement as the applicant, or an inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to the inventor for whom the substitute statement was provided, is required.
  Xi CHEN

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tnguyen/



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| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 44274384 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 12-NOV-2021 |
| **Filing Date:** | |
| **Time Stamp:** | 18:38:07 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $160 |
| RAM confirmation Number | E2021ABI38500824 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Oath or Declaration filed | Declaration.pdf | 953272<br>87706b5f75eb0f4f843244e4f679d8ec85aa89e7 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 38238<br>70d30654cdb5eb1d0b111f806debd72509c13632 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 991510 | | |

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**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**
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# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 17523847 |
| **Filing Date:** | |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Attorney Docket Number:** | 144604-8001.US00 |

Filed as Large 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:** | | | | |
| LATE FILING FEE FOR OATH OR DECLARATION | 1051 | 1 | 160 | 160 |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **160** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 44255268 |
| **Application Number:** | 17523847 |
| **International Application Number:** | |
| **Confirmation Number:** | 5063 |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Customer Number:** | 25096 |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Filer Authorized By:** | John M. Wechkin |
| **Attorney Docket Number:** | 144604-8001.US00 |
| **Receipt Date:** | 10-NOV-2021 |
| **Filing Date:** | |
| **Time Stamp:** | 21:06:59 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $7160 |
| RAM confirmation Number | E2021A0L07542543 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | Transmittals.pdf | 250411<br>724ba3ab1e331a4c034e6d9b3cc85b5972293b47 | yes | 2 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal of New Application | | 1 | 1 | |
| | TrackOne Request | | 2 | 2 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Application Data Sheet | ADS.pdf | 1256715<br>94f93e472fd0d017243c871637f4402d22a506e8 | no | 10 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | | Application.pdf | 516251<br>3c1de437794aaf7094d6724337856a0454d66adf | yes | 104 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Specification | | 1 | 98 | |
| | Claims | | 99 | 103 | |
| | Abstract | | 104 | 104 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 4 | Drawings-only black and white line drawings | Drawings.pdf | 1569369<br>fb3a506d8acdce7bb6975bce4e69d685cd6c3326 | no | 22 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Fee Worksheet (SB06) | fee-info.pdf | 53195<br>53ea7862c6a337f4ec0e6c3435e6230cfc4151e7 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 3645941 | | |

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**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**
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# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| **First Named Inventor/Applicant Name:** | Xinan XU |
| **Filer:** | John M. Wechkin/Wade Barbus |
| **Attorney Docket Number:** | 144604-8001.US00 |

Filed as Large Entity

**Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| UTILITY APPLICATION FILING | 1011 | 1 | 320 | 320 |
| UTILITY SEARCH FEE | 1111 | 1 | 700 | 700 |
| UTILITY EXAMINATION FEE | 1311 | 1 | 800 | 800 |
| REQUEST FOR PRIORITIZED EXAMINATION | 1817 | 1 | 4200 | 4200 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| CLAIMS IN EXCESS OF 20 | 1202 | 10 | 100 | 1000 |
| **Miscellaneous-Filing:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL | 1504 | 1 | 0 | 0 |
| PROCESSING FEE, EXCEPT PROV. APPLS. | 1830 | 1 | 140 | 140 |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **7160** |

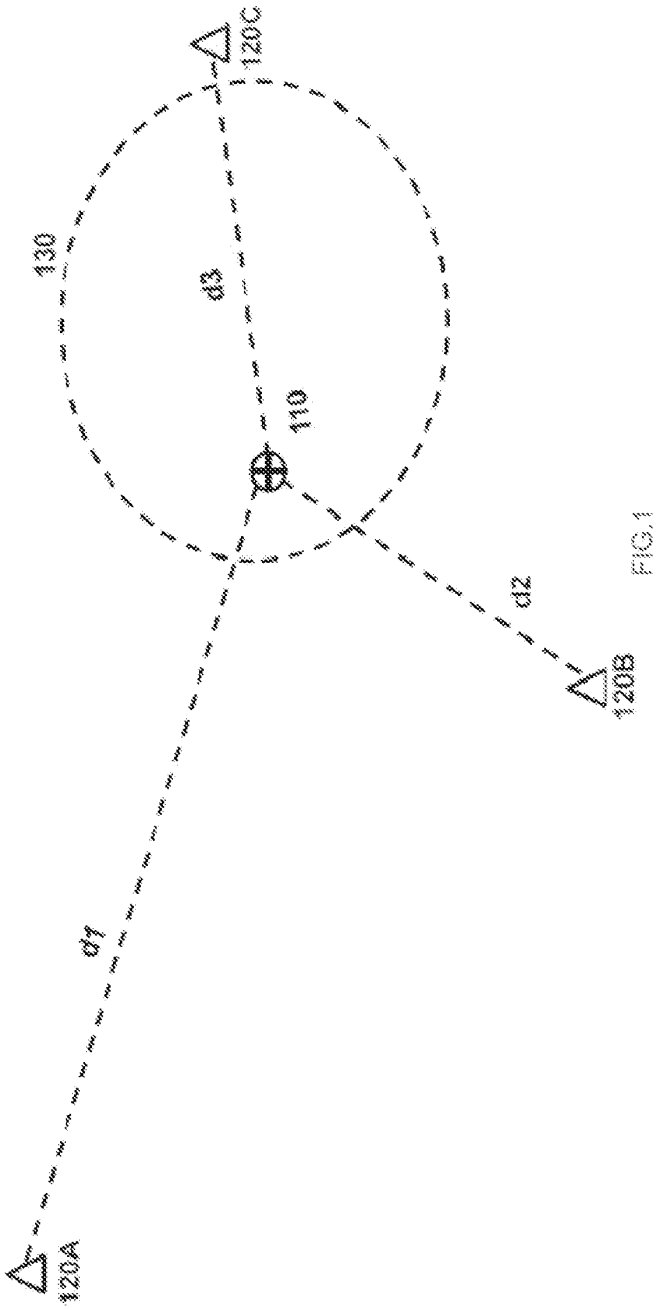



FIG.1

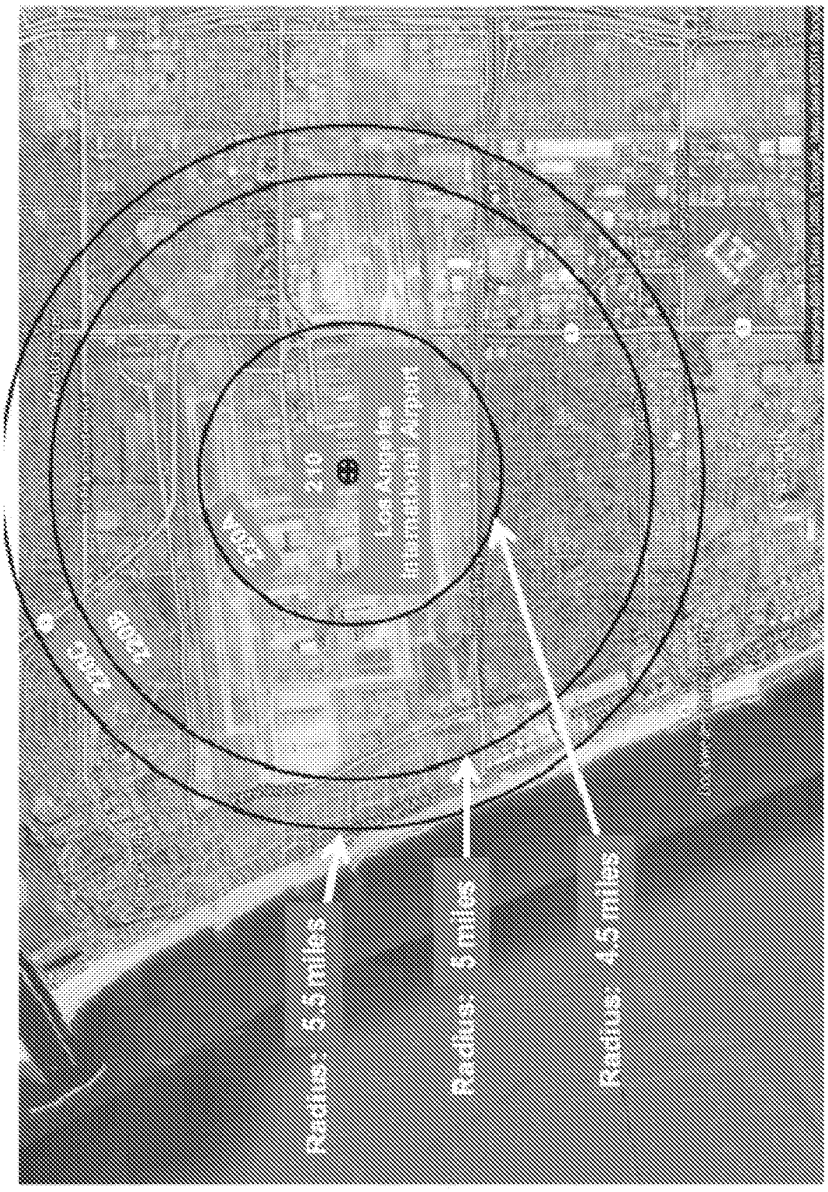

Radius - 5.5 miles
Radius - 5 miles
Radius - 4.5 miles
Los Angeles International Airport
405
105
110

FIG.2

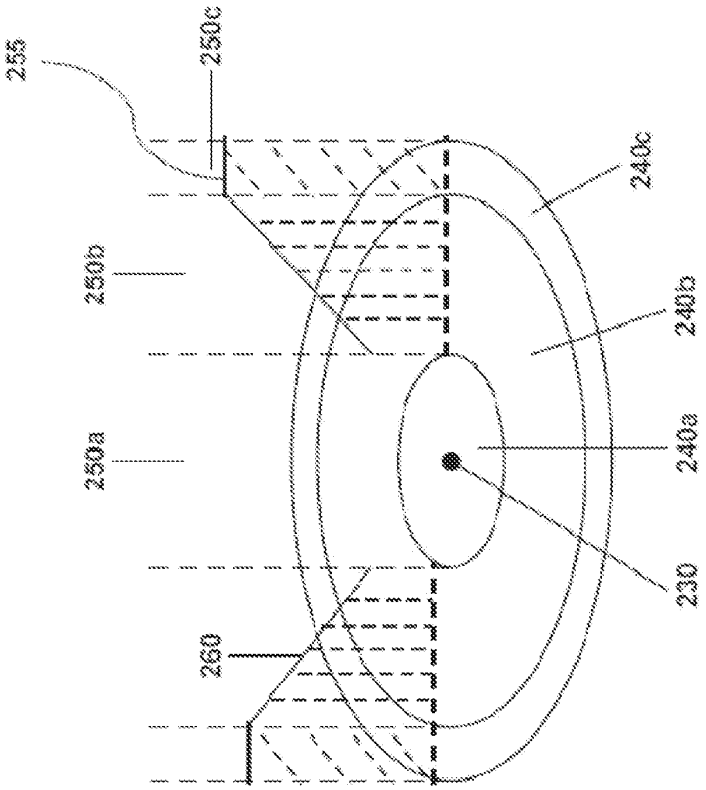



FIG.3

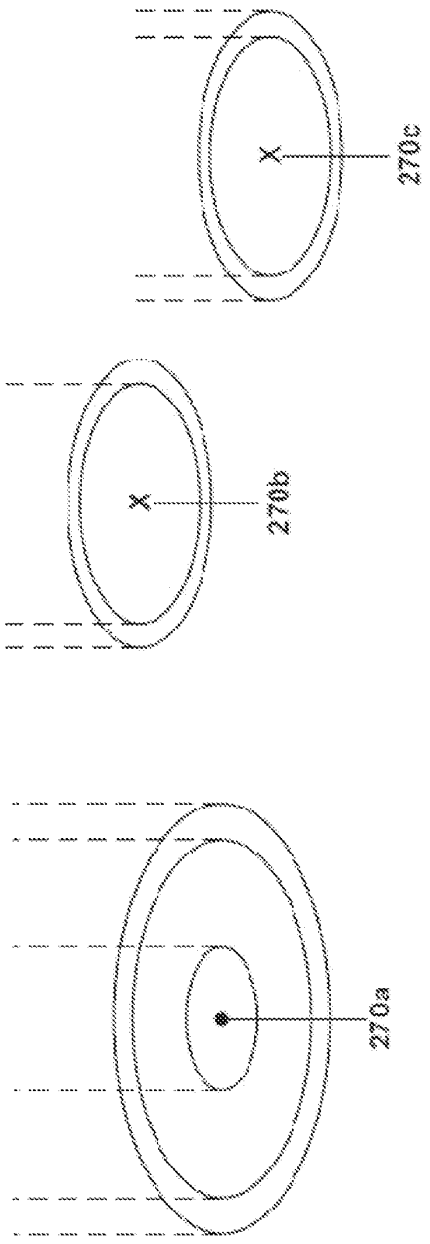



FIG 4

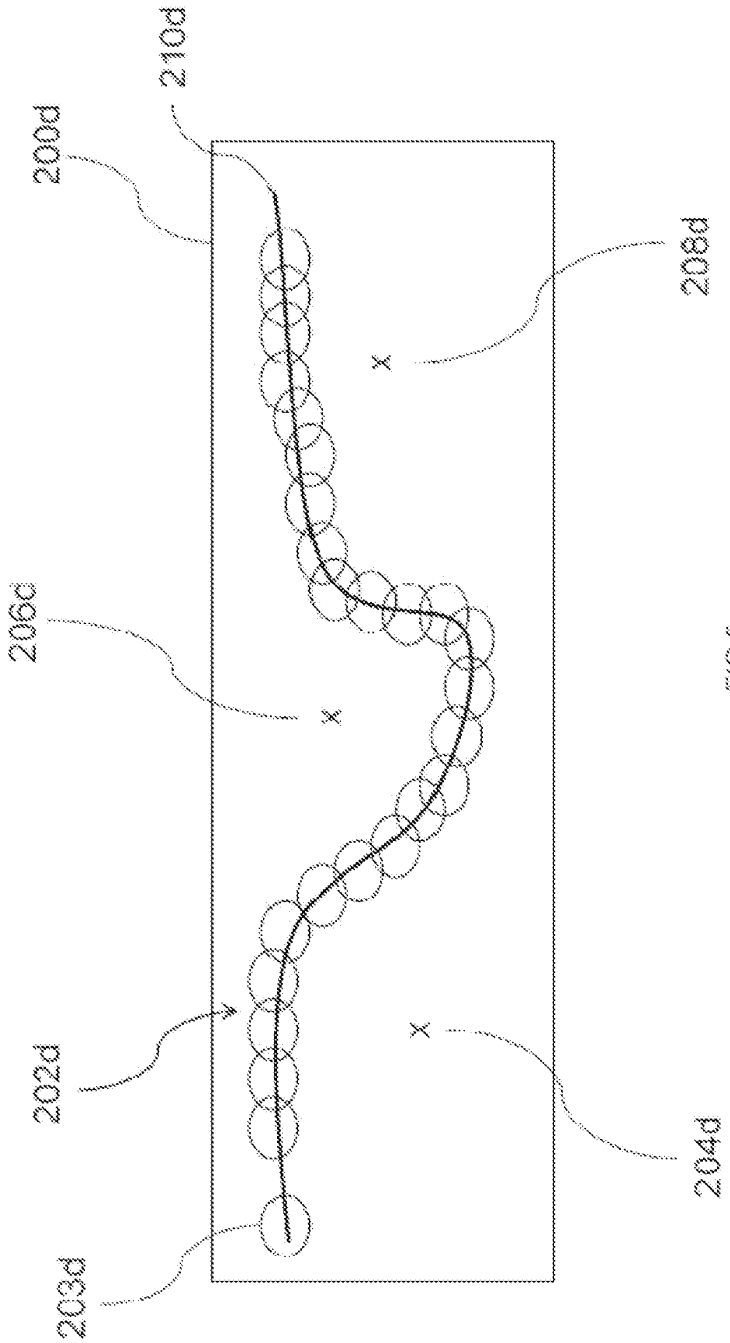



FIG.6

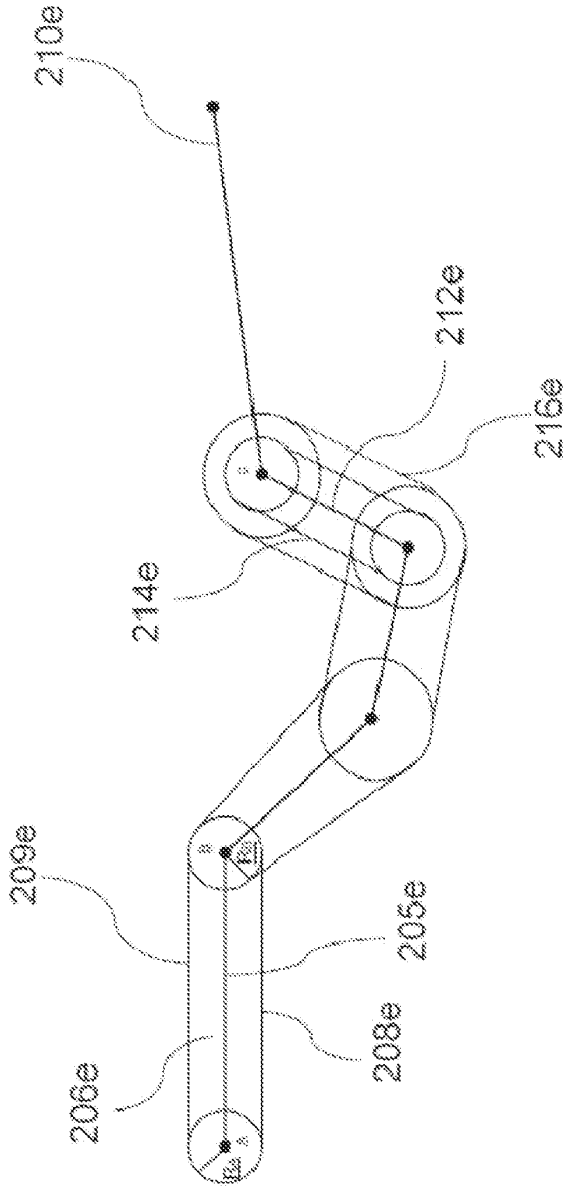



FIG 6

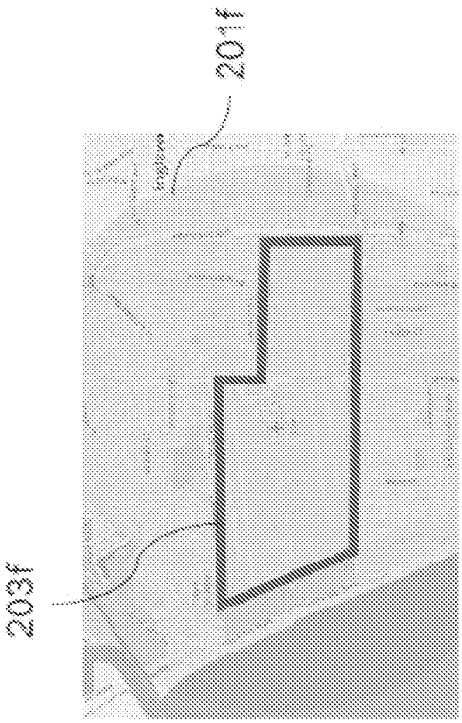



FIG.7

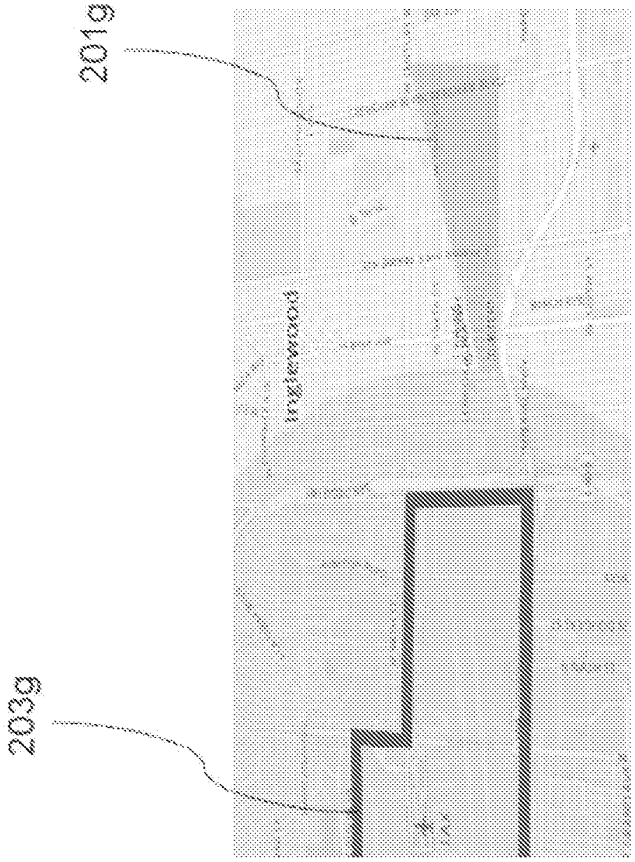



FIG.8

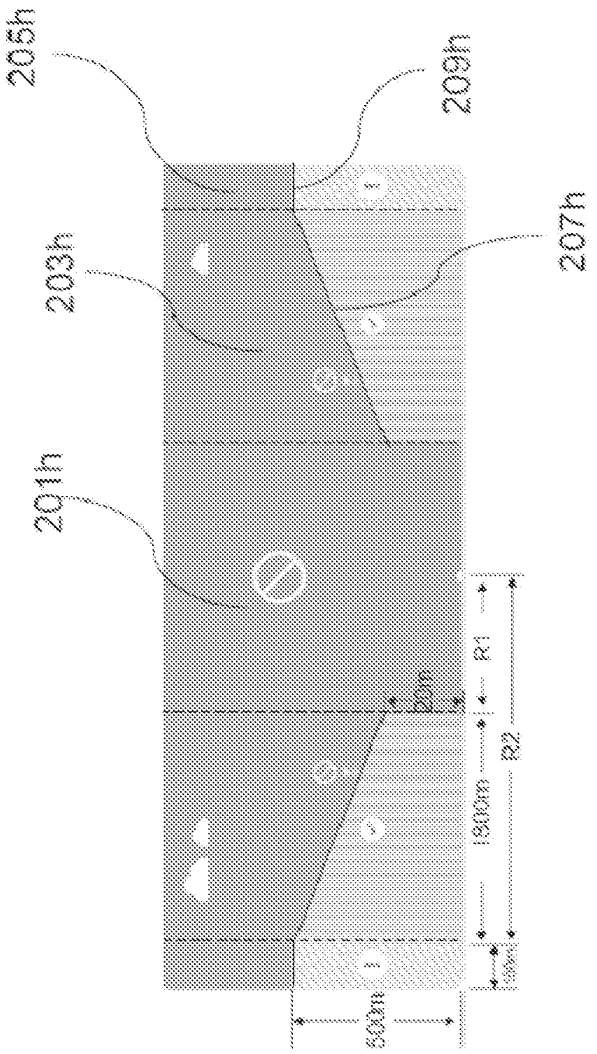



FIG.9

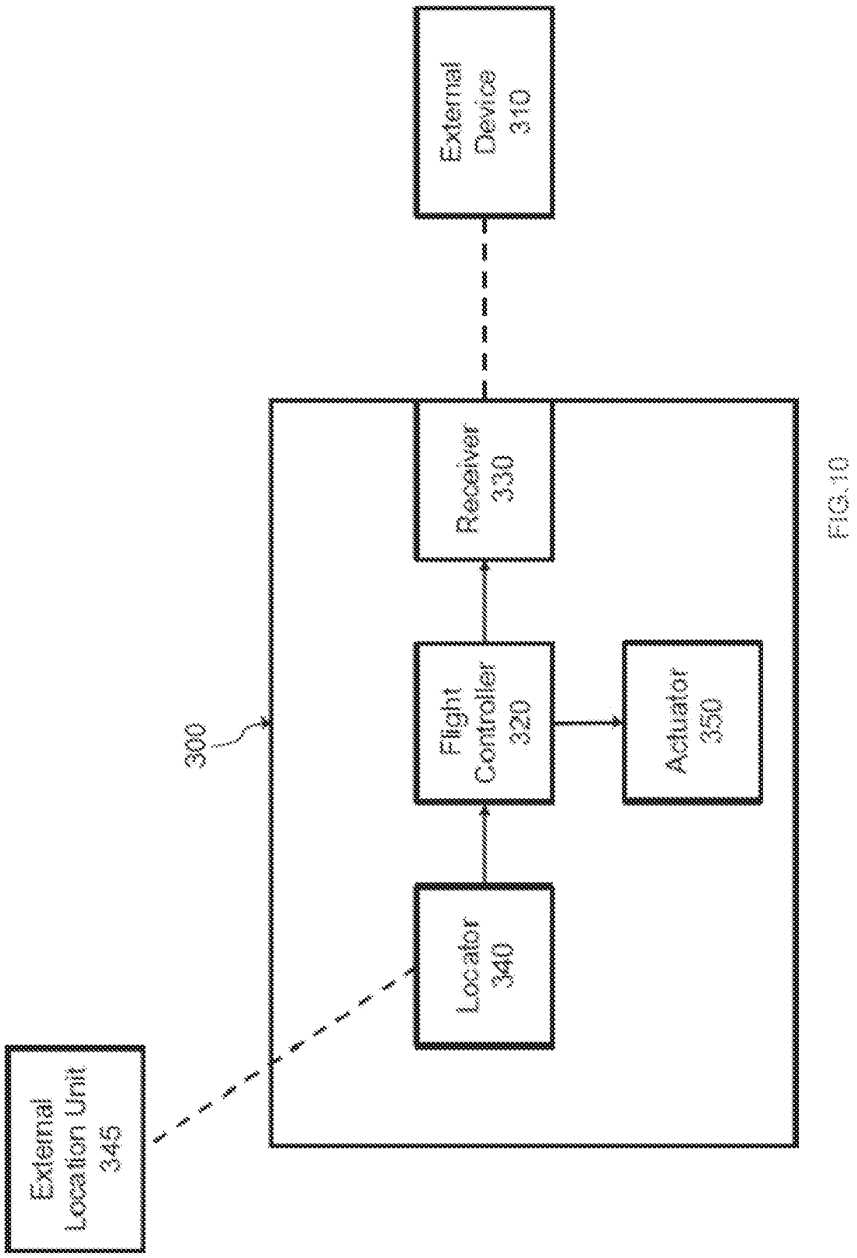

External Device 310
Receiver 330
Flight Controller 320
Actuator 350
Locator 340
300
External Location Unit 345

FIG.10

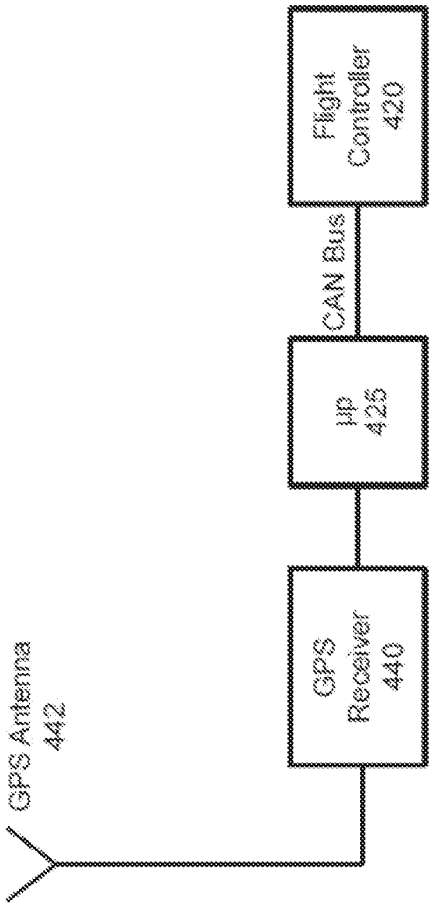

Flight Controller 420
CAN Bus
μp 425
GPS Receiver 440
GPS Antenna 442

FIG.11

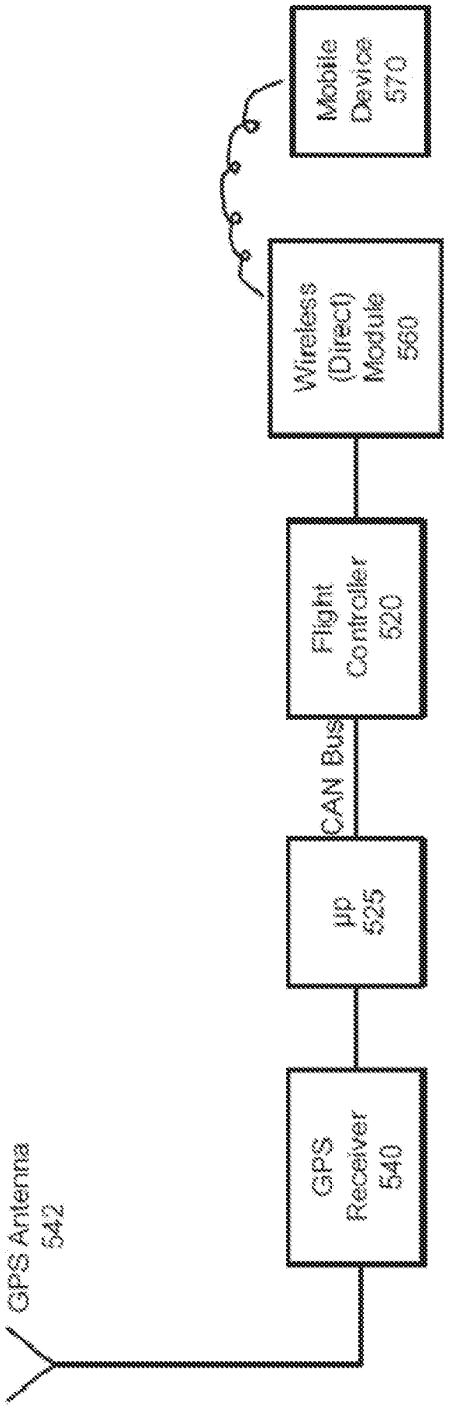

GPS Antenna
542
GPS
Receiver
540
IP
525
CAN Bus
Flight
Controller
520
Wireless
(Direct)
Module
560
Mobile
Device
570

FIG.12

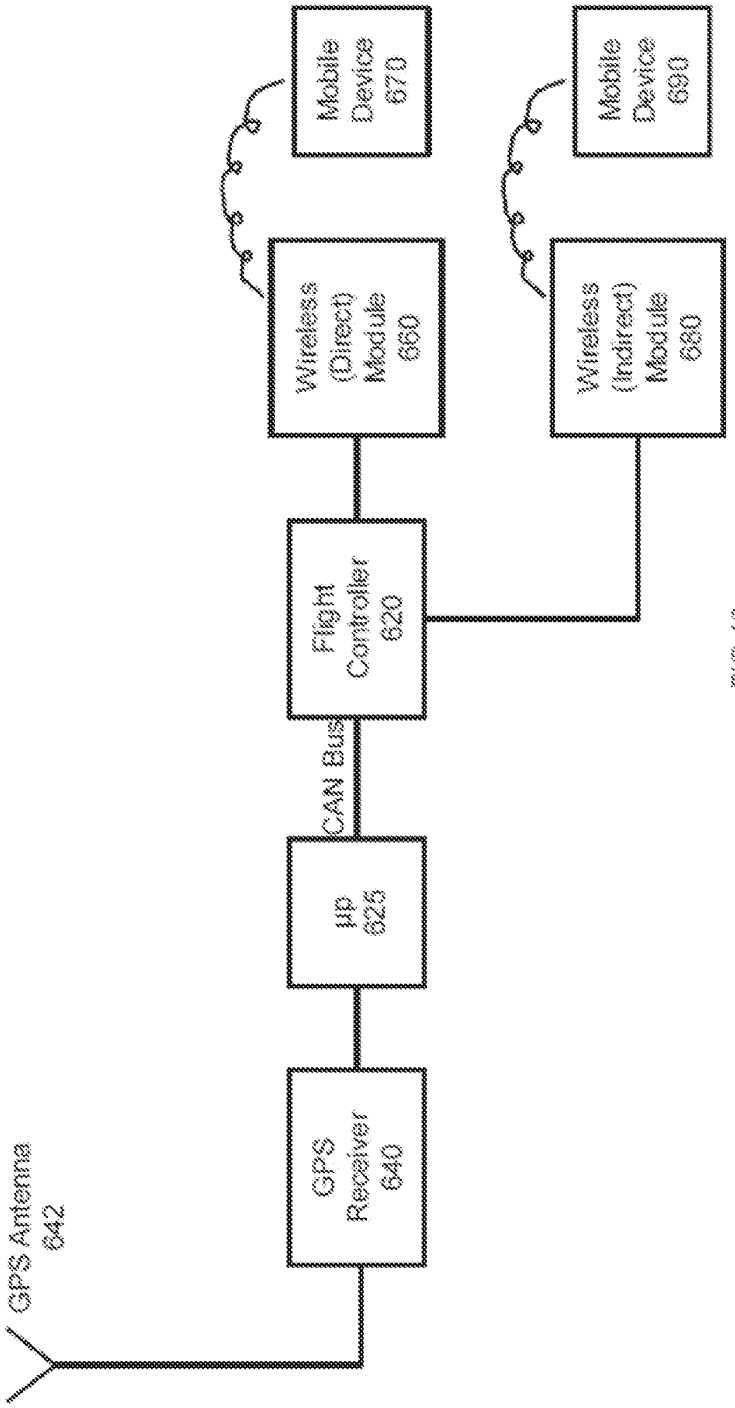

GPS Antenna
642
GPS
Receiver
640
μp
625
CAN Bus
Flight
Controller
620
Wireless
(Direct)
Module
660
Wireless
(Indirect)
Module
680
Mobile
Device
670
Mobile
Device
690

FIG.13

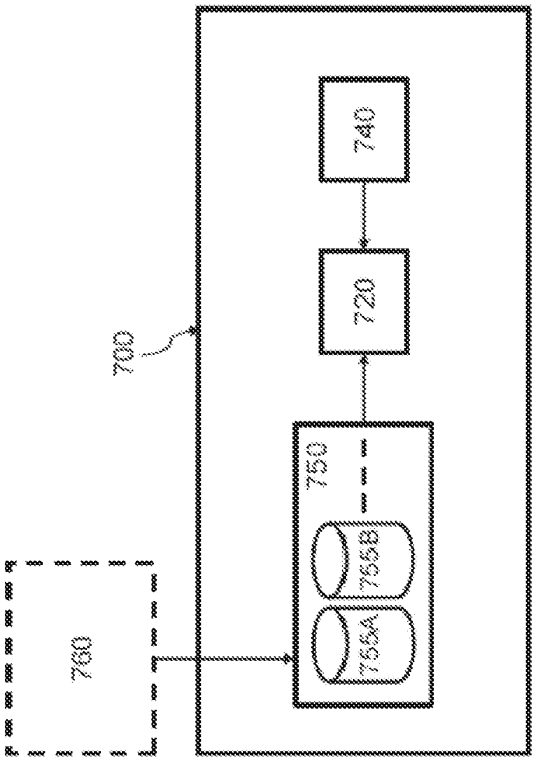



FIG.14

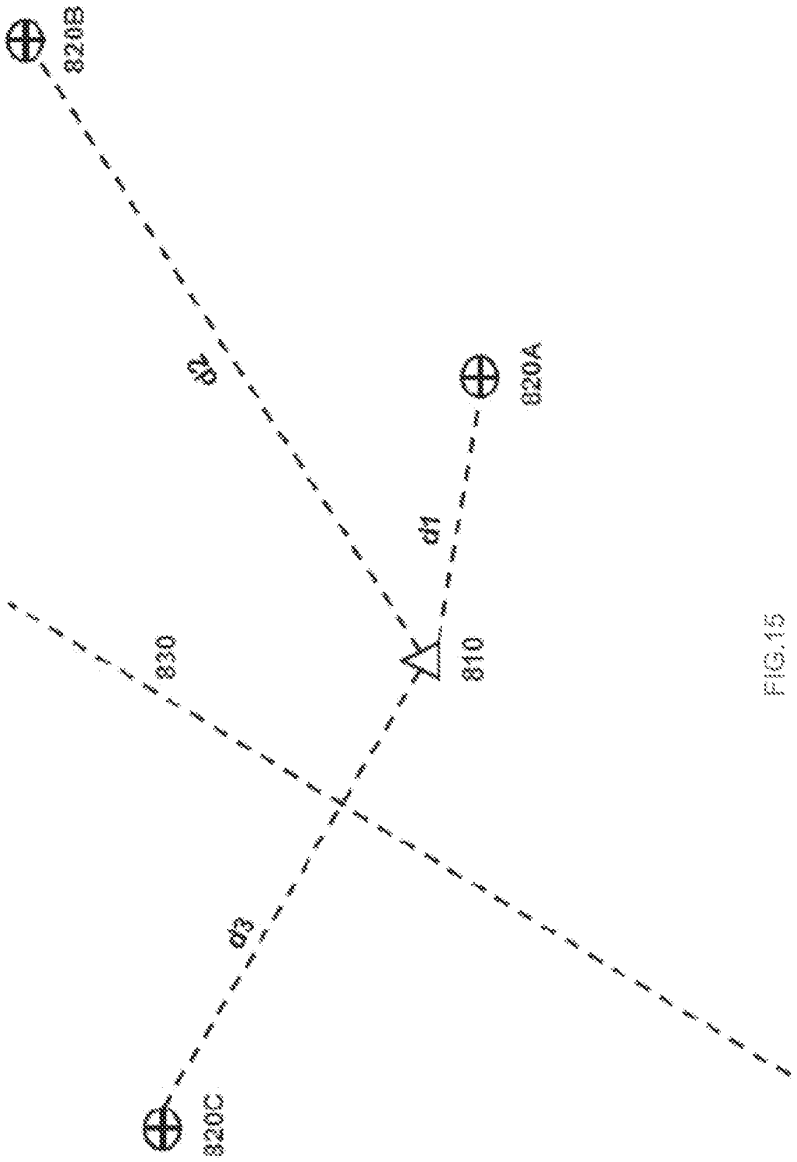



FIG.15

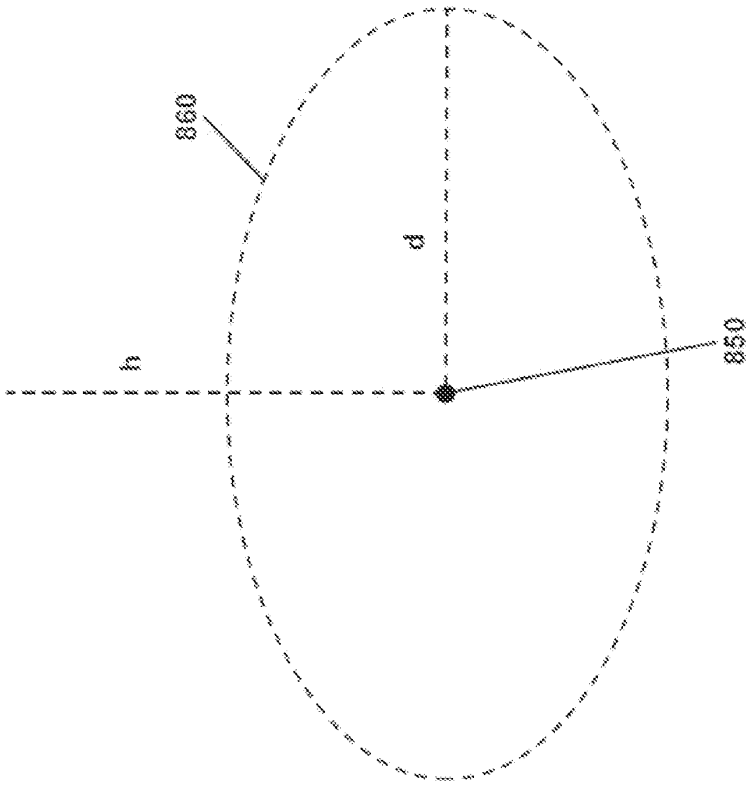



FIG.16

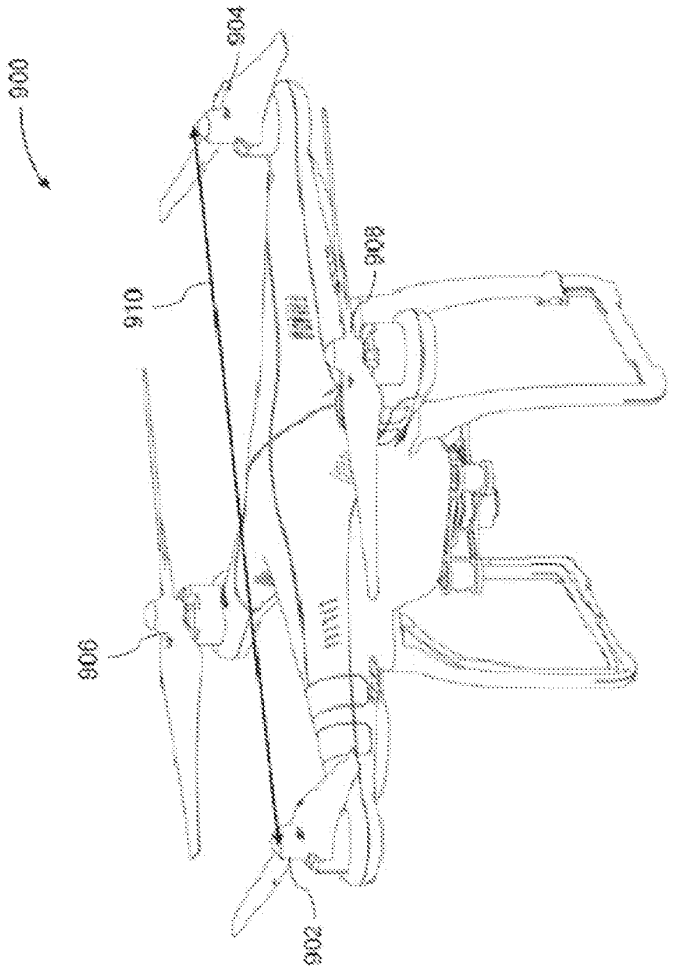



FIG.17

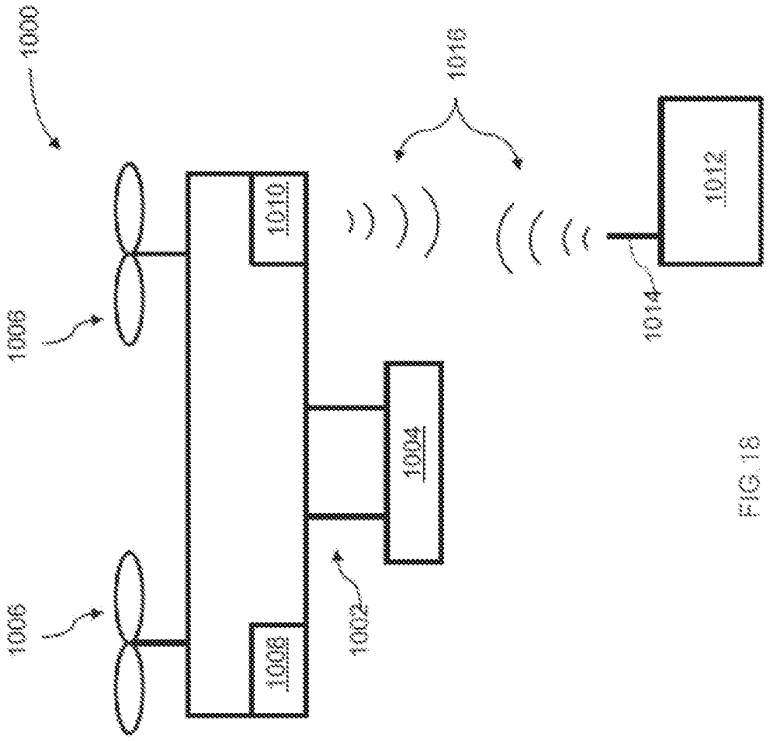



FIG 18

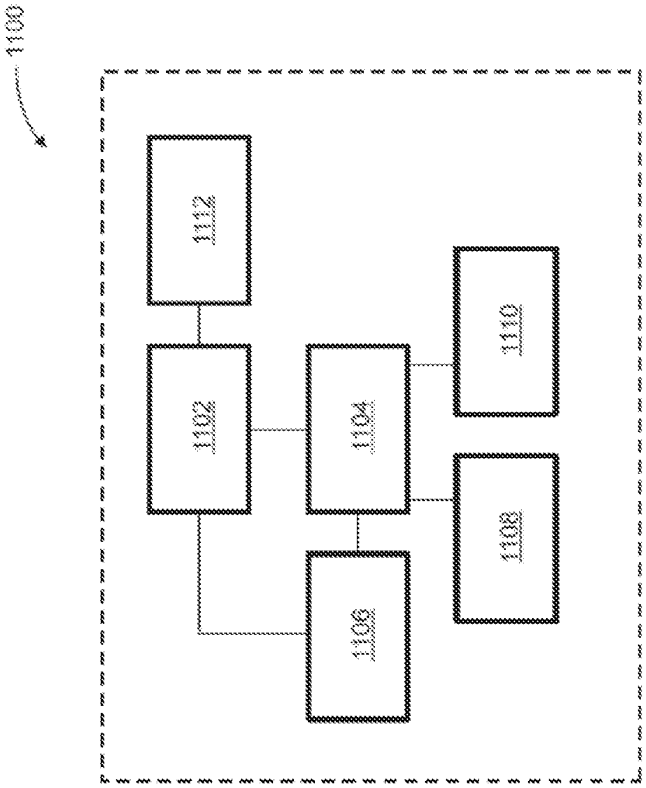



FIG. 19

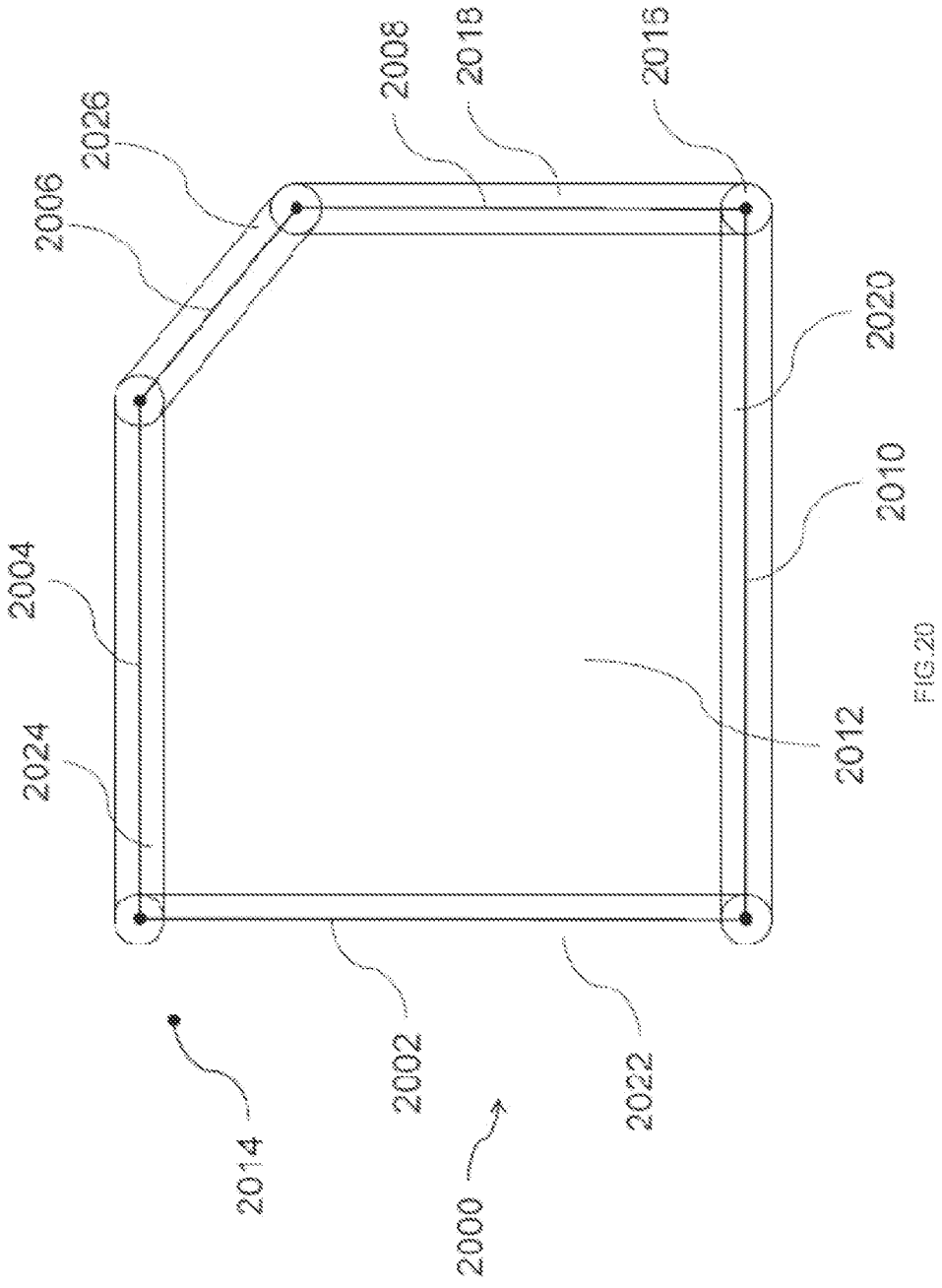

2026
2006
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2024
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2022
2000

FIG. 20

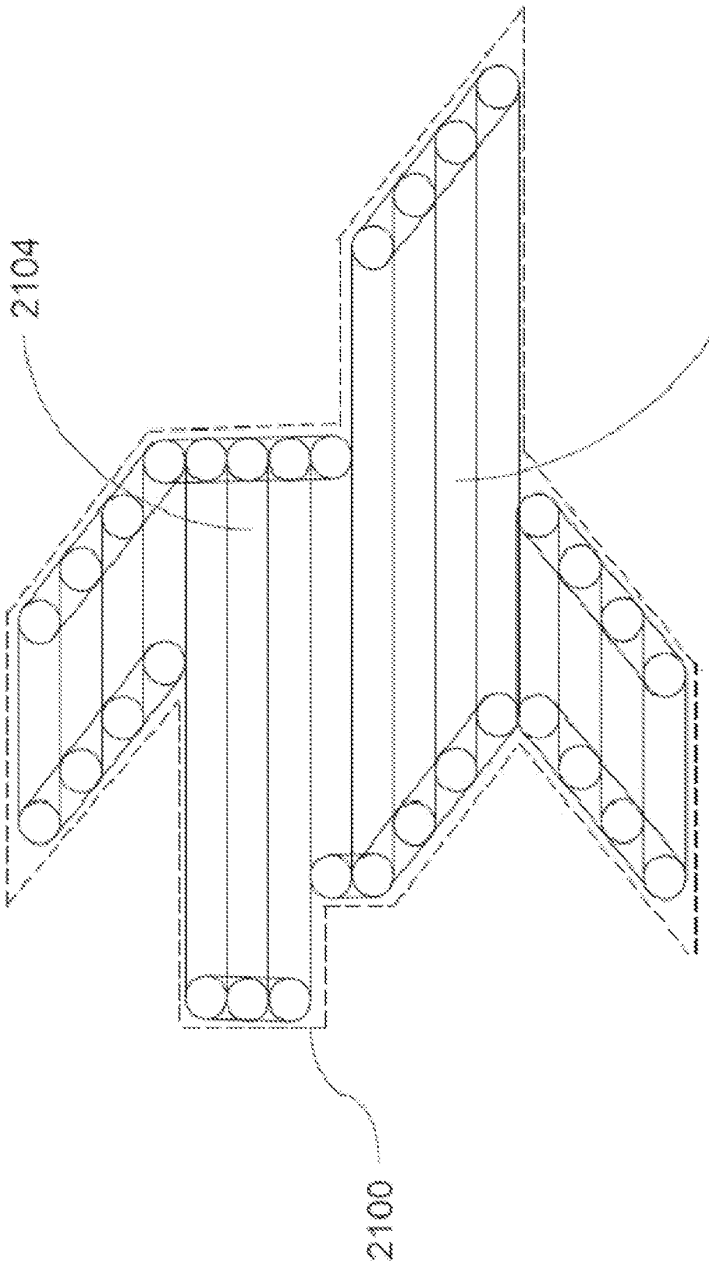



FIG.21

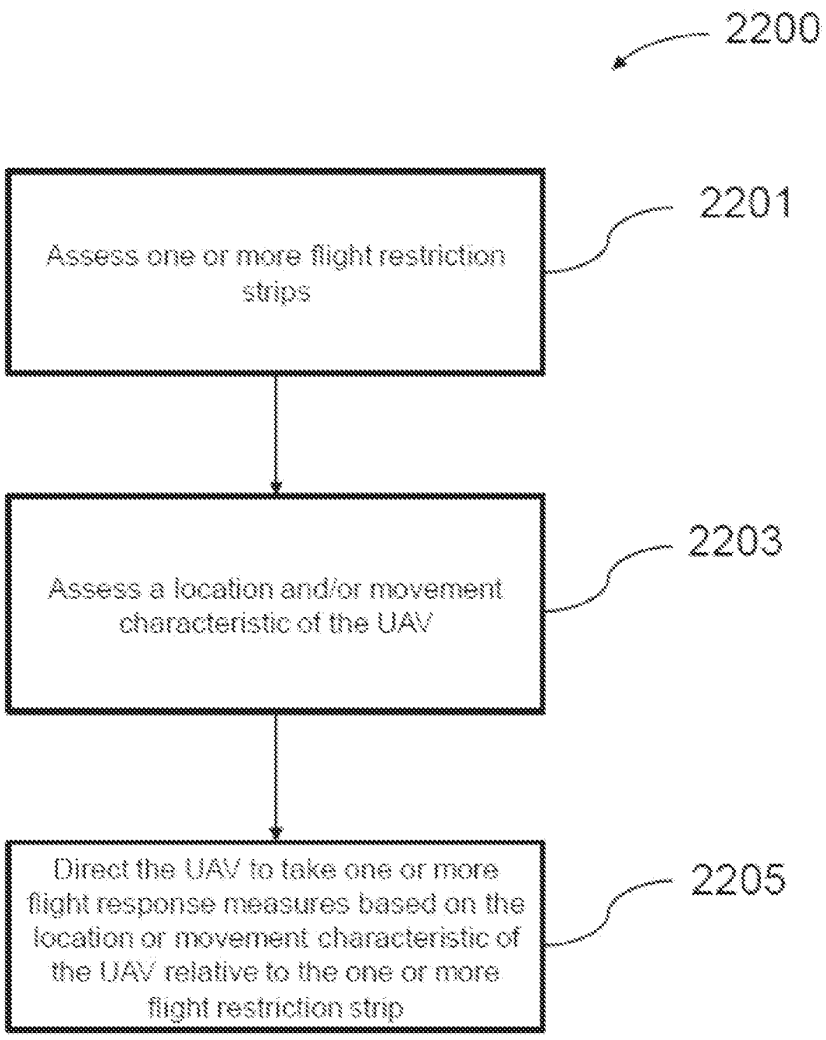

2200
Assess one or more flight restriction strips
2201
Assess a location and/or movement characteristic of the UAV
2203
Direct the UAV to take one or more flight response measures based on the location or movement characteristic of the UAV relative to the one or more flight restriction strip
2205

FIG 22

ABSTRACT

Systems, methods, and devices are provided for controlling an unmanned aerial vehicle (UAV) associated with flight response measures. The flight response measure may be generated by assessing one or more flight-restriction strips, assessing at least one of a location or a movement characteristic of the UAV relative to the one or more flight-restriction strips, and directing, with aid of one or more processors, the UAV to take one or more flight response measures based on at least one of the location or movement characteristic of the UAV relative to the one or more flight-restriction strips.



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CLAIMS

1. A method for supporting a vehicle restriction region, comprising:

receiving, via one or more processors, two or more points associated with the restriction region;

generating, via the one or more processors, one or more restriction strips along a boundary of the restriction region by connecting adjacent points of the two or more points, the one or more restriction strips defining at least a portion of the restriction region; and

automatically causing a ground vehicle to undertake one or more response measures based on at least one of a location or a movement characteristic of the ground vehicle relative to the restriction region.

2. The method of claim 1, wherein the two or more points are input by a user.

3. The method of claim 1, wherein the two or more points correspond to coordinate information of the boundary.

4. The method of claim 1, wherein at least one of the restriction strips is configured to have an area encompassed by a first circle, a second circle, and one or more lines running tangent to the first circle and the second circle.

5. The method of claim 4, wherein the first circle and the second circle are centered, respectively, at the adjacent points that are connected, to generate the at least one restriction strip.

6. The method of claim 4, wherein the first circle and the second circle have the same radius.

7. The method of claim 4, wherein a radius of the first circle or a radius of the second circle is defined based on a width of the at least one restriction strip.



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8. The method of claim 1, wherein the one or more restriction strips correspond to one or more restriction lines that define the restriction region.

9. The method of claim 1, wherein each of the one or more restriction strips is configured with a width that is larger than or equal to a minimum width.

10. The method of claim 9, wherein the minimum width is defined to prevent the ground vehicle from encroaching in the restriction region.

11. The method of claim 1, wherein the boundary is a closed boundary and the restriction region is a closed region.

12. The method of claim 11, wherein the one or more restriction strips have ends, and wherein an end of one restriction strip overlaps with an end of another restriction strip to enclose the restriction region.

13. The method of claim 12, wherein the one or more response measures are undertaken only in an area outside the restriction region.

14. The method of claim 1, wherein the boundary is an open boundary and the restriction region is an open region.

15. The method of claim 1, wherein the movement characteristic includes at least one of a velocity, an acceleration, a deceleration, a direction of travel, or a projected path of the ground vehicle.

16. The method of claim 1, wherein causing the ground vehicle to undertake the one or more response measures includes:

calculating a distance between the location of the ground vehicle and the boundary of the restriction region; and



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determining whether to cause the ground vehicle to undertake the one or more response measures based at least in part on comparing the calculated distance to a distance threshold.

17. The method of claim 1, further comprising:

determining which of the one or more response measures to cause the ground vehicle to undertake, based on the location or the movement characteristic of the ground vehicle relative to the restriction region.

18. The method of claim 1, wherein causing the ground vehicle to undertake the one or more response measures based on the location or the movement characteristic of the ground vehicle includes:

calculating an estimated amount of time for the ground vehicle to approach the restriction region, or a time or distance for the ground vehicle to begin to experience a response measure.

19. The method of claim 1, wherein the one or more response measures include at least one of:

decelerating the ground vehicle;

providing a safety measure to prevent the ground vehicle from entering the restriction region;

changing a direction of the ground vehicle;

adjusting a path of the ground vehicle; or

providing an alert regarding the ground vehicle .

20. The method of claim 1, wherein the ground vehicle includes a housing configured to carry a person.

21. The method of claim 1, wherein causing the ground vehicle to undertake one or more response measures includes taking control away from a user of the ground vehicle.

22. The method of claim 1, wherein causing the ground vehicle to undertake one or more response measures includes ceasing to take commands from a user of the ground vehicle.

23. The method of claim 1, wherein the restriction region has an irregular shape.

24. The method of claim 1, wherein the restriction region corresponds to a man-made feature.

25. A method for restricting motion of a ground vehicle, comprising:

receiving, via one or more processors, multiple points associated with an irregularly-shaped restriction region;

generating, via the one or more processors, a boundary around the restriction region, by forming restriction strips between neighboring points of the multiple points; and

automatically disabling the ground vehicle in response to the ground vehicle penetrating the restriction region, wherein:

the ground vehicle is configured to carry one or more persons;

the ground vehicle is electrically powered; and

the irregularly-shaped restriction region corresponds to a man-made feature.

26. The method of claim 25, further comprising taking control of the ground vehicle.

27. The method of claim 25, further comprises providing at least one of the one or more persons with limited time to take corrective action before taking control of the ground vehicle.

28. A system for restricting motion of a ground vehicle, comprising:

one or more processors having instructions that, when executed:

receive multiple points associated with an irregularly-shaped restriction region;

generate a boundary around the restriction region, by forming restriction strips between neighboring points of the multiple points; and

automatically disable the ground vehicle in response to the ground vehicle penetrating the restriction region, wherein:



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the ground vehicle is configured to carry one or more persons;

the ground vehicle is electrically powered; and

the irregularly-shaped restriction region corresponds to a man-made feature.

29. The method of claim 28, wherein the instructions, when executed, take control of the ground vehicle.

30. The method of claim 28, wherein the instructions, when executed, provide at least one of the one or more persons with limited time to take corrective action before taking control of the ground vehicle.



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# POLYGON SHAPED FLIGHT-RESTRICTION ZONES

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application is a continuation of U.S. Patent Application No. 16/810,631, filed March 5, 2020, which is a continuation of U.S. Patent Application No. 15/699,359, filed on September 08, 2017, which is a continuation of International Application No. PCT/CN2015/098149, filed on December 21, 2015, which claims priority to International Application No. PCT/CN2015/073915, filed on March 9, 2015.

## BACKGROUND

**[0002]** Aerial vehicles such as unmanned aerial vehicles (UAVs) can be used for performing surveillance, reconnaissance, and exploration tasks for military and civilian applications. Such vehicles may carry a payload configured to perform a specific function.

**[0003]** It may be desirable to provide flight restriction zones in order to affect UAV behavior in certain regions. For example, it may be desirable to provide flight restriction zones near airports or important buildings. In some instances, the flight restriction zones may best be represented by shapes, such as regular or irregular polygon shapes.

## SUMMARY

**[0004]** In some instances, it may be desirable to control or limit flight of an aerial vehicle, such as an unmanned aerial vehicle (UAV), within or near regions that are irregularly shaped. Thus, a need exists for providing improved flight restriction zones that are irregularly shaped, and for providing associated flight response measures for UAVs within or near the flight restriction zones. The flight restriction zones may be generated with flight restriction strips. The present



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disclosure provides systems, methods, computer readable mediums, and devices related to flight restriction strips and associated flight response measures of a UAV relative to the flight restriction strips.

**[0005]** Thus, in one aspect, a method for controlling an unmanned aerial vehicle (UAV) is provided. The method comprises: assessing one or more flight-restriction strips; assessing at least one of (1) a location, or (2) movement characteristic of the UAV relative to the one or more flight-restriction strips; and directing, with aid of one or more processors, the UAV to take one or more flight response measures based on at least one of the location or the movement characteristic of the UAV relative to the one or more flight-restriction strips.

**[0006]** In another aspect, an apparatus for controlling an unmanned aerial vehicle (UAV) is provided. The apparatus comprises one or more controllers running on one or more processors, individually or collectively configured to: assess one or more flight-restriction strips; assess at least one of (1) a location, or (2) a movement characteristic of the UAV relative to the one or more flight-restriction strips; and direct the UAV to take one or more flight response measures based on at least one of the location or movement characteristic of the UAV relative to the one or more flight-restriction strips.

**[0007]** In another aspect, a non-transitory computer readable medium for controlling an unmanned aerial vehicle (UAV) is provided. The non-transitory computer readable medium comprises code, logic, or instructions to: assess one or more flight-restriction strips; assess at least one of (1) a location, or (2) a movement characteristic of the UAV relative to the one or more flight-restriction strips; and direct the UAV to take one or more flight response measures based on at least one of the location or movement characteristic of the UAV relative to the one or more flight-restriction strips.



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**[0008]** In another aspect, an unmanned aerial vehicle (UAV) is provided. The UAV comprises: one or more propulsion units configured to effect flight of the UAV; and one or more processors that direct the UAV to take one or more flight response measures in response to at least one of an assessed (1) location, or (2) movement characteristic of the UAV relative to one or more flight-restriction strips.

**[0009]** In another aspect, a method for supporting flight restriction is provided. The method comprises: generating, with aid of one or more processors, a flight restriction zone using one or more flight-restriction strips, wherein the one or more flight-restriction strips require the UAV to take one or more flight response measures based on at least one of an assessed (1) location, or (2) movement characteristic of the UAV relative to the one or more flight restriction strips.

**[0010]** In another aspect, an apparatus for supporting flight restriction is provided. The apparatus comprises one or more controllers running on one or more processors, individually or collectively, configured to: generate a flight restriction zone using one or more flight-restriction strips, wherein the one or more flight-restriction strips require the UAV to take one or more flight response measures based on at least one of an assessed (1) location, or (2) movement characteristic of the UAV relative to the one or more flight-response strips.

**[0011]** In another aspect, a non-transitory computer readable medium for supporting flight restriction is provided. The non-transitory computer readable medium comprises code, logic, or instructions to: generate a flight restriction zone using one or more flight-restriction strips, wherein the one or more flight-restriction strips require the UAV to take one or more flight response measures based on at least one of an assessed (1) location, or (2) movement characteristic of the UAV relative to the one or more flight-response strips.



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**[0012]** It shall be understood that different aspects of the disclosure can be appreciated individually, collectively, or in combination with each other. Various aspects of the disclosure described herein may be applied to any of the particular applications set forth below or for any other types of movable objects. Any description herein of aerial vehicles, such as unmanned aerial vehicles, may apply to and be used for any movable object, such as any vehicle. Additionally, the systems, devices, and methods disclosed herein in the context of aerial motion (e.g., flight) may also be applied in the context of other types of motion, such as movement on the ground or on water, underwater motion, or motion in space.

**[0013]** Other objects and features of the present disclosure will become apparent by a review of the specification, claims, and appended figures.

## INCORPORATION BY REFERENCE

**[0014]** All publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0015]** The novel features of the disclosure are set forth with particularity in the appended claims. A better understanding of the features and advantages of the present disclosure will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the disclosure are utilized, and the accompanying drawings of which:

**[0016] FIG. 1** provides an example of unmanned aerial vehicle locations relative to a flight-restricted region, in accordance with an embodiment of the disclosure.



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**[0017] FIG. 2** shows an example of a plurality of flight-restricted region proximity zones, in accordance with an embodiment of the disclosure.

**[0018] FIG. 3** provides an additional example of plurality of flight-restricted region proximity zones in accordance with an embodiment of the disclosure.

**[0019] FIG. 4** provides an example of a plurality of types of flight-restricted regions and their related proximity zones, in accordance with an embodiment of the disclosure.

**[0020] FIG. 5** provides a flight restricted region having a regular shape and an irregular shape, in accordance with an embodiment of the disclosure.

**[0021] FIG. 6** provides flight restricted region defined by a plurality of flight restricted strips, in accordance with an embodiment of the disclosure.

**[0022] FIG. 7** provides an example of a flight restricted region of a regular shape around a region of irregular shape, in accordance with embodiments.

**[0023] FIG. 8** provides an oblique view of a flight ceiling, in accordance with embodiments.

**[0024] FIG. 9** provides a side view of a flight restricted region, in accordance with embodiments.

**[0025] FIG. 10** provides a schematic illustration of an unmanned aerial vehicle in communication with an external device, in accordance with an embodiment of the disclosure.

**[0026] FIG. 11** provides an example of an unmanned aerial vehicle using a global positioning system (GPS) to determine the location of the unmanned aerial vehicle, in accordance with an embodiment of the disclosure.

**[0027] FIG. 12** is an example of an unmanned aerial vehicle in communication with a mobile device, in accordance with an embodiment of the disclosure.

**[0028] FIG. 13** is an example of an unmanned aerial vehicle in communication with one or more mobile devices, in accordance with an embodiment of the disclosure.

**[0029] FIG. 14** provides an example of unmanned aerial vehicle with an on-board memory unit, in accordance with an aspect of the disclosure.

**[0030] FIG. 15** shows an example of an unmanned aerial vehicle in relation to multiple flight-restricted regions, in accordance with an embodiment of the disclosure.

**[0031] FIG. 16** shows an example of a flight limitation feature in accordance with an embodiment of the disclosure.

**[0032] FIG. 17** illustrates an unmanned aerial vehicle, in accordance with an embodiment of the disclosure.

**[0033] FIG. 18** illustrates a movable object including a carrier and a payload, in accordance with an embodiment of the disclosure.

**[0034] FIG. 19** is a schematic illustration by way of block diagram of a system for controlling a movable object, in accordance with an embodiment of the disclosure.

**[0035] FIG. 20** illustrates an irregular polygon area defined by a plurality of flight restricted strips, in accordance with embodiments.

**[0036] FIG. 21** illustrates a plurality of flight restricted strips that fill an irregular polygon area, in accordance with embodiments.

**[0037] FIG. 22** illustrates a method for controlling a UAV, in accordance with embodiments.

## DETAILED DESCRIPTION OF THE DISCLOSURE

**[0038]** The systems, methods, computer readable mediums, and devices of the present disclosure provide flight restriction strips, flight restriction zones generated by the flight restriction strips, and associated flight response measures of a UAV relative to the flight restriction strips and/or



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zones. The flight restriction zones as used herein may refer to any region in which it is possible to limit or affect operation of an aerial vehicle. The aerial vehicle may be an unmanned aerial vehicle (UAV), or any other type of movable object. Some jurisdictions may have one or more no-fly zones where UAVs are not permitted to fly (e.g., flight prohibited regions). For example, in the US, UAVs may not fly within certain proximities of airports. Additionally, it may be prudent to restrict flight of aerial vehicles in certain regions. For example, it may be prudent to restrict flight of aerial vehicles in large cities, across national borders, near governmental buildings, and the like.

**[0039]** The flight restriction zones may be provided around and/or overlap regions where restriction of flight is desired. Regions where restriction of flight is desired may also be referred to herein as flight restricted regions. The flight restriction zones may be generated and may have arbitrary shapes (e.g., circular shapes) or shapes that mimic the flight restricted regions. The regions where restriction of aerial vehicles is desired may comprise irregular shapes. For example, the flight restricted regions may best be defined by irregular polygonal shapes. Therefore, a need exists to provide flight restricted zones having irregular shapes.

**[0040]** In some instances, flight restricted zones having regular shapes may be provided. In some instances, the flight restricted zone may be generated or determined based on a threshold distance, or proximity, from a location of one or more flight restricted regions. For example, a location of one or more flight-restricted regions, such as airports, may be stored on-board the UAV.

**[0041]** Alternatively or in addition, information about the location of one or more flight-restricted regions may be accessed from a data source off-board the UAV. For example, if the Internet or another network is accessible, the UAV may obtain information regarding flight restriction regions from a server online. The one or more flight-restricted regions may be associated each with one



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or more flight response measures. The one or more flight response measures may be stored on-board the UAV. Alternatively or in addition, information about the one or more flight response measures may be accessed from a data source off-board the UAV. For example, if the Internet or another network is accessible, the UAV may obtain information regarding flight response measures from a server online. The location of the UAV may be determined. This may occur prior to take-off of the UAV and/or while the UAV is in flight. In some instances, the UAV may have a GPS receiver that may be used to determine the location of the UAV. In other examples, the UAV may be in communication with an external device, such as a mobile control terminal. The location of the external device may be determined and used to approximate the location of the UAV. Information about the location of one or more flight restricted regions accessed from a data source off-board the UAV may depend on, or be governed by a location of the UAV or an external device in communication with the UAV. For example, the UAV may access information on other flight-restricted regions about or within 1 mile, 2 miles, 5 miles, 10 miles, 20 miles, 50 miles, 100 miles, 200 miles, or 500 miles of the UAV. Information accessed from a data source off-board the UAV may be stored on a temporary or a permanent database. For example, information accessed from a data source off-board the UAV may add to a growing library of flight-restricted regions on board the UAV. Alternatively, only the flight restricted regions about or within 1 mile, 2 miles, 5 miles, 10 miles, 20 miles, 50 miles, 100 miles, 200 miles, or 500 miles of the UAV may be stored on a temporary database, and flight restricted regions previously within, but currently outside the aforementioned distance range (e.g., within 50 miles of the UAV) may be deleted. In some embodiments, information on all airports may be stored on-board the UAV while information on other flight-restricted regions may be accessed from a data source off-board the UAV (e.g., from an online server). The distance between the UAV and a flight-restricted region



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may be calculated. Based on the calculated distance, one or more flight response measures may be taken. For example, if the UAV is within a first radius of a flight-restricted region, the UAV may automatically land. If the UAV is within a second radius of the flight-restricted region, the UAV may be give an operator a time period to land, after which the UAV will automatically land. If the UAV is within a third radius of the flight-restricted region, the UAV may provide an alert to an operator of the UAV regarding the proximity of the flight-restricted region. In some instances, if the UAV is within a particular distance from the flight-restricted region, the UAV may not be able to take off.

**[0042]** The systems, devices, and methods herein may provide automated response of a UAV to a detected proximity to a flight-restricted region. Different actions may be taken, based on different detected distances to the restricted region, which may permit the user to take action with reduced interference when not too close, and which may provide greater interference to provide automated landing when the UAV is too close to comply with regulations and provide greater safety. The systems, devices, and methods herein may also use various systems for determining the location of the UAV to provide greater assurance that the UAV will not inadvertently fly into a flight-restricted region.

**[0043] FIG. 1** provides an example of unmanned aerial vehicle locations **120A, 120B, 120C** relative to a flight-restricted region **110**, in accordance with an embodiment of the disclosure.

**[0044]** A flight-restricted region **110** may have any location. In some instances, a flight-restricted region location may be a point, or the center or location of the flight-restricted region may be designated by a point (e.g., latitude and longitude coordinates, optionally altitude coordinate). For example, a flight-restricted region location may be a point at the center of an airport, or representative of the airport or other type of flight-restricted region. In other examples, a flight-

restricted region location may include an area or region. The area or region **130** may have any shape (e.g., rounded shape, rectangular shape, triangular shape, shape corresponding to one or more natural or man-made feature at the location, shape corresponding to one or more zoning rules, or any other boundaries). For example, the flight-restricted region may be the boundaries of an airport, the border between nations, other jurisdictional borders, or other type of flight-restricted region. The flight restricted regions may be defined by straight or curved lines. In some instances, the flight-restricted region may include a space. The space may be a three-dimensional space that includes latitude, longitude, and/or altitude coordinates. The three-dimensional space may include length, width, and/or height. The flight-restricted region may include space from the ground up to any altitude above the ground. This may include altitude straight up from one or more flight-restricted region on the ground. For example, for some latitudes and longitudes, all altitudes may be flight restricted. In some instances, some altitudes for particular lateral regions may be flight-restricted, while others are not. For example, for some latitudes and longitudes, some altitudes may be flight restricted while others are not. Thus, the flight-restricted region may have any number of dimensions, and measurement of dimensions, and/or may be designated by these dimension locations, or by a space, area, line, or point representative of the region.

**[0045]** A flight-restricted region may include one or more locations where unauthorized aerial vehicles may not fly. This may include unauthorized unmanned aerial vehicles (UAVs) or all UAVs. Flight-restricted regions may include prohibited airspace, which may refer to an area (or volume) of airspace within which flight of aircraft is not allowed, usually due to security concerns. Prohibited areas may contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas can be established for security or other reasons associated with the national welfare. These areas may be published in



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the Federal Register and are depicted on aeronautical charts in the United States, or in other publications in various jurisdictions. The flight-restricted region may include one or more of special use airspace (e.g., where limitations may be imposed on aircraft not participating in designated operations), such as restricted airspace (i.e., where entry is typically forbidden at all times from all aircraft and is not subject to clearance from the airspace's controlling body), military operations areas, warning areas, alert areas, temporary flight restriction (TFR) areas, national security areas, and controlled firing areas.

**[0046]** Examples of flight-restricted regions may include, but are not limited to, airports, flight corridors, military or other government facilities, locations near sensitive personnel (e.g., when the President or other leader is visiting a location), nuclear sites, research facilities, private airspace, de-militarized zones, certain jurisdictions (e.g., townships, cities, counties, states/provinces, countries, bodies of water or other natural landmarks), national borders (e.g., the border between the U.S. and Mexico), or other types of no-fly zones. A flight-restricted region may be a permanent no-fly zone or may be a temporary area where flight is prohibited. In some instances, a list of flight-restricted regions may be updated. Flight-restricted regions may vary from jurisdiction to jurisdiction. For instance, some countries may include schools as flight-restricted regions while others may not.

**[0047]** An aerial vehicle, such as a UAV **120A, 120B, 120C** may have a location. The location of a UAV may be determined to be one or more coordinates of the UAV relative to a reference frame (e.g., underlying earth, environment). For example, the latitude and/or longitude coordinates of a UAV may be determined. Optionally, an altitude of the UAV may be determined. The location of the UAV may be determined to any degree of specificity. For example, the location of the UAV may be determined to within about 2000 meters, 1500 meters, 1200 meters, 1000 meters, 750



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meters, 500 meters, 300 meters, 100 meters, 75 meters, 50 meters, 20 meters, 10 meters, 7 meters, 5 meters, 3 meters, 2 meters, 1 meter, 0.5 meters, 0.1 meters, 0.05 meters, or 0.01 meters.

**[0048]** A location of a UAV **120A, 120B, 120C** may be determined relative to a location of flight-restricted region **110**. This may include comparing coordinates representative of the location of the UAV with coordinates of a location representative of the flight-restricted region. In some embodiments, assessing relative locations between the flight-restricted region and the UAV may include calculating a distance between the flight-restricted region and the UAV. For example, if a UAV **120A** is at a first location, the distance **d1** between the UAV and the flight-restricted region **110** may be calculated. If the UAV **120B** is at a second location, the distance **d2** between the UAV and the flight-restricted region may be calculated. In another example, if the UAV **120C** is at a third location, the distance **d3** between the UAV and the flight-restricted region may be calculated. In some instances, only the distances between the UAV and the flight-restricted region may be located and/or calculated. In other examples, other information, such as direction or bearing between the UAV and flight-restricted region may be calculated. For example, the relative cardinal direction (e.g., north, west, south, east) between the UAV and flight-restricted region, or angular direction (e.g., angular between) between the UAV and flight-restricted region may be calculated. Relative velocities and/or acceleration between the UAV and flight-restricted region and related directions may or may not be calculated.

**[0049]** The distance may be calculated periodically or continuously while the UAV is in flight. The distance may be calculated in response to a detected event (e.g., receiving a GPS signal after not having received the GPS signal for a period of time prior). As the location of the UAV is updated, the distance to the flight-restricted region may also be recalculated.



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**[0050]** The distance between a UAV **120A, 120B, 120C** and a flight-restricted region **110** may be used to determine whether to take a flight response measure and/or which type of flight response measure to take. Examples of flight response measures that may be taken by a UAV may include automatically landing the UAV immediately, providing a time period for an operator of the UAV to land the UAV on a surface after which the UAV will automatically land if the operator has not already landed the UAV, provide an alert to an operator of the unmanned aerial vehicle that the unmanned aerial vehicle is near the flight-restricted region, automatically take evasive action by adjusting the flight path of the UAV, preventing the UAV from entering the flight restriction region, or any other flight response measure.

**[0051]** The flight response measures may be mandatory for all operators of a UAV. Alternatively flight response measures may be ignored by an authorized user, such as an authorized operator of the UAV. The authorized user may be authenticated. For example, the authorized user may be authenticated by an external device, a server, or the UAV. The external device may be a mobile device, a controller (e.g., of a UAV), and the like. For example, a user may log in to a server and verify their identity. When an operator of the UAV operates the UAV in a flight restricted region, a determination may be performed whether the user is authorized to fly the UAV in the flight restricted region. If the operator is authorized to fly the UAV operator may ignore the flight response measure that is imposed. For example, an airport staff may be an authorized user with regards to a flight restricted region at or near an airport. For example, a federal agent or officer (e.g., border patrol agent) may be an authorized user at or near a national border.

**[0052]** In one example, it may be determined whether the distance **d1** falls within a distance threshold value. If the distance exceeds the distance threshold value, then no flight response measure may be needed and a user may be able to operate and control the UAV in a normal manner.



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In some instances, the user may control the flight of the UAV by providing real-time instructions to the UAV from an external device, such as a remote terminal. In other instances, the user may control flight of the UAV by providing instructions ahead of time (e.g., flight plan or path) that may be followed by the UAV. If the distance **d1** falls beneath the distance threshold value, then a flight response measure may be taken. The flight response measure may affect operation of the UAV. The flight response measure may take control of the UAV away from the user, may provide a user limited time to take corrective action before taking control of the UAV away from the user, impose an altitude restriction, and/or may provide an alert or information to the UAV.

**[0053]** The distance may be calculated between coordinates representative of the UAV and the flight-restricted region. A flight response measure may be taken based on the calculated distance. The flight response measure may be determined by the distance without taking direction or any other information into account. Alternatively, other information, such as direction may be taken into account. In one example, a UAV at a first position **120B** may be a distance **d2** from the flight-restricted region. A UAV at a second position **120C** may be a distance **d3** from the flight-restricted region. The distance **d2** and **d3** may be substantially the same. However, the UAVs **120B, 120C** may be at different directions relative to the flight-restricted region. In some instances, the flight response measure, if any, may be the same for the UAVs based solely on the distance and without regard to the directions. Alternatively, the directions or other conditions may be considered and different flight response measures may possibly be taken. In one example, a flight-restricted region may be provided over an area **130** or space. This area or space may include portions that are or are not equidistant from coordinates representative of the flight-restricted region **110**. In some instances, if flight-restricted region extends further to the east, even if **d3** is the same as **d2**, different flight response measures may or may not be taken. Distances may be calculated between



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the UAV had flight-restricted region coordinates. Alternatively, distance from the UAV to the closest boundary of the flight-restricted region may be considered.

**[0054]** In some examples, a single distance threshold value may be provided. Distances exceeding the distance threshold value may permit regular operation of the UAV while distance within the distance threshold value may cause a flight response measure to be taken. In other examples, multiple distance threshold values may be provided. Different flight response measures may be selected based on which distance threshold values that a UAV may fall within. Depending on the distance between the UAV and the flight-restricted region, different flight response measures may be taken.

**[0055]** In one example, a distance **d2** may be calculated between a UAV **120B** and the fight-restricted region **110**. If the distance falls within a first distance threshold, a first flight response measure may be taken. If the distance falls within a second distance threshold, a second flight response measure may be taken. In some instances, if the second distance threshold may be greater than the first distance threshold. If the distance meets both distance thresholds, both the first flight response measure and the second flight response measure may be taken. Alternatively, if the distance falls within the second distance threshold but outside the first distance threshold, the second flight response measure is taken without taking the first flight response measure, and if the distance falls within the first distance threshold, the first flight response measure is taken without taking the second flight response measure. Any number of distance thresholds and/or corresponding flight response measures may be provided. For example, a third distance threshold may be provided. The third distance threshold may be greater than the first and/or second distance thresholds. A third flight response measure may be taken if the distance falls within the third distance threshold. The third flight response measure may be taken in conjunction with other flight



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response measures, such as the first and second flight response measures if the first and second distance thresholds are also met respectively. Alternatively, the third flight response measure may be taken without taking the first and second flight response measures.

**[0056]** Distance thresholds may have any value. For example, the distance thresholds may be on the order of meters, tens of meters, hundreds of meters, or thousands of meters. The distance thresholds may be about 0.05 miles, 0.1 miles, 0.25 miles, 0.5 miles, 0.75 miles, 1 mile, 1.25 miles,1.5 miles, 1.75 miles, 2 miles, 2.25 miles, 2.5 miles, 2.75 miles, 3 miles,3.25 miles, 3.5 miles,3.75 miles, 4 miles,4.25 miles, 4.5 miles,4.75 miles, 5 miles, 5.25 miles, 5.5 miles,5.75 miles, 6 miles, 6.25 miles, 6.5 miles,6.75 miles, 7 miles, 7.5 miles, 8 miles, 8.5 miles, 9 miles, 9.5 miles, 10 miles, 11 miles, 12 miles, 13 miles, 14 miles, 15 miles, 17 miles, 20 miles, 25 miles, 30 miles, 40 miles, 50 miles, 75 miles, or 100 miles. The distance threshold may optionally match a regulation for a flight-restricted region (e.g., if FAA regulations did not allow a UAV to fly within X miles of an airport, the distance threshold may optionally be X miles), may be greater than the regulation for the flight-restricted region (e.g., the distance threshold may be greater than X miles), or may be less than the regulation for the flight-restricted region (e.g., the distance threshold may be less than X miles). The distance threshold may be greater than the regulation by any distance value (e.g., may be X + 0.5 miles, X + 1 mile, X + 2 miles, etc). In other implementations, the distance threshold may be less than the regulation by any distance value (e.g., may be X – 0.5 miles, X – 1 mile, X – 2 miles, etc.).

**[0057]** A UAV location may be determined while the UAV is in flight. In some instances, the UAV location may be determined while the UAV is not in flight. For instance, the UAV location may be determined while the UAV is resting on a surface. The UAV location may be assessed when the UAV is turned on, and prior to taking off from the surface. The distance between the

UAV and the flight-restricted region may be assessed while the UAV is on a surface (e.g., prior to taking off / after landing). If the distance falls beneath a distance threshold value, the UAV may refuse to take off. For example, if the UAV is within 4.5 miles of an airport, the UAV may refuse to take off. In another example if the UAV is within 5 miles of an airport, the UAV may refuse to take off. Any distance threshold value, such as those described elsewhere herein may be used. In some instances, multiple distance threshold values may be provided. Depending on the distance threshold value, the UAV may have different take-off measures. For example, if the UAV falls beneath a first distance threshold, the UAV may not be able to take off. If the UAV falls within a second distance threshold, the UAV may be able to take off, but may only have a very limited period of time for flight. In another example, if the UAV falls within a second distance threshold, the UAV may be able to take off but may only be able to fly away from the flight-restricted region (e.g., increase the distance between the UAV and the flight-restricted region). In another example if the UAV falls beneath a second distance threshold or a third distance threshold, the UAV may provide an alert to the operator of the UAV that the UAV is near a flight-restricted region, while permitting the UAV to take off. In another example if a UAV falls within a distance threshold, it may be provided with a maximum altitude of flight. If the UAV is beyond the maximum altitude of flight, the UAV may be automatically brought to a lower altitude while a user may control other aspects of the UAV flight.

**[0058] FIG. 2** shows an example of a plurality of flight-restricted region proximity zones **220A, 220B, 220C**, in accordance with an embodiment of the disclosure. A flight-restricted region **210** may be provided. The location of the flight-restricted region may be represented by a set of coordinates (i.e., a point), area, or space. One or more flight-restricted proximity zones may be provided around the flight-restricted region.



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**[0059]** In one example, the flight-restricted region **210** may be an airport. Any description herein of an airport may apply to any other type of flight-restricted region, or vice versa. A first flight-restricted proximity zone **220A** may be provided, with the airport therein. In one example, the first flight-restricted proximity zone may include anything within a first radius of the airport. For example, the first flight-restricted proximity zone may include anything within 4.5 miles of the airport. The first flight-restricted proximity zone may have a substantially circular shape, including anything within the first radius of the airport. The flight-restricted proximity zone may have any shape. If a UAV is located within the first flight-restricted proximity zone, a first flight response measure may be taken. For example, if the UAV is within 4.5 miles of the airport, the UAV may automatically land. The UAV may automatically land without any input from an operator of the UAV, or may incorporate input from the operator of the UAV. The UAV may automatically start decreasing in altitude. The UAV may decrease in altitude at a predetermined rate, or may incorporate location data in determining the rate at which to land. The UAV may find a desirable spot to land, or may immediately land at any location. The UAV may or may not take input from an operator of the UAV into account when finding a location to land. The first flight response measure may be a software measure to prevent users from being able to fly near an airport. An immediate landing sequence may be automatically initiated when the UAV is in the first flight-restricted proximity zone.

**[0060]** A second flight-restricted proximity zone **220B** may be provided around an airport. The second flight-restricted proximity zone may include anything within a second radius of the airport. The second radius may be greater than the first radius. For example, the second flight-restricted proximity zone may include anything within 5 miles of the airport. In another example, the second flight-restricted proximity zone may include anything within 5 miles of the airport and also outside



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the first radius (e.g., 4.5 miles) of the airport. The second flight-restricted proximity zone may have a substantially circular shape including anything within the second radius of the airport, or a substantially ring shape including anything within the second radius of the airport and outside the first radius of the airport. If a UAV is located within the second flight-restricted proximity zone, a second flight response measure may be taken. For example, if the UAV is within 5 miles of the airport and outside 4.5 miles of the airport, the UAV may prompt an operator of the UAV to land within a predetermined time period (e.g., 1 hour, 30 minutes, 14 minutes, 10 minutes, 5 minutes, 3 minutes, 2 minutes, 1 minute, 45 seconds, 30 seconds, 15 seconds, 10 seconds, or five seconds). If the UAV is not landed within the predetermined time period, the UAV may automatically land.

**[0061]** When the UAV is within the second flight-restricted proximity zone, the UAV may prompt the user (e.g., via mobile application, flight status indicator, audio indicator, or other indicator) to land within the predetermined time period (e.g., 1 minute). Within the time period, the operator of the UAV may provide instructions to navigate the UAV to a desired landing surface and/or provide manual landing instructions. After the predetermined time period has been exceeded, the UAV may automatically land without any input from an operator of the UAV, or may incorporate input from the operator of the UAV. The UAV may automatically start decreasing in altitude after the predetermined time period. The UAV may decrease in altitude at a predetermined rate, or may incorporate location data in determining the rate at which to land. The UAV may find a desirable spot to land, or may immediately land at any location. The UAV may or may not take input from an operator of the UAV into account when finding a location to land. The second flight response measure may be a software measure to prevent users from being able to fly near an airport. A time-delayed landing sequence may be automatically initiated when the UAV is in the second flight-restricted proximity zone. If the UAV is able to fly outside the second flight-restricted



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proximity zone within the designated time period, then the automated landing sequence may not come into effect and the operator may be able to resume normal flight controls of the UAV. The designated time period may act as a grace period for an operator to land the UAV or exit the area near the airport.

**[0062]** A third flight-restricted proximity zone **220C** may be provided around an airport. The third flight-restricted proximity zone may include anything within a third radius of the airport. The third radius may be greater than the first radius and/or second radius. For example, the third flight-restricted proximity zone may include anything within 5.5 miles of the airport. In another example, the third flight-restricted proximity zone may include anything within 5.5 miles of the airport and also outside the second radius (e.g., 5 miles) of the airport. The third flight-restricted proximity zone may have a substantially circular shape including anything within the third radius of the airport, or a substantially ring shape including anything within the third radius of the airport and outside the second radius of the airport. If a UAV is located within the third flight-restricted proximity zone, a third flight response measure may be taken. For example, if the UAV is within 5.5 miles of the airport and outside 5 miles of the airport, the UAV may send an alert to an operator of the UAV. Alternatively, if the UAV is anywhere within 5.5 miles of the airport, an alert may be provided.

**[0063]** Any numerical value used to describe the dimension of the first, second, and/or third flight-restricted proximity zones are provided by way of example only and may be interchanged for any other distance threshold value or dimension as described elsewhere herein. While flight restricted proximity zones having a substantially circular or ring shape have been described primarily herein, flight restricted proximity zones may have any shape (e.g., shape of an airport), to which the measures described herein are equally applicable. The radius of the flight restricted proximity



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zones may be determined. For example, the radius may be determined based on an area of the flight restricted region. Alternatively or in conjunction, the radius may be determined based on an area of the one or more other flight restricted proximity zones. Alternatively or in conjunction, the radius may be determined based on other considerations. For example, at an airport, the second radius may be based on a minimum safe radius that encompasses the airport. For example, for a runaway of an airport, the second radius may be determined based on a length of the runway.

**[0064]** When the UAV is within the third flight-restricted proximity zone, the UAV may alert the user (e.g., via mobile application, flight status indicator, audio indicator, or other indicator) regarding the close proximity to the flight-restricted region. In some examples, an alert can include a visual alert, audio alert, or tactile alert via an external device. The external device may be a mobile device (e.g., tablet, smartphone, remote controller) or a stationary device (e.g., computer). In other examples the alert may be provided via the UAV itself. The alert may include a flash of light, text, image and/or video information, a beep or tone, audio voice or information, vibration, and/or other type of alert. For example, a mobile device may vibrate to indicate an alert. In another example, the UAV may flash light and/or emit a noise to indicate the alert. Such alerts may be provided in combination with other flight response measures or alone.

**[0065]** In one example, the location of the UAV relative to the flight-restricted region may be assessed. If the UAV falls within the first flight-restricted proximity zone, the UAV may not be able to take off. For example, if the UAV is within 4.5 miles of the flight-restricted region (e.g., airport), the UAV may not be able to take off. Information about why the UAV is not able to take off may or may not be conveyed to the user. If the UAV falls within the second flight-restricted proximity zone, the UAV may or may not be able to take off. For example, if the UAV is within 5 miles of the airport, the UAV may not be able to take off. Alternatively, the UAV may be able



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to take off but have restricted flight capabilities. For example, the UAV may only be able to fly away from the flight-restricted region, may only be able to fly to a particular altitude, or have a limited period of time for which the UAV may fly. If the UAV falls within the third flight-restricted proximity zone, the UAV may or may not be able to take off. For example, if the UAV is within 5.5 miles of the airport, the UAV may provide an alert to the user about the proximity to the airport. Distance, bearing, airport name, type of facility, or other information may be provided in the alert to the user. The alert may be provided to the user when the UAV is within 5.5 miles of the airport but outside 5 miles. In another example, the alert may be provided if the UAV is within 5.5 miles, and may be combined with other take-off responses or provided on its own. This may provide a safety measure that may prevent the UAV from flying in a flight-restricted region.

**[0066]** In some instances, flight response measures closer to a flight-restricted region may provide more rapid response by the UAV to land. This may reduce user autonomy in controlling the UAV flight but may provide greater compliance with regulations and provide greater safety measures. Flight response measures further from the flight-restricted region may permit a user to have more control over the UAV. This may provide increased user autonomy in controlling the UAV and allow the user to take action to prevent the UAV from entering restricted airspace. The distance can be used to measure risk or likelihood of the UAV falling within restricted airspace, and based on the measure of risk take an appropriate level of action.

**[0067] FIG. 3** provides an additional example of a plurality of flight-restricted region proximity zones **240a, 240b, 240c**, in accordance with an embodiment of the disclosure. A flight-restricted region **230** may be provided. As previously described, the location of the flight-restricted region may be represented by a set of coordinates (i.e., point), area, or space. One or more flight-restricted proximity zones may be provided around the flight-restricted region.



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**[0068]** The flight-restricted proximity zones **240a, 240b, 240c** may include lateral regions around the flight restricted region **230**. In some instances, the flight-restricted proximity zones may refer to spatial regions **250a, 250b, 250c** that extend in the altitude direction corresponding to the lateral regions. The spatial regions may or may not have an upper and/or lower altitude limit. In some examples, a flight ceiling **260** may be provided, above which a spatial flight-restricted proximity zone **250b** comes into play. Beneath the flight ceiling, a UAV may freely traverse the region.

**[0069]** The flight-restricted region **230** may be an airport. Optionally, the flight-restricted region may be an international airport (or Category A airport as described elsewhere herein). Any description herein of an airport may apply to any other type of flight-restricted region, or vice versa. A first flight-restricted proximity zone **240a** may be provided, with the airport therein. In one example, the first flight-restricted proximity zone may include anything within a first radius of the airport. For example, the first flight-restricted proximity zone may include anything within 1.5 miles (or 2.4 km) of the airport. The first flight-restricted proximity zone may have a substantially circular shape, including anything within the first radius of the airport. The flight-restricted proximity zone may have any shape. If a UAV is located within the first flight-restricted proximity zone, a first flight response measure may be taken. For example, if the UAV is within 1.5 miles of the airport, the UAV may automatically land. The UAV may automatically land without any input from an operator of the UAV, or may incorporate input from the operator of the UAV. The UAV may automatically start decreasing in altitude. The UAV may decrease in altitude at a predetermined rate, or may incorporate location data in determining the rate at which to land. The UAV may find a desirable spot to land, or may immediately land at any location. The UAV may or may not take input from an operator of the UAV into account when finding a location to land. The first flight response measure may be a software measure to prevent users from being



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able to fly near an airport. An immediate landing sequence may be automatically initiated when the UAV is in the first flight-restricted proximity zone.

**[0070]** In some implementations the first flight-restricted proximity zone **240a** may extend from a ground level upwards indefinitely, or beyond a height at which the UAV can fly. When a UAV enters any portion of a spatial region **250a** above the ground, a first flight response measure may be initiated.

**[0071]** A second flight-restricted proximity zone **240b** may be provided around an airport. The second flight-restricted proximity zone may include anything within a second radius of the airport. The second radius may be greater than the first radius. For example, the second flight-restricted proximity zone may include anything within about 2 miles, 2.5 miles, 3 miles, 4 miles, 5 miles (or 8 km), or 10 miles of the airport. In another example, the second flight-restricted proximity zone may include anything within about 2 miles, 2.5 miles, 3 miles, 4 miles, 5 miles, or 10 miles of the airport and also outside the first radius (e.g., 1.5 miles) of the airport. The second flight-restricted proximity zone may have a substantially circular shape including anything within the second radius of the airport, or a substantially ring shape including anything within the second radius of the airport and outside the first radius of the airport.

**[0072]** In some instances, a changing permissible altitude may be provided. For example, a flight ceiling **260** may be provided within the second flight-restricted proximity zone. If a UAV is beneath the flight ceiling, the airplane may freely fly and may be outside the second flight-restricted proximity zone. If the UAV is above the flight ceiling, the UAV may fall within the second flight-restricted proximity zone and be subjected to a second flight response. In some instances, the flight ceiling may be a slanted flight ceiling as illustrated. The slanted flight ceiling may indicate a linear relationship between a distance from the flight-restricted region **230** and the



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UAV. For example, if the UAV is laterally 1.5 miles away from the flight-restricted region, the flight ceiling may be at 35 feet. If the UAV is laterally 5 miles away from the flight-restricted region, the flight ceiling may be at 400 feet. The flight ceiling may increase linearly from the inner radius to the outer radius. For example, the flight ceiling may increase linearly at less than or equal to about a 5°, 10°, 15°, 30°, 45°, or 70° angle until a maximum height set by a system is reached. The flight ceiling may increase linearly at greater than or equal to about a 5°, 10°, 15°, 30°, 45°, or 70° angle until a maximum height set by a system is reached. The angle at which the flight ceiling increases at may be referred to as an angle of inclination. The flight ceiling at the inner radius may have any value, such as about 0 feet, 5 feet, 10 feet, 15 feet, 20 feet, 25 feet, 30 feet, 35 feet, 40 feet, 45 feet, 50 feet, 55 feet, 60 feet, 65 feet, 70 feet, 80 feet, 90 feet, 100 feet, 120 feet, 150 feet, 200 feet, or 300 feet. The flight ceiling at the outer radius may have any other value, such as 20 feet, 25 feet, 30 feet, 35 feet, 40 feet, 45 feet, 50 feet, 55 feet, 60 feet, 65 feet, 70 feet, 80 feet, 90 feet, 100 feet, 120 feet, 150 feet, 200 feet, 250 feet, 300 feet, 350 feet, 400 feet, 450 feet, 500 feet, 550 feet, 600 feet, 700 feet, 800 feet, 900 feet, 1000 feet, 1500 feet, or 2000 feet. In other embodiments, the flight ceiling may be a flat flight ceiling (e.g., a constant altitude value), a curved flight ceiling, or any other shape of flight ceiling.

**[0073]** If a UAV is located within the second flight-restricted proximity zone, a second flight response measure may be taken. For example, if the UAV is within 5 miles of the airport and outside 1.5 miles of the airport, and above the flight ceiling, the UAV may prompt an operator of the UAV to decrease altitude to beneath the flight ceiling within a predetermined time period (e.g., 1 hour, 30 minutes, 14 minutes, 10 minutes, 5 minutes, 3 minutes, 2 minutes, 1 minute, 45 seconds, 30 seconds, 15 seconds, 10 seconds, or five seconds). For example, if the UAV is within 5 miles of the airport and outside 1.5 miles of the airport, and above the flight ceiling, the UAV may



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automatically descend until it is below the flight ceiling, without prompting the operator. If the UAV is beneath the flight ceiling within the predetermined time period, or otherwise outside the second flight-restricted proximity zone, the UAV may operate as normal. For example, an operator of the UAV may have unrestricted control with regards to the UAV as long as the UAV is below the flight ceiling.

**[0074]** When the UAV is within the second flight-restricted proximity zone, the UAV may automatically decrease in altitude at a predetermined rate, or may incorporate location data in determining the rate at which to decrease altitude. The UAV may decrease altitude while continuing on its trajectory and/or incorporating commands from an operator regarding lateral movements of the UAV. Additionally, the UAV may incorporate commands from an operator regarding downward movement of the UAV (e.g., hastening the descent of the UAV). The UAV may or may not take input from an operator of the UAV into account when decreasing altitude.

**[0075]** When the UAV is within the second flight-restricted proximity zone, the UAV may prompt the user (e.g., via mobile application, flight status indicator, audio indicator, or other indicator) to land within the predetermined time period (e.g., 1 minute) or to decrease altitude to beneath the flight ceiling within the predetermined time period. Within the time period, the operator of the UAV may provide instructions to navigate the UAV to a desired landing surface and/or provide manual landing instructions, or may decrease the altitude of the UAV to beneath the flight ceiling. After the predetermined time period has been exceeded, the UAV may automatically land without any input from an operator of the UAV, may automatically decrease altitude to beneath the flight ceiling without any input from an operator, or may incorporate input from the operator of the UAV. The UAV may automatically start decreasing in altitude after the predetermined time period, substantially as described herein.



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**[0076]** The second flight response measure may be a software measure to prevent users from being able to fly near an airport. A time-delayed landing sequence may be automatically initiated when the UAV is in the second flight-restricted proximity zone. If the UAV is able to fly outside the second flight-restricted proximity zone within the designated time period (e.g., outside the outer radius or beneath the fight ceiling), then the automated landing sequence may not come into effect and the operator may be able to resume normal flight controls of the UAV. The designated time period may act as a grace period for an operator to land the UAV or exit the area near the airport. Alternatively, no designated time period may be provided.

**[0077]** In some implementations the second-restricted proximity zone **240b** may extend from a flight ceiling **260** upwards indefinitely, or beyond a height at which the UAV can fly. When a UAV enters any portion of a spatial region **250b** above the flight ceiling, a second flight response measure may be initiated.

**[0078]** A third flight-restricted proximity zone **220c** may be provided around an airport. The third flight-restricted proximity zone may include anything within a third radius of the airport. The third radius may be greater than the first radius and/or second radius. For example, the third flight-restricted proximity zone may include anything within about 330 feet (or about 100 meters) of the second radius (about 5.06 miles of the airport). In another example, the third flight-restricted proximity zone may include anything within 5.06 miles of the airport and also outside the second radius (e.g., 5 miles) of the airport. The third flight-restricted proximity zone may have a substantially circular shape including anything within the third radius of the airport, or a substantially ring shape including anything within the third radius of the airport and outside the second radius of the airport.



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**[0079]** In some instances, a permissible altitude may be provided as described herein (e.g., changing permissible altitude, flat flight ceiling, etc). A flat flight ceiling **255** of the third flight-restricted proximity region may be of the same altitude as the flight ceiling at an outer radius of the second flight-restricted proximity zone. If a UAV is below the flat flight ceiling **255**, the UAV may freely operate and may be outside the third flight-restricted proximity zone. If the UAV is above the flat flight ceiling **255**, the UAV may fall within the third flight-restricted proximity zone and subject to a third flight-response.

**[0080]** If a UAV is located within the third flight-restricted proximity zone, a third flight response measure may be taken. For example, if the UAV is within 5.06 miles of the airport and outside 5 miles of the airport, the UAV may send an alert to an operator of the UAV. Alternatively, if the UAV is anywhere within 5.06 miles of the airport, an alert may be provided. In some embodiments, if the UAV is beneath the flight ceiling within the predetermined time period, or otherwise outside the second flight-restricted proximity zone, the UAV may operate as normal. For example, an operator of the UAV may have unrestricted control with regards to the UAV as long as the UAV is below the flight ceiling. In some embodiments, if the UAV is above the flight ceiling, the flight response measure may be to automatically descend the UAV until it is within a permissible altitude.

**[0081]** In some implementations the third flight-restricted proximity zone **240c** may extend from a ground level upwards indefinitely, or beyond a height at which the UAV can fly. When a UAV enters any portion of a spatial region **250c** above the ground, a third flight response measure may be initiated.

**[0082]** Any numerical value used to describe the dimension of the first, second, and/or third flight-restricted proximity zones are provided by way of example only and may be interchanged for any



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other distance threshold value or dimension as described elsewhere herein. Similarly, flight ceilings may be located in none, one, two, or all three flight-restricted proximity zones and may have any altitude value or configuration as described elsewhere herein.

**[0083]** When the UAV is within the third flight-restricted proximity zone, the UAV may alert the user via any method described elsewhere herein. Such alerts may be provided in combination with other flight response measures or alone.

**[0084]** In one example, the location of the UAV relative to the flight-restricted region may be assessed. If the UAV falls within the first flight-restricted proximity zone, the UAV may not be able to take off. For example, if the UAV is within 1.5 miles of the flight-restricted region (e.g., airport), the UAV may not be able to take off. Information about why the UAV is not able to take off may or may not be conveyed to the user. If the UAV falls within the second flight-restricted proximity zone, the UAV may or may not be able to take off. For example, if the UAV is within 5 miles of the airport, the UAV may be able to take off and fly freely beneath the flight ceiling. Alternatively, the UAV may be able to take off but have restricted flight capabilities. For example, the UAV may only be able to fly away from the flight-restricted region, may only be able to fly to a particular altitude, or have a limited period of time for which the UAV may fly. If the UAV falls within the third flight-restricted proximity zone, the UAV may or may not be able to take off. For example, if the UAV is within 5.06 miles of the airport, the UAV may provide an alert to the user about the proximity to the airport. Distance, bearing, airport name, type of facility, or other information may be provided in the alert to the user. The alert may be provided to the user when the UAV is within 5.06 miles of the airport but outside 5 miles. In another example, the alert may be provided if the UAV is within 5.06 miles, and may be combined with other take-off responses



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or provided on its own. This may provide a safety measure that may prevent the UAV from flying in a flight-restricted region.

**[0085] FIG. 7** provides an example of a flight restriction zone of a regular shape **201f** around a region of irregular shape **203f**, in accordance with embodiments. Region of irregular shape **203f** may represent the outer perimeter of an airport wherein encroachment by a UAV may be undesirable or even dangerous. The region of regular shape **201f** may represent a flight restricted proximity zone that may be set up to prevent encroachment of the UAV onto the airport. The flight restricted proximity zone may be a first flight-restricted proximity zone, as described herein. For example, a software response measure may prevent a UAV from entering the first flight-restricted proximity zone, regardless of altitude. If the UAV falls within the flight restricted region **201f**, the UAV may automatically land and not be able to take off.

**[0086] FIG. 8** provides an oblique view of a flight ceiling **201g**, in accordance with embodiments. The flight ceiling **201g** may represent a second flight-restricted proximity zone near an airport **203g** with a changing permissible altitude (e.g., linearly increasing permissible altitude), substantially as described herein.

**[0087] FIG. 9** provides a side view of a flight restriction zone, in accordance with embodiments. Region **201h** may represent a first flight-restricted proximity zone, Region **203h** may represent a second flight-restricted proximity zone, and Region **205h** may represent a third flight-restricted proximity zone, substantially as described herein. For instance, a UAV may not be permitted to fly anywhere within the first flight-restricted proximity zone **201h**. If the UAV falls within the first-flight restricted proximity zone, it may automatically land and be unable to take off. A UAV may not be permitted to fly anywhere above a slanted flight ceiling **207h** into a second flight-restricted proximity zone **203h**. The UAV may be permitted to fly freely below the slanted flight



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ceiling and may automatically descend to comply with the slanted flight ceiling while moving laterally. A UAV may not be permitted to fly above a flat flight ceiling **209h** into a third flight-restricted proximity zone **205h**. The UAV may be permitted to fly freely below the flat flight ceiling and if within a third flight-restricted proximity zone, the UAV may automatically descend until it is below the flat flight ceiling. In some embodiments, the UAV may receive an alert or a warning while operating in the third flight-restricted proximity zone.

**[0088] FIG. 4** provides an example of a plurality of types of flight-restricted regions and their related proximity zones, in accordance with an embodiment of the disclosure. In some instances, multiple types of flight-restricted regions may be provided. The multiple types of flight-restricted regions may include different categories of flight-restricted regions. In some instances, one or more, two or more, three or more, four or more, five or more, six or more, seven or more, eight or more, nine or more, ten or more, twelve or more fifteen or more, twenty or more, thirty or more, forty or more, fifty or more, or one hundred or more different categories of flight-restricted regions may be provided.

**[0089]** In one example, a first category of flight-restricted regions (Category A) may include larger international airports. A second category of flight-restricted regions (Category B) may include smaller domestic airports. In some instances, classification between Category A and Category B flight-restricted regions may occur with aid of a governing body or regulatory authority. For example, a regulatory authority, such as the Federal Aviation Administration (FAA) may define different categories of flight-restricted regions. Any division between to the two categories of airports may be provided.

**[0090]** For example, Category A may include airports having 3 or more, 4 or more, 5 or more, 6 or more, 7 or more, 8 or more, 9 or more, 10 or more, 12 or more, 15 or more, 17 or more, or 20



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or more runways. Category B may include airports having one, two or less, 3 or less, 4 or less, or 5 or less runways.

**[0091]** Category A may include airports having at least one runway having a length of 5,000 feet or more, 6,000 feet or more, 7,000 feet or more, 8,000 feet or more, 9,000 feet or more, 10,000 feet or more, 11,000 feet or more, 12,000 feet or more, 13,000 feet or more, 14,000 feet or more, 15,000 feet or more, 16,000 feet or more, 17,000 feet or more, or 18,000 feet or more. Category B may include airports that do not have a runway having any of the lengths described herein. In some instances,

**[0092]** In another example, Category A may include airports having one or more, two or more, three or more, four or more, five or more, six or more, seven or more, eight or more, 10 or more, 12 or more, 15 or more, 20 or more, 30 or more, 40 or more, or 50 or more gates for receiving aircraft. Category B may have no gates, or may have one or less, two or less, three or less, four or less, five or less, or six or less gates for receiving aircraft.

**[0093]** Optionally, Category A may include airports capable of receiving planes capable of holding 10 or more individuals, 12 or more individuals, 16 or more individuals, 20 or more individuals, 30 or more individuals, 40 or more individuals, 50 or more individuals, 60 or more individuals, 80 or more individuals, 100 or more individuals, 150 or more individuals, 200 or more individuals, 250 or more individuals, 300 or more individuals, 350 or more individuals, or 400 or more individuals. Category B may include airports not capable of receiving planes capable of holding one or more number of individuals as described herein. For example, Category B may include airports not capable of receiving planes configured to hold 10 or more individuals, 12 or more individuals, 16 or more individuals, 20 or more individuals, 30 or more individuals, 40 or more individuals, 50 or more individuals, 60 or more individuals, 80 or more individuals, 100 or more individuals, 150 or



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more individuals, 200 or more individuals, 250 or more individuals, 300 or more individuals, 350 or more individuals, or 400 or more individuals.

**[0094]** In another example, Category A may include airports capable of receiving planes capable of traveling 100 or more miles, 200 or more miles, 300 or more miles, 400 or more miles, 500 or more miles, 600 or more miles, 800 or more miles, 1000 or more miles, 1200 or more miles, 1500 or more miles, 2000 or more miles, 3000 or more miles, 4000 or more miles, 5000 or more miles, 6,000 or more miles, 7000 or more miles, or 10,000 or more miles without stopping. Category B may include airports not capable of receiving planes capable of traveling the number of miles without stopping as described herein. For example, Category B may include airports not capable of receiving planes capable of traveling 100 or more miles, 200 or more miles, 300 or more miles, 400 or more miles, 500 or more miles, 600 or more miles, 800 or more miles, 1000 or more miles, 1200 or more miles, 1500 or more miles, 2000 or more miles, 3000 or more miles, 4000 or more miles, 5000 or more miles, 6,000 or more miles, 7000 or more miles, or 10,000 or more miles without stopping.

**[0095]** In another example, Category A may include airports capable of receiving planes weighing more than about 200,000 pounds, 250,000 pounds, 300,000 pounds, 350,000 pounds, 400,000 pounds, 450,000 pounds, 500,000 pounds, 550,000 pounds, 600,000 pounds, 650,000 pounds, 700,000 pounds. Category B may include airports not capable of receiving planes with weights as described herein. For example, Category B may include airports not capable of receiving planes weighing more than about 200,000 pounds, 250,000 pounds, 300,000 pounds, 350,000 pounds, 400,000 pounds, 450,000 pounds, 500,000 pounds, 550,000 pounds, 600,000 pounds, 650,000 pounds, 700,000 pounds.



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**[0096]** In some implementations, Category A may include airports capable of receiving planes longer than about 3,000 feet, 4,000 feet, 5,000 feet, 6,000 feet, 7,000 feet, 8,000 feet, 9,000 feet, 10,000 feet, or 12,000 feet in length. Category B may include airports not capable of receiving planes with lengths as described herein. For example, Category B may include airports not capable of receiving planes longer than about 3,000 feet, 4,000 feet, 5,000 feet, 6,000 feet, 7,000 feet, 8,000 feet, 9,000 feet, 10,000 feet, or 12,000 feet in length.

**[0097]** Different flight rules or restrictions may apply for each category of flight-restricted region. In one example, Category A locations may have stronger flight restrictions than Category B locations. For example, Category A may have a larger flight-restricted region than Category B. Category A may require more rapid response by a UAV than Category B. For instance, Category A may automatically start causing a UAV to land at a farther distance from the Category A location than Category B would require.

**[0098]** One or more Category A flight restricted region **270a** may be provided, and one or more Category B flight restricted regions **270b, 270c** may be provided. Different flight rules may be provided for each category. The flight rules within the same category may be the same.

**[0099]** Category A locations may impose flight restriction rules, such as those described elsewhere herein. In one example, Category A may impose flight restriction rules such as those illustrated in **FIG. 3**. A UAV may not be able to take off within a first flight-restricted proximity zone. The UAV may be able to freely fly beneath a flight ceiling of a second flight-restricted proximity zone. If the UAV is above the flight ceiling and within the second flight-restricted proximity zone, the UAV may be forced to descent to beneath the flight ceiling. An alert may be provided if the UAV is within a third flight-restricted proximity zone.

**[00100]** Category B locations may impose different flight restriction rules from Category A.



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**[00101]** Examples of flight restriction rules for Category B may include those described elsewhere herein.

**[00102]** In some instances, for Category B locations, a first flight-restricted proximity zone may be provided, with the category B location **270b, 270c** located therein. In one example, the first flight-restricted proximity zone may include anything within a first radius of the airport. For example, the first flight-restricted proximity zone may include anything within 0.6 miles (or about 1 km) of the airport. The first flight-restricted proximity zone may have a substantially circular shape, including anything within the first radius of the airport. The flight-restricted proximity zone may have any shape. If a UAV is located within the first flight-restricted proximity zone, a first flight response measure may be taken. For example, if the UAV is within 0.6 miles of the airport, the UAV may automatically land. The UAV may automatically land without any input from an operator of the UAV, or may incorporate input from the operator of the UAV. The UAV may automatically start decreasing in altitude. The UAV may decrease in altitude at a predetermined rate, or may incorporate location data in determining the rate at which to land. The UAV may find a desirable spot to land, or may immediately land at any location. The UAV may or may not take input from an operator of the UAV into account when finding a location to land. The first flight response measure may be a software measure to prevent users from being able to fly near an airport. An immediate landing sequence may be automatically initiated when the UAV is in the first flight-restricted proximity zone. The UAV may not be able to take off if within the first flight-restricted proximity zone.

**[00103]** A second flight-restricted proximity zone may be provided around an airport. The second flight-restricted proximity zone may include anything within a second radius of the airport. The second radius may be greater than the first radius. For example, the second flight-restricted



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proximity zone may include anything within 1.2 miles (or about 2 km) of the airport. In another example, the second flight-restricted proximity zone may include anything within 1.2 miles of the airport and also outside the first radius (e.g., 0.6 miles) of the airport. The second flight-restricted proximity zone may have a substantially circular shape including anything within the second radius of the airport, or a substantially ring shape including anything within the second radius of the airport and outside the first radius of the airport.

**[00104]** If the UAV is located within the second flight-restricted proximity zone, a second flight response measure may be taken. For example, if the UAV is within 1.2 miles of the airport and outside 0.6 miles of the airport (i.e., if the UAV is within about 0.6 miles or 1 km of the first radius), the UAV may send an alert to an operator of the UAV. Alternatively, if the UAV is anywhere within 1.2 miles of the airport, an alert may be provided. When the UAV is within the second flight-restricted proximity zone, the UAV may alert the user via any method described elsewhere herein. Such alerts may be provided in combination with other flight response measures or alone. A UAV may be able to take off from a second flight-restricted proximity zone.

**[00105]** Any numerical value used to describe the dimension of the first, and/or second flight-restricted proximity zones are provided by way of example only and may be interchanged for any other distance threshold value or dimension as described elsewhere herein.

**[00106]** As previously mentioned, any number of different types of categories may be provided, having their own set of rules. Different flight response measures may be taken for different categories. The different flight response measures may be provided in accordance with different boundaries for the flight-restricted regions. The same flight response measures may be taken for the same categories. The various categories may vary in size, shape, and the like. Flight-restricted regions belonging to various categories may be located anywhere within the world. Information

about such flight restricted regions and different categories may be stored in memory locally on-board the UAV. Updates to the information stored on-board the UAV may be made. Categories may be assigned or may be determined based on data or characteristics of a flight restricted region. Such information may include updates in flight-restricted regions and/or categories to which the flight-restricted regions belong. Such information may also include flight response measures for different flight-restricted regions and/or categories.

**[00107]** A user may set up waypoints for flight of a UAV. A UAV may be able to fly to a waypoint. The waypoints may have predefined location (e.g., coordinates). Waypoints may be a way for UAVs to navigate from one location to another or follow a path. In some instances, users may enter waypoints using a software. For example, a user may enter coordinates for way points and/or use a graphical user interface, such as a map, to designate waypoints. In some embodiments, waypoints may not be set up in flight-restricted regions, such as airports. Waypoints may not be set up within a predetermined distance threshold of a flight-restricted region. For example, waypoints may not be set up within a predetermined distance of an airport. The predetermined distance may be any distance value described elsewhere herein, such as 5 miles (or 8 km).

**[00108]** A waypoint may or may not be permitted outside a flight-restricted proximity zone. In some instances, a waypoint may be permitted beneath a flight ceiling within a predetermined distance of a flight-restricted region. Alternatively, a waypoint may not be permitted beneath a flight ceiling within a predetermined distance of a flight-restricted region. In some instances, a map showing information about waypoints and waypoint safety rules may be provided.

**[00109]** While flight restricted proximity zones having a substantially circular or ring shape have been described primarily herein, flight restricted zones may have any shape as previously



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mentioned, to which the measures described herein are equally applicable. It may be desirable to provide a flight restriction zone having an irregular shape in many instances. For example, a flight restriction zone having a regular shape such as a round shape or a rectangular shape may be over or under inclusive (e.g., **FIG. 7**).

**[00110] FIG. 5** provides a flight restriction zone having a regular shape **200D** and an irregular shape **202d**. **FIG. 5** may be representative of a flight restriction zone imposed near boundaries of a region **210d** (e.g., near a national border or at boundaries of an airport or boundary of an airport runway). Boundaries may be provided between any two regions. The regions may include different flight restrictions, if any. The boundary may be a closed boundary enclosing a region or an open boundary that does not enclose a region. For example, a closed boundary may be a boundary around an airport (e.g., enclosing the airport). For example, an open boundary may be a shoreline between the land and a body of water. Jurisdictional boundaries may be provided between different jurisdictions (e.g., nations, states, provinces, cities, towns, properties, etc). For example, the boundary may be between two nations, such as the United States and Mexico. For example, the boundary may be between two states such as California and Oregon. A flight restriction zone may be provided to avoid crossing a boundary (e.g., a national border) such as boundary **210d**. For a flight restriction zone having a regular shape **200d** to cover a boundary **210d**, an area encompassing much more than the boundary may be covered, and the flight restriction zone may be over inclusive. For example, the flight restriction zone may be associated with one or more flight response measures. The flight response may be to prevent a UAV from entering the flight restriction zone. If flight is prohibited within the flight restriction zone, coordinates that should be freely navigable or accessible by the UAV such as **204d**, **206d**, and **208d** may be inaccessible due to the flight restriction zone **200d**.



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**[00111]** In contrast, a flight restriction zone having an irregular shape may closely mimic the desired boundary and allow the UAV to have greater freedom in navigating a region. A flight restriction zone having an irregular shape may be generated by a plurality of flight restricted elements having a regular shape. The flight restricted elements may be centered at points along the boundary, wherein the points are determined as mentioned further below in the application. For example, flight restriction zone **202d** is composed of a plurality of cylindrical flight restricted elements such as flight restricted element **203d**. For instance, a plurality of flight restricted elements having a regular shape may overlap one another to together form a flight restriction zone having an irregular shape. This may permit tracing a boundary or filling in a region (e.g., enclosed region). The center points of the regular shapes may be along a boundary, within a boundary, or outside a boundary. The center points of the regular shapes may be spaced apart regularly or irregularly. However, the database required for storing such information and the computational power necessary to process such a plurality of flight restriction elements may be large. Alternatively, a flight restriction zone having an irregular shape may be composed of a plurality of flight restricted strips.

**[00112] FIG. 6** provides a flight restriction zone defined by a plurality of flight restricted strips (also referred to herein as flight restriction strips). The size or shape of the flight restriction zone may be selected based on a shape of the boundary. Data regarding a location of a boundary may be acquired using one or more processors. For example, the one or more processors may download (e.g., automatically or on command) a location or information regarding boundaries from a database, such as a third party data source. For example, a user may input data regarding the location of a boundary. In some instances, the user may be an authorized user, as described herein. Boundaries of a region may be represented as a collection of points connected by lines. The points



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along a boundary may be manually determined. In some instances, the points along a boundary may be manually controlled by an authorized user. The points along the boundary may be automatically determined. For example, one or more processors may select a plurality of points along the boundary. The points may be selected based on a shape of the boundary. The points along the boundary may be determined in advance or in real time. The points along the boundary may be determined based on coordinate points of the boundary (e.g., received through a local map of an environment). For example, the points along the boundary may be determined based on a change in the coordinate points (e.g., change in longitude and/or latitude) along the boundary. The points along the boundary may be equidistant from each other. The points along the boundary may be of unequal distance between each other. For example, boundary **210d** of **FIG. 5** may be represented as a collection of points and lines as shown in boundary **210e** of **FIG. 6**. Boundary **210e** is composed of five straight lines, each line having two end points. Each straight line of a boundary may be referred to herein as a flight restriction line. Each flight restriction line may represent a longitudinal axis of a flight restricted strip. For example, flight restriction line **205e** represents a longitudinal axis of flight restricted strip **206e**. A flight restricted strip may be generated from the points along the boundary that were determined using one or more processors.

**[00113]** The flight restricted strip may comprise a longitudinal axis and a lateral axis. The flight restricted strip may comprise a length and a width. In some instances, the length may be substantially equal to a length of the flight restriction line. In some instances, the width may be determined, e.g., by one or more processors based on parameters of the desired boundary or enclosure. Alternatively, the length may be predetermined or set based on other parameters (e.g., relevant provisions such as laws and regulations). In some instances, a flight restricted strip may comprise a length longer than a width. The length of the flight restricted strip is at least 10%, 25%,



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50%, 75%, 100%, 200%, 500%, or more longer than the width of the flight restricted strip. In some instances, the flight restricted strip may be defined by a length, a width, and one or more coordinates. The one or more coordinates may comprise a center coordinate of the flight restricted strip. Alternatively or in addition, the one or more coordinates may comprise other coordinate such as end coordinates along the longitudinal axis of the flight restriction line. In some instances, the flight restriction strip may further be defined by an orientation. The orientation may be comprise an angle, e.g., with respect to a given coordinate system. The angle may be equal to less than about 5 °, 10 °, 15 °, 30 °, 45 °, 60 °, 75 °, 90 °, 120 °, 150 °, or 180 °.

**[00114]** A flight restricted strip may be defined by one or more shapes, such as geometric shapes. For example, the geometric shapes may comprise circles and/or rectangles. In some instances, the geometric shapes may comprise an area encompassed by a first circle and a second circle and lines running tangent to the first circle and the second circle. In some instances, the geometric shapes may comprise any polygon or circular shapes.

**[00115]** One or more flight restricted strips may be used to generate and/or define a flight restriction zone as further described herein. For example, an area of the one or more flight restriction strips together may define a flight restriction zone. In some instances, the one or more flight restriction strips may enclose an area. The area enclosed by the one or more flight restriction strips may define a flight restriction zone. In some instances, an area outside of the region enclosed by the one or more flight restriction strips may define a flight restriction zone. The one or more flight restriction strips that generate or define the flight restriction zone may comprise same shapes, lengths, and/or widths. The one or more flight restriction strips that generate or define the flight restriction zone may comprise different shapes, lengths, and/or widths.



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**[00116]** In some instances, a flight-restricted strip may be defined by two circles each with a respective radius $R_1$ and $R_2$ and each respectively centered at the two end points of the flight restriction line. The two circles may be connected by two lines running tangent to the two circles. The area encompassed by the two circles and the tangent lines may represent a flight restricted strip. For example, flight restricted strip **206e** is defined by an area encompassed by a circle of radius $R_A$ centered at point A, a circle of radius $R_B$ centered at point B, and lines **208e** and **209e** tangent to the two circles. The two end points of the flight restriction line may be provided as a pair. Thus flight restricted strips may accurately mimic the intended boundary region and a flight restricted strip that is unintended (e.g., extending from point B to point C in **FIG. 6**) may not arise. While flight restricted strip **206e** is defined by two circles centered at points A and B, the circular shape is not meant to be limiting and it is to be understood that any shape may be used, such as a square, trapezoid, rectangle, etc. In such a case, the flight restricted zone may be defined by the shape centered at the two ends and two lines tangent to the two shapes.

**[00117]** Radius $R_1$ and $R_2$ may be configurable in a database. Radius $R_1$ and $R_2$ may or may not be equal. Radius $R_1$ and $R_2$ may be set to give the flight restricted strip a width. Radius $R_1$ and $R_2$ may be set at any desired radius. The radius may depend on the type of flight restricted region under consideration. For example, for a flight restricted region having to do with a national border, the radius may be about or less than 100km, 50km, 25km, 10km, 5km, 2km, or 1km. For example, for a flight restricted region having to do with boundaries of an airport, the radius may be about or less than 500m, 200m, 100m, 50m, 20m, 10m, or 5m. Alternatively or in conjunction, the radius may be selected based on a shape (e.g., angularities) of the boundary itself. For example, for a twisting or looping boundary, a larger radius may be selected to cover the whole loop. Alternatively or in conjunction, the radius may be selected based on real world considerations. For



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example, if there is a territorial dispute between two countries, a larger radius such as 100km may be set to ensure a broader area is covered by the flight restricted strip. Radius $R_1$ and $R_2$ may each be about or less than 50km, 25km, 10km, 5km, 2km, 1km, 500m, 200m, 100m, 50m, 20m, 10m, or 5m. The radius may give a width or a buffer such that the UAV cannot fly too close to the flight restricted region. For example, the radius may give a width or a buffer to the flight restricted strip such that a UAV cannot fly too close to a national border or an airport. Alternatively or in conjunction, the radius may be selected depending on parameters of a UAV that interact with flight restricted strips and/or flight restriction zones. For example, the radius may be selected based on velocity, acceleration, and/or deceleration capabilities of the UAV, e.g., to ensure that the UAV will be incapable of going past a width of the flight restriction strips.

**[00118]** The length of a flight restricted strip (e.g., length of line **205e** for flight restricted strip **206e**) may depend on the type of flight restricted region under consideration. For example, for a flight restricted region having to do with a national border, the length of each flight restricted strip may be about or less than 500km, 200km, 100km, 65km, 50km, 25km, 10km, 5km, 2km, or 1km. For example, for a flight restricted region having to do with boundaries of an airport, the length of each flight restricted strip may be about or less than 10,000ft, 5,000ft, 2,000ft, 1,000ft, 500ft, 200ft, or 100ft.Alternatively or in conjunction, the length of a flight restricted strip may be selected based on a shape of the boundary itself. For example, for a twisting or looping boundary, a smaller length may be selected to closely trace the boundary. The length of each flight restricted strip may be about or less than 500km, 200km, 100km, 65km, 50km, 25km, 10km, 5km, 2km, 1km, 2,000ft, 1,000ft, 500ft, 200ft, or 100ft.

**[00119]** A flight restriction line may have one or more flight restricted strips associated with it. For example, **FIG. 6** shows flight restriction line **212e** having two flight restricted strips **214e**,



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**216e** associated with it. Each flight restriction line may have one, two, three, four, five, or more flight restricted strips associated with it. A UAV may take a different flight response measure depending on the flight restricted strip it is in, substantially as described herein. For example, a UAV may be barred from laterally moving into flight restricted strip **214e**. If the UAV is within flight restricted strip **214e**, a first flight response measure may be taken (e.g., automatically land). If the UAV is within flight restricted strip **216e**, a second flight response may be taken (e.g. prompt an operator of the UAV to land within a predetermined time period). The flight response measure may affect operation of the UAV. The flight response measure may take control of the UAV away from the user, may provide a user limited time to take corrective action before taking control of the UAV away from the user, impose an altitude restriction, and/or may provide an alert or information to the UAV.

**[00120]** A flight restricted strip may be abstracted (e.g., converted) into a feature circle for storing in a database. A feature circle may be defined by a center coordinate $C_F$ and a radius $R_F$. $C_F$ may be obtained by taking a center coordinate of the flight restriction line. $R_F$ may be obtained with the equation $R + \frac{L}{2}$ where R equals $\frac{R1+R2}{2}$, R1 is the radius of the first circle of the flight restricted strip, R2 is the radius of the second circle of the flight restricted strip, and L is the length of the flight restriction line. Thus, when R1=R2, a feature circle may be represented by a center coordinate, R, and L. The database required for storing such information and the computational power necessary to process a plurality of flight restricted strips may be small. The flight restricted strips may completely cover a boundary of a region. For example, the flight restricted strips may completely cover a border of a jurisdiction, such as the U.S.-Mexican border. The flight restriction zone (e.g., composed of a plurality of flight restricted strips) may cause a UAV to take a flight



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response. For example, the flight restricted region may prevent a UAV from crossing into the boundary of a region, may prevent a UAV from taking off in the boundary of a region, may force a UAV to land if it enters the flight restricted region, and the like.

**[00121]** In some instances, one or more flight restriction strips may define an enclosed area. The area may comprise convex portions. The area may comprise concave portions. In some instances, a polygon area may be defined by a plurality of flight restricted strips. For example, an area or a region that comprises 3, 4, 5, 6, 7, 8, 9, 10, or more vertices connected by lines may be defined by a plurality of flight restricted strips. For example a polygon area such as a triangular, rectangular, pentagonal, hexagonal, heptagonal, octagonal area may be defined by a plurality of flight restricted strips. In some instances, the number of flight restricted strips that can represent the polygon area may correspond to the number of vertices of the area. The polygon may be regular or irregular. A regular polygon may be equiangular and equilateral. An irregular polygon may not be equiangular and equilateral. The flight restriction strips as described herein may present an effective way of providing flight restriction zones around regions that can be defined by, or mimic, irregular polygon shapes.

**[00122]** Information regarding the one or more flight-restriction strips and/or the flight restriction zones may be stored on-board the UAV. Alternatively or in addition, information about the one or more flight-restriction strips and/or flight restriction zones may be accessed from a data source off-board the UAV. The information may comprise any information related to the flight restricted strips and/or zones. For example, the information may comprise a location of the one or more flight restriction strips or the zones. For example, the information may comprise a shape or size (e.g., length or width) of the flight restriction strips. For example, the information may comprise information regarding geometric shapes that define the one or more flight restriction trips. For



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example, the information may comprise a shape or size of the flight restriction zones. In some instances, if the Internet or another network is accessible, the UAV may obtain information regarding flight restriction strips and/or zones from a server online. The one or more flight-restriction strips or the flight restriction zones may be associated each with one or more flight response measures. The one or more flight response measures may be stored on-board the UAV. Alternatively or in addition, information about the one or more flight response measures may be accessed from a data source off-board the UAV. For example, if the Internet or another network is accessible, the UAV may obtain information regarding flight response measures from a server online. The location of the UAV may be determined as previously described herein. A position of the UAV relative to the one or more flight restriction strips or the flight restriction zone may be determined. Based on the positional information determined, one or more flight response measures may be taken. For example, if the UAV is within the flight restriction zone, the UAV may automatically land. If the UAV is near the flight restriction zone, the UAV may be prevented from entering the zone.

**[00123] FIG. 20** illustrates an irregular polygon area defined by a plurality of flight restricted strips, in accordance with embodiments. In some instances, the polygon area **2000** may be defined by several flight restriction lines, e.g., flight restriction lines **2002**, **2004**, **2006**, **2008**, and **2010**. The flight restriction lines may represent a boundary of a region where providing a flight restriction zone is desired, e.g., region **2012**. The polygon area may be defined by any number of flight restriction lines and may comprise any shape, e.g., any polygonal shape. For example, the polygon area may be triangular, rectangular, pentagonal, hexagonal, heptagonal, or octagonal areas.

**[00124]** For example, in **FIG. 20**, the polygon area may be pentagonal region defined by five flight restriction lines **2002**, **2004**, **2006**, **2008**, and **2010.** Flight restricted lines (e.g., and



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corresponding flight restriction strips) of the same or differing lengths may define an enclosed area (e.g., pentagon region). Each of the five flight restriction lines may comprise end points. A flight restricted strip may be provided around each of the flight restriction lines as previously described herein, e.g., by selecting, or determining a relevant radius. In some instances, flight restricted strips of differing radii or widths may be used to enclose an area. Alternatively, flight restricted strips of the same radii or widths may be used to enclose the area. Each of the flight restricted strips may be defined by same shapes (e.g., the same geometric shapes such as circles and rectangles). In some instances, the shapes defining each of the flight restricted strips may comprise an area encompassed by a first circle and a second circle and lines running tangent to the first circle and the second circle. Alternatively, each of the flight restricted strips may be defined by different shapes (e.g., one flight restricted strip may comprise circles and rectangles while another flight restricted strip may be comprised of rectangles). While a region (e.g., boundary) that can be represented by an octagon is shown for illustrative purposes, it is to be understood that any region (e.g., enclosed or open, regular or irregular) may be represented by the flight restricted strips described herein.

**[00125]** The flight restricted strips may enclose an area, or a region **2012**. In some instances, end points of the flight restriction lines may overlap to enclose the region. Alternatively, end points of the flight restriction lines may not overlap. For example, an end point of one flight restriction line may overlap a mid-point (or any other region that is not an end point) to enclose the region. In some instances, flight restriction strips may connect together to form a loop, or overlap to enclose the region. In this case, the end points of the flight restriction lines may overlap, or may be sufficiently close without overlapping such that flight restriction strips still overlaps. In some instances, the flight strips may not overlap but may tangentially touch one another to enclose the



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region. In some instances, the shape of the flight restricted strips may be particular suited for forming an overlapping and/or enclosing a region. For example, a flight restricted strip comprising two circles at the end may be particularly suited for overlapping with other flight restricted strips comprising circles as the overlapping region may comprise a smooth region that is defined and/or calculated easily. For example, a flight restricted strip comprising a circle at an end may perfectly overlap with another flight restricted strip comprising a circle at an end (e.g., if ends of the flight restriction lines overlap and the width of the flight restriction strips are the same). For example, a coordinate and radius that defines one end circle of a first flight restricted strip may also define an end circle of a second flight restricted strip. For example, circle **2016** may represent a circle of a flight restricted strip **2018** but also a circle of a flight restricted strip **2020**.

**[00126]** The flight restricted strips **2018**, **2020**, **2022**, **2024**, and **2026** together may define a flight restriction zone. An area of, or within the flight restriction strips may be associated with flight response measures, previously described herein. In some instances, each area within the flight restricted strips **2018**, **2020**, **2022**, **2024**, and **2026** enclosing the region **2012** may be associated with a same set of flight response measures. For example, each of the five flight restriction strips may be associated with flight response measures that prevent a UAV from entering the flight restriction strips. Alternatively, different flight restriction strips may be associated with different flight response measures. For example, flight restricted strips **2018**, **2020**, **2022**, and **2024** may be associated with a flight response measures that prevent a UAV from entering the flight restriction strips while flight restriction strip **2026** may be associated with a flight response measure that sends an alert to an operator of the UAV while permitting flight within the flight restriction strip. In some instances, a UAV may be permitted to fly in regions outside of the flight restriction strips. For example, the UAV may be permitted to fly in regions **2012** and/or **2014**.



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**[00127]** In some instances, a flight restriction zone associated with flight response measures may be generated in region **2012** in association with the flight restriction strips. The flight restriction zone may be generated in region **2012** alternatively, or in addition to the flight restriction zone defined by the areas of the flight restriction strips themselves. In some instances, the area **2012** enclosed by the flight restricted strips may be associated with flight response measures. For example, whether a coordinate or position (e.g., UAV position) is within the enclosed area may be determined via graphical methods by utilizing information regarding the flight restriction strips, and a UAV may be caused to comply with flight response measures.

**[00128]** Only a limited number of flight restricted strips (e.g., enough to enclose an area) may be necessary to define a flight restriction zone enclosed by flight restriction strips. A limited number of flight restricted strips may be sufficient to define even large flight restriction zones. A small amount of data and/or processing capability may be necessary for calculating whether a position (e.g., UAV position) is within the enclosed region, e.g., due to use of a limited number flight restricted strips that is necessary. In some instances, defining a flight restriction zone by enclosing a region with flight restriction strips may be suitable for areas equal to or greater than about 100 $m^2$, 500 $m^2$, 1000 $m^2$, 2500 $m^2$, 5000 $m^2$, 10000 $m^2$, 20000 $m^2$, or 50000 $m^2$.

**[00129]** The area enclosed by the flight restricted strips may be associated with the same set of flight response measures as the surrounding flight restricted strips. For example, a UAV within region **2012** or any of the flight restriction strips may be prevented from taking off (e.g., even if not directly within a flight restricted strip). For example, a UAV that inadvertently, or through error, ends up in region **2012** or any of the flight restriction strips may be forced to land or be compelled to fly out of the region (e.g., the flight restriction zone). Alternatively, the area **2012** enclosed by the flight restriction strips may be associated with a different set of flight response



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measures than the flight restriction strips. For example, the flight restriction strips may be associated with a flight response measure that prevents a UAV from entering the flight restricted strips while the region enclosed by the flight restriction strips (e.g., flight restriction zone) may be associated with a flight response measure that compels a UAV to land when in the region **2012**.

**[00130]** In some instances, a flight restriction zone associated with flight response measures may be generated in an area outside the region enclosed by the flight restricted strips. The area outside the region enclosed by the flight restricted strips may herein be referred to as an outside region. The flight restriction zone may be generated in the outside region alternatively, or in addition to the flight restriction zone defined by the areas of the flight restriction strips themselves and/or the flight restriction zone in the region enclosed by the flight restriction strips. For example, a UAV in region **2014** may be prevented from taking off. For example, a UAV that inadvertently, or through error, ends up in region **2014** may be forced to land or be compelled to fly out of the region to region **2012**. In some instances, the flight restriction strips may provide an enclosed area **2012** in which the UAV is permitted to operate freely in. An area outside of the permitted area (e.g., enclosed area) may be associated with flight response measures that compel the UAV to abide by certain rules. In some instances, the area excluding the enclosed area **2012** may be associated with the same set of flight response measures as the flight restricted strips. Alternatively, the area excluding the enclosed area may be associated with a different set of flight response measures than the flight restriction strips.

**[00131]** In some instances, a plurality of flight restricted strips may fill a region. The region may be a polygonal area (e.g., regular or irregular) as previously described herein. The region may be a region enclosed by flight restricted strips, substantially as described in **FIG. 20.** Alternatively, the region may not be enclosed but may nevertheless be filled by a plurality of flight restricted



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strips. **FIG. 21** illustrates a plurality of flight restricted strips that fill an irregular polygon area, in accordance with embodiments. The irregular polygon area may have a complex shape **2100**. The plurality of flight restriction strips that fill the area may define a flight restriction zone associated with flight response measures. In some instances, whether a coordinate or position (e.g., UAV position) is within the flight restriction zone may be determined via iterative or recursive methods, e.g., iteratively or recursively determining whether a current point is within any one of the plurality of flight restriction strips that fill the area.

**[00132]** The flight restriction strips that fill the region may be substantially non-overlapping. Alternatively, the flight restriction strips that fill the region may be overlapping. In some instances, the flight restriction strips that fill the region may be substantially parallel. Alternatively, the flight restriction strips that fill the region may not be parallel and may be perpendicular to one another, or at arbitrary angles with respect to one another. In some instances, the flight restriction strips within the region may comprise rows and/or columns of flight restriction strips.

**[00133]** Each of the flight restriction strips within the region may comprise a same width. In some instances, different flight restriction strips within the region may comprise different widths. For example, the widths of each of the flight restriction strips may be defined by a shape of a region or parameters of UAV. Each of the flight restriction strips within the region may comprise different lengths. For example, the lengths of each of the flight restriction strips may be defined by a shape of a region. In some instances, each of the flight restriction strips within the region may comprise a same length. Each of the flight restriction strips within the region may be defined by the same geometric shapes, e.g., circles at ends and a rectangular midsection. I some instances, different flight restriction strips within the region may be defined by different geometric shapes.



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**[00134]** In some instances, the flight restriction strips may divide the region **2100** into a plurality of sections. In some instances, a flight restriction zone may be provided within at least one of the plurality of sections. In some instances, the flight restriction strips may form one or more sectional lines (e.g., dividing lines) in the region. The region **2100** may be divided into different sections depending on the sectional lines. For example, flight restriction strip **2102** may be an example of a sectional line. In some instances, different flight restriction zones (e.g., associated with different flight response measures) may be provided on different sides of the sectional line. In some instances, a flight restriction zone may be provided in at least one of the plurality of sections on a side of the sectional line. The flight restricted strips may completely fill a region, e.g., as shown in **FIG. 21**. Alternatively, there may be areas not covered by flight restriction strips within the region.

**[00135]** In some instances, different flight restriction strips within the region **2100** may be associated with a same set of flight response measures. Alternatively, different flight restriction strips within the region **2100** may be associated with different sets of flight response measures. For example, flight restriction strip **2104** may permit flight of the UAV while other flight restriction strips may prevent UAV flight. In some instances, the UAV may enter or exit only through select flight restriction strips within the flight restriction zone. For example, flight restriction strip **2104** may provide a single route to cross through region **2100**. While permitting flight or grounding flight have been primarily discussed herein, it is to be understood that the flight restriction strips may be associated with any of the flight response measures previously discussed herein, e.g., having to do with payload operation, sending an alert, etc.

**[00136]** Filling a flight restriction zone may be suitable for areas that comprise a relatively complex shape. Filling a flight restriction zone may be suitable for relatively complex shaped



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areas because there is no need to define and enclose an area with a set number of flight restricted strips. Filling a flight restriction zone may be suitable for relatively small areas compared to simply enclosing an area, e.g., due to data storage and processing loads required. In some instances, defining a flight restriction zone by filling a region with flight restriction strips may be suitable for areas equal to or less than about 100 $m^2$, 500 $m^2$, 1000 $m^2$, 2500 $m^2$, 5000 $m^2$, 10000 $m^2$, 20000 $m^2$, or 50000 $m^2$. In some instances, defining a flight restriction zone by filling a region may depend both on a complexity of a shape of the area and the size of the area. For example, the more complex the area is, the more suitable it may be to define a flight restriction zone by filling a region, even if the area is large.

**[00137]** In some instances, the flight response measures as referred to herein may depend upon characteristics or parameters associated with the UAV. For example, the flight response measures may depend upon a location and/or movement characteristics of the UAV. In some instances, flight response measures may be provided in association with flight restricted strips for UAVs outside the flight restriction strips. **FIG. 22** illustrates a method **2200** for controlling a UAV, in accordance with embodiments. In step **2201**, one or more flight restriction strips may be assessed. For example, a location of the flight restriction strips may be assessed. For example, other parameters of the flight restriction strips such as a size or shape of the flight restriction strips may be assessed.

**[00138]** The flight restriction strips may be substantially as described herein. For example, each flight restriction strip may be defined using one or more geometric shapes, e.g., circles, rectangles, etc. In some instances, the geometric shape may be an area encompassed by a first circle and a second circle and lines running tangent to the first circle and the second circle. The flight restriction strip may comprise a length and a width. The width may be determined as previously



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described herein. For example, a width of the flight restriction strip may be defined to ensure that a UAV interacting with the flight restriction strip does not encroach into a flight restriction zone. In some instances, a minimum width of the flight restriction strip may be defined to ensure that a UAV, which is flying at maximum level flight speed directly into a flight restriction zone, will not encroach into the flight restriction zone when a maximum brake, deceleration or reverse acceleration is applied.

**[00139]** In some instances, one or more flight restriction strips may generate the flight restriction zone. For example, a flight restriction zone may be generated by one or more flight restriction strips that trace a boundary or enclose an area, e.g., an irregular polygon area. In some instances, a plurality of flight restriction strips may connect together to form a loop (e.g., enclose an area). The plurality of flight restriction strips may overlap (e.g., at the ends) and enclose a region. The area or region enclosed by the flight restriction strips (e.g., the loop) may define a flight restriction zone. Alternatively, a flight restriction zone may be provided outside of the loop. In some instances, one or more flight restriction strips may substantially fill an area to generate the flight restriction zone. In some instances, one or more flight restriction strips may divide an area into a plurality of sections substantially as described with respect to **FIG. 21**. Different flight restriction zones may be provided within the area.

**[00140]** The flight restriction strips and/or flight restriction zones as referred herein may be generated with aid of one or more processors. The flight restriction zone may be generated using one or more flight restriction strips. The one or more processors may be off-board the UAV. For example, the flight restricted strips and/or zones may be generated at a database off board the UAV. In some instances, the flight restricted strips and/or zones may be generated at a server, e.g., cloud server. In some instances, the flight restricted strips and/or zones may be generated by



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a third party unaffiliated with a UAV that may interact with the flight restriction strips and/or zones. For example, the flight restricted strips and/or zones may be generated or mandated by a governmental entity. For example, the flight restricted strips and/or zones may be generated by a party providing a platform for generating and storing recommended flight restricted regions. In some instances, a UAV may desire to abide by the generated flight restricted strips and/or zones. In some instances, a UAV may desire to utilize the generated flight restricted strips and/or zones in imposing appropriate flight response measures. In some instances, the generated flight restriction strips and/or zones may be delivered to the UAV. For example, information about the flight restricted strips and/or zones may be delivered to a controller (e.g., flight controller) of the UAV. The UAV may be required to follow appropriate flight response measures associated with the flight restriction strips and/or zones in response to the delivered information. The information regarding the flight restriction strips and/or zones may be delivered from a third party or a government entity to the UAV. The information regarding the flight restricted strips and/or zones may be delivered to the UAV via wired connection and/or wireless connections. Alternatively, the flight restricted strips and/or zones may be generated with aid of one or more processors on-board the UAV. The information regarding the flight restricted strips and/or zones may be updated at any given interval, e.g., regular intervals or irregular intervals. For example, the information regarding the flight restricted strips and/or zones may be updated about or more often than every 30 minutes, every hour, every 3 hours, every 6 hours, every 12 hours, every day, every 3 days, every week, every 2 weeks, every 4 weeks, every month, every 3 months, every 6 months, or every year. The information regarding the flight restricted strips and/or zones may be uploaded to the UAV prior to UAV take off. In some instances, the information regarding the flight restricted region may be uploaded or updated during UAV flight.



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**[00141]** In step **2203**, a location and/or movement characteristic of the UAV may be assessed. In some instances, the location and/or movement characteristic of the UAV may be assessed relative to one or more flight restriction strips. For example, a location of the UAV may be assessed. The location may be assessed using any of the methods previously disclosed herein, e.g., via GPS. A movement characteristic of the UAV may be any characteristic associated with movement of the UAV. For example, the movement characteristic may comprise a minimum, average, and/or maximum velocity of the UAV. For example, the movement characteristic may comprise a minimum, average, and/or maximum acceleration of the UAV. In some instances, the movement characteristic may comprise braking capabilities of the UAV, e.g., minimum, average, and/or maximum deceleration of the UAV. In some instances, the movement characteristic may comprise a direction of travel of the UAV. The direction of travel may be assessed in two dimensional or three dimensional coordinates. In some instances, the movement characteristic may comprise a projected flight path of the UAV. For example, a movement characteristic of whether a UAV is directly flying towards a flight restriction strip or a flight restriction zone may be assessed.

**[00142]** In some instances, assessing the movement characteristic of the UAV relative to the one or more flight restriction strips may comprise detecting which of the one or more flight restriction strips the UAV is most likely to approach or intersect if no response is taken. For example, a direction or flight path of the UAV may be estimated or determined. The direction or flight path of the UAV may be compared to a location of the one or more flight restriction strips to determine which of the flight restriction strips the UAV is likely to approach. In some instances, assessing the movement characteristic of the UAV relative to the one or more flight restriction strips may comprise determining, or calculating, an estimated amount of time at which the UAV would approach the flight restriction strip. For example, based on the direction or flight path, a current



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UAV speed, and a location of the detected flight restriction strip that the UAV is most likely to approach, a time to approach may be calculated. In some instances, based on the estimated amount of time, the method **2200** may further comprise determining a time or distance at which the UAV will begin to experience a flight response measure prior to reaching the flight-restriction strip. For example, for a fast moving UAV headed towards a flight restriction strip, a flight response measure may be imposed when the UAV is further away from the flight restriction strip compared to a slow moving UAV headed towards the same flight restriction strip.

**[00143]** In some instances, the method **2200** may further comprise assessing the location of the UAV relative to a flight restriction zone based on the location of the UAV relative to the one or more flight restriction strips. Assessing the location of the UAV relative to the flight restriction zone may comprise assessing whether the location of the UAV is within a region surrounded by the one or more flight restriction strips forming a border or boundary of the region. In some instances, assessing the location of the UAV relative to the flight restriction zone may be based on graphical methods as previously described herein. In some instances, assessing the location of the UAV relative to the flight restriction zone may be based on recursive analysis of whether the location of the UAV is within one or more flight restriction strips that fill the flight restriction zone.

**[00144]** In step **2205**, one or more processors may direct the UAV to take one or more flight response measures. The one or more flight response measures may be based on the previously assessed location and/or movement characteristics of the UAV. The one or more flight response measures may comprise any of the flight response measures previously described herein. For example, the one or more flight response measures may include preventing the UAV from entering the one or more flight restriction strips. The one or more flight response measures may include



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providing an alert to the UAV that the UAV is approaching the one or more flight restriction strips. The one or more flight response measures may include causing the UAV to land. The one or more flight response measures may include causing the UAV to slow down. In some instances, the flight response measure may comprise decelerating the UAV. In some instances, the flight response measure may comprise changing a direction of a path of the UAV.

**[00145]** The one or more flight response measure may be taken when the UAV is within the one or more flight restriction strips. In some instances, the one or more flight response measures may be taken when the UAV is about to exit the one or more flight restriction strips. In some instances, the one or more flight response measure may be taken when the UAV is about to enter the one or more flight restriction strips. For example, the one or more flight response measure may be taken when the UAV is within a distance threshold of the one or more flight restriction strips. The distance may be a static distance threshold. In some instances, the distance may be a variable distance threshold based on the location and/or movement characteristics of the UAV, e.g., acceleration, velocity.

**[00146]** In some instances, an apparatus for controlling an unmanned aerial vehicle (UAV) may be provided for performing the method **2200**. The apparatus may comprise one or more controller running on one or more processors, individually or collectively configured to: assess one or more flight restriction strips; assess a location and/or movement characteristic of the UAV relative to the one or more flight restriction strips; and direct the UAV to take one or more flight response measure based on the location and/or movement characteristic of the UAV relative to the one or more flight restriction strips.

**[00147]** In some instances, a non-transitory computer readable medium for controlling an unmanned aerial vehicle (UAV) may be provided for performing the method **2200**. The non-

transitory computer readable medium may comprise code, logic, or instructions to: assess one or more flight-restriction strips; assess a location and/or movement characteristic of the UAV relative to the one or more flight-restriction strips; and direct the UAV to take one or more flight response measures based on the location and/or movement characteristic of the UAV relative to the one or more flight-restriction strips.

**[00148]** In some instances, an unmanned aerial vehicle (UAV) may be provided for performing the method **2200**. The UAV may comprise one or more propulsion units configured to effect flight of the UAV; and one or more processors that direct the UAV to take one or more flight response measures in response to an assessed location and/or movement characteristic of the UAV relative to one or more flight-restriction strips.

**[00149]** **FIG. 10** provides a schematic illustration of an unmanned aerial vehicle **300** in communication with an external device, **310** in accordance with an embodiment of the disclosure.

**[00150]** The UAV **300** may include one or more propulsion units that may control position of the UAV. The propulsion units may control the location of the UAV (e.g., with respect to up to three directions, such as latitude, longitude, altitude) and/or orientation of the UAV (e.g., with respect to up to three axes of rotation, such as pitch, yaw, roll). The propulsion units may permit the UAV to maintain or change position. The propulsion units may include one or more rotor blades that may rotate to generate lift for the UAV. The propulsion units may be driven by one or more actuators **350**, such as one or more motors. In some instances, a single motor may drive a single propulsion unit. In other examples, a single motor may drive multiple propulsion units, or a single propulsion unit may be driven by multiple motors.

**[00151]** Operation of one or more actuator **350** of the UAV **300** may be controlled by a flight controller **320**. The flight controller may include one or more processors and/or memory units.



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The memory units may include non-transitory computer readable media, which may comprise code, logic, or instructions for performing one or more steps. The processors may be capable of performing one or more steps described herein. The processors may provide the steps in accordance with the non-transitory computer readable media. The processors may perform location-based calculations and/or utilize algorithms to generate a flight command for the UAV.

**[00152]** The flight controller **320** may receive information from a receiver **330** and/or locator **340**. The receiver **330** may communicate with an external device **310**. The external device may be a remote terminal. The external device may be a control apparatus that may provide one or more sets of instructions for controlling flight of the UAV. A user may interact with the external device to issue instructions to control flight of the UAV. The external device may have a user interface that may accept a user input that may result in controlling flight of the UAV. Examples of external devices are described in greater detail elsewhere herein.

**[00153]** The external device **310** may communicate with the receiver **330** via a wireless connection. The wireless communication may occur directly between the external device and the receiver and/or may occur over a network, or other forms of indirect communication. In some embodiments, the wireless communications may be proximity-based communications. For example, the external device may be within a predetermined distance from the UAV in order to control operation of the UAV. Alternatively, the external device need not be within a predetermined proximity of the UAV. Communications may occur directly, over a local area network (LAN), wide area network (WAN) such as the Internet, cloud environment, telecommunications network (e.g., 3G, 4G), WiFi, Bluetooth, radiofrequency (RF), infrared (IR), or any other communications technique. In alternate embodiments, the communications between the external device and the receiver may occur via a wired connection.

**[00154]** Communications between the external device and the UAV may be two-way communications and/or one-way communications. For example, the external device may provide instructions to the UAV that may control the flight of the UAV. The external device may operate other functions of the UAV, such as one or more settings of the UAV, one or more sensors, operation of one or more payloads, operation of a carrier of the payload, or any other operations of the UAV. The UAV may provide data to the external device. The data may include information about the location of the UAV, data sensed by one or more sensors of the UAV, images captured by a payload of the UAV, or other data from the UAV. The instructions from the external device and/or data from the UAV may be transmitted simultaneously or sequentially. They may be transferred over the same communication channel or different communication channels. In some instances, instructions from the external device may be conveyed to the flight controller. The flight controller may utilize the flight control instructions from the external device in generating a command signal to one or more actuators of the UAV.

**[00155]** The UAV may also include a locator **340**. The locator may be used to determine a location of the UAV. The location may include a latitude, longitude, and/or altitude of the aerial vehicle. The location of the UAV may be determined relative to a fixed reference frame (e.g., geographic coordinates). The location of the UAV may be determined relative to a flight-restricted region. The location of the flight-restricted region relative to the fixed reference frame may be used to determine the relative locations between the UAV and the flight-restricted region. The locator may use any technique or later developed in the art to determine the location of the UAV. For example, the locator may receive a signal from an external location unit **345**. In one example, the locator may be a global positioning system (GPS) receiver and the external location unit may be a GPS satellite. In another example, the locator may be an inertial measurement unit (IMU),



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ultrasonic sensor, visual sensors (e.g., cameras), or communication unit communicating with an external location unit. The external location unit may include a satellite, tower, or other structure that may be capable of providing location information. One or more external location units may utilize one or more triangulation techniques in order to provide a location of the UAV. In some instances, the external location unit may be the external device **310** or other remote control device. The location of the external device may be used as the location of the UAV or to determine the location of the UAV. The location of the external device may be determined using a location unit within the external device and/or one or more base stations capable of determining the location of the external device. The location unit of the external device may use any of the techniques described herein including, but not limited to, GPS, laser, ultrasonic, visual, inertial, infrared, or other location sensing techniques. The location of an external device may be determined using any technique, such as GPS, laser ultrasonic, visual, inertial, infrared, triangulation, base stations, towers, relays, or any other technique.

**[00156]** In alternate embodiments, an external device or external location unit may not be needed to determine the location of the UAV. For instance, the IMU may be used to determine the location of the UAV. An IMU can include one or more accelerometers, one or more gyroscopes, one or more magnetometers, or suitable combinations thereof. For example, the IMU can include up to three orthogonal accelerometers to measure linear acceleration of the movable object along up to three axes of translation, and up to three orthogonal gyroscopes to measure the angular acceleration about up to three axes of rotation. The IMU can be rigidly coupled to the aerial vehicle such that the motion of the aerial vehicle corresponds to motion of the IMU. Alternatively the IMU can be permitted to move relative to the aerial vehicle with respect to up to six degrees of freedom. The IMU can be directly mounted onto the aerial vehicle, or coupled to a support structure mounted



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onto the aerial vehicle. The IMU may be provided exterior to or within a housing of the movable object. The IMU may be permanently or removably attached to the movable object. In some embodiments, the IMU can be an element of a payload of the aerial vehicle. The IMU can provide a signal indicative of the motion of the aerial vehicle, such as a position, orientation, velocity, and/or acceleration of the aerial vehicle (e.g., with respect to one, two, or three axes of translation, and/or one, two, or three axes of rotation). For example, the IMU can sense a signal representative of the acceleration of the aerial vehicle, and the signal can be integrated once to provide velocity information, and twice to provide location and/or orientation information. The IMU may be able to determine the acceleration, velocity, and/or location/orientation of the aerial vehicle without interacting with any external environmental factors or receiving any signals from outside the aerial vehicle. The IMU may alternatively be used in conjunction with other location determining devices, such as GPS, visual sensors, ultrasonic sensors, or communication units.

**[00157]** The location determined by the locator **340** may be used by the flight controller **320** in the generation of one or more command signal to be provided to the actuator. For instance, the location of the UAV, which may be determined based on the locator information, may be used to determine a flight response measure to be taken by the UAV. The location of the UAV may be used to calculate a distance between the UAV and the flight-restricted region. The flight controller may calculate the distance with aid of a processor. The flight controller may determine which flight response measure, if any, needs to be taken by the UAV. The flight controller may determine the command signal to the actuator(s), which may control the flight of the UAV.

**[00158]** The UAV's flight controller may calculate its own current location via the locator (e.g., GPS receiver) and the distance to the flight-restricted region (e.g., center of the airport location or



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other coordinates representative of the airport location). Any distance calculation known or later developed in the art may be used.

**[00159]** In one embodiment, the distance between the two points (i.e., UAV and flight-restricted region) may be calculated using the following technique. An Earth-centered, Earth-fixed (ECEF) coordinate system may be provided. The ECEF coordinate system may be a Cartesian coordinate system. It may represent positions as X, Y, and Z coordinates. Local East, North, Up (ENU) coordinates are formed from a plane tangent to the Earth's surface fixed to a specific location and hence it is sometimes known as a "local tangent" or "local geodetic" plane. The east axis is labeled *x*, the north *y* and the up *z*.

**[00160]** For navigation calculations, the location data (e.g., GPS location data) may be converted into the ENU coordinate system. The conversion may contain two steps:

**[00161]** The data can be converted from a geodetic system to ECEF.

$$X = (N(\phi) + h)cos\phi cos\lambda$$
$$Y = (N(\phi) + h)cos\phi sin\lambda$$
$$Z = (N(\phi)(1 - e^2) + h)sin\phi$$

**[00162]**

**[00163]** Where

$$N(\phi) = \frac{a}{\sqrt{1 - e^2 sin^2\phi}}$$

**[00164]**

**[00165]** *a* and *e* are the semi-major axis and the first numerical eccentricity of the ellipsoid respectively.

**[00166]** *N(Φ)* is called the Normal and is the distance from the surface to the Z-axis along the ellipsoid normal.



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**[00167]** The data in ECEF system may then be converted to the ENU coordinate system.

**[00168]** To transform data from the ECEF to the ENU system, the local reference may be chosen to the location when the UAV just receives a mission is sent to the UAV.

**[00169]**
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -sin\lambda_r & cos\lambda_r & 0 \\ -sin\phi_r cos\lambda_r & -sin\phi_r sin\lambda_r & cos\phi_r \\ cos\phi_r cos\lambda_r & cos\phi_r sin\lambda_r & sin\phi_r \end{bmatrix} \begin{bmatrix} X - X_r \\ Y - Y_r \\ Z - Z_r \end{bmatrix}$$

**[00170]** The calculations may employ the Haversine Formula, which may give that the distance between two points A and B on the Earth surface is:

**[00171]**
$$d_{A-B} = 2arcsin\left(\sqrt{sin^2\left(\frac{\Delta\phi}{2}\right) + cos\phi_A cos\lambda_B sin^2\left(\frac{\Delta\lambda}{2}\right)}\right) R_e$$

**[00172]** Where $\Delta\phi = \phi_A - \phi_B, \Delta\lambda = \lambda_A - \lambda_B$, and $R_e$ is the radius of the Earth.

**[00173]** If the UAV is continuously calculating the current position and the distance to thousands of potential flight-restricted regions, such as airports, a large amount of computational power may be used. This may result in slowing down operations of one or more processors of the UAV. One or more techniques to simplify and/or speed up the calculations may be employed.

**[00174]** In one example, the relative location and/or distance between the UAV and the flight-restricted region may be calculated at specified time intervals. For example, the calculations may occur every hour, every half hour, every 15 minutes, every 10 minutes, every 5 minutes, every 3 minutes, every 2 minutes, every minute, every 45 seconds, every 30 seconds, every 15 seconds, every 12 seconds, every 10 seconds, every 7 seconds, every 5 seconds, every 3 seconds, every second, every 0.5 seconds, or every 0.1 second. The calculations may be made between the UAV and one or more flight-restricted regions (e.g., airports).

**[00175]** In another example, every time the aircraft's location is first obtained (e.g., via GPS receiver), the relatively distant airports may be filtered out. For example, airports that are far away need not pose any concern for the UAV. In one example, flight-restricted regions outside a distance threshold may be ignored. For example, flight-restricted regions outside a flight range of a UAV may be ignored. For example, if the UAV is capable of flying 100 miles in a single flight, flight-restricted regions, such as airports, that are greater than 100 miles away when the UAV is turned on may be ignored. In some instances, the distance threshold may be selected based on the type of UAV or capability of UAV flight.

**[00176]** In some examples, the distance threshold may be about 1000 miles, 750 miles, 500 miles, 300 miles, 250 miles, 200 miles, 150 miles, 120 miles, 100 miles, 80 miles, 70 miles, 60 miles, 50 miles, 40 miles, 30 miles, 20 miles, or 10 miles. Removing remote flight-restricted regions from consideration may leave only a few nearby coordinates, every time calculate the distance to these points. For example, only several airports or other types of flight-restricted regions may be within the distance threshold from the UAV. For example, when a UAV is first turned on, only several airports may fall within a distance of interest to the UAV. The distance of the UAV relative to these airports may be calculated. They may be calculated continuously in real-time, or may be updated periodically at time intervals in response to detected conditions. By reducing the number of flight-restricted regions of interest, less computational power may be employed, and calculations may occur more quickly and free up other operations of the UAV.

**[00177]** **FIG. 11** provides an example of an unmanned aerial vehicle using a global positioning system (GPS) to determine the location of the unmanned aerial vehicle, in accordance with an embodiment of the disclosure. The UAV may have a GPS module. The GPS module may include a GPS receiver **440** and/or a GPS antenna **442**. The GPS antenna may pick up one or more signals

from a GPS satellite or other structure and convey the captured information to the GPS receiver. The GPS module may also include a microprocessor **425**. The microprocessor may receive information from the GPS receiver. The microprocessor may convey the data from the GPS receiver in a raw form or may process or analyze it. The microprocessor may perform calculations using the GPS receiver data and/or may provide location information based on the calculations.

**[00178]** The GPS module may be operably connected to a flight controller **420**. The flight controller of a UAV may generate command signals to be provided to one or more actuators of the UAV and thereby control flight of the UAV. Any connection may be provided between the GPS module and the flight controller. For example, a communication bus, such as a controller area network (CAN) bus may be used to connect the GPS module and the flight controller. The GPS receiver may receive data via the GPS antenna, and may communicate data to the microprocessor, which may communicate data to a flight controller via the communication bus.

**[00179]** The UAV may find a GPS signal prior to taking off. In some instances, once the UAV is turned on, the UAV may search for the GPS signal. If the GPS signal is found, the UAV may be able to determine its location prior to taking off. If the GPS signal is found before the UAV has taken off, it can determine its distance relative to one or more flight-restricted region. If the distance falls beneath a distance threshold value (e.g., is within a predetermined radius of the flight-restricted region) the UAV may refuse to take off. For example if the UAV is within a 5 mile range of an airport, the UAV may refuse to take off.

**[00180]** In some embodiments, if the UAV is unable to find the GPS signal prior to takeoff, it may refuse to takeoff. Alternatively, the UAV may take off, even if it unable to find the GPS signal prior to takeoff. In another example, if the flight controller cannot detect the presence of the GPS module (which may include the GPS receiver, GPS antenna and/or microprocessor), it may refuse



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to take off. Inability to obtain the GPS signal and inability to detect the presence of the GPS module may be treated as different situations. For example, the inability to obtain the GPS signal may not prevent the UAV from taking off if the GPS module is detected. This may be because a GPS signal may be received after the UAV has taken off. In some instances, increasing the altitude of the UAV or having fewer obstructions around the UAV may make it easier to receive a GPS signal, and as long as the module is detected and operational. If the UAV finds a GPS signal during flight, it can obtain its location and take emergency measures. Thus, it may be desirable to permit the UAV to take off when the GPS module is detected, regardless of whether a GPS signals detected prior to take off. Alternatively, the UAV may take off when the GPS signal is detected and may not take off when the GPS signal is not detected.

**[00181]** Some embodiments may rely on the aircraft GPS module to determine the location of the UAV. If the GPS module takes too long to successfully determine position, this will affect the capabilities of the flight. UAV flight functionality may be limited if the GPS module is inoperational or a GPS signal can not be detected. For example, a maximum altitude of the UAV may be lowered or a flight ceiling may be enforced if the GPS module is inoperational or the GPS signal can not be detected. In some instances, other systems and methods may be used to determine a location of the UAV. Other location techniques may be used in combination with GPS or in the place of GPS.

**[00182] FIG. 12** is an example of an unmanned aerial vehicle in communication with a mobile device, in accordance with an embodiment of the disclosure. The UAV may have a GPS module. The GPS module may include a GPS receiver **540** and/or a GPS antenna **542**. The GPS antenna may pick up one or more signals from a GPS satellite or other structure and convey the captured information to the GPS receiver. The GPS module may also include a microprocessor **525**. The



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microprocessor may receive information from the GPS receiver. The GPS module may be operably connected to a flight controller **520**.

**[00183]** In some instances, the flight controller **520** may be in communication with a communication module. In one example, the communication module may be a wireless module. The wireless module may be a wireless direct module **560** which may permit direct wireless communications with an external device **570**. The external device may optionally be a mobile device, such as a cell phone, smartphone, watch, tablet, remote controller, laptop, or other device. The external device may be a stationary device, e.g., personal computer, server computer, base station, tower, or other structure. The external device may be a wearable device, such as a helmet, hat, glasses, earpiece, gloves, pendant, watch, wristband, armband, legband, vest, jacket, shoe, or any other type of wearable device, such as those described elsewhere herein. Any description herein of a mobile device may also encompass or be applied to a stationary device or any other type of external device and vice versa. The external device may be another UAV. The external device may or may not have an antenna to aid in communications. For example, the external device may have a component that may aid in wireless communications. For example, direct wireless communications may include WiFi, radio communications, Bluetooth, IR communications, or other types of direct communications.

**[00184]** The communication module may be provided on-board the UAV. The communication module may permit one-way or two-way communications with the mobile device. The mobile device may be a remote control terminal, as described elsewhere herein. For example, the mobile device may be a smartphone that may be used to control operation of the UAV. The smartphone may receive inputs from a user that may be used to control flight of the UAV. In some instances, the mobile device may receive data from the UAV. For example, the mobile device may include



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a screen that may display images captured by the UAV. The mobile device may have a display that shows images captured by a camera on the UAV in real-time.

**[00185]** For example, one or more mobile devices **570**may be connected to the UAV via a wireless connection (e.g., WiFi) to be able to receive data from the UAV in real-time. For example, the mobile device may show images from the UAV in real-time. In some instances, the mobile device (e.g., mobile phone) can be connected to the UAV and may be in close proximity to the UAV. For example, the mobile device may provide one or more control signals to the UAV. The mobile device may or may not need to be in close proximity to the UAV to send the one or more control signals. The control signals may be provided in real-time. The user may be actively controlling flight of the UAV and may provide flight control signals to the UAV. The mobile device may or may not need to be in close proximity to the UAV to receive data from the UAV. The data may be provided in real-time. One or more image capture device of the UAV or other types of sensors may capture data, and the data may be transmitted to the mobile device in real-time. In some instances, the mobile device and UAV may be in close proximity, such as within about 10 miles, 8 miles, 5 miles, 4 miles, 3 miles, 2 miles, 1.5 miles, 1 mile, 0.75 miles, 0.5 miles, 0.3 miles, 0.2 miles, 0.1 miles, 100 yards, 50 yards, 20 yards, or 10 yards.

**[00186]** A location of the mobile device **570** may be determined. The mobile device location results can be transmitted to the UAV, because during flight, the mobile device and UAV distance will typically not be too far. The mobile device location may be used by the UAV as the UAV location. This may be useful when the GPS module is inoperational or not receiving a GPS signal. The mobile device may function as a location unit. The UAV can perform assessments using the mobile device location results. For example, if it is determined that the mobile device is at a particular set of coordinates or a certain distance from a flight-restricted region, that data may be



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used by the flight controller. The location of the mobile device may be used as the UAV location, and the UAV flight controller may perform calculations using the mobile device location as the UAV location. Thus, the calculated distance between the UAV and the flight-restricted region may be the distance between the mobile device and the flight-restricted region. This may be a viable option when the mobile device is typically close to the UAV.

**[00187]** The mobile device may be used to determine the location of the UAV in addition to or instead of using a GPS module. In some instances, the UAV may not have a GPS module and may rely on the mobile device for determining the UAV location. In other instances, the UAV may have a GPS module, but may rely on the mobile device when unable to detect a GPS signal using the GPS module. Other location determining for the UAV may be used in combination of instead of the techniques described herein.

**[00188]** **FIG. 13** is an example of an unmanned aerial vehicle in communication with one or more mobile devices, in accordance with an embodiment of the disclosure. The UAV may have a GPS module. The GPS module may include a GPS receiver **640** and/or a GPS antenna **642**. The GPS antenna may pick up one or more signals from a GPS satellite or other structure and convey the captured information to the GPS receiver. The GPS module may also include a microprocessor **625**. The microprocessor may receive information from the GPS receiver. The GPS module may be operably connected to a flight controller **620**.

**[00189]** In some instances, the flight controller **620** may be in communication with a communication module. In one example, the communication module may be a wireless module. The wireless module may be a wireless direct module **560** which may permit direct wireless communications with an external mobile device **570**. For example, direct wireless



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communications may include WiFi, radio communications, Bluetooth, IR communications, or other types of direct communications.

**[00190]** Alternatively, the wireless module may be a wireless indirect module **580** which may permit indirect wireless communications with an external mobile device **590**. Indirect wireless communication may occur over a network, such as a telecommunications/mobile network. The network may be the type of network that requires insertion of a SIM card to permit communications. The network may utilize 3G/4G or other similar types of communications. The UAV can use a mobile base station to determine the location of the mobile device. Alternatively, the mobile base station location may be used as the mobile device location and/or the UAV location. For example, the mobile base station may be a mobile phone tower, or other type of static or moving structure. Although this technique may not be precise as GPS, this error can be very, very small relative to distance thresholds described (e.g., 4.5 miles, 5 miles, and 5.5 miles). In some implementations, the UAV can use the Internet to connect to the user's mobile device, to obtain the mobile device's base station location. The UAV may communicate with the mobile device which may communicate with a base station, or the UAV may communicate directly with the base station.

**[00191]** The UAV may have both a wireless direct module and a wireless indirect module. Alternatively, the UAV may have only a wireless direct module, or only a wireless indirect module. The UAV may or may not have a GPS module in combination with the wireless module(s). In some instances, when multiple location units are provided, the UAV may have a preference of order. For example, if the UAV has a GPS module and the GPS module is receiving a signal, the UAV may preferably use the GPS signal to provide the location of the UAV without using communication modules. If the GPS module is not receiving a signal, the UAV may rely on a



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wireless direct or indirect module. The UAV may optionally first try a wireless direct module, but if unable to get a location may try to use the wireless indirect module to get a location. The UAV may have a preference for a location technique that has a higher likelihood of providing a more precise and/or accurate location of the UAV. Alternatively, other factors may be provided, such as location technique that uses less power or is more reliable (less likely to fail) may have a higher preference. In another example, the UAV may gather location data from multiple sources and may compare the data. For example, the UAV may use GPS data in conjunction with data from a communication module using the location of the mobile device or base station. The data may or may not be averaged or other calculations may be performed to determine the location of the UAV. Simultaneous location data gathering may occur.

**[00192] FIG. 14** provides an example of unmanned aerial vehicle **700** with an on-board memory unit **750**, in accordance with an aspect of the disclosure. The UAV may have a flight controller **720** which may generate one or more command signals to effect flight of the UAV. A location unit **740** may be provided. The location unit may provide data indicative of a location of the UAV. The location unit may be a GPS receiver, communication module receiving location data from an external device, ultrasonic sensor, visual sensor, IR sensor, inertial sensor, or any other type of device that may be useful for determining the location of the UAV. The flight controller may use the location of the UAV to generate the flight command signal.

**[00193]** The memory unit **750** may include data about location of one or more flight-restricted regions. For example, one or more on-board database or memory **755A** may be provided, storing lists of flight-restricted regions and/or their location. In one example, coordinates of various flight-restricted regions, such as airports, may be stored in the on-board memory of the UAV. In one example, the memory storage device may store latitude and longitude coordinates of many airports.



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All airports in the world, continent, country, or region of the world may be stored in the memory unit. Other types of flight-restricted regions may be stored. The coordinates may include only latitude and longitude coordinates, may further include altitude coordinates, or may include boundaries of flight-restricted regions. Thus information about flight-restricted regions, such as locations and/or associated rules, may be pre-programmed onto the UAV. In one example, every airport's latitude and longitude coordinates may be respectively stored as a "double" data type. For instance, every airport's position may occupy 16 bytes.

**[00194]** The UAV may be able to access the on-board memory to determine the location of flight-restricted regions. This may be useful in situations where a communication of a UAV may be inoperable or may have trouble accessing an external source. For instance, some communication systems may be unreliable. In some instances, accessing on-board stored information may be more reliable and/or may require less power consumption. Accessing on-board stored information may also be faster than downloading the information in real-time.

**[00195]** In some instances, other data may be stored on-board the UAV. For example, databases and/or memory **755B** may be provided about rules relating to the particular flight-restricted regions or different jurisdictions. For example, the memory may store information on-board about flight rules for different jurisdictions. For example, Country A may not permit a UAV to fly within 5 miles of an airport, while Country B may not permit a UAV to fly within 9 miles of an airport. In another example, Country A may not permit a UAV to fly within 3 miles of a school during school hours, while Country B has no restrictions on UAV flight near schools. In some instances, the rules may be specific to jurisdictions. In some instances the rules may be specific to flight-restricted regions, regardless of jurisdiction. For example, within Country A, Airport A may not permit UAV flight anywhere within 5 miles of the airport at all times, while Airport B may permit



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UAV flight near the airport from 1:00-5:00 A.M. The rules may be stored on-board the UAV and may optionally be associated with the relevant jurisdictions and/or flight-restricted regions.

**[00196]** The flight controller **720** may access the on-board memory to calculate a distance between the UAV and a flight-restricted region. The flight controller may use information from the location unit **740** as the location of the UAV, and may use information from the on-board memory **750** for the flight-restricted region location. A calculation of the distance between the UAV and flight-restricted region may be made by the flight controller, with aid of a processor.

**[00197]** The flight controller **720** may access on-board memory to determine a flight response measure to take. For example, the UAV may access the on-board memory about different rules. The location of the UAV and/or the distance may be used to determine the flight response measure to be taken by the UAV in accordance with the relevant rules. For example, if the location of the UAV is determined to be within Country A, and Airport A is nearby, the flight controller may review the rules for Country A and Airport A in determining the flight response measure to take. This may affect the command signal generated and sent to one or more actuators of the UAV.

**[00198]** The on-board memory **750** of the UAV may be updated. For example, a mobile device in communication with the UAV may be used for updates. When the mobile device and UAV are connected the on-board memory may be updated. The mobile device and the UAV may be updated via a wireless connection, such as a direct or indirect wireless connection. In one example, the connection may be provided via WiFi or Bluetooth. The mobile device may be used to control flight of the UAV and/or receive data from the UAV. Information such as flight-restricted regions, or locations/rules associated with the flight-restricted regions may be updated. Such updates may occur while the mobile device interacting with the UAV. Such updates may occur when the mobile



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device first connects with the UAV, at periodic time intervals, when events are detected, or continuously in real-time.

**[00199]** In another example, a wired connection may be provided between the UAV and an external device for providing updates to on-board memory. For example, a USB port or similar port on the UAV may be used to connect to a personal computer (PC), and may use PC software to update. In another example, the external device may be a mobile device, or other type of external device. The updates may occur when the UAV first connects to the external device, at periodic time intervals while the wired connection remains, when events are detected, or continuously in real-time while the wired connection remains.

**[00200]** An additional example may permit the UAV to have a communication device for accessing the Internet or other network. Every time the UAV starts, it can automatically check whether the on-board memory needs to be updated. For example, every time the UAV starts, it can automatically check whether information about flight-restricted regions needs to be updated. In some embodiments, the UAV only checks whether there are updates to be made upon being turned on. In other embodiments, the UAV may make checks periodically, upon detected events or commands, or continuously.

**[00201] FIG. 15** shows an example of an unmanned aerial vehicle **810** in relation to multiple flight-restricted regions **820a, 820b, 820c**, in accordance with an embodiment of the disclosure. For example, a UAV may be flying near several airports or other types of flight-restricted regions. The location of the flight-restricted regions may be stored on-board the UAV. Alternatively or in addition, the UAV may download or access the locations of the flight-restricted regions from off-board the UAV.



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**[00202]** A location of the UAV may be compared with the location of the flight restricted regions. Respective distances **d1, d2, d3** may be calculated. A flight response measure may be determined for the UAV with respect to the flight-restricted regions based on the distances. For example, the UAV **810** may be within a first radius of a first flight-restricted region **820A**, which may cause the UAV to take a first flight response measure. The UAV may be within a second radius of a second flight-restricted region **820B**, but may exceed the first radius. This may cause the UAV to take a second flight response measure.

**[00203]** In some instances, the UAV may be within distances to two or more flight-restricted regions such that it may receive instructions to perform two or more flight response measures. When two or more flight response measures are determined for the UAV, the responses for respective flight restricted regions may be simultaneously performed. For example, the UAV may be within a first radius of a flight-restricted region **820A**, which may cause the UAV to take a first flight measure and second radius of a flight restricted region **820B**, which may cause the UAV to take a second flight measure. In such a case, the UAV may perform both the first and second flight response measure. For example, if the UAV is within the first radius, the user may have a certain time period to operate the UAV and may be forced to land automatically after this this time period (e.g., the first flight response measure). Meanwhile, if the UAV is also within the second radius, the user may receive a warning on approaching a flight restricted zone.

**[00204]** In some instances, the flight response measures may have a hierarchy for performance, and a subset of the flight response measures may be performed. For example, the strictest flight response measure may be performed. For example, the UAV **810** may be at a distance **d1**, **d2**, and **d3** to flight restricted-regions **820A**, **820B**, and **820C**. The distance **d1**, **d2**, and **d3** may be within a first, second, and third radius that elicits a first, second, and third flight response measure. If the



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first flight response measure is to automatically land the UAV, the second flight response measure is to provide the user with a warning, and the third flight response measure is to decrease the allowable altitude of the UAV, only the first flight response measure may be performed.

**[00205]** In some instances, the UAV may be within distances to two or more flight restricted-regions that elicits a same flight response measure. If the UAV can comply with all flight response measures, the UAV may comply. If the UAV cannot comply with all flight response measures, the UAV determine a separate flight response measure to follow. For example, the UAV **810** may be at a distance **d1**, **d2**, and **d3** to flight restricted-regions **820A**, **820B**, and **820C**. The distance **d1**, **d2**, and **d3** may all be within a second radius that elicits a second flight response measure. The second flight response measure may be to fly the UAV away from the flight restricted regions **820A**, **820B**, and **820C**. The UAV may be unable to determine a flight path that enables it to fly away from all three flight restricted regions **820A**, **820B**, and **820C**. In such a case, the UAV may determine a separate flight response measure to follow. For example, the separate flight response measure may be to automatically land the UAV, or to give the user a predetermined period of time to operate the UAV before automatically landing the UAV. Alternatively, the second flight response measure may be to give a user a predetermined period of time to fly the UAV away from the flight restricted regions **820A**, **820B**, and **820C**. If the UAV remains in the same region after having been operated by the user, the flight measure may automatic land the UAV.

**[00206]** In some instances, different jurisdictions may have different UAV no-fly provisions. For example, different countries may have different rules and/or some rules may be more complicated depending on jurisdiction, and may need to be accomplished step by step. Examples of jurisdictions may include, but are not limited to continents, unions, countries, states/provinces, counties, cities, towns, private property or land, or other types of jurisdictions.



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**[00207]** The location of the UAV may be used to determine the jurisdiction within which the UAV is currently located and whole rules may apply. For example, GPS coordinates can be used to determine the country at which the UAV is located, and which laws apply. For example, Country A may prohibit flight of a UAV within 5 miles of an airport, while Country B may prohibit flight within 6 miles of an airport. Then after the aircraft obtains GPS coordinates, it can determine whether it is currently located within Country A or Country B. Based on this determination, it may assess whether the flight restrictions are in play within 5 miles or 6 miles, and may take a flight response measure accordingly.

**[00208]** For example, a boundary between jurisdictions **830** may be provided. The UAV may be determined to fall within Country A which is to the right of the boundary, based on the UAV location. Country B may be to the left of the boundary and may have different rules from Country A. In one example, the location of the UAV may be determined using any of the location techniques described elsewhere herein. Coordinates of the UAV may be calculated. In some instances, an on-board memory of the UAV may include boundaries for different jurisdiction. For example, the UAV may be able to access on-board memory to determine which jurisdiction the UAV falls within, based on its location. In other examples, information about the different jurisdictions may be stored off-board. For example, the UAV may communicate externally to determine which jurisdiction into which the UAV falls.

**[00209]** Rules associated with various jurisdictions may be accessed from on-board memory of the UAV. Alternatively, the rules may be downloaded or accessed from a device or network outside the UAV. In one example, Country A and Country B may have different rules. For example, Country A, within which the UAV **810** is located, may not permit UAVs to fly within 10 miles of an airport. Country B may not permit UAVs to fly within 5 miles of an airport. In



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one example, a UAV may currently have a distance **d2** 9 miles from Airport B **820B**. The UAV may have a distance **d3** 7 miles from Airport C **820C**. Since the UAV is in Country A, the UAV may need to take measures in response to its 9 mile proximity to Airport B, which falls within the 10 mile threshold. However, if the UAV was in Country B, no flight response measures may be required. Since Airport B is located in Country B, no flight response measure may be required by the UAV, since it is beyond the 5 mile threshold applicable in Country B.

**[00210]** Thus, the UAV may be able to access information about the jurisdiction into which the UAV falls and/or applicable flight rules for the UAV. The no-fly rules that are applicable may be used in conjunction with the distance/location information to determine whether a flight response measure is needed and/or which flight response measure should be taken.

**[00211]** An optional flight limitation feature may be provided for the UAV. The flight limitation feature may permit the UAV to fly only within a predetermined region. The predetermined region may include an altitude limitation. The predetermined region may include a lateral (e.g., latitude and/or longitude) limitation. The predetermined region may be within a defined three-dimensional space. Alternatively, the predetermined region may be within a defined two-dimensional space without a limitation in the third dimension (e.g., within an area without an altitude limitation).

**[00212]** The predetermined region may be defined relative to a reference point. For example, the UAV may only fly within a particular distance of the reference point. In some instances, the reference point may be a home point for the UAV. The home point may be an origination point for the UAV during a flight. For example, when the UAV takes off, it may automatically assign its home point as the take-off location. The home point may be a point that is entered or pre-programmed into the UAV. For example, a user may define a particular location as the home-point.



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**[00213]** The predetermined region may have any shape or dimension. For example, the predetermined region may have a hemi-spherical shape. For instance, any region falling within a predetermined distance threshold from a reference point may be determined to be within the predetermined region. The radius of the hemi-sphere may be the predetermined distance threshold. In another example, the predetermined region may have a cylindrical shape. For instance, any region falling within a predetermined threshold from a reference point laterally may be determined to be within the predetermined region. An altitude limit may be provided as the top of the cylindrical predetermined region. A conical shape may be provided for a predetermined region. As a UAV moves away laterally from the reference point, the UAV may be permitted to fly higher and higher (ceiling), or may have a higher and higher minimum height requirement (floor). In another example, the predetermined region may have a prismatic shape. For instance, any region falling within an altitude range, a longitude range, and a latitude range may be determined to be within the predetermined region. Any other shapes of predetermined region in which a UAV may fly may be provided.

**[00214]** In one example, one or more boundaries of the predetermined region may be defined by a geo-fence. The geo-fence may be a virtual perimeter for a real-world geographic area. The geo-fence may be pre-programmed or pre-defined. The geo-fence may have any shape. The geo-fence may include a neighborhood, or follow any boundary. Data about the geo-fence and/or any other predetermined region may be stored locally on-board the UAV. Alternatively, the data may be stored off-board and may be accessed by the UAV.

**[00215] FIG. 16** shows an example of a flight limitation feature in accordance with an embodiment of the disclosure. A reference point **850**, which may be a home point may be provided. The UAV may not be able to fly beyond a predetermined height **h**. The height may



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have any distance threshold limit as described elsewhere herein. In one example, the height may be no more than 1300 feet or 400 m. In other examples, the height limit may be less than or equal to about 50 feet, 100 feet, 200 feet, 300 feet, 400 feet, 500 feet, 600 feet, 700 feet, 800 feet, 900 feet, 1000 feet, 1100 feet, 1200 feet, 1300 feet, 1400 feet, 1500 feet, 1600 feet, 1700 feet, 1800 feet, 1900 feet, 2000 feet, 2200 feet, 2500 feet, 2700 feet, 3000 feet, 3500 feet, 4000 feet, 5000 feet, 6000 feet, 7000 feet, 8000 feet, 9000 feet, 10,000 feet, 12,000 feet, 15,000 feet, 20,000 feet, 25,000 feet, or 30,000 feet. Alternatively, the height limit may be greater than or equal to any of the height limits described.

**[00216]** The UAV may not be able to fly beyond a predetermined distance **d** relative to the reference point. The distance may have any distance threshold limit as described elsewhere herein. In one example, the height may be no more than 1 mile or 1.6 km. In other examples, the distance limit may be less than or equal to about 0.01 miles, 0.05 miles, 0.1 miles, 0.3 miles, 0.5 miles, 0.7 miles, 0.9 miles, 1 mile, 1.2 miles, 1.5 miles, 1.7 miles, 2 miles, 2.5 miles, 3 miles, 3.5 miles, 4 miles, 4.5 miles, 5 miles, 5.5 miles, 6 miles, 6.5 miles, 7 miles, 7.5 miles, 8 miles, 8.5 miles, 9 miles, 9.5 miles, 10 miles, 11 miles, 12 miles, 13 miles, 14 miles, 15 miles, 16 miles, 17 miles, 18 miles, 19 miles, 20 miles, 25 miles, 30 miles, 35 miles, 40 miles, 45 miles, 50 miles. Alternatively, the distance limit may be greater than or equal to any of the distance limits described. The distance limit may be greater than or equal to the height limit. Alternatively, the distance limit may be less than or equal to the height limit.

**[00217]** The predetermined region within which the UAV may fly may be a cylindrical region with the reference point **850** at the center of a circular cross-section **860**. The circular cross-section may have a radius that is the predetermined distance **d**. The height of the predetermined region may be the height **h**. The height of the predetermined region may be the length of the cylindrical



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region. Alternatively, any other shape, including those described elsewhere herein, may be provided.

**[00218]** The height and/or distance limits may be set to default values. A user may or may not be able to alter the default values. For example, a user may be able to enter in new values for the flight limitation dimensions. In some instances, a software may be provided that may assist the user in entering new flight limitation dimensions. In some instances, information about flight-restricted regions may be accessible and used to advise the user in entering flight limitation dimensions. In some instances, the software may prevent the user from entering particular flight limitation dimensions if they are in contradiction with one or more flight regulations or rules. In some instances, a graphical tool or aid may be provided which may graphically depict the flight limitation dimensions and/or shapes. For example, a user may see a cylindrical flight limitation region, and the various dimensions.

**[00219]** In some instances, flight regulations or rules may trump flight limitation dimensions set up by a user. For example, if a user defines a radius of 2 miles for an aircraft to fly, but there is an airport within 1 mile of the home point, the flight response measures pertaining to flight-restricted regions may apply.

**[00220]** The UAV may be able to fly freely within the predetermined flight limitation region. If the UAV is nearing an edge of the flight limitation region, an alert may be provided to a user. For example, if the UAV is within several hundred feet of the edge of the flight limitation region, the user may be alerted and given an opportunity to take evasive action. Any other distance threshold, such as those described elsewhere herein, may be used to determine whether the UAV is near the edge of the flight limitation region. If the UAV continues on to the edge of the flight limitation region, the UAV may be forced to turn around to stay within the flight limitation region.

Alternatively, if the UAV passes out of the flight limitation region, the UAV may be forced to land. A user may still be able to control the UAV in a limited manner but the altitude may decrease.

**[00221]** A UAV may determine where it is relative to the predetermined flight region using any location system as described elsewhere herein. In some instances, a combination of sensors may be used to determine a location of a UAV. In one example, the UAV may use GPS to determine its location, and follow the one or more flight rules as described herein. If the GPS signal is lost, the UAV may employ other sensors to determine its location. In some instances, the other sensors may be used to determine a local location of the UAV. If the GPS signal is lost, the UAV may follow a set of flight rules that may come into effect when the GPS signal is lost. This may include lowering the altitude of the UAV. This may include reducing the size of the predetermined region within which the UAV may fly. This may optionally including landing the UAV, and/or alerting the user of the loss of GPS connection for the UAV.

**[00222]** A flight limitation feature may be an optional feature. Alternatively, it may be built into a UAV. A user may or may not be able to turn the flight limitation feature on or off. Using a flight limitation feature may advantageously permit the UAV to fly freely within a known region. If anything were to happen to the UAV or the user lose visual sight or contact with the UAV, the user may be able to find the UAV more easily. Furthermore, the user may know that the UAV has not wandered into a flight-restricted region or other dangerous region. The flight limitation feature may also increase the likelihood that good communications will be provided between a remote controller and the UAV, and reduce likelihood of loss of control.

**[00223]** The systems, devices, and methods described herein can be applied to a wide variety of movable objects. As previously mentioned, any description herein of a UAV may apply to and be used for any movable object. Any description herein of a UAV may apply to any aerial vehicle.

A movable object of the present disclosure can be configured to move within any suitable environment, such as in air (e.g., a fixed-wing aircraft, a rotary-wing aircraft, or an aircraft having neither fixed wings nor rotary wings), in water (e.g., a ship or a submarine), on ground (e.g., a motor vehicle, such as a car, truck, bus, van, motorcycle, bicycle; a movable structure or frame such as a stick, fishing pole; or a train), under the ground (e.g., a subway), in space (e.g., a spaceplane, a satellite, or a probe), or any combination of these environments. The movable object can be a vehicle, such as a vehicle described elsewhere herein. In some embodiments, the movable object can be carried by a living subject, or take off from a living subject, such as a human or an animal. Suitable animals can include avines, canines, felines, equines, bovines, ovines, porcines, delphines, rodents, or insects.

**[00224]** The movable object may be capable of moving freely within the environment with respect to six degrees of freedom (e.g., three degrees of freedom in translation and three degrees of freedom in rotation). Alternatively, the movement of the movable object can be constrained with respect to one or more degrees of freedom, such as by a predetermined path, track, or orientation. The movement can be actuated by any suitable actuation mechanism, such as an engine or a motor. The actuation mechanism of the movable object can be powered by any suitable energy source, such as electrical energy, magnetic energy, solar energy, wind energy, gravitational energy, chemical energy, nuclear energy, or any suitable combination thereof. The movable object may be self-propelled via a propulsion system, as described elsewhere herein. The propulsion system may optionally run on an energy source, such as electrical energy, magnetic energy, solar energy, wind energy, gravitational energy, chemical energy, nuclear energy, or any suitable combination thereof. Alternatively, the movable object may be carried by a living being.



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**[00225]** In some instances, the movable object can be a vehicle. Suitable vehicles may include water vehicles, aerial vehicles, space vehicles, or ground vehicles. For example, aerial vehicles may be fixed-wing aircraft (e.g., airplane, gliders), rotary-wing aircraft (e.g., helicopters, rotorcraft), aircraft having both fixed wings and rotary wings, or aircraft having neither (e.g., blimps, hot air balloons). A vehicle can be self-propelled, such as self-propelled through the air, on or in water, in space, or on or under the ground. A self-propelled vehicle can utilize a propulsion system, such as a propulsion system including one or more engines, motors, wheels, axles, magnets, rotors, propellers, blades, nozzles, or any suitable combination thereof. In some instances, the propulsion system can be used to enable the movable object to take off from a surface, land on a surface, maintain its current position and/or orientation (e.g., hover), change orientation, and/or change position.

**[00226]** The movable object can be controlled remotely by a user or controlled locally by an occupant within or on the movable object. In some embodiments, the movable object is an unmanned movable object, such as a UAV. An unmanned movable object, such as a UAV, may not have an occupant onboard the movable object. The movable object can be controlled by a human or an autonomous control system (e.g., a computer control system), or any suitable combination thereof. The movable object can be an autonomous or semi-autonomous robot, such as a robot configured with an artificial intelligence.

**[00227]** The movable object can have any suitable size and/or dimensions. In some embodiments, the movable object may be of a size and/or dimensions to have a human occupant within or on the vehicle. Alternatively, the movable object may be of size and/or dimensions smaller than that capable of having a human occupant within or on the vehicle. The movable object may be of a size and/or dimensions suitable for being lifted or carried by a human. Alternatively, the movable



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object may be larger than a size and/or dimensions suitable for being lifted or carried by a human. In some instances, the movable object may have a maximum dimension (e.g., length, width, height, diameter, diagonal) of less than or equal to about: 2 cm, 5 cm, 10 cm, 50 cm, 1 m, 2 m, 5 m, or 10 m. The maximum dimension may be greater than or equal to about: 2 cm, 5 cm, 10 cm, 50 cm, 1 m, 2 m, 5 m, or 10 m. For example, the distance between shafts of opposite rotors of the movable object may be less than or equal to about: 2 cm, 5 cm, 10 cm, 50 cm, 1 m, 2 m, 5 m, or 10 m. Alternatively, the distance between shafts of opposite rotors may be greater than or equal to about: 2 cm, 5 cm, 10 cm, 50 cm, 1 m, 2 m, 5 m, or 10 m.

**[00228]** In some embodiments, the movable object may have a volume of less than 100 cm x 100 cm x 100 cm, less than 50 cm x 50 cm x 30 cm, or less than 5 cm x 5 cm x 3 cm. The total volume of the movable object may be less than or equal to about: 1 $cm^3$, 2 $cm^3$, 5 $cm^3$, 10 $cm^3$, 20 $cm^3$, 30 $cm^3$, 40 $cm^3$, 50 $cm^3$, 60 $cm^3$, 70 $cm^3$, 80 $cm^3$, 90 $cm^3$, 100 $cm^3$, 150 $cm^3$, 200 $cm^3$, 300 $cm^3$, 500 $cm^3$, 750 $cm^3$, 1000 $cm^3$, 5000 $cm^3$, 10,000 $cm^3$, 100,000 $cm^3$, 1 $m^3$, or 10 $m^3$. Conversely, the total volume of the movable object may be greater than or equal to about: 1 $cm^3$, 2 $cm^3$, 5 $cm^3$, 10 $cm^3$, 20 $cm^3$, 30 $cm^3$, 40 $cm^3$, 50 $cm^3$, 60 $cm^3$, 70 $cm^3$, 80 $cm^3$, 90 $cm^3$, 100 $cm^3$, 150 $cm^3$, 200 $cm^3$, 300 $cm^3$, 500 $cm^3$, 750 $cm^3$, 1000 $cm^3$, 5000 $cm^3$, 10,000 $cm^3$, 100,000 $cm^3$, 1 $m^3$, or 10 $m^3$.

**[00229]** In some embodiments, the movable object may have a footprint (which may refer to the lateral cross-sectional area encompassed by the movable object) less than or equal to about: 32,000 $cm^2$, 20,000 $cm^2$, 10,000 $cm^2$, 1,000 $cm^2$, 500 $cm^2$, 100 $cm^2$, 50 $cm^2$, 10 $cm^2$, or 5 $cm^2$. Conversely, the footprint may be greater than or equal to about: 32,000 $cm^2$, 20,000 $cm^2$, 10,000 $cm^2$, 1,000 $cm^2$, 500 $cm^2$, 100 $cm^2$, 50 $cm^2$, 10 $cm^2$, or 5 $cm^2$.

**[00230]** In some instances, the movable object may weigh no more than 1000 kg. The weight of the movable object may be less than or equal to about: 1000 kg, 750 kg, 500 kg, 200 kg, 150 kg,



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100 kg, 80 kg, 70 kg, 60 kg, 50 kg, 45 kg, 40 kg, 35 kg, 30 kg, 25 kg, 20 kg, 15 kg, 12 kg, 10 kg, 9 kg, 8 kg, 7 kg, 6 kg, 5 kg, 4 kg, 3 kg, 2 kg, 1 kg, 0.5 kg, 0.1 kg, 0.05 kg, or 0.01 kg. Conversely, the weight may be greater than or equal to about: 1000 kg, 750 kg, 500 kg, 200 kg, 150 kg, 100 kg, 80 kg, 70 kg, 60 kg, 50 kg, 45 kg, 40 kg, 35 kg, 30 kg, 25 kg, 20 kg, 15 kg, 12 kg, 10 kg, 9 kg, 8 kg, 7 kg, 6 kg, 5 kg, 4 kg, 3 kg, 2 kg, 1 kg, 0.5 kg, 0.1 kg, 0.05 kg, or 0.01 kg.

**[00231]** In some embodiments, a movable object may be small relative to a load carried by the movable object. The load may include a payload and/or a carrier, as described in further detail elsewhere herein. In some examples, a ratio of a movable object weight to a load weight may be greater than, less than, or equal to about 1:1. In some instances, a ratio of a movable object weight to a load weight may be greater than, less than, or equal to about 1:1. Optionally, a ratio of a carrier weight to a load weight may be greater than, less than, or equal to about 1:1. When desired, the ratio of an movable object weight to a load weight may be less than or equal to: 1:2, 1:3, 1:4, 1:5, 1:10, or even less. Conversely, the ratio of a movable object weight to a load weight can also be greater than or equal to: 2:1, 3:1, 4:1, 5:1, 10:1, or even greater.

**[00232]** In some embodiments, the movable object may have low energy consumption. For example, the movable object may use less than about: 5 W/h, 4 W/h, 3 W/h, 2 W/h, 1 W/h, or less. In some instances, a carrier of the movable object may have low energy consumption. For example, the carrier may use less than about: 5 W/h, 4 W/h, 3 W/h, 2 W/h, 1 W/h, or less. Optionally, a payload of the movable object may have low energy consumption, such as less than about: 5 W/h, 4 W/h, 3 W/h, 2 W/h, 1 W/h, or less.

**[00233] FIG. 17** illustrates an unmanned aerial vehicle (UAV) **900**, in accordance with embodiments of the present disclosure. The UAV may be an example of a movable object as described herein. The UAV **900** can include a propulsion system having four rotors **902**, **904**, **906**,



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and **908**. Any number of rotors may be provided (e.g., one, two, three, four, five, six, or more). The rotors, rotor assemblies, or other propulsion systems of the unmanned aerial vehicle may enable the unmanned aerial vehicle to hover/maintain position, change orientation, and/or change location. The distance between shafts of opposite rotors can be any suitable length **910**. For example, the length **910** can be less than or equal to 1 m, or less than equal to 5 m. In some embodiments, the length **910** can be within a range from 1 cm to7 m, from70 cm to 2 m, or from 5 cm to 5 m. Any description herein of a UAV may apply to a movable object, such as a movable object of a different type, and vice versa. The UAV may use an assisted takeoff system or method as described herein.

**[00234]** In some embodiments, the movable object can be configured to carry a load. The load can include one or more of passengers, cargo, equipment, instruments, and the like. The load can be provided within a housing. The housing may be separate from a housing of the movable object, or be part of a housing for a movable object. Alternatively, the load can be provided with a housing while the movable object does not have a housing. Alternatively, portions of the load or the entire load can be provided without a housing. The load can be rigidly fixed relative to the movable object. Optionally, the load can be movable relative to the movable object (e.g., translatable or rotatable relative to the movable object). The load can include a payload and/or a carrier, as described elsewhere herein.

**[00235]** In some embodiments, the movement of the movable object, carrier, and payload relative to a fixed reference frame (e.g., the surrounding environment) and/or to each other, can be controlled by a terminal. The terminal can be a remote control device at a location distant from the movable object, carrier, and/or payload. The terminal can be disposed on or affixed to a support platform. Alternatively, the terminal can be a handheld or wearable device. For example, the



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terminal can include a smartphone, tablet, laptop, computer, glasses, gloves, helmet, microphone, or suitable combinations thereof. The terminal can include a user interface, such as a keyboard, mouse, joystick, touchscreen, or display. Any suitable user input can be used to interact with the terminal, such as manually entered commands, voice control, gesture control, or position control (e.g., via a movement, location or tilt of the terminal).

**[00236]** The terminal can be used to control any suitable state of the movable object, carrier, and/or payload. For example, the terminal can be used to control the position and/or orientation of the movable object, carrier, and/or payload relative to a fixed reference from and/or to each other. In some embodiments, the terminal can be used to control individual elements of the movable object, carrier, and/or payload, such as the actuation assembly of the carrier, a sensor of the payload, or an emitter of the payload. The terminal can include a wireless communication device adapted to communicate with one or more of the movable object, carrier, or payload.

**[00237]** The terminal can include a suitable display unit for viewing information of the movable object, carrier, and/or payload. For example, the terminal can be configured to display information of the movable object, carrier, and/or payload with respect to position, translational velocity, translational acceleration, orientation, angular velocity, angular acceleration, or any suitable combinations thereof. In some embodiments, the terminal can display information provided by the payload, such as data provided by a functional payload (e.g., images recorded by a camera or other image capturing device).

**[00238]** Optionally, the same terminal may both control the movable object, carrier, and/or payload, or a state of the movable object, carrier and/or payload, as well as receive and/or display information from the movable object, carrier and/or payload. For example, a terminal may control the positioning of the payload relative to an environment, while displaying image data captured by



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the payload, or information about the position of the payload. Alternatively, different terminals may be used for different functions. For example, a first terminal may control movement or a state of the movable object, carrier, and/or payload while a second terminal may receive and/or display information from the movable object, carrier, and/or payload. For example, a first terminal may be used to control the positioning of the payload relative to an environment while a second terminal displays image data captured by the payload. Various communication modes may be utilized between a movable object and an integrated terminal that both controls the movable object and receives data, or between the movable object and multiple terminals that both control the movable object and receives data. For example, at least two different communication modes may be formed between the movable object and the terminal that both controls the movable object and receives data from the movable object.

**[00239]** **FIG. 18** illustrates a movable object **1000** including a carrier **1002** and a payload **1004**, in accordance with embodiments. Although the movable object **1000** is depicted as an aircraft, this depiction is not intended to be limiting, and any suitable type of movable object can be used, as previously described herein. One of skill in the art would appreciate that any of the embodiments described herein in the context of aircraft systems can be applied to any suitable movable object (e.g., an UAV). In some instances, the payload **1004** may be provided on the movable object **1000** without requiring the carrier **1002**. The movable object **1000** may include propulsion mechanisms **1006**, a sensing system **1008**, and a communication system **1010**.

**[00240]** The propulsion mechanisms **1006** can include one or more of rotors, propellers, blades, engines, motors, wheels, axles, magnets, or nozzles, as previously described. The movable object may have one or more, two or more, three or more, or four or more propulsion mechanisms. The propulsion mechanisms may all be of the same type. Alternatively, one or more propulsion



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mechanisms can be different types of propulsion mechanisms. The propulsion mechanisms **1006** can be mounted on the movable object **1000** using any suitable means, such as a support element (e.g., a drive shaft) as described elsewhere herein. The propulsion mechanisms **1006** can be mounted on any suitable portion of the movable object **1000**, such on the top, bottom, front, back, sides, or suitable combinations thereof.

**[00241]** In some embodiments, the propulsion mechanisms **1006** can enable the movable object **1000** to take off vertically from a surface or land vertically on a surface without requiring any horizontal movement of the movable object **1000** (e.g., without traveling down a runway). Optionally, the propulsion mechanisms **1006** can be operable to permit the movable object **1000** to hover in the air at a specified position and/or orientation. One or more of the propulsion mechanisms **1000** may be controlled independently of the other propulsion mechanisms. Alternatively, the propulsion mechanisms **1000** can be configured to be controlled simultaneously. For example, the movable object **1000** can have multiple horizontally oriented rotors that can provide lift and/or thrust to the movable object. The multiple horizontally oriented rotors can be actuated to provide vertical takeoff, vertical landing, and hovering capabilities to the movable object **1000**. In some embodiments, one or more of the horizontally oriented rotors may spin in a clockwise direction, while one or more of the horizontally rotors may spin in a counterclockwise direction. For example, the number of clockwise rotors may be equal to the number of counterclockwise rotors. The rotation rate of each of the horizontally oriented rotors can be varied independently in order to control the lift and/or thrust produced by each rotor, and thereby adjust the spatial disposition, velocity, and/or acceleration of the movable object **1000** (e.g., with respect to up to three degrees of translation and up to three degrees of rotation).



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**[00242]** The sensing system **1008** can include one or more sensors that may sense the spatial disposition, velocity, and/or acceleration of the movable object **1000** (e.g., with respect to up to three degrees of translation and up to three degrees of rotation). The one or more sensors can include global positioning system (GPS) sensors, motion sensors, inertial sensors, proximity sensors, or image sensors. The sensing data provided by the sensing system **1008** can be used to control the spatial disposition, velocity, and/or orientation of the movable object **1000** (e.g., using a suitable processing unit and/or control module, as described below). Alternatively, the sensing system **1008** can be used to provide data regarding the environment surrounding the movable object, such as weather conditions, proximity to potential obstacles, location of geographical features, location of manmade structures, and the like.

**[00243]** The communication system **1010** enables communication with terminal **1012** having a communication system **1014** via wireless signals **1016**. The communication systems **1010**, **1014** may include any number of transmitters, receivers, and/or transceivers suitable for wireless communication. The communication may be one-way communication, such that data can be transmitted in only one direction. For example, one-way communication may involve only the movable object **1000** transmitting data to the terminal **1012**, or vice-versa. The data may be transmitted from one or more transmitters of the communication system **1010** to one or more receivers of the communication system **1012**, or vice-versa. Alternatively, the communication may be two-way communication, such that data can be transmitted in both directions between the movable object **1000** and the terminal **1012**. The two-way communication can involve transmitting data from one or more transmitters of the communication system **1010** to one or more receivers of the communication system **1014**, and vice-versa.



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**[00244]** In some embodiments, the terminal **1012** can provide control data to one or more of the movable object **1000**, carrier **1002**, and payload **1004** and receive information from one or more of the movable object **1000**, carrier **1002**, and payload **1004** (e.g., position and/or motion information of the movable object, carrier or payload; data sensed by the payload such as image data captured by a payload camera). In some instances, control data from the terminal may include instructions for relative positions, movements, actuations, or controls of the movable object, carrier and/or payload. For example, the control data may result in a modification of the location and/or orientation of the movable object (e.g., via control of the propulsion mechanisms **1006**), or a movement of the payload with respect to the movable object (e.g., via control of the carrier **1002**). The control data from the terminal may result in control of the payload, such as control of the operation of a camera or other image capturing device (e.g., taking still or moving pictures, zooming in or out, turning on or off, switching imaging modes, change image resolution, changing focus, changing depth of field, changing exposure time, changing viewing angle or field of view). In some instances, the communications from the movable object, carrier and/or payload may include information from one or more sensors (e.g., of the sensing system **1008** or of the payload **1004**). The communications may include sensed information from one or more different types of sensors (e.g., GPS sensors, motion sensors, inertial sensor, proximity sensors, or image sensors). Such information may pertain to the position (e.g., location, orientation), movement, or acceleration of the movable object, carrier and/or payload. Such information from a payload may include data captured by the payload or a sensed state of the payload. The control data provided transmitted by the terminal **1012** can be configured to control a state of one or more of the movable object **1000**, carrier **1002**, or payload **1004**. Alternatively or in combination, the carrier **1002** and payload **1004** can also each include a communication module configured to communicate with



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terminal **1012**, such that the terminal can communicate with and control each of the movable object **1000**, carrier **1002**, and payload **1004** independently.

**[00245]** In some embodiments, the movable object **1000** can be configured to communicate with another remote device in addition to the terminal **1012**, or instead of the terminal **1012**. The terminal **1012** may also be configured to communicate with another remote device as well as the movable object **1000**. For example, the movable object **1000** and/or terminal **1012** may communicate with another movable object, or a carrier or payload of another movable object. When desired, the remote device may be a second terminal or other computing device (e.g., computer, laptop, tablet, smartphone, or other mobile device). The remote device can be configured to transmit data to the movable object **1000**, receive data from the movable object **1000**, transmit data to the terminal **1012**, and/or receive data from the terminal **1012**. Optionally, the remote device can be connected to the Internet or other telecommunications network, such that data received from the movable object **1000** and/or terminal **1012** can be uploaded to a website or server.

**[00246] FIG. 19** is a schematic illustration by way of block diagram of a system **1100** for controlling a movable object, in accordance with embodiments. The system **1100** can be used in combination with any suitable embodiment of the systems, devices, and methods disclosed herein. The system **1100** can include a sensing module **1102**, processing unit **1104**, non-transitory computer readable medium **1106**, control module **1108**, and communication module **1110**.

**[00247]** The sensing module **1102** can utilize different types of sensors that collect information relating to the movable objects in different ways. Different types of sensors may sense different types of signals or signals from different sources. For example, the sensors can include inertial sensors, GPS sensors, proximity sensors (e.g., lidar), or vision/image sensors (e.g., a camera). The

sensing module **1102** can be operatively coupled to a processing unit **1104** having a plurality of processors. In some embodiments, the sensing module can be operatively coupled to a transmission module **1112** (e.g., a Wi-Fi image transmission module) configured to directly transmit sensing data to a suitable external device or system. For example, the transmission module **1112** can be used to transmit images captured by a camera of the sensing module **1102** to a remote terminal.

**[00248]** The processing unit **1104** can have one or more processors, such as a programmable processor (e.g., a central processing unit (CPU)). The processing unit **1104** can be operatively coupled to a non-transitory computer readable medium **1106**. The non-transitory computer readable medium **1106** can store logic, code, and/or program instructions executable by the processing unit **1104** for performing one or more steps. The non-transitory computer readable medium can include one or more memory units (e.g., removable media or external storage such as an SD card or random access memory (RAM)). In some embodiments, data from the sensing module **1102** can be directly conveyed to and stored within the memory units of the non-transitory computer readable medium **1106**.The memory units of the non-transitory computer readable medium **1106** can store logic, code and/or program instructions executable by the processing unit **1104** to perform any suitable embodiment of the methods described herein. For example, the processing unit **1104** can be configured to execute instructions causing one or more processors of the processing unit **1104** to analyze sensing data produced by the sensing module. The memory units can store sensing data from the sensing module to be processed by the processing unit **1104**.In some embodiments, the memory units of the non-transitory computer readable medium **1106** can be used to store the processing results produced by the processing unit **1104**.

**[00249]** In some embodiments, the processing unit **1104** can be operatively coupled to a control module **1108** configured to control a state of the movable object. For example, the control module **1108** can be configured to control the propulsion mechanisms of the movable object to adjust the spatial disposition, velocity, and/or acceleration of the movable object with respect to six degrees of freedom. Alternatively or in combination, the control module **1108** can control one or more of a state of a carrier, payload, or sensing module.

**[00250]** The processing unit **1104** can be operatively coupled to a communication module **1110** configured to transmit and/or receive data from one or more external devices (e.g., a terminal, display device, or other remote controller). Any suitable means of communication can be used, such as wired communication or wireless communication. For example, the communication module **1110** can utilize one or more of local area networks (LAN), wide area networks (WAN), infrared, radio, WiFi, point-to-point (P2P) networks, telecommunication networks, cloud communication, and the like. Optionally, relay stations, such as towers, satellites, or mobile stations, can be used. Wireless communications can be proximity dependent or proximity independent. In some embodiments, line-of-sight may or may not be required for communications. The communication module **1110** can transmit and/or receive one or more of sensing data from the sensing module **1102**, processing results produced by the processing unit **1104**, predetermined control data, user commands from a terminal or remote controller, and the like.

**[00251]** The components of the system **1100** can be arranged in any suitable configuration. For example, one or more of the components of the system **1100** can be located on the movable object, carrier, payload, terminal, sensing system, or an additional external device in communication with one or more of the above. Additionally, although **FIG. 19** depicts a single processing unit **1104** and a single non-transitory computer readable medium **1106**, one of skill in the art would



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appreciate that this is not intended to be limiting, and that the system **1100** can include a plurality of processing units and/or non-transitory computer readable media. In some embodiments, one or more of the plurality of processing units and/or non-transitory computer readable media can be situated at different locations, such as on the movable object, carrier, payload, terminal, sensing module, additional external device in communication with one or more of the above, or suitable combinations thereof, such that any suitable aspect of the processing and/or memory functions performed by the system **1100** can occur at one or more of the aforementioned locations.

**[00252]** While some embodiments of the present disclosure have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the disclosure. It should be understood that various alternatives to the embodiments of the disclosure described herein may be employed in practicing the disclosure. It is intended that the following claims define the scope of the disclosure and that methods and structures within the scope of these claims and their equivalents be covered thereby.

Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/AIA/424 (04-14)

# CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

| First Named Inventor: | Xinan XU | Nonprovisional Application Number (if known): | Not Yet Assigned |
|---|---|---|---|
| Title of Invention: | POLYGON SHAPED FLIGHT-RESTRICTION ZONES | | |

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ **Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ **Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

| Signature /John M. Wechkin/ | Date November 10, 2021 |
|---|---|
| Name (Print/Typed) John Wechkin | Practitioner Registration Number 42,216 |

***Note:*** *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☑ *Total of 1 forms are submitted.

PTO/AIA/15 (10-17)
Approved for use through 11/30/2020. OMB 0651-0032
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# UTILITY PATENT APPLICATION TRANSMITTAL

*(Only for new nonprovisional applications under 37 CFR 1.53(b))*

| | |
|---|---|
| *Attorney Docket No.* | 144604-8001.US00 |
| *First Named Inventor* | Xinan XU |
| *Title* | POLYGON SHAPED FLIGHT-RESTRICTION ZONES |
| *Priority Mail Express® Label No.* | |

## APPLICATION ELEMENTS

*See MPEP chapter 600 concerning utility patent application contents.*

1. [ ] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✓] **Specification** [*Total Pages* 104] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✓] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 22]
6. **Inventor's Oath or Declaration** [*Total Pages* ____] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [ ] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
7. [✓] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

## ADDRESS TO:

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

## ACCOMPANYING APPLICATION PAPERS

10. [ ] **Assignment Papers** (cover sheet & document(s))
    Name of Assignee _____
11. [ ] **37 CFR 3.73(c) Statement** [ ] **Power of Attorney** (*when there is an assignee*)
12. [ ] **English Translation Document** (*if applicable*)
13. [ ] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
14. [ ] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [✓] **Other:** Certification and Request for Prioritized Examination - Track 1

***Note**: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

## 19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 25096 **OR** [ ] Correspondence address below

| | | | | | |
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| Name | | | | | |
| Address | | | | | |
| City | | State | | Zip Code | |
| Country | | Telephone | | Email | |

| | | | |
|---|---|---|---|
| Signature | /John M. Wechkin/ | Date | Nov. 10, 2021 |
| Name (Print/Type) | John Wechkin | Registration No. (Attorney/Agent) | 42,216 |

This collection of information is required by 37 CFR 1.53(b). 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 1.11 and 1.14. This collection is estimated to take 12 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, 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.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

DocCode – SCORE

# SCORE Placeholder Sheet for IFW Content

Application Number: 17523847 Document Date: 11/10/2021

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

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Form Revision Date: March 1, 2019