

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:



Practitioners associated with Customer Number:

132059

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned, according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:



The address associated with Customer Number:

132059

OR

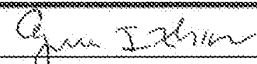
☐	Firm or Individual Name			
	Address			
	City	State	Zip	
	Country			
	Telephone	Email		

Assignee Name and Address: Brain Corporation
9401 Waples Street, Suite 100
San Diego, CA 92121

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	9/2/2016
Name	Dr. Eugene M. Izhikevich	Telephone	
Title	Co-founder, Chairman, and CEO of Brain Corporation		

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 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.

COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

CUSTOMER NO. 132059

CERTIFICATE OF ELECTRONIC
(EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1)(i)(C) from the Pacific Time Zone of the United States on the local date shown below.

Date: June 18, 2018

By: Peter J. Gutierrez, III
Peter J. Gutierrez, III; Reg. No. 56,732

U.S. CONTINUATION APPLICATION TRANSMITTAL

Examiner:

Transmitted herewith for filing is the patent Application of

Inventor(s): **BORJA IBARZ GABARDOS**

JEAN-BAPTISTE PASSOT

For: **SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS
NAVIGATION**

Enclosed are:

- (X) Application Data Sheet (7 pages);
- (X) A copy of the Declaration filed with the parent Application (3 pages);
- (X) Specification, including twenty (20) claims and Abstract, in thirty-six (36) pages;
- (X) Twelve (12) sheet(s) of drawings including thirteen (13) figures;
- (X) 3.73(c) Assignee Statement (2 pages); and
- (X) Power of Attorney (1 page).
- (X) This Application is a continuation of, and claims the benefit of priority to, co-owned and co-pending U.S. Patent Application Serial No. 15/341,612 of the same title filed November 2, 2016, the contents of which being incorporated herein by reference in its entirety.
- (X) Applicant claims small entity status. (See 37 CFR 1.27).

CLAIMS AS FILED

FOR	NUMBER FILED	NUMBER EXTRA	RATE	FEE
Basic Filing Fee			\$75	\$75
Utility Search Fee			\$330	\$330
Utility Examination Fee			\$380	\$380
Total Claims	20 - 20 =	-0- ×	\$ 50	\$0
Independent Claims	3 - 3 =	-0- ×	\$230	\$0
If application contains any multiple dependent claims(s), then add			\$410	\$0
TOTAL FILING FEE:				\$785

GAZDZINSKI & ASSOCIATES, PC

Dated: June 18, 2018

By: Peter J. Gutierrez, III/
Peter J. Gutierrez, III
Registration No. 56,732
Attorney of Record
16644 West Bernardo Drive, Suite 201
San Diego, CA 92127
Tel: (858) 675-1670
Fax: (858) 675-1674

Electronic Acknowledgement Receipt	
EFS ID:	32930378
Application Number:	16011499
International Application Number:	
Confirmation Number:	6846
Title of Invention:	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION
First Named Inventor/Applicant Name:	BORJA IBARZ GABARDOS
Customer Number:	132059
Filer:	Peter John Gutierrez III/Chrissie McGaw
Filer Authorized By:	Peter John Gutierrez III
Attorney Docket Number:	BRAIN.134C1/BC201609C1
Receipt Date:	18-JUN-2018
Filing Date:	
Time Stamp:	19:48:04
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	Application Data Sheet	ADS.pdf	1906501 10283f33959b0082220f9ddc0a65d7b6340c1499	no	7
Warnings:					

Information:					
This is not an USPTO supplied ADS fillable form					
2	Oath or Declaration filed	Dec.pdf	917522	no	3
			2436d87375008938fd7c23dae1903dd3f810b52f		
Warnings:					
Information:					
3	Specification	Spec.pdf	221503	no	36
			360b09b9b29d9504a01e4e14c5989f3643ffda52		
Warnings:					
Information:					
4	Drawings-only black and white line drawings	Figs.pdf	1500300	no	12
			eea91ff59d6e8294512bbeef423365a7ab68006a		
Warnings:					
Information:					
5	Assignee showing of ownership per 37 CFR 3.73	373_Statement.pdf	643964	no	2
			e47e82f21b2dd397e53e18c15fdd0902e3d28489		
Warnings:					
Information:					
6	Power of Attorney	POA_Brain.pdf	483945	no	1
			da07d920c96cba156b8359a4bc79e8e1438f0573		
Warnings:					
Information:					
7	Transmittal Letter	Trans_.pdf	395045	no	2
			42db6b57a4906e6aa244a3df624549597a9361df		
Warnings:					
Information:					
Total Files Size (in bytes):			6068780		

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.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Borja		Ibarz Gabardos		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	La Jolla	State/Province	CA	Country of Residence	US
Mailing Address of Inventor:					
Address 1	8011 Paseo del Ocaso				
Address 2					
City	La Jolla	State/Province	CA		
Postal Code	92037	Country	US		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Jean-Baptiste		Passot		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Solana Beach	State/Province	CA	Country of Residence	US
Mailing Address of Inventor:					
Address 1	930 Via Mil Cumbres, Unit #172				
Address 2					
City	Solana Beach	State/Province	CA		
Postal Code	92075	Country	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).
--

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		

☐ An Address is being provided for the correspondence information of this application.

Customer Number	132059		
Email Address	docket@gazpat.com	Add Email	Remove Email

Application Information:

Title of the Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		
Attorney Docket Number	BRAIN.134C1/BC201609C1	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	12	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:
☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	132059		

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
	Continuation of	15341612	2016-11-02	10001780	2018-06-19
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.					

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)¹ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

		Remove	
Application Number	Country ¹	Filing Date (YYYY-MM-DD)	Access Code ¹ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant 1			
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
Clear			
☐ Assignee	☐ Legal Representative under 35 U.S.C. 117	☐ Joint Inventor	
☒ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Brain Corporation		
Mailing Address Information For Applicant:			
Address 1	9401 Waples Street, Suite 100		
Address 2			
City	San Diego	State/Province	CA
Country	US	Postal Code	92121
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1	
		Application Number		
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION			

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is **not** checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Peter J. Gutierrez, III/		Date (YYYY-MM-DD)	2018-06-18
First Name	Peter	Last Name	Gutierrez	Registration Number
56.732				
Additional Signature may be generated within this form by selecting the Add button.				

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BRAIN.134C1/BC201609C1
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

COMBINED DECLARATION AND ASSIGNMENT FOR PATENT APPLICATIONS

Title of Invention: **SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION**

As a below named inventor (hereinafter designated as the undersigned), I hereby declare that:

This declaration is directed to the application attached hereto. If the application is not attached hereto, the application is as identified by the attorney docket number as set forth above and/or the following:

U.S. Application Serial No.: 15/341,612; or
PCT International Application No.: _____
Filed on: November 2, 2016

The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I have reviewed and understand the contents of the above-identified application, including the claims. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56.

WHEREAS, **BRAIN CORPORATION**, with its principal place of business at 9401 Waples Street, Suite 100, San Diego, CA 92121, its heirs, successors, legal representatives and assigns (hereinafter designated as the Assignee) is desirous of acquiring the entire right, title and interest in and to said invention and in and to any Letters Patent(s) that may be granted therefor in the United States of America and in any foreign countries.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the undersigned has sold, assigned and transferred, and by these presents does (do) sell, assign and transfer unto said Assignee the full and exclusive right to the said invention in the United States of America, its territories, dependencies and possessions and the entire right, title and interest in and to any and all Letters Patent(s) which may be granted therefor in the United States of America, its territories, dependencies and possessions, and if the box above is designated, in any and all foreign countries; and to any and all divisions, reissues, re-examinations, continuations, conversions and extensions thereof, and provisional applications to which priority is claimed therefrom, for the full term or terms for which the same may be granted.

The undersigned agrees to execute all papers necessary in connection with this application and any continuing, divisional, conversion, re-exam, provisional, or reissue applications thereof and also to execute separate assignments in connection with such applications as the Assignee may deem necessary or expedient.

The undersigned agrees to execute all papers necessary in connection with any interference which may be declared concerning this application or continuation, division, conversion, re-exam, provisional, or reissue thereof or Letters Patent(s) or reissue patent issued thereon and to cooperate with the Assignee in every way possible in obtaining and producing evidence and proceeding with such interference.

GAZDZINSKI & ASSOCIATES, PC
16644 West Bernardo Drive, Suite 201, San Diego, CA 92127
Telephone: (858) 675-1670 - Facsimile: (858) 675-1674 - Email: docket@gazpat.com

COMBINED DECLARATION AND ASSIGNMENT FOR PATENT APPLICATIONS

The undersigned agrees to execute all papers and documents and to perform any act which may be necessary in connection with claims or provisions of the International Convention for the Protection of Industrial Property or similar agreements.

The undersigned agrees to perform all affirmative acts which may be necessary to obtain a grant of (a) valid United States of America patent(s) or a grant of (a) valid United States of America and any foreign patent(s) to the Assignee and to vest all rights therein hereby conveyed to said Assignee as fully and entirely as the same would have been held by the undersigned if this Assignment and sale had not been made.

The undersigned hereby authorizes and requests the Patent and Trademark Office Officials in the United States of America and in any foreign countries to issue any and all Letters Patent(s) resulting from said application or any continuing, divisional conversion or reissue applications thereof to the said Assignee, as Assignee of the entire interest, and hereby covenants that he has the full right to convey the entire interest herein assigned, and that he has not executed, and will not execute, any agreement in conflict herewith.

The undersigned hereby grants the law firm of GAZDZINSKI & ASSOCIATES, PC, Customer No. 132059, the power to insert any further identification which may be necessary or desirable in order to comply with the rules of the U.S. Patent and Trademark Office.

The undersigned hereby covenants that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this assignment.

The undersigned hereby acknowledges that any willful false statement made in this declaration is punishable under 18 U.S.C. § 1001 by fine or imprisonment of not more than five (5) years, or both.

Executed by the undersigned on the date opposite the undersigned name.

LEGAL NAME OF INVENTOR

Inventor's Name: **BORJA IBARZ GABARDOS**

Date: 3/6/78

Signature: _____

An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use a separate form for each inventor; or check the box below and complete the attached page(s) to list additional inventors.

☒ Additional inventors are being named on the supplemental sheet attached hereto.

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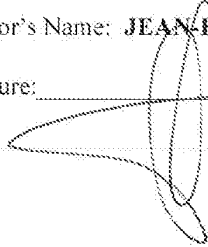
SUPPLEMENTAL SHEET FOR COMBINED DECLARATION AND ASSIGNMENT

LEGAL NAME OF JOINT INVENTOR, IF ANY

Inventor's Name: **JEAN-BAPTISTE PASSOT**

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A handwritten signature in black ink, appearing to be "JB Passot", written over a horizontal line.

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**SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN
AUTONOMOUS NAVIGATION**

Priority

[0001] This application is a continuation of, and claims the benefit of priority to, co-owned and co-pending U.S. Patent Application Serial No. 15/341,612 of the same title filed November 2, 2016, the contents of which being incorporated herein by reference in its entirety.

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Background

Technological Field

[0003] The present application relates generally to robotics, and more specifically to systems and methods for dynamic route planning in autonomous navigation.

Background

[0004] Robotic navigation can be a complex problem. In some cases, robots can determine a route to travel. By way of illustration, a robot can learn routes demonstrated by a user (e.g., the user can control a robot along a route and/or can upload a map containing a route). As another illustration, a robot can plan its own route in an environment based on its knowledge of the environment (e.g., a map). However, a challenge that can occur is that after a robot determines a route, features of the environment can change. For example, items can fall into the path of the route and/or parts of the environment can change. Current robots may not be able to make real time adjustments to its planned path in response to these changes

(e.g., blockages). In such situations, current robots may stop, collide into objects, and/or make sub-optimal adjustments to its route. Accordingly, there is a need for improved systems and methods for autonomous navigation, including systems and methods for dynamic route planning.

Summary

[0005] The foregoing needs are satisfied by the present disclosure, which provides for, *inter alia*, apparatus and methods for dynamic route planning in autonomous navigation. Example implementations described herein have innovative features, no single one of which is indispensable or solely responsible for their desirable attributes. Without limiting the scope of the claims, some of the advantageous features will now be summarized.

[0006] In a first aspect, a robot is disclosed. In one exemplary implementation, the robot includes: one or more sensors configured to collect data about an environment including detected points on one or more objects in the environment; and a controller configured to: create a map of the environment based at least in part on the collected data, determine a route in the map in which the robot will travel, generate one or more route poses on the route, wherein each route pose comprises a footprint indicative of poses of the robot along the route and each route pose has a plurality of points disposed therein, determine forces on each of the plurality of points of each route pose, the forces comprising repulsive forces from one or more of the detected points on the one or more objects and attractive forces from one or more of the plurality of points on others of the one or more route poses, reposition one or more route poses in response to the forces on each point of the one or more route poses, and perform interpolation between one or more route poses to generate a collision-free path between the one or more route poses for the robot to travel.

[0007] In one variant, the one or more route poses form a sequence in which the robot travels along the route; and the interpolation comprises a linear interpolation between sequential ones of the one or more route poses.

[0008] In another variant, the interpolation generates one or more interpolation route poses having substantially similar footprints to the footprint of each route pose. In another variant, the determination of the forces on each point of the one or more route poses further comprises computing a force function that associates, at least in part, the forces on each point of each route pose with one or more characteristics of objects in the environment.

[0009] In another variant, the one or more characteristics includes one or more of distance, shape, material, and color. In another variant, the force function associates zero repulsive force exerted by a first detected point on a first object where a distance between the first point and a second point of a first route pose is above a predetermined distance threshold.

[0010] In another variant, the footprint of each route pose has substantially similar size and shape as the footprint of the robot.

[0011] In another variant, the robot comprises a floor cleaner.

[0012] In a second aspect, a method for dynamic navigation of a robot is disclosed. In one exemplary implementation, the method includes: generating a map of the environment using data from one or more sensors; determining a route on the map, the route including one or more route poses, each route pose comprising a footprint indicative at least in part of a pose and a shape of the robot along the route and each route pose having a plurality of points disposed therein; computing repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses; repositioning the first route pose in response to at least the repulsive force; and performing an interpolation between the repositioned first route pose and another of the one or more route poses.

[0013] In one variant, determining attractive forces from a point on another of the one or more route poses exerted on the plurality of points of the first route pose. In another variant, detecting a plurality of objects in the environment with the one or more sensors, each of the plurality of objects having detected points; and defining a force function, the force function computing repulsive forces exerted by each of the detected points of the plurality of objects on the plurality of points of the first route pose, wherein each repulsive force is a vector.

[0014] In another variant, repositioning the first route pose includes calculating the minimum of the force function.

[0015] In another variant, the repositioning of the first route pose includes translating and rotating the first route pose.

[0016] In another variant, interpolation includes: generating an interpolation route pose having a footprint substantially similar to a shape of the robot; and determining a translation and rotation of the interpolation route pose based at least on a collision-free path

between the translated and rotated first route pose and the another of the one or more route poses.

[0017] In another variant, the method further comprising computing a magnitude of the repulsive forces as proportional to a distance between the point on the object and each of the plurality of points of the first route pose if the point on the object is outside of the footprint of the first route pose.

[0018] In another variant, computing a magnitude of the repulsive forces as inversely proportional to a distance between the point on the object and each of the plurality of points of the first route pose if the point on the object is inside the footprint of the first route pose.

[0019] In another variant, the method further includes computing the torque forces onto the plurality of points of the first route pose due to the repulsive forces.

[0020] In a third aspect, a non-transitory computer-readable storage apparatus is disclosed. In one embodiment, the non-transitory computer-readable storage apparatus has a plurality of instructions stored thereon, the instructions being executable by a processing apparatus to operate a robot. The instructions are configured to, when executed by the processing apparatus, cause the processing apparatus to: generate a map of the environment using data from one or more sensors; determine a route on the map, the route including one or more route poses, each route pose comprising a footprint indicative at least in part of a pose and a shape of the robot along the route and each route pose having a plurality of points disposed therein; and compute repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses.

[0021] In one variant, the instructions when executed by the processing apparatus, further cause the processing apparatus to determine attractive forces from a point on another of the one or more route poses exerted on the plurality of points of the first route pose.

[0022] In another variant, the instructions when executed by the processing apparatus, further cause the processing apparatus to determine torque forces from a point on another of the one or more route poses exerted on the plurality of points of the first route pose.

[0023] These and other objects, features, and characteristics of the present disclosure, as well as the methods of operation and functions of the related elements of structure and the combination of parts and economies of manufacture, will become more apparent upon

consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the disclosure. As used in the specification and in the claims, the singular form of “a”, “an”, and “the” include plural referents unless the context clearly dictates otherwise.

Brief Description of the Drawings

[0024] The disclosed aspects will hereinafter be described in conjunction with the appended drawings, provided to illustrate and not to limit the disclosed aspects, wherein like designations denote like elements.

[0025] FIG. 1 illustrates various side elevation views of exemplary body forms for a robot in accordance with principles of the present disclosure.

[0026] FIG. 2A is a diagram of an overhead view of a robot navigating a path in accordance with some implementations of this disclosure.

[0027] FIG. 2B illustrates an overhead view of a user demonstrating a route to a robot before the robot autonomously travels a route in an environment.

[0028] FIG. 3 is a functional block diagram of a robot in accordance with some principles of this disclosure.

[0029] FIG. 4A is a top view diagram illustrating the interaction between a robot and an obstacle in accordance with some implementations of this disclosure.

[0030] FIG. 4B is a diagram of a global layer, intermediate layer, and local layer in accordance with implementations of the present disclosure.

[0031] FIG. 4C is a process flow diagram of an exemplary method for dynamic route planning in accordance with some implementations of this disclosure.

[0032] FIG. 4D illustrates an overhead view of route poses along with repulsive forces exerted by objects in accordance with some implementations of the present disclosure.

[0033] FIG. 4E illustrates example points on a route pose in accordance with some implementations of the present disclosure.

[0034] FIG. 4F illustrates an overhead view showing attractive forces between route

poses in accordance with some implementations of the present disclosure.

[0035] FIG. 5 is an overhead view of a diagram showing interpolation between route poses in accordance with some implementations of this disclosure.

[0036] FIG. 6 is a process flow diagram of an exemplary method for operation of a robot in accordance with some implementations of this disclosure.

[0037] FIG. 7 is a process flow diagram of an exemplary method for operation of a robot in accordance with some implementations of this disclosure.

[0038] All Figures disclosed herein are © Copyright 2018 Brain Corporation. All rights reserved.

Detailed Description

[0039] Various aspects of the novel systems, apparatuses, and methods disclosed herein are described more fully hereinafter with reference to the accompanying drawings. This disclosure can, however, be embodied in many different forms and should not be construed as limited to any specific structure or function presented throughout this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Based on the teachings herein, one skilled in the art should appreciate that the scope of the disclosure is intended to cover any aspect of the novel systems, apparatuses, and methods disclosed herein, whether implemented independently of, or combined with, any other aspect of the disclosure. For example, an apparatus can be implemented or a method can be practiced using any number of the aspects set forth herein. In addition, the scope of the disclosure is intended to cover such an apparatus or method that is practiced using other structure, functionality, or structure and functionality in addition to or other than the various aspects of the disclosure set forth herein. It should be understood that any aspect disclosed herein can be implemented by one or more elements of a claim.

[0040] Although particular aspects are described herein, many variations and permutations of these aspects fall within the scope of the disclosure. Although some benefits and advantages of the preferred aspects are mentioned, the scope of the disclosure is not intended to be limited to particular benefits, uses, and/or objectives. The detailed description and drawings are merely illustrative of the disclosure rather than limiting, the scope of the

disclosure being defined by the appended claims and equivalents thereof.

[0041] The present disclosure provides for improved systems and methods for dynamic route planning in autonomous navigation. As used herein, a robot can include mechanical or virtual entities configured to carry out complex series of actions automatically. In some cases, robots can be machines that are guided by computer programs or electronic circuitry. In some cases, robots can include electro-mechanical components that are configured for navigation, where the robot can move from one location to another. Such navigating robots can include autonomous cars, floor cleaners, rovers, drones, carts, and the like.

[0042] As referred to herein, floor cleaners can include floor cleaners that are manually controlled (e.g., driven or remote control) and/or autonomous (e.g., using little to no user control). For example, floor cleaners can include floor scrubbers that a janitor, custodian, or other person operates and/or robotic floor scrubbers that autonomously navigate and/or clean an environment. Similarly, floor cleaners can also include vacuums, steamers, buffers, mop, polishers, sweepers, burnishers, etc.

[0043] Detailed descriptions of the various implementations and variants of the system and methods of the disclosure are now provided. While many examples discussed herein are in the context of robotic floor cleaners, it will be appreciated that the described systems and methods contained herein can be used in other robots. Myriad other example implementations or uses for the technology described herein would be readily envisaged by those having ordinary skill in the art, given the contents of the present disclosure.

[0044] Advantageously, the systems and methods of this disclosure at least: (i) provide for dynamic route planning in an autonomously navigating robot; (ii) enhance efficiency in navigating environments, which can allow for improved and/or efficient utilization of resources (e.g., energy, fuel, cleaning fluid, etc.) usage; and (iii) provide computational efficiency which can reduce consumption of processing power, energy, time, and/or other resources in navigating robots. Other advantages are readily discernable by one having ordinary skill given the contents of the present disclosure.

[0045] For example, many current robots that can autonomously navigate are programmed to navigate a route and/or path to a goal. In order to navigate these routes, these robots can create a path plan (e.g., a global solution). Also, these robots can have localized

plans in a small area around it (e.g., in the order of a few meters), where the robot can determine how it will navigate around obstacles detected by its sensors (typically with basic commands to turn when an object is detected). The robot can then traverse the space in the pattern and avoid obstacles detected by its sensors by, e.g., stopping, slowing down, deviating left or right, etc. However, in many current applications, such traversal and avoidance can be complicated and robots can either have undesirable results (e.g., stoppages or collisions) and/or not be able to navigate through more complex situations. In some cases, such current applications can also be computationally expensive and/or slow to run, causing robots to act unnaturally.

[0046] Advantageously, using systems and methods disclosed herein, robots can deviate from its programming, following more efficient paths and/or making more complex adjustments to avoid obstacles. In some implementations described herein, such movements can be determined in a more efficient, faster way, that also appears more natural as a robot plans more complex paths.

[0047] A person having ordinary skill in the art would appreciate that a robot, as referred to herein, can have a number of different appearances/forms. FIG. 1 illustrates various side elevation views of exemplary body forms for a robot in accordance with principles of the present disclosure. These are non-limiting examples meant to further illustrate the variety of body forms, but not to restrict robots described herein to any particular body form. For example, body form 100 illustrates an example where the robot is a stand-up shop vacuum. Body form 102 illustrates an example where the robot is a humanoid robot having an appearance substantially similar to a human body. Body form 104 illustrates an example where the robot is a drone having propellers. Body form 106 illustrates an example where the robot has a vehicle shape having wheels and a passenger cabin. Body form 108 illustrates an example where the robot is a rover.

[0048] Body form 110 can be an example where the robot is a motorized floor scrubber. Body form 112 can be a motorized floor scrubber having a seat, pedals, and a steering wheel, where a user can drive body form 112 like a vehicle as body form 112 cleans, however, body form 112 can also operate autonomously. Other body forms are further contemplated, including industrial machines that can be robotized, such as forklifts, tugs, boats, planes, etc.

[0049] FIG. 2A is a diagram of an overhead view of robot 202 navigating a path 206 in accordance with some implementations of this disclosure. Robot 202 can autonomously navigate through environment 200, which can comprise various objects 208, 210, 212, 218. Robot 202 can start at an initial location and end at an end location. As illustrated, the initial position and the end position are substantially the same, illustrating a substantially closed loop. However, in other cases, the initial location and the end location may not be substantially the same, forming an open loop.

[0050] By way of illustration, in some implementations, robot 202 can be a robotic floor cleaner, such as a robotic floor scrubber, vacuum cleaner, steamer, mop, burnisher, sweeper, and the like. Environment 200 can be a space having floors that are desired to be cleaned. For example, environment 200 can be a store, warehouse, office building, home, storage facility, etc. One or more of objects 208, 210, 212, 218 can be shelves, displays, objects, items, people, animals, or any other entity or thing that may be on the floor or otherwise impede the robot's ability to navigate through environment 200. Route 206 can be the cleaning path traveled by robot 202 autonomously. Route 206 can follow a path that weaves between objects 208, 210, 212, 218 as illustrated in example route 206. For example, where objects 208, 210, 212, 218 are shelves in a store, robot 202 can go along the aisles of the store and clean the floors of the aisles. However, other routes are also contemplated, such as, without limitation, weaving back and forth along open floor areas and/or any cleaning path a user could use to clean the floor (e.g., if the user is manually operating a floor cleaner). In some cases, robot 202 can go over a portion a plurality of times. Accordingly, routes can overlap on themselves. Accordingly, route 206 is meant merely as illustrative examples and can appear differently as illustrated. Also, as illustrated, one example of environment 200 is shown, however, it should be appreciated that environment 200 can take on any number of forms and arrangements (e.g., of any size, configuration, and layout of a room or building) and is not limited by the example illustrations of this disclosure.

[0051] In route 206, robot 202 can begin at the initial location, which can be robot 202's starting point. Robot 202 can then clean along route 206 autonomously (e.g., with little or no control from a user) until it reaches an end location, where it can stop cleaning. The end location can be designated by a user and/or determined by robot 202. In some cases, the end location can be the location in route 206 after which robot 202 has cleaned the desired area of

floor. As previously described, route 206 can be a closed loop or an open loop. By way of illustrative example, an end location can be a location for storage for robot 202, such as a temporary parking spot, storage room/closet, and the like. In some cases, the end location can be the point where a user training and/or programming tasks for robot 202 stopped training and/or programming.

[0052] In the context of floor cleaners (e.g., floor scrubbers, vacuum cleaners, etc.), robot 202 may or may not clean at every point along route 206. By way of illustration, where robot 202 is a robotic floor scrubber, the cleaning system (e.g., water flow, cleaning brushes, etc.) of robot 202 may only be operating in some portions of route 206 and not others. For example, robot 202 may associate certain actions (e.g., turning, turning on/off water, spraying water, turning on/off vacuums, moving vacuum hose positions, gesticulating an arm, raising/lowering a lift, moving a sensor, turning on/off a sensor, etc.) with particular positions and/or trajectories (e.g., while moving in a certain direction or in a particular sequence along route 206) along the demonstrated route. In the context of floor cleaners, such association may be desirable when only some areas of the floor are to be cleaned but not others and/or in some trajectories. In such cases, robot 202 can turn on a cleaning system in areas where a user demonstrated for robot 202 to clean, and turn off the cleaning system otherwise.

[0053] FIG. 2B illustrates an overhead view of a user demonstrating route 216 to robot 202 before robot 202 autonomously travels route 206 in environment 200. In demonstrating route 216, a user can start robot 202 at an initial location. Robot 202 can then weave around objects 208, 210, 212, 218. Robot 202 can stop at an end location, as previously described. In some cases (and as illustrated), autonomously navigated route 206 can be exactly the same as demonstrated route 216. In some cases, route 206 might not be precisely the same as route 216, but can be substantially similar. For example, as robot 202 navigates route 206, robot 202 uses its sensors to sense where it is in relationship to its surrounding. Such sensing may be imprecise in some instances, which may cause robot 202 to not navigate the precise route that had been demonstrated and robot 202 had been trained to follow. In some cases, small changes to environment 200, such as the moving of shelves and/or changes in the items on the shelves, can cause robot 202 to deviate from route 216 when it autonomously navigates route 206. As another example, as previously described,

robot 202 can avoid objects by turning around them, slowing down, etc. when autonomously navigating route 206. These objects might not have been present (and avoided) when the user demonstrated route 216. For example, the objects may be temporarily and/or transient items, and/or may be transient and/or dynamic changes to the environment 200. As another example, the user may have done a poor job demonstrating route 216. For example, the user may have crashed and/or bumped into a wall, shelf, object, obstacle, etc. As another example, an obstacle may have been present while the user had demonstrated route 216, but no longer there when robot 202 autonomously navigates route 206. In these cases, robot 202 can store in memory (e.g., memory 302) one or more actions that it can correct, such as crashing and/or bumping to a wall, shelf, object, obstacle, etc. When robot 202 then autonomously navigates demonstrated route 216 (e.g., as route 206), robot 202 can correct such actions and not perform them (e.g., not crash and/or bump into a wall, shelf, object, obstacle, etc.) when it is autonomously navigating. In this way, robot 202 can determine not to autonomously navigate at least a portion of a navigable route, such as a demonstrated route. In some implementations, determining not to autonomously navigate at least a portion of the navigable route includes determining when to avoid an obstacle and/or object.

[0054] As previously mentioned, as a user demonstrates route 216, the user can turn on and off the cleaning system of robot 202, or perform other actions, in order to train robot 202 where (e.g., at what position), and/or along what trajectories, to clean along route 216 (and subsequently when robot 202 autonomously cleans route 206). The robot can record these actions in memory 302 and later perform them when autonomously navigating. These actions can include any actions that robot 202 may perform, such as turning, turning on/off water, spraying water, turning on/off vacuums, moving vacuum hose positions, gesticulating an arm, raising/lowering a lift, moving a sensor, turning on/off a sensor, etc.

[0055] FIG. 3 is a functional block diagram of a robot 202 in accordance with some principles of this disclosure. As illustrated in FIG. 3, robot 202 can include controller 304, memory 302, user interfaces unit 308, exteroceptive sensors unit 306, proprioceptive sensors unit 310, and communications unit 312, as well as other components and subcomponents (e.g., some of which may not be illustrated). Although a specific implementation is illustrated in FIG. 3, it is appreciated that the architecture may be varied in certain implementations as

would be readily apparent to one of ordinary skill given the contents of the present disclosure.

[0056] Controller 304 can control the various operations performed by robot 202. Controller 304 can include one or more processors (e.g., microprocessors) and other peripherals. As used herein, processor, microprocessor, and/or digital processor can include any type of digital processing device such as, without limitation, digital signal processors (“DSPs”), reduced instruction set computers (“RISC”), general-purpose (“CISC”) processors, microprocessors, gate arrays (e.g., field programmable gate arrays (“FPGAs”)), programmable logic device (“PLDs”), reconfigurable computer fabrics (“RCFs”), array processors, secure microprocessors, specialized processors (e.g., neuromorphic processors), and application-specific integrated circuits (“ASICs”). Such digital processors may be contained on a single unitary integrated circuit die, or distributed across multiple components.

[0057] Controller 304 can be operatively and/or communicatively coupled to memory 302. Memory 302 can include any type of integrated circuit or other storage device configured to store digital data including, without limitation, read-only memory (“ROM”), random access memory (“RAM”), non-volatile random access memory (“NVRAM”), programmable read-only memory (“PROM”), electrically erasable programmable read-only memory (“EEPROM”), dynamic random-access memory (“DRAM”), Mobile DRAM, synchronous DRAM (“SDRAM”), double data rate SDRAM (“DDR/2 SDRAM”), extended data output (“EDO”) RAM, fast page mode RAM (“FPM”), reduced latency DRAM (“RLDRAM”), static RAM (“SRAM”), “flash” memory (e.g., NAND/NOR), memristor memory, pseudostatic RAM (“PSRAM”), etc. Memory 302 can provide instructions and data to controller 304. For example, memory 302 can be a non-transitory, computer-readable storage medium having a plurality of instructions stored thereon, the instructions being executable by a processing apparatus (e.g., controller 304) to operate robot 202. In some cases, the instructions can be configured to, when executed by the processing apparatus, cause the processing apparatus to perform the various methods, features, and/or functionality described in this disclosure. Accordingly, controller 304 can perform logical and arithmetic operations based on program instructions stored within memory 302.

[0058] In some implementations, exteroceptive sensors unit 306 can comprise systems and/or methods that can detect characteristics within and/or around robot 202. Exteroceptive sensors unit 306 can comprise a plurality and/or a combination of sensors. Exteroceptive sensors unit 306 can include sensors that are internal to robot 202 or external, and/or have components that are partially internal and/or partially external. In some cases, exteroceptive sensors unit 306 can include exteroceptive sensors such as sonar, LIDAR, radar, lasers, cameras (including video cameras, infrared cameras, 3D cameras, etc.), time of flight (“TOF”) cameras, antenna, microphones, and/or any other sensor known in the art. In some implementations, exteroceptive sensors unit 306 can collect raw measurements (e.g., currents, voltages, resistances gate logic, etc.) and/or transformed measurements (e.g., distances, angles, detected points in obstacles, etc.). Exteroceptive sensors unit 306 can generate data based at least in part on measurements. Such data can be stored in data structures, such as matrices, arrays, etc. In some implementations, the data structure of the sensor data can be called an image.

[0059] In some implementations, proprioceptive sensors unit 310 can include sensors that can measure internal characteristics of robot 202. For example, proprioceptive sensors unit 310 can measure temperature, power levels, statuses, and/or any other characteristic of robot 202. In some cases, proprioceptive sensors unit 310 can be configured to determine the odometry of robot 202. For example, proprioceptive sensors unit 310 can include proprioceptive sensors unit 310, which can comprise sensors such as accelerometers, inertial measurement units (“IMU”), odometers, gyroscopes, speedometers, cameras (e.g. using visual odometry), clock/timer, and the like. Odometry to facilitate autonomous navigation of robot 202. This odometry can include robot 202’s position (e.g., where position includes robot’s location, displacement and/or orientation, and can sometimes be interchangeable with the term pose as used herein) relative to the initial location. In some implementations, proprioceptive sensors unit 310 can collect raw measurements (e.g., currents, voltages, resistances gate logic, etc.) and/or transformed measurements (e.g., distances, angles, detected points in obstacles, etc.). Such data can be stored in data structures, such as matrices, arrays, etc. In some implementations, the data structure of the sensor data can be called an image.

[0060] In some implementations, user interfaces unit 308 can be configured to enable

a user to interact with robot 202. For example, user interfaces 308 can include touch panels, buttons, keypads/keyboards, ports (e.g., universal serial bus (“USB”), digital visual interface (“DVI”), Display Port, E-Sata, Firewire, PS/2, Serial, VGA, SCSI, audioport, high-definition multimedia interface (“HDMI”), personal computer memory card international association (“PCMCIA”) ports, memory card ports (e.g., secure digital (“SD”) and miniSD), and/or ports for computer-readable medium), mice, rollerballs, consoles, vibrators, audio transducers, and/or any interface for a user to input and/or receive data and/or commands, whether coupled wirelessly or through wires. User interfaces unit 308 can include a display, such as, without limitation, liquid crystal display (“LCDs”), light-emitting diode (“LED”) displays, LED LCD displays, in-plane-switching (“IPS”) displays, cathode ray tubes, plasma displays, high definition (“HD”) panels, 4K displays, retina displays, organic LED displays, touchscreens, surfaces, canvases, and/or any displays, televisions, monitors, panels, and/or devices known in the art for visual presentation. In some implementations user interfaces unit 308 can be positioned on the body of robot 202. In some implementations, user interfaces unit 308 can be positioned away from the body of robot 202, but can be communicatively coupled to robot 202 (e.g., via communication units including transmitters, receivers, and/or transceivers) directly or indirectly (e.g., through a network, server, and/or a cloud).

[0061] In some implementations, communications unit 312 can include one or more receivers, transmitters, and/or transceivers. Communications unit 312 can be configured to send/receive a transmission protocol, such as BLUETOOTH®, ZIGBEE®, Wi-Fi, induction wireless data transmission, radio frequencies, radio transmission, radio-frequency identification (“RFID”), near-field communication (“NFC”), infrared, network interfaces, cellular technologies such as 3G (3GPP/3GPP2), high-speed downlink packet access (“HSDPA”), high-speed uplink packet access (“HSUPA”), time division multiple access (“TDMA”), code division multiple access (“CDMA”) (e.g., IS-95A, wideband code division multiple access (“WCDMA”), etc.), frequency hopping spread spectrum (“FHSS”), direct sequence spread spectrum (“DSSS”), global system for mobile communication (“GSM”), Personal Area Network (“PAN”) (e.g., PAN/802.15), worldwide interoperability for microwave access (“WiMAX”), 802.20, long term evolution (“LTE”) (e.g., LTE/LTE-A), time division LTE (“TD-LTE”), global system for mobile communication (“GSM”), narrowband/frequency-division multiple access (“FDMA”), orthogonal frequency-division

multiplexing (“OFDM”), analog cellular, cellular digital packet data (“CDPD”), satellite systems, millimeter wave or microwave systems, acoustic, infrared (e.g., infrared data association (“IrDA”)), and/or any other form of wireless data transmission.

[0062] As used herein, network interfaces can include any signal, data, or software interface with a component, network, or process including, without limitation, those of the FireWire (e.g., FW400, FW800, FWS800T, FWS1600, FWS3200, etc.), universal serial bus (“USB”) (e.g., USB 1.X, USB 2.0, USB 3.0, USB Type-C, etc.), Ethernet (e.g., 10/100, 10/100/1000 (Gigabit Ethernet), 10-Gig-E, etc.), multimedia over coax alliance technology (“MoCA”), Coaxsys (e.g., TVNET™), radio frequency tuner (e.g., in-band or OOB, cable modem, etc.), Wi-Fi (802.11), WiMAX (e.g., WiMAX (802.16)), PAN (e.g., PAN/802.15), cellular (e.g., 3G, LTE/LTE-A/TD-LTE/TD-LTE, GSM, etc.), IrDA families, etc. As used herein, Wi-Fi can include one or more of IEEE-Std. 802.11, variants of IEEE-Std. 802.11, standards related to IEEE-Std. 802.11 (e.g., 802.11 a/b/g/n/ac/ad/af/ah/ai/aj/aq/ax/ay), and/or other wireless standards.

[0063] Communications unit 312 can also be configured to send/receive a transmission protocol over wired connections, such as any cable that has a signal line and ground. For example, such cables can include Ethernet cables, coaxial cables, Universal Serial Bus (“USB”), FireWire, and/or any connection known in the art. Such protocols can be used by communications unit 312 to communicate to external systems, such as computers, smart phones, tablets, data capture systems, mobile telecommunications networks, clouds, servers, or the like. Communications unit 312 can be configured to send and receive signals comprising of numbers, letters, alphanumeric characters, and/or symbols. In some cases, signals can be encrypted, using algorithms such as 128-bit or 256-bit keys and/or other encryption algorithms complying with standards such as the Advanced Encryption Standard (“AES”), RSA, Data Encryption Standard (“DES”), Triple DES, and the like. Communications unit 312 can be configured to send and receive statuses, commands, and other data/information. For example, communications unit 312 can communicate with a user operator to allow the user to control robot 202. Communications unit 312 can communicate with a server/network in order to allow robot 202 to send data, statuses, commands, and other communications to the server. The server can also be communicatively coupled to computer(s) and/or device(s) that can be used to monitor and/or control robot 202 remotely.

Communications unit 312 can also receive updates (e.g., firmware or data updates), data, statuses, commands, and other communications from a server for robot 202.

[0064] In some implementations, one or the components and/or subcomponents can be instantiated remotely from robot 202. For example, mapping and localization units 262, may be located in a cloud and/or connected to robot 202 through communications unit 312. Connections can be direct and/or through a server and/or network. Accordingly, implementations of the functionality of this disclosure should also be understood to include remote interactions where data can be transferred using communications unit 312, and one or more portions of processes can be completed remotely.

[0065] FIG. 4A is a top view diagram illustrating the interaction between robot 202 and an obstacle 402 in accordance with some implementations of this disclosure. In navigating route 216, robot 202 can encounter obstacle 402. Obstacle 402 can impede the path of robot 202, which is illustrated as route portion 404. If robot were to continue following on route portion 404, it may collide with obstacle 402. However, in some circumstances, using exteroceptive sensors unit 306 and/or proprioceptive sensors unit 310, robot 202 can stop before colliding with obstacle 402.

[0066] This interaction with obstacle 402 illustrates advantages of implementations in accordance with the present disclosure. FIG. 4B is a diagram of global layer 406, intermediate layer 408, and local layer 410 in accordance with implementations of the present disclosure. Global layer 406, intermediate layer 408, and local layer 410 can be hardware and/or software layers instantiated in one or more of memory 302 and/or controller 304. Global layer 406 can include software and/or hardware that implements global mapping and routing. For example, the high-level mapping can include a map of environment 200. The map can also include a representation of route 216, allowing robot 202 to navigate the space in environment 200.

[0067] In some implementations, global layer 406 can include a global planner. In this way, global layer 406 can determine one or more of: the location of robot 202 (e.g., in global coordinates such as two-dimensional coordinates, three-dimensional coordinates, four-dimensional coordinates, etc.); the path robot 202 should take to reach its goal; and/or higher-level (e.g., long-range) planning. In this way, robot 202 can determine its general path and/or direction to travel from one location to another.

[0068] Local layer 410 includes software and/or hardware that implements local planning. For example, local layer 410 can include short-range planning configured for maneuvering in local constraints of motion. Local layer 410 can process data received from exteroceptive sensors unit 306 and determine the presence and/or positioning of obstacles and/or objects near robot 202. For example, if an object is within range of a sensor of exteroceptive sensors unit 306 (e.g., a LIDAR, sonar, camera, etc.), robot 202 can detect the object. The local layer 410 can compute and/or control motor functionality to navigate around objects, such by controlling actuators to turn, move forward, reverse, etc. In some cases, processing in local layer 410 can be computationally intensive. For example, local layer 410 can receive data from sensors of exteroceptive sensors unit 306 and/or proprioceptive sensors unit 310. Local layer 410 can then determine motor functions to avoid an object detected by exteroceptive sensors unit 306 (e.g., using a motor to turn a steering column left and right, and/or using a motor to push the robot forward). The interplay of local layer 410 and global layer 406 can allow robot 202 to make local adjustments while still moving generally along a route to its goal.

[0069] However, in some circumstances, it can be desirable to make adjustments at a finer level than what would be computed by global layer 406, yet not at the computationally intensive level of precise motor functions of local layer 410. Accordingly, intermediate layer 408 can include hardware and/or software that can determine intermediate adjustments of robot 202 as it navigates around objects.

[0070] In intermediate layer 408, robot 202 can plan how to avoid objects and/or obstacles in its environment. In some cases, intermediate layer 408 can be initialized with at least a partial path and/or route from a global path planner from global layer 406.

[0071] Because objects (e.g., obstacles, walls, etc.) present things in which robot 202 could collide, objects and/or obstacles can put forth a repulsive force on robot 202. In some cases, by objects repulsing robot 202, robot 202 can navigate along a collision-free path around those objects and/or obstacles.

[0072] FIG. 4C is a process flow diagram of an exemplary method 450 for dynamic route planning in accordance with some implementations of this disclosure. In some implementations, method 450 can be performed by intermediate layer 408 and/or by controller 304. Block 452 can include obtaining a route containing one or more route poses.

In some cases, this route can be created by robot 202 and/or uploaded onto robot 202. In some cases, the route can be passed from global layer 406 to intermediate layer 408. Block 454 can include selecting a first route pose. Block 456 can include, for the first route pose, determining repulsive forces from objects in the environment. Block 458 can include, for the first route pose, determining attractive forces from other route poses. Block 460 can include determining the translation and/or rotation of the first route pose due to the repulsive forces and attractive forces. Block 462 can include performing interpolation to account for the translated and/or rotated route pose. This process and others will be illustrated throughout this disclosure.

[0073] By way of illustration, FIG. 4D illustrates route poses 414 and 416 along with repulsive forces exerted by objects in accordance with some implementations of the present disclosure. For example, the points on a route can be discretized locations along the path, such as route poses, illustrating the pose of robot 202 throughout its route. In some cases, such discretized locations can also have associated probabilities, such as particles or bubbles. Route poses can identify the position and/or orientation that robot 202 would travel on the route. In a planar application, the route pose can include (x, y, θ) coordinates. In some cases, θ can be the heading of the robot in the plane. The route poses can be regularly or irregularly spaced on robot 202's route. In some cases, intermediate layer can obtain the route containing one or more route poses from global layer 406, as described in block 452 of method 450. In some implementations, route poses can form a sequence, wherein robot 202 travels between sequential route poses on a route. For example, route poses 414 and 416 could be a sequence of route poses where robot 202 travels to route pose 414 and then to route pose 416.

[0074] By way of illustrative example, route poses 414 and 416 illustrate discretized locations along the route portion 404. This illustrative example shows route poses 414 and 416 as shaped as robot 202, with substantially similar footprints. The footprints of route poses 414 and 416 can be adjusted in size depending on how conservative one desires to be with respect to robot collisions. A smaller footprint can present higher likelihoods of a collision, but such a smaller footprint can allow robot 202 to clear more areas that it should be able to as it autonomously navigates. A larger footprint might decrease the likelihood of a collision, but robot 202 would not go through some places autonomously that it otherwise

should be able to. The footprint can be predetermined by a footprint parameter that sets the size (e.g., scales) of the footprint of robot 202, as illustrated in route poses (e.g., route poses 414 and 416). In some cases, there can be a plurality of footprint parameters that control the sizes of route poses of robot 202 asymmetrically.

[0075] In FIG. 4D, while route poses 414 and 416 are illustrated and described, it should be appreciated by someone having ordinary skill in the art that there can be any number of route poses throughout a route, and the descriptions of the implementations of this disclosure can be applied to those route poses. Advantageously, having route poses 414 and 416 shaped like robot 202 (e.g., a footprint of robot 202) can allow robot 202 to determine places in which robot 202 can fit while travelling. The footprint parameter(s) can be used to adjust how robot 202 projects itself. For example, a larger footprint used in route poses 414 and/or 416 can be more conservative in that it can cause, at least in part, robot 202 to travel further away from objects. In contrast, a smaller footprint can cause, at least in part, robot 202 to travel closer to objects. Route poses (e.g., route poses 414 and 416) can be of different sizes from one another. By way of illustration, it may be desirable for robot 202 to be more conservative in certain scenarios, such as on turns. Accordingly, in this illustration, the footprint of route poses on turns can be larger than the footprint of route poses on straightaways. Such dynamic reshaping of route poses can be performed by making the size of the route poses dependent on the rotation of the route pose relative to other route poses, or the changes in translation and/or rotation of route pose. One or more of the route poses on a route (e.g., route poses 414 and/or 416) can also be a different shape other than the shape of robot 202. For example, the route poses can be circular, square, triangular, and/or any other shape.

[0076] As described in block 454 from method 450, one can observe either route poses 414 or 416 as a first route pose. However, for purposes of illustration, and to illustrate the breadth of the described implementations of this disclosure, route poses 414 and 416 will be described together.

[0077] Points along objects (e.g., points determined by mapping, detecting by sensors of exteroceptive sensors unit 306, etc.) can exert a repulsive force on route poses of robot 202 (e.g., route poses 414 and 416). In this way, the objects can, conceptually, prevent robot 202 from colliding into them. In some cases, these points can represent at least in part poses

and/or sets of poses. For example, arrows 412 illustrate repulsive forces from points along object 210.

[0078] In some implementations, the forces exerted by points by objects may be uniform in that each point on route poses 414 and 416 can have substantially similar forces exerted on them. However, in other implementations, the forces exerted by points of objects on route poses 414 and 416 may not be uniform and may vary based on a force function.

[0079] By way of illustration, a force function (e.g., a repulsive force function) can in some cases determine at least in part the repulsive force exerted on a point on route poses 414 or 416 by an object. For example, the force functions can be used in block 456 of method 450 to determine the repulsive forces from objects in the environment for a first route pose (e.g., a first route pose of route poses 414 and 416). In some implementations, the force function can be dependent on characteristics of where an object appears relative to route poses 414 and 416. The force function can then represent the force experienced by points route poses 414 and 416 (e.g., one or more points on the surface of route poses 414 and 416, the center of route poses 414 and 416, the center of mass of route poses 414 and 416, and/or any point of and/or around route poses 414 and 416). Because the forces can be dependent on their direction and magnitudes, repulsive forces (and/or attractive forces) can be vectors. In some cases, repulsive forces can exert rotational forces on a route pose, which can manifest in torque forces.

[0080] For example, repulsion forces and torque forces can be calculated at n different poses along a path. In some cases, these n different poses can be associated with route poses. Each pose can consist of m points in a footprint. In some cases, these m points can be points on the route poses.

[0081] In some cases, a plurality of points can define the body of robot 202 as reflected in route poses 414 and 416, providing representative coverage over a portion of the body of robot 202 and/or substantially all of robot 202. For example, 15-20 points can be distributed throughout the surface and/or interior of robot 202 and be reflected in route poses 414 and 416. However, in some cases, there can be fewer points. FIG. 4E illustrates example points on route pose 414, such as point 418. Each point can experience, at least in part, the forces (e.g., repulsive forces) placed on it by objects in the surrounding of route poses 414.

[0082] Advantageously, by having a plurality of points on the body of route poses 414 and 416 that can experience forces, points of route poses 414 and 416 can translate and/or rotate relative to one another, causing, at least in part, repositioning (e.g., translation and/or rotation) of route poses 414 and 416. These translations and/or rotations of route poses 414 and 416 can cause deformations of the route navigated by robot 202.

[0083] Torsion forces can occur when different points on a route pose experience different magnitudes and directions of forces. Accordingly, the torsion force can cause the route poses to rotate. In some cases, predetermined parameters can define at least in part the torsion experienced by route poses 414 and 416. For example, a predetermined torsion parameter can include a multiplier for the rotational forces experience on a point on route poses 414 or 416. This predetermined torsion parameter can be indicative of force due to misalignment of route poses 414 or 416 and the path. In some cases, the predetermined torsion parameter may vary based on whether the force is repulsive or cohesive.

[0084] Returning to FIG. 4D, a characteristic on which the force function depends in part can be a position of a point on an object relative to route poses 414 and 416. Distance can be determined based at least in part on sensors of exteroceptive sensors unit 306. As a first example, the repulsive force exerted onto route poses 414 and 416 from a point on an object exterior to robot 202 (e.g., not within the footprint of route poses 414 and 416 such as points on obstacles 210 and 212 as illustrated) can be characterized at least in part by the function $r(d) \propto 1/d$, where r is the repulsion of a point on an object and d is the distance between the point on an object and a point on route pose 414 or route pose 416. In this way, the repulsion of a point on an object is inversely proportional to the distance between the point on the object and the point on route pose 414 or route pose 416. Advantageously, such a function allows objects close to route poses 414 and 416 to exert more repulsion, and thereby potentially more strongly influence the course of robot 202 to avoid a collision than objects further away.

[0085] In some cases, a predetermined repulsive distance threshold can be put on the distance between a point on route pose 414 and route pose 416 and a point on an object. This predetermined repulsive distance threshold can be indicative at least in part of the maximum distance between a points on either route pose 414 and route pose 416 and a point on an object in which the point on the object can exert a repulsive force (and/or a torsion force) on

points on either route poses 414 and 416. Accordingly, when a point on an object is a distance (e.g., from a point on either route pose 414 and route pose 416) that is above (or equal to and/or above, depending on the definition of the threshold), the repulsive force and/or torsion force can be zero or substantially zero. Advantageously, having a predetermined repulsive distance threshold can, in some cases, prevent some points on objects from exerting forces on points on route poses 414 and 416. In this way, when there is a predetermined repulsive distance, robot 202 can get closer to certain objects and/or not be influenced by further away objects.

[0086] As a second example, the repulsive force exerted onto route poses 414 and 416 from a point on the interior of route poses 414 and 416 (e.g., within the footprint of route poses 414 and 416). For example, object 402 has portion 420 that appears interior to route pose 416. In these cases, a different force function can be exerted by points of object 402 in portion 420 onto points of route pose 416 in portion 420. In some implementations, this force can be characterized at least in part by the function $r(d) \propto d$, where the variables are as described above. Advantageously, by having a different force function defined for interior objects, route pose 416 can move asymmetrically causing rotations.

[0087] In some implementations, the force function can also depend on other characteristics of objects, such as shape, material, color, and/or any other characteristic of the object. These characteristics can be determined by one or more of sensors of exteroceptive sensors 306 in accordance with known methods in the art. Advantageously, taking into account characteristics can be further informative of how robot 202 should navigate around objects. In some instances, the cost map can be used to compute additional repulsion values based on these characteristics.

[0088] For example, the shape of an object can be indicative at least in part of an associated repercussion of collision. By way of illustration, a humanoid shape may be indicative of a person. As such, an object detected with this shape can place a greater repulsive force on route poses 414 and 416 in order to push the path further away from the humanoid shape. As another example, the shape of an object can be indicative in part of increased damage (e.g., to the object or robot 202) if a collision occurred. By way of illustration, pointed objects, skinny objects, irregular objects, predetermined shapes (e.g., vase, lamp, display, etc.) and/or any other shape can be indicative at least in part of resulting

in increased damage. Size may be another characteristic of shape that can be taken into account. For example, smaller objects may be more fragile in the event of a collision, but larger objects could cause more damage to robot 202. In the case of size, force functions can take into account the size of the objects so that the points on those objects repulse points on route poses 414 and 416 proportionally as desired. By way of illustration, if route pose 414 is between a larger object and a smaller object, if points of the larger object have a relatively larger repulsive force as defined at least in part on the force function, route pose 414 will be pushed relatively closer to the smaller object. If the points of the smaller object have a relatively larger repulsive force as defined at least in part on the force function, route pose 414 will be pushed relatively closer to the larger object. Accordingly, the repulsive force on route poses 414 and 416 can be adjusted based at least in part on the shape. The shape can be detected at least in part by sensors of exteroceptive sensors unit 306. As another illustrative example, walls can be identified in a cost map, and a repulsive force can be associated with walls due to their size and shape.

[0089] In some implementations, the force function can also depend on the material of the objects. For example, certain materials can be indicative at least in part of more damage if a collision occurred. By way of illustration, glass, porcelain, mirrors, and/or other fragile material can prove to be more damaging in the event of a collision. In some cases, such as in the case of mirrors, the material can sometimes cause errors in the sensors of exteroceptive sensor units 306. Accordingly, in some cases, it may be desirable for robot 202 to navigate further away from such objects, which can be reflected in the force function (e.g., increasing the repulsion force exerted by points on objects of some materials versus other materials).

[0090] In some implementations, color can be detected by sensors of exteroceptive sensor units 306. The force function can be dependent at least in part on the color of an object and/or points on an object. For example, certain objects in an environment may be a certain color (e.g., red, yellow, etc.) to indicate at least in part that robot 202 (or in some cases people) should be cautious of those objects. Accordingly, in some cases, it may be desirable for robot 202 to navigate further away from such objects, which can be reflected in the force function.

[0091] In some implementations, the force function can be dependent on other factors, such as the location of an object. For example, certain areas of a map (e.g., as passed from global layer 406) can have characteristics. By way of illustration, some areas of the map (e.g., a cost map) can be areas in which robot 202 should not pass. There can also be places where robot 202 cannot go into because they are not accessible (such as into an object). Accordingly, in some cases, the force function can be adjusted to account for such places. In some implementations, the force function can cause points in those places to exert no force (or substantially no force) on points on route poses 414 and 416. Advantageously, no force can be reflective of regions where robot 202 would not go (e.g., inside objects and the like). In contrast, in some implementations, such places can be treated as obstacles, exerting a repulsive force on route poses 414 and 416. Advantageously, having such a repulsion force can keep robot 202 from attempting to enter such areas.

[0092] In some implementations, not all forces on route poses 414 and 416 are repulsive. For example, points on route poses (e.g., route poses 414 and 416) can exert attractive (e.g., cohesive) forces, which can, at least in part, pull route poses towards each other. FIG. 4F illustrates attractive forces between route poses 414 and 416 in accordance with some implementations of the present disclosure. The arrows are indicative at least in part that route poses are drawn towards each other along route portion 404. Advantageously, the cohesive force between route poses can cause, at least in part, robot 202 towards following a path substantially similar to the path planned by global layer 406 (e.g., a route substantially similar to an original route, such as an originally demonstrated route that robot 202 should follow in the absence of objects around which to navigate).

[0093] The cohesive force can be set by a force function (e.g., a cohesive force function), which can be dependent on characteristics of the path, such as the spacing distance between route poses/particles, the smoothness of the path, how desirable it is for robot 202 to follow a path, etc. In some cases, the cohesive force function can be based at least in part on a predetermined cohesion multiplier, which can determine at least in part the force pulling route poses together. A lower predetermined cohesion multiplier can reduce the cohesive strength of route portion 404 (e.g., draw of route poses towards it) and, in some cases, may cause a loss in smoothness of the path travelled by robot 202. In some cases, only sequential route poses exert cohesive forces on the points of one another. In other cases, all route poses

exert cohesive forces on one another. In still other cases, some route poses exert cohesive forces on others. The determination of which route poses are configured to exert cohesive forces on one another can depend on a number of factors, which may vary on a case-by-case basis. For example, if a route is circular, it may be desirable for all route poses to exert cohesive forces on one another to tighten the circle. As another example, if the route is complex, then it may be desirable for certain complex paths to only have sequential route poses exert cohesive forces on one another. This limitation may allow robot 202 to make more turns and/or have more predictable results because other positioned route poses will not unduly influence it. Ones between the aforementioned examples in complexity may have some of the route poses exerting cohesive forces. As another example, the number of route poses may also be a factor. Having a lot of route poses on a route may cause unexpected results if all of them exert cohesive forces on one another. If there are fewer route poses, this might not be a problem, and all or some of the route poses can exert forces. In some cases, there can be a predetermined cohesive force distance threshold, where if a point on a first route pose is distance that is more than the predetermined cohesive force distance threshold (or more than or equal to, depending on how it is defined) from a point on a second route pose, the cohesive force can be zero or substantially zero.

[0094] In some implementations the cohesive force function and the repulsive force function can be the same force function. In other implementations, the cohesive force function and the repulsive force functions are separate. The cohesive force function can be used to determine the attractive forces from other route poses in accordance with block 458 from method 450. In some implementations, both the cohesive forces and repulsive forces can result in torsion (e.g., causing rotation) of a route pose.

[0095] As described with reference to intermediate layer 408, route poses 414 and 416 can experience different attractive and repulsive forces. In some implementations, the forces can be stored in arrays. For example, there can be an array of forces indicative of repulsion, torsion, cohesion, etc.

[0096] In some cases, forces can be toggled, such as by using an on/off parameter that can turn on or off any individual force and/or group of forces from a point. For example, the on/off parameter can be binary wherein one value turns the force on and another turns the force off. In this way, some forces can be turned off, such as based on the distance an object

is from a route pose, whether a point is in the interior of an object or no go zone, distance between route poses, etc.

[0097] On the balance, the net forces on route poses 414 and 416 can reposition one or more of route poses 414 and 416. For example, route poses 414 and 416 can be displaced. Route poses 414 and 416 can displace (e.g., translated and/or rotated) until their net forces, in any direction, are substantially zero and/or minimized. In this way, route poses 414 and 416 can be displaced to locations indicative at least in part to an adjusted route for robot 202 to travel to avoid objects (e.g., obstacle 402). The translation and/or rotation of a route pose due to the repulsive forces and attractive forces can be determined in accordance with block 460 of method 450.

[0098] There can be different adjustments made to determining the displacement of route poses 414 and 416. For example, in some cases, instead of considering all forces on route poses 414 and 416, attractive forces may only be considered. Advantageously, such a system can allow robot 202 to stick to static paths. Based at least in part on the displacement of route poses 414 and 416, robot 202 can set a new path for the route planner. In the new path, the trajectory can be representative of a point on robot 202, such as the center of robot 202, as robot 202 travels the path.

[0099] After robot 202 determines the displacement of route poses 414 and 416, robot 202 can determine a path to travel. For example, based on the positions (e.g., locations and/or orientations) of route poses 414 and 416, robot 202 can determine the path to navigate to and/or between route poses 414 and 416, and/or any other route poses from its present location. In some cases, robot 202 will travel between consecutive (e.g., sequential) route poses in order, defining at least in part a path. For example, this determination can be based at least in part on an interpolation between route poses taking into account the path robot 202 can travel between those points. In many cases, linear interpolation can be used. By using performing interpolation, robot 202 can account for the translated and/or rotated route pose in accordance with block 462 in method 450.

[00100] FIG. 5 is an overhead view of a diagram showing interpolation between route poses 414 and 416 in accordance with some implementations of this disclosure. Based on forces placed on route poses 414 and 416, as described herein, route poses 414 and 416 have displaced. As illustrated, route pose 414 has both translated and rotated. The translation can

be measured in standard units, such as inches, feet, meters, or any other unit of measurement (e.g., measurements in the metric, US, or other system of measurement) and/or relative/non-absolute units, such as ticks, pixels, percentage of range of a sensor, and the like. Rotation can be measured in degrees, radians, etc. Similarly, route pose 416 has also been translated and/or rotated. Notably, both route poses 414 and 416 clear obstacle 402. Since route poses 414 and 416 represent discretized locations along a path travelled by robot 202, robot 202 can interpolate between them to determine the path it should take. Interpolated poses 502A – 502D illustrate a path travelled between route poses 414 and 416. Notably, robot 202 may also interpolate other paths (not illustrated) to move to route poses and/or between route poses.

[00101] Interpolated poses 502A – 502D can have associated footprints substantially similar to the footprints of one or more of route poses 414 and 416. In some cases, as illustrated in FIG. 5, interpolated poses 502A – 502D can be interpolated route poses. Accordingly, interpolated poses 502A – 502D can represent the position and/or orientation that robot 202 would be along a route. Advantageously, this can allow the interpolated path to guide robot 202 to places where robot 202 would fit. Moreover, interpolated poses 502A – 502D can be determined such that there is no overlap between the footprint of any one of interpolated poses 502 – 502D and an object (e.g., obstacle 402, object 210, or object 212), thereby avoiding collisions.

[00102] Interpolated poses 502A – 502D can also be determined taking into account the rotation and/or translation to get from route pose 414 to route pose 416. For example, robot 202 can determine the pose of route pose 414 and the pose of route pose 416. Robot 202 can then find the difference between the poses of route poses 414 and route poses 416, and then determine how to get from the pose of route pose 414 to the pose of route pose 416. For example, robot 202 can distribute the rotation and translation between interpolated poses 502A – 502D such that robot 202 would rotate and translate from route pose 414 to route pose 416. In some cases, robot 202 can distribute the rotation and translation substantially equally between interpolated poses 502A – 502D. For example, if there are N number of interpolation positions, robot 202 can divide the difference in location and rotation of the poses of route poses 414 and 416 substantially evenly across those N number of interpolation positions. Alternatively, robot 202 can divide the difference in location and/or rotation of the

poses of route poses 414 and 416 un-evenly across those N number of interpolation positions. Advantageously, even division can allow for robot 202 to travel smoothly from route pose 414 to route pose 416. However, un-even division can allow robot 202 to more easily account for and avoid objects by allowing finer movements in some areas as compared to others. For example, in order to avoid an object in which interpolated poses 502A – 502D comes near, robot 202 would have to make a sharp turn. Accordingly, more interpolated poses around that turn may be desirable in order to account for the turn. In some cases, the number of interpolation positions can be dynamic, and more or fewer than N number of interpolation positions can be used as desired.

[00103] FIG. 6 is a process flow diagram of an exemplary method 600 for operation of a robot in accordance with some implementations of this disclosure. Block 602 includes creating a map of the environment based at least in part on collected data. Block 604 includes determining a route in the map in which the robot will travel. Block 606 includes generating one or more route poses on the route, wherein each route pose comprises a footprint indicative of poses of the robot along the route and each route pose has a plurality of points therein. Block 608 includes determining forces on each of the plurality of points of each route pose, the forces comprising repulsive forces from one or more of the detected points on the one or more objects and attractive forces from one or more of the plurality of points on others of the one or more route poses. Block 610 includes repositioning each route pose in response to the forces on each point of each route pose. Block 612 includes perform interpolation between the one or more repositioned route poses to generate a collision-free path between the one or more route poses for the robot to travel.

[00104] FIG. 7 is a process flow diagram of an exemplary method 700 for operation of a robot in accordance with some implementations of this disclosure. Block 702 includes generating a map of the environment using data from one or more sensors. Block 704 includes determining a route on the map, the route including one or more route poses, each route pose comprising a footprint indicative at least in part of a pose, size, and shape of the robot along the route and each route pose having a plurality of points therein. Block 706 includes computing repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses. Block 708 includes repositioning the first route pose in response to at least the repulsive force. Block 710

includes performing an interpolation between the repositioned first route pose and another of the one or more route poses.

[00105] As used herein, computer and/or computing device can include, but are not limited to, personal computers (“PCs”) and minicomputers, whether desktop, laptop, or otherwise, mainframe computers, workstations, servers, personal digital assistants (“PDAs”), handheld computers, embedded computers, programmable logic devices, personal communicators, tablet computers, mobile devices, portable navigation aids, J2ME equipped devices, cellular telephones, smart phones, personal integrated communication or entertainment devices, and/or any other device capable of executing a set of instructions and processing an incoming data signal.

[00106] As used herein, computer program and/or software can include any sequence or human or machine cognizable steps which perform a function. Such computer program and/or software may be rendered in any programming language or environment including, for example, C/C++, C#, Fortran, COBOL, MATLAB™, PASCAL, Python, assembly language, markup languages (e.g., HTML, SGML, XML, VoXML), and the like, as well as object-oriented environments such as the Common Object Request Broker Architecture (“CORBA”), JAVA™ (including J2ME, Java Beans, etc.), Binary Runtime Environment (e.g., BREW), and the like.

[00107] As used herein, connection, link, transmission channel, delay line, and/or wireless can include a causal link between any two or more entities (whether physical or logical/virtual), which enables information exchange between the entities.

[00108] It will be recognized that while certain aspects of the disclosure are described in terms of a specific sequence of steps of a method, these descriptions are only illustrative of the broader methods of the disclosure, and may be modified as required by the particular application. Certain steps may be rendered unnecessary or optional under certain circumstances. Additionally, certain steps or functionality may be added to the disclosed implementations, or the order of performance of two or more steps permuted. All such variations are considered to be encompassed within the disclosure disclosed and claimed herein.

[00109] While the above detailed description has shown, described, and pointed out novel features of the disclosure as applied to various implementations, it will be understood

that various omissions, substitutions, and changes in the form and details of the device or process illustrated may be made by those skilled in the art without departing from the disclosure. The foregoing description is of the best mode presently contemplated of carrying out the disclosure. This description is in no way meant to be limiting, but rather should be taken as illustrative of the general principles of the disclosure. The scope of the disclosure should be determined with reference to the claims.

[00110] While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The disclosure is not limited to the disclosed embodiments. Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed disclosure, from a study of the drawings, the disclosure and the appended claims.

[00111] It should be noted that the use of particular terminology when describing certain features or aspects of the disclosure should not be taken to imply that the terminology is being re-defined herein to be restricted to include any specific characteristics of the features or aspects of the disclosure with which that terminology is associated. Terms and phrases used in this application, and variations thereof, especially in the appended claims, unless otherwise expressly stated, should be construed as open ended as opposed to limiting. As examples of the foregoing, the term “including” should be read to mean “including, without limitation,” “including but not limited to,” or the like; the term “comprising” as used herein is synonymous with “including,” “containing,” or “characterized by,” and is inclusive or open-ended and does not exclude additional, unrecited elements or method steps; the term “having” should be interpreted as “having at least;” the term “such as” should be interpreted as “such as, without limitation;” the term “includes” should be interpreted as “includes but is not limited to;” the term “example” is used to provide exemplary instances of the item in discussion, not an exhaustive or limiting list thereof, and should be interpreted as “example, but without limitation;” adjectives such as “known,” “normal,” “standard,” and terms of similar meaning should not be construed as limiting the item described to a given time period or to an item available as of a given time, but instead should be read to encompass known, normal, or standard technologies that may be available or known now or at any time in the future; and use of terms like “preferably,” “preferred,” “desired,” or “desirable,” and words

of similar meaning should not be understood as implying that certain features are critical, essential, or even important to the structure or function of the present disclosure, but instead as merely intended to highlight alternative or additional features that may or may not be utilized in a particular embodiment. Likewise, a group of items linked with the conjunction “and” should not be read as requiring that each and every one of those items be present in the grouping, but rather should be read as “and/or” unless expressly stated otherwise. Similarly, a group of items linked with the conjunction “or” should not be read as requiring mutual exclusivity among that group, but rather should be read as “and/or” unless expressly stated otherwise. The terms “about” or “approximate” and the like are synonymous and are used to indicate that the value modified by the term has an understood range associated with it, where the range can be $\pm 20\%$, $\pm 15\%$, $\pm 10\%$, $\pm 5\%$, or $\pm 1\%$. The term “substantially” is used to indicate that a result (e.g., measurement value) is close to a targeted value, where close can mean, for example, the result is within 80% of the value, within 90% of the value, within 95% of the value, or within 99% of the value. Also, as used herein “defined” or “determined” can include “predefined” or “predetermined” and/or otherwise determined values, conditions, thresholds, measurements, and the like.

WHAT IS CLAIMED IS:

1. A robot comprising:
 - one or more sensors configured to collect data about an environment including detected points on one or more objects in the environment; and
 - a controller configured to:
 - create a map of the environment based at least in part on the collected data;
 - determine a route in the map in which the robot will travel;
 - generate one or more route poses on the route, wherein each route pose comprises a footprint indicative of poses of the robot along the route and each route pose has a plurality of points disposed therein;
 - determine forces on each of the plurality of points of each route pose, the forces comprising repulsive forces from one or more of the detected points on the one or more objects and attractive forces from one or more of the plurality of points on others of the one or more route poses;
 - reposition one or more route poses in response to the forces on each point of the one or more route poses; and
 - perform interpolation between one or more route poses to generate a collision-free path between the one or more route poses for the robot to travel.
2. The robot of Claim 1, wherein:
 - the one or more route poses form a sequence in which the robot travels along the route; and
 - the interpolation comprises a linear interpolation between sequential ones of the one or more route poses.
3. The robot of Claim 1, wherein the interpolation generates one or more interpolation route poses having substantially similar footprints to the footprint of each route pose.
4. The robot of Claim 1, wherein the determination of the forces on each point of the one or more route poses further comprises a computation of a force function that associates, at least in part, the forces on each point of each route pose with one or more characteristics of objects in the environment.
5. The robot of Claim 4, wherein the one or more characteristics includes one or

more of distance, shape, material, and color.

6. The robot of Claim 4, wherein:

the force function associates zero repulsive force exerted by a first detected point on a first object where a distance between the first detected point and a second point of a first route pose is above a predetermined distance threshold.

7. The robot of Claim 1, wherein the footprint of each route pose has substantially similar size and shape as the footprint of the robot.

8. The robot of Claim 1, wherein the robot comprises a floor cleaner.

9. A method for dynamic navigation of a robot in an environment, comprising:
generating a map of the environment using data from one or more sensors;
determining a route on the map, the route including one or more route poses, each route pose comprising a footprint indicative at least in part of a pose and a shape of the robot along the route and each route pose having a plurality of points disposed therein;
computing repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses;
repositioning the first route pose in response to at least the repulsive forces; and
performing an interpolation between the repositioned first route pose and another of the one or more route poses.

10. The method of Claim 9, further comprising determining attractive forces from a point on another of the one or more route poses exerted on the plurality of points of the first route pose.

11. The method of Claim 9, further comprising:

detecting a plurality of objects in the environment with the one or more sensors, each of the plurality of objects having detected points; and

defining a force function, the force function computing repulsive forces exerted by each of the detected points of the plurality of objects on the plurality of points of the first route pose, wherein each repulsive force comprises a vector.

12. The method of Claim 11, wherein repositioning the first route pose comprises calculating a minimum of the force function.

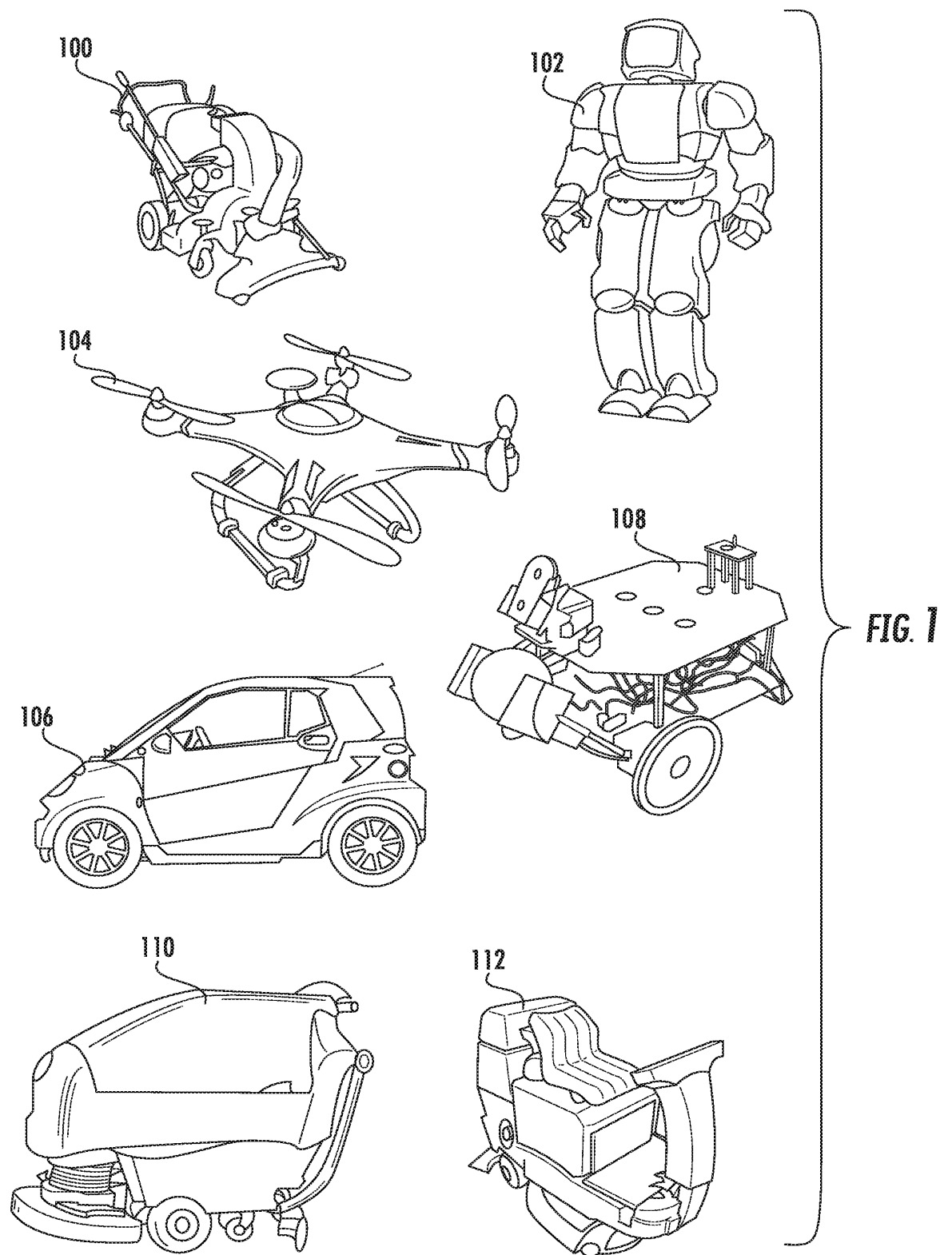
13. The method of Claim 9, wherein the repositioning of the first route pose comprises translating and rotating the first route pose.

14. The method of Claim 9, wherein the interpolation comprises:
generating an interpolation route pose having a footprint substantially similar to the shape of the robot; and
determining a translation and rotation of the interpolation route pose based at least on a collision-free path between the translated and rotated first route pose and the another of the one or more route poses.
15. The method of Claim 9, further comprising computing a magnitude of the repulsive forces as proportional to a distance between the point on the object and each of the plurality of points of the first route pose if the point on the object is outside of the footprint of the first route pose.
16. The method of Claim 9, further comprising computing a magnitude of the repulsive forces as inversely proportional to a distance between the point on the object and each of the plurality of points of the first route pose if the point on the object is inside the footprint of the first route pose.
17. The method of Claim 9, further comprising computing the torque forces onto the plurality of points of the first route pose due to the repulsive forces.
18. A non-transitory computer-readable storage apparatus having a plurality of instructions stored thereon, the instructions being executable by a processing apparatus to operate a robot, the instructions configured to, when executed by the processing apparatus, cause the processing apparatus to:
generate a map of an environment using data from one or more sensors;
determine a route on the map, the route comprising one or more route poses, each route pose comprising a footprint indicative at least in part of a pose and a shape of the robot along the route and each route pose having a plurality of points disposed therein; and
compute repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses.
19. The non-transitory computer-readable storage apparatus of Claim 18, further comprising one or more instructions, which when executed by the processing apparatus, further cause the processing apparatus to determine attractive forces from a point on another of the one or more route poses exerted on the plurality of points of the first route pose.
20. The non-transitory computer-readable storage apparatus of Claim 18, further

comprising one or more instructions, which when executed by the processing apparatus, further cause the processing apparatus to determine torque forces from a point on another of the one or more route poses exerted on the plurality of points of the first route pose.

**SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN
AUTONOMOUS NAVIGATION**Abstract of the Disclosure

Systems and methods for dynamic route planning in autonomous navigation are disclosed. In some exemplary implementations, a robot can have one or more sensors configured to collect data about an environment including detected points on one or more objects in the environment. The robot can then plan a route in the environment, where the route can comprise one or more route poses. The route poses can include a footprint indicative at least in part of a pose, size, and shape of the robot along the route. Each route pose can have a plurality of points therein. Based on forces exerted on the points of each route pose by other route poses, objects in the environment, and others, each route poses can reposition. Based at least in part on interpolation performed on the route poses (some of which may be repositioned), the robot can dynamically route.



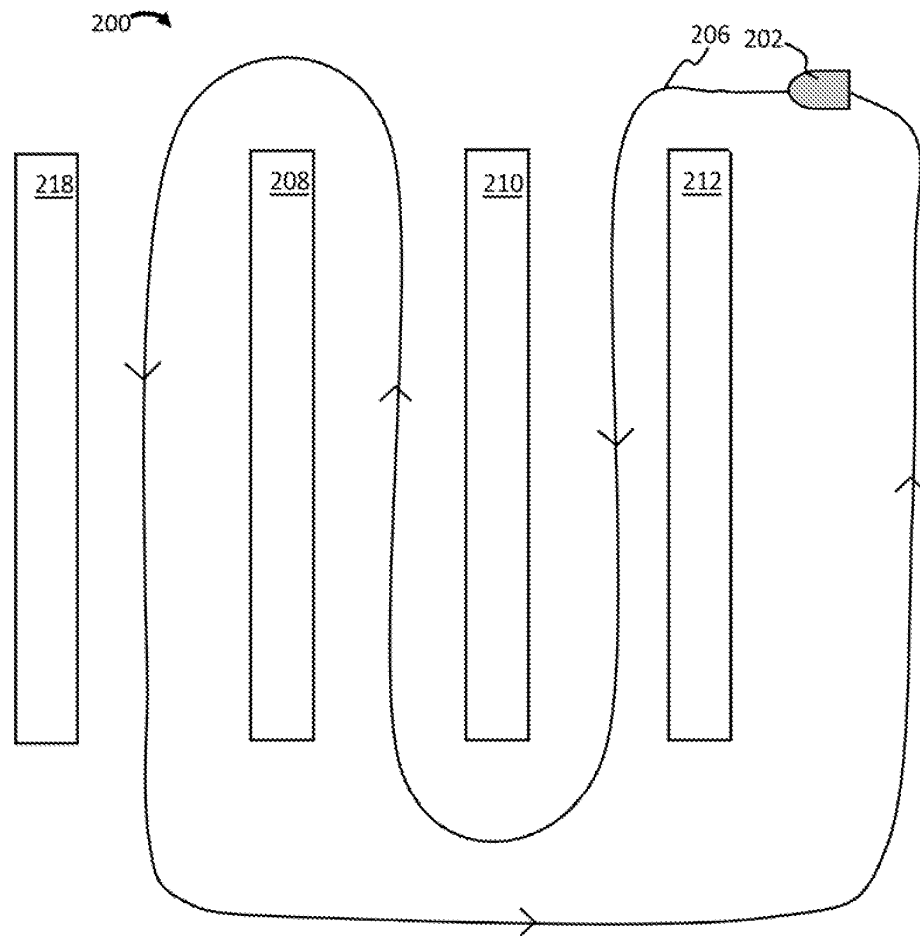


FIG. 2A

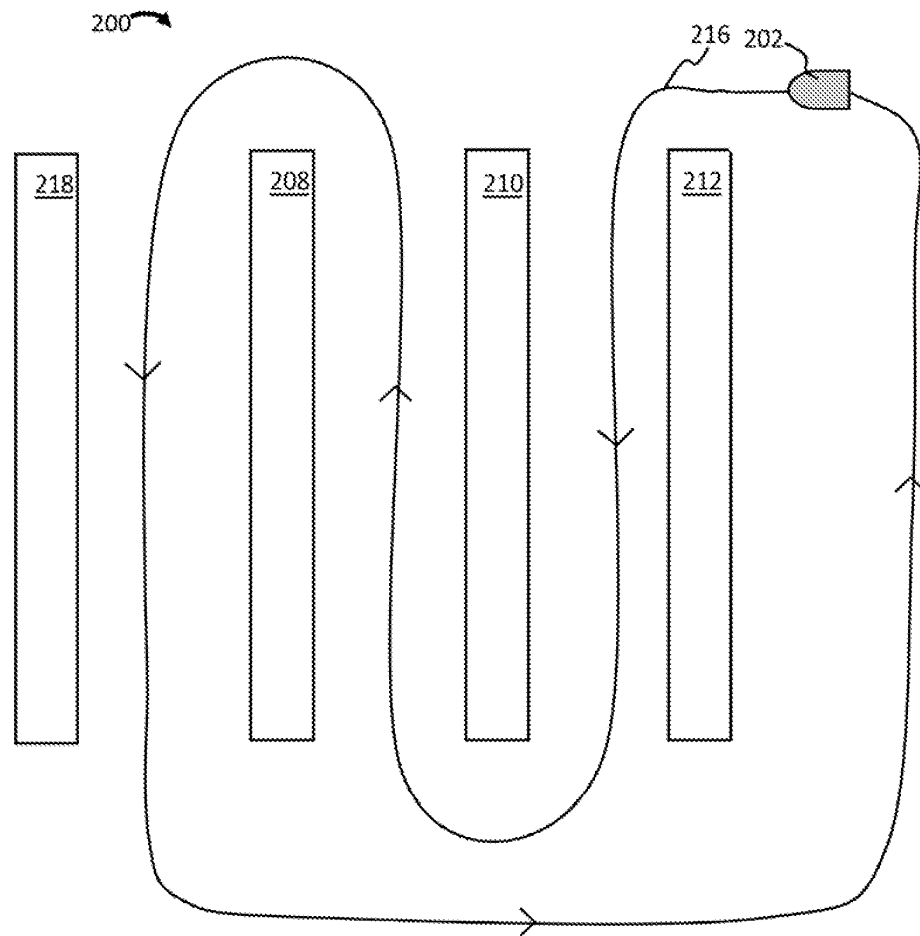


FIG. 2B

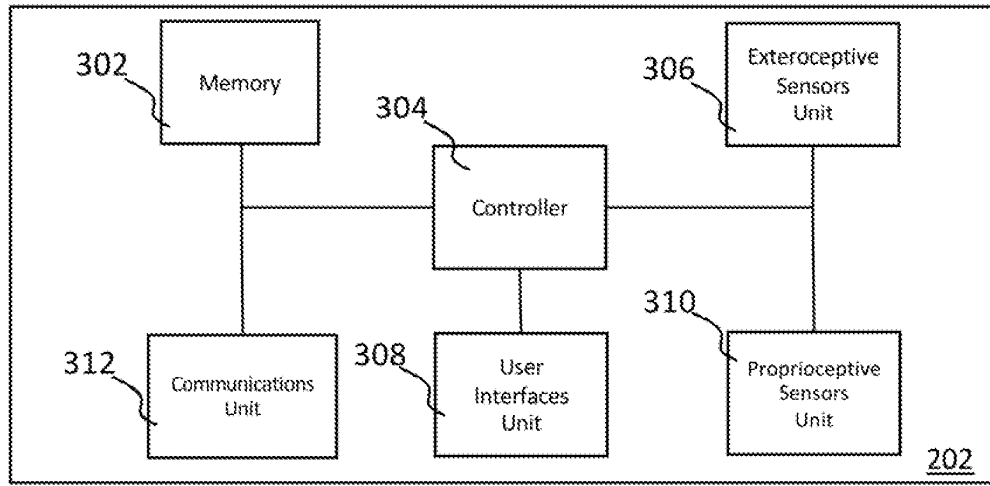


FIG. 3

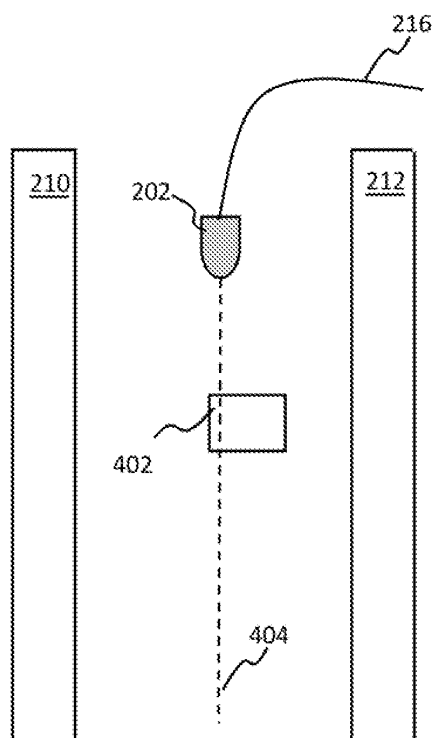


FIG. 4A

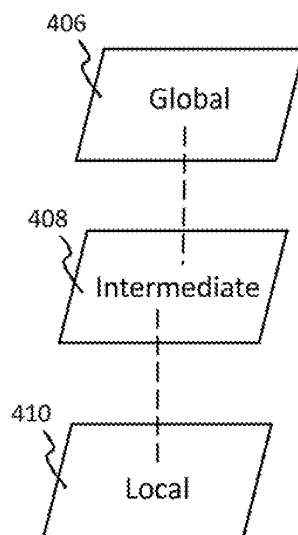


FIG. 4B

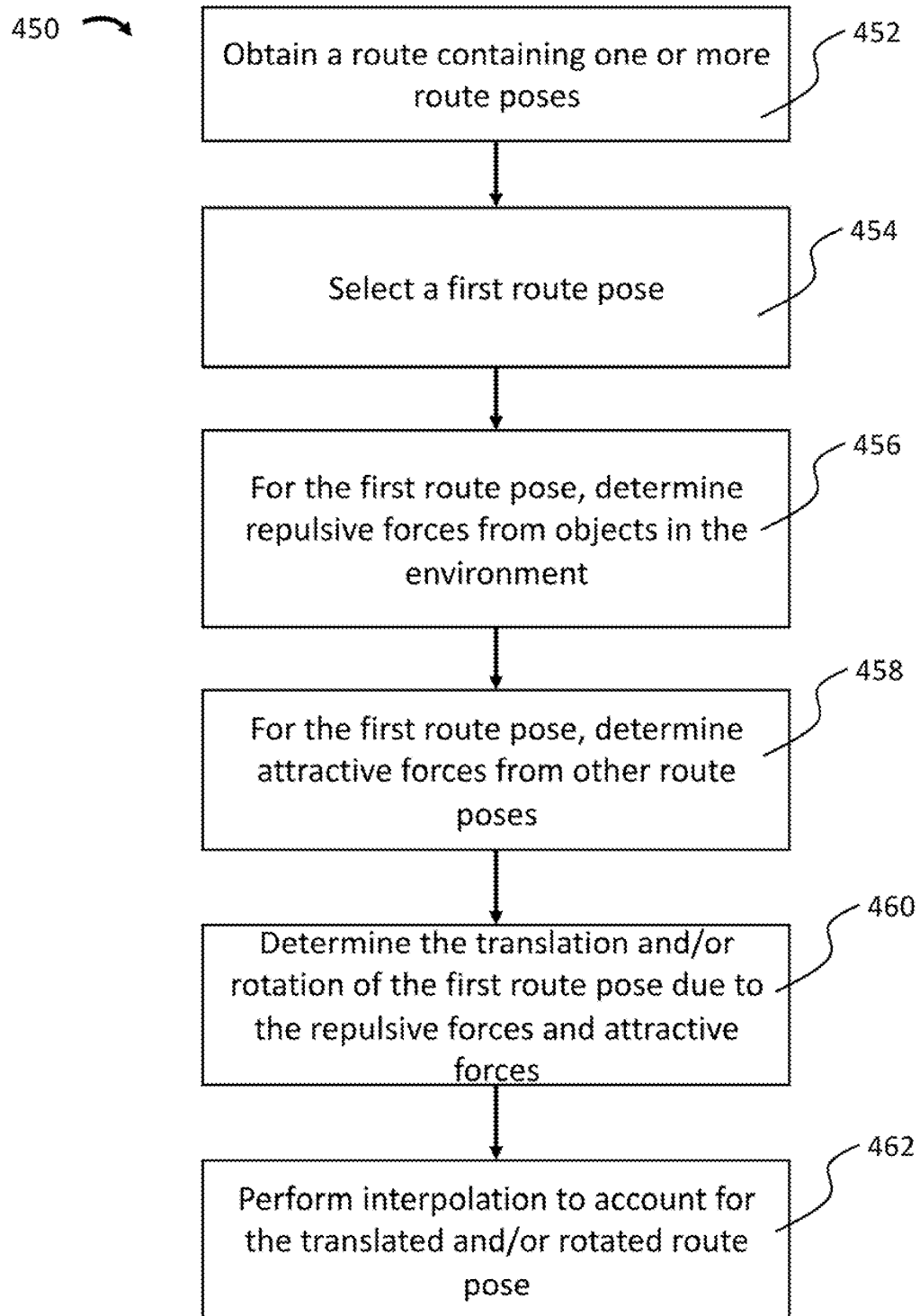


FIG. 4C

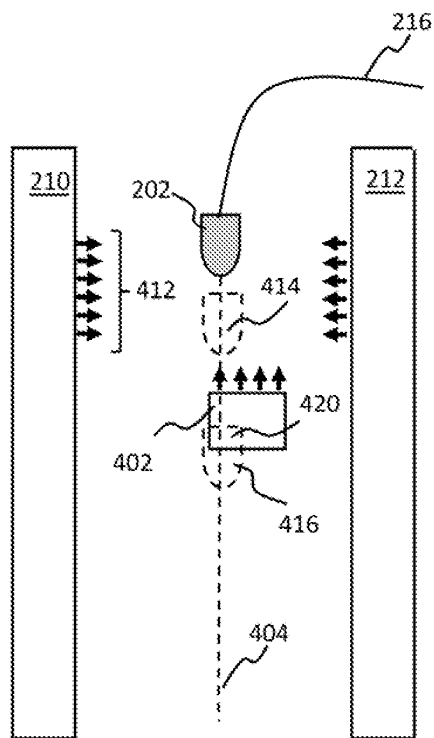


FIG. 4D



FIG. 4E

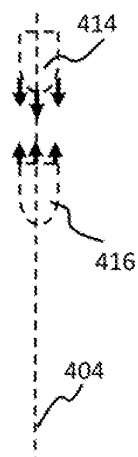


FIG. 4F

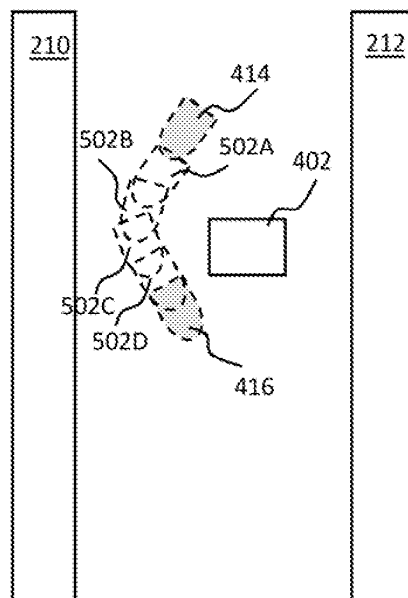


FIG. 5

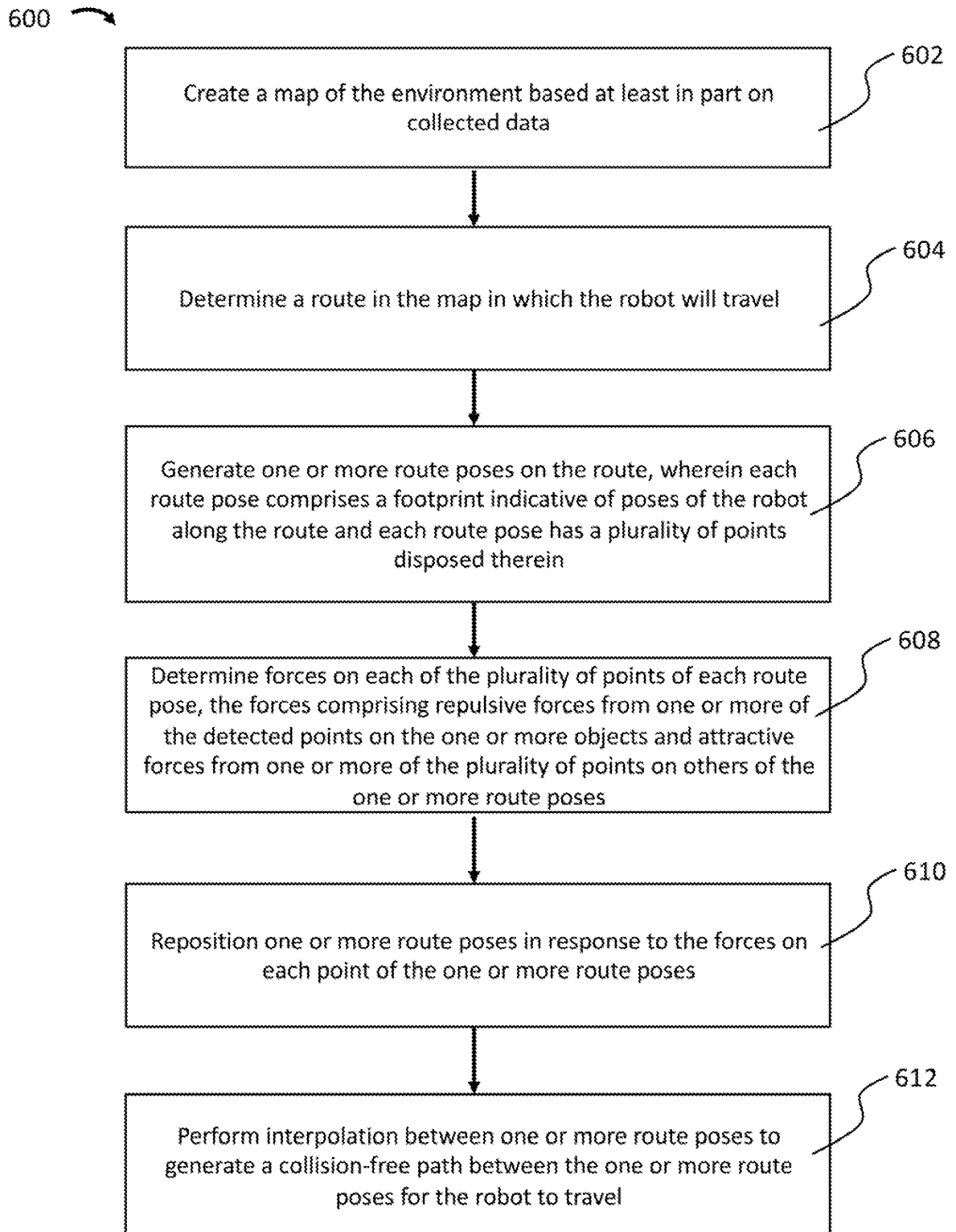


FIG. 6

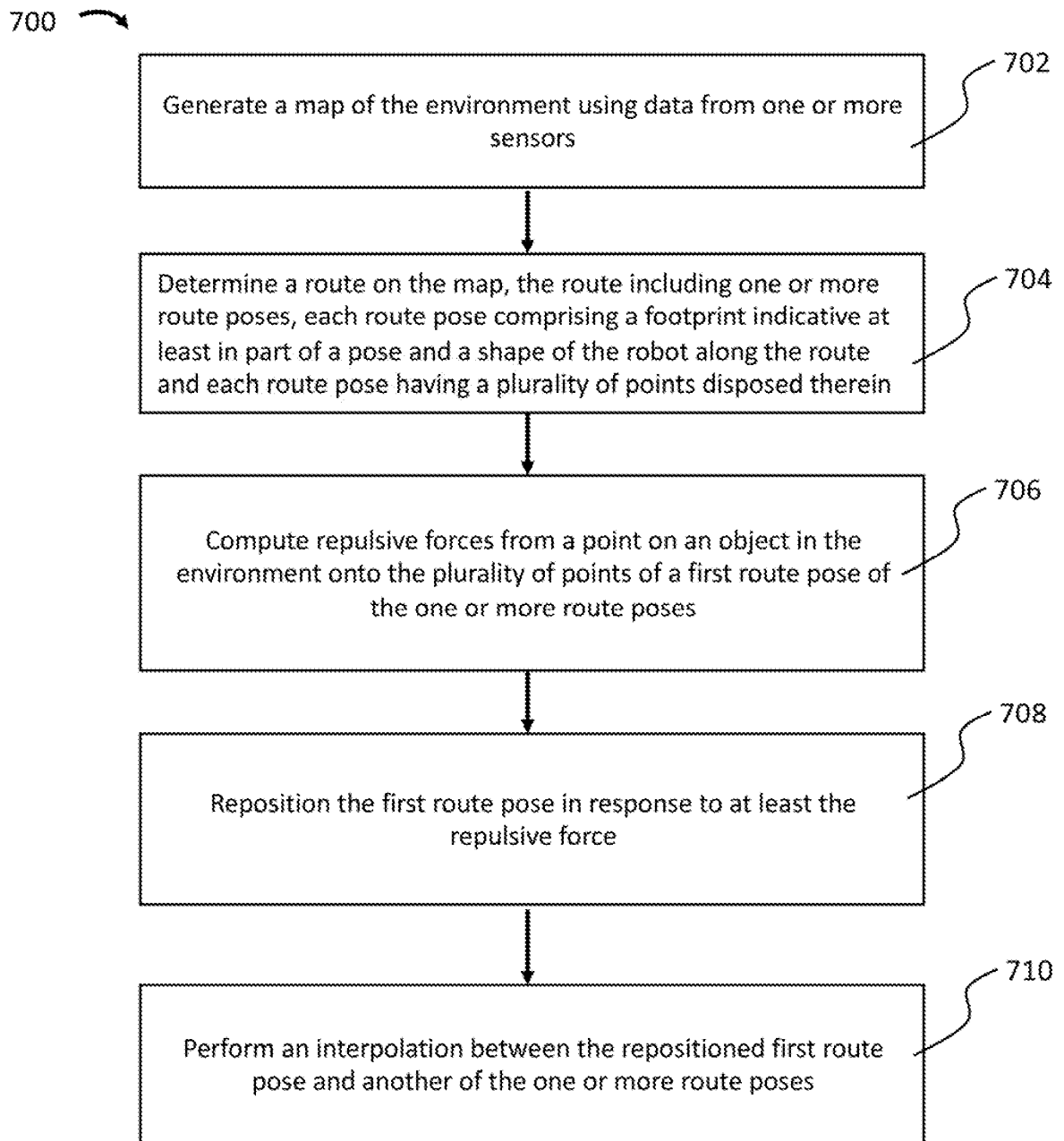


FIG. 7

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: BORJA IBARZ GABARDOS, et al.Application No./Patent No.: To be AssignedFiled/Issue Date: June 18, 2018Titled: SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATIONBrain Corporation, a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose one of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose one of options A or B below):

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 041921, Frame 0848, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(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.**

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STATEMENT UNDER 37 CFR 3.73(c)

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6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Peter J. Gutierrez, III/

June 18, 2018

Signature

Date

Peter J. Gutierrez, III

56,732

Printed or Typed Name

Title or Registration Number

[Page 2 of 2]

SCORE Placeholder Sheet for IFW Content

Application Number: 16011499

Document Date: 06/18/2018

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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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
16/011,499	06/18/2018	2837	0.00	BRAIN.134C1/BC201609C1	20	3

CONFIRMATION NO. 6846

FILING RECEIPT



132059
Gazdzinski & Associates, PC
16644 West Bernardo Drive
Suite 201
San Diego, CA 92127

Date Mailed: 07/09/2018

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

Inventor(s)

Borja Ibarz Gabardos, La Jolla, CA;
Jean-Baptiste Passot, Solana Beach, CA;

Applicant(s)

Brain Corporation, San Diego, CA

Power of Attorney: The patent practitioners associated with Customer Number 132059

Domestic Priority data as claimed by applicant

This application is a CON of 15/341,612 11/02/2016 PAT 10001780

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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: 07/06/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/011,499**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

Preliminary Class

318

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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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>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific 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).

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/011,499	06/18/2018	Borja Ibarz Gabardos	BRAIN.134C1/BC201609C1

CONFIRMATION NO. 6846

FORMALITIES LETTER



132059
Gazdzinski & Associates, PC
16644 West Bernardo Drive
Suite 201
San Diego, CA 92127

Date Mailed: 07/09/2018

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.
The surcharge is due for any one of:
 - late submission of the basic filing fee, search fee, or examination fee,
 - late submission of inventor's oath or declaration,
 - filing an application that does not contain at least one claim on filing, or
 - submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **75** basic filing fee.
- \$ **80** surcharge.
- \$ **330** search fee.
- \$ **380** examination fee.
- \$(**0**) previous unapplied payment amount.
- \$ **865** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

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.

/elbanaybanay/

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/011,499				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	330		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *	x 50 =	0.00	OR					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 230 =	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						
			TOTAL	785		TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	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.										

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Borja Ibarz Gabardos et al.

Serial No. 16/011,499

Filing Date: June 18, 2018

Confirmation No. 6846

**SYSTEMS AND METHODS FOR
DYNAMIC ROUTE PLANNING IN
AUTONOMOUS NAVIGATION**

**RESPONSE TO NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL
APPLICATION**

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

Dear Sir:

This is in response to the Notice To File Missing Parts Of Non-Provisional Application mailed by the U.S. Patent Office on July 9, 2018. This paper is being timely filed by September 9, 2018.

Applicant submits herewith the fees totaling \$865.00.

The Commissioner is hereby authorized to charge the fees and to credit any overpayment to Deposit Account No. 18-0586.

Date: September 5, 2018

Respectfully submitted,

/Sidarth Kapoor /
Sidarth Kapoor
Registration No. 68,159
REED SMITH LLP
136 Main Street
Suite 250
Princeton, NJ 08540
T – 609-524-2077
Attorney for Applicant

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/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/011,499
Filing Date	06-18-2018
First Named Inventor	Borja Ibarz Gabardos
Title	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION
Art Unit	2837
Examiner Name	
Attorney Docket Number	P23293US01

SIGNATURE of Applicant or Patent Practitioner

Signature	/Sidarth Kapoor/	Date (Optional)	09-05-2018
Name	Sidarth Kapoor	Registration Number	68159
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 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.

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: 26418
- 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):

Brain Corp

- ☐ 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	<u>Andy Ng</u>	Date (Optional)	
Name	Andy Ng		
Title	General Counsel		

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 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.

Electronic Patent Application Fee Transmittal				
Application Number:		16011499		
Filing Date:		18-Jun-2018		
Title of Invention:		SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		
First Named Inventor/Applicant Name:		Borja Ibarz Gabardos		
Filer:		Sidharth Kapoor/Cody Nye		
Attorney Docket Number:		BRAIN.134C1/BC201609C1		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	80	80
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				865

Electronic Acknowledgement Receipt	
EFS ID:	33636522
Application Number:	16011499
International Application Number:	
Confirmation Number:	6846
Title of Invention:	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION
First Named Inventor/Applicant Name:	Borja Ibarz Gabardos
Customer Number:	132059
Filer:	Sidharth Kapoor/Cody Nye
Filer Authorized By:	Sidharth Kapoor
Attorney Docket Number:	BRAIN.134C1/BC201609C1
Receipt Date:	05-SEP-2018
Filing Date:	18-JUN-2018
Time Stamp:	17:43:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$865
RAM confirmation Number	090618INTEFSW17441000
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	Applicant Response to Pre-Exam Formalities Notice	P23293US01_-_2018-09-05_-_Response_Missing_Parts_-_16011499.pdf	470060 f67b6e868c178b4d5e663d980c3ebbb4e9fec6c1	no	1
Warnings:					
Information:					
2	Power of Attorney	P23293US01_-_2018-09-05_-_POA_-_16011499.pdf	1282433 62e22ffebf91523b853caa22614cdfd282f6087f	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	37530 8005d59cf8e67fc5d3d2ef9ce728e8540b910c71	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1790023		
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. <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.					



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
16/011,499	06/18/2018	Borja Ibarz Gabardos	BRAIN.134C1/BC201609C1

CONFIRMATION NO. 6846

POWER OF ATTORNEY NOTICE



132059
Gazdzinski & Associates, PC
16644 West Bernardo Drive
Suite 201
San Diego, CA 92127

Date Mailed: 09/10/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/05/2018.

- 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.

/mnguyen/



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
16/011,499	06/18/2018	2837	865	P23293US01	20	3

CONFIRMATION NO. 6846

UPDATED FILING RECEIPT



26418
REED SMITH LLP
P.O. BOX 488 (NYC)
PITTSBURGH, PA 15230-0488

Date Mailed: 09/10/2018

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

Inventor(s)

Borja Ibarz Gabardos, La Jolla, CA;
Jean-Baptiste Passot, Solana Beach, CA;

Applicant(s)

Brain Corporation, San Diego, CA

Power of Attorney: The patent practitioners associated with Customer Number 26418

Domestic Priority data as claimed by applicant

This application is a CON of 15/341,612 11/02/2016 PAT 10001780

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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: 07/06/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/011,499**

Projected Publication Date: 12/20/2018

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

Preliminary Class

318

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>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific 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.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/011,499				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	330		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *	x 50 =	0.00	OR					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 230 =	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						
			TOTAL	785		TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	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
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01

CONFIRMATION NO. 6846

POA ACCEPTANCE LETTER



OC000000102140468

26418
REED SMITH LLP
P.O. BOX 488 (NYC)
PITTSBURGH, PA 15230-0488

Date Mailed: 09/10/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/05/2018.

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.

/mnguyen/



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01	6846
26418	7590	10/04/2018	EXAMINER	
REED SMITH LLP			FREJD, RUSSELL WARREN	
P.O. BOX 488 (NYC)				
PITTSBURGH, PA 15230-0488				
			ART UNIT	PAPER NUMBER
			3661	
			NOTIFICATION DATE	DELIVERY MODE
			10/04/2018	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):

nycipdocketing@reedsmith.com
ptoipinbox@reedsmith.com

DETAILED ACTION

1. Claims 1-20 of application 16/011499, filed on 18-June-2018, are presented for examination. The present application is a CON of application 15/341612, filed on 2-November-2016, now USP 10,001,780.

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

IDS IN CONTINUED EXAMINATIONS OR CONTINUING APPLICATIONS

2. Continuation Applications, Divisional Applications, or Continuation-in-Part Applications Filed Under 37 CFR 1.53(b)

The examiner will consider information which has been considered by the Office in a parent application when examining: (A) a continuation application filed under 37 CFR 1.53(b), (B) a divisional application filed under 37 CFR 1.53(b), or (C) a continuation-in-part application filed under 37 CFR 1.53(b). A listing of the information need not be resubmitted in the continuing application unless the applicant desires the information to be printed on the patent.

*If resubmitting a listing of the information, applicant should submit a new listing that complies with the format requirements in 37 CFR 1.98(a)(1). Applicants are strongly discouraged from submitting a list that includes copies of PTO/SB/08 ** or PTO-892 forms from other applications. A completed PTO/SB/08 ** form from another application may already have initials of an examiner and the application number of another application. This information will likely confuse the record. Furthermore, when the spaces provided on the form have initials of an examiner, there are no spaces available next to the documents listed for the examiner of the subsequent application to provide his or her initials, and the previously relevant initials may be erroneously construed as being applied for the current application.*

Abstract Objections

3. The Abstract of the Disclosure is objected to because of a typographical informality that was corrected by the Examiner's Amendment in the parent application (i.e. the term "poses" on line 9), but appears again in the present Abstract. Correction is required. See M.P.E.P. § 608.01(b).

Specification Objections

4. The specification is objected to because of the following informalities:

In view of the fact that continuation information was provided in paragraph [0001] of the specification, the continuation information should be updated to reflect the current patent status of parent application 15/341612, which is now USP 10,001,780. Appropriate correction is required.

Double Patenting Rejections

5.1 *The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See e.g., In re Berg, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); In re Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); In re Longi, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); In re Van Ornum, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, In re Thorington, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).*

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.32(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal

Disclaimer that meets all requirements is auto-processed and approved immediately upon submission.

For more information about eTerminal Disclaimers, refer to

<http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

5.2 Claims 1-20 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of USP 10,001,780. Although the conflicting claims are not identical, they are not patentably distinct from each other because both the present invention and the '780 patent are directed to dynamic navigation of a robot in an environment. Furthermore, the features of claims 1-20 of the present invention are identical to, or nearly so, with the corresponding features in claims 1-20 of the '780 patent. In fact, the only differences between the present claims and the '780 patent, are the minor phrase changes that were amended by applicant, and the Examiner's Amendment, in claims 12, 14 and 17.

For at least these reasons, one of ordinary skill would have found it obvious that the features in claims 1-20 of the present invention, and claims 1-20 of the '780 patent, which were present before the effective filing date of the present invention, are not patentably distinct in so far as the present invention is an obvious variation of the '780 patent, and the specifications of both the present invention and the '780 patent support the identical critical features noted above.

Allowed Claims

6. Claims 1-20 are considered allowable, pending resolution of any rejections or objections noted above, since when reading the claims in light of the specification, as per MPEP § 2111.01, none of the references of record, either individually or in combination, disclose the specific arrangement of elements in the same combination specified in independent claims 1, 9 and 18.

There are inventions in the field that provide similar functionality and/or have similar features, as the prior art of record shows. The examiner's search failed to find this combination of features, nor was it obvious in light of the prior art. It is for these reasons that the claims of the present application are found to be patentable over the prior art.

Dependent claims 2-8, 10-17 and 19-20 are deemed allowable as depending either directly or indirectly from allowed independent claims 1, 9 and 18.

Response Guidelines

7.1 A shortened statutory period for response to this non-final action is set to expire **3 (three) months and 0 (zero) days** from the date of this letter. Failure to respond within the period for response will cause the application to become abandoned (see MPEP 710.02, 710.02(b)).

7.2 Any response to the Examiner in regard to this non-final action should be

directed to: Russell Frejd, telephone number (571) 272-3779, Monday-Friday from 0730 to 1600 ET. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Black, can be reached at telephone number (571) 272-6956.

mailed to: Commissioner of Patents and Trademarks
P.O. Box 1450, Alexandria, VA 22313-1450

faxed to: (571) 273-8300

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

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

Application/Control Number: 16/011,499
Art Unit: 3661

Page 6

Hand-delivered responses should be brought to the Customer Service Window,
Randolph Building, 401 Dulany Street, Alexandria, VA, 22314.

/RUSSELL FREJD/
Primary Examiner AU 3661

<i>Notice of References Cited</i>	Application/Control No. 16/011,499		Applicant(s)/Patent Under Reexamination	
	Examiner RUSSELL FREJD		Art Unit 3661	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-8174568-B2	05-2012	Samarasekera; Supun	G01C21/005	348/113
*	B	US-8843244-B2	09-2014	Phillips; Emilie	G05D1/0038	701/2
*	C	US-20080059015-A1	03-2008	Whittaker; William L.	G05D1/0274	701/23
*	D	US-20160078303-A1	03-2016	Samarasekera; Supun	G01C21/005	348/47
*	E	US-20170329333-A1	11-2017	Passot; Jean-Baptiste	A47L11/4011	1/1
*	F	US-20170329347-A1	11-2017	Passot; Jean-Baptiste	A47L11/4011	1/1
	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					
	O					
	P					
	Q					
	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.

<i>Index of Claims</i> 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS									
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47									
CLAIM			DATE						
Final	Original	09/29/2018							
	1	✓							
	2	✓							
	3	✓							
	4	✓							
	5	✓							
	6	✓							
	7	✓							
	8	✓							
	9	✓							
	10	✓							
	11	✓							
	12	✓							
	13	✓							
	14	✓							
	15	✓							
	16	✓							
	17	✓							
	18	✓							
	19	✓							
	20	✓							

<i>Search Notes</i> 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

CPC - Searched*		
Symbol	Date	Examiner
G05D: 1/0214, 1/0088, 1/0276, 2201/0203	9/28/18	RF
A47L: 11/4011, 11/4061, 2201/04	"	"
G01C: 21/343, 21/3415	"	"

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
G05D: 1/0214, 1/0088, 1/0276, 2201/0203	9/28/18	RF
A47L: 11/4011, 11/4061, 2201/04	"	"
G01C: 21/343, 21/3415	"	"
WEST	"	"

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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WEST Search History

DATE: Friday, September 28, 2018

<u>Hide?</u>	<u>Set</u>	<u>Query</u>	<u>Hit</u> <u>Count</u>
<i>Prior Art</i>			
<i>DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=ADJ</i>			
☐	L82	Gabardos.in. and (autonomous with navigation) and (robot same map same environment)	7
☐	L81	L79 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L80	L79 and (route same footprint same points)	2
☐	L79	L78 and (route same (pose or poses))	5
☐	L78	Ibarz.in. and (autonomous with navigation) and (robot same map same environment)	7
☐	L77	L66 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L76	L67 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L75	L69 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L74	L71 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	0
☐	L73	L71 and (route same footprint same points)	0
☐	L72	L71 and (route same (pose or poses))	0
☐	L71	L66 and ((autonomous guided vehicle? or AGV?) and (navigat\$ same map same environment))	10
☐	L70	L66 ((autonomous guided vehicle? or AGV?) and (navigat\$ same map same environment))	0
☐	L69	L68 and (route same footprint same points)	2
☐	L68	L67 and (route same (pose or poses))	7
☐	L67	L66 and (autonomous with navigation) and (robot same map same environment)	210
☐	L66	(G05D1/0214,1/0276,1/0088,2201/0203 or G01C21/343,21/3415 or A4711/4011,11/4061,2201/04).cpc.	7370
☐	L65	L55 and (interpolation same route same poses same (collision with free) same path)	0
☐	L64	L55 and (route same map same robot same travel)	0
☐	L63	L62 and (route same map same robot same travel)	0
☐	L62	L55 and (robot same sensor? same environment same object?)	2
☐	L61	L60 and (route same footprint same points)	0
☐	L60	L55 and (route same (pose or poses))	2
☐	L59	L55 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	0
		L55 and ((autonomous guided vehicle? or AGV?) and (navigat\$ same map	

☐	L58	same environment))	0
☐	L57	L55 and (autonomous with navigation) and (dynamic with route with planning)	0
☐	L56	L55 and (autonomous with navigation) and (robot same map same environment)	0
☐	L55	L54 OR L53	19
☐	L54	(7212651 OR 7576639 OR 8514236 OR 9746339).PN. OR 20020107649 OR 20120072166 OR 20140002843 OR 20160182502	11
☐	L53	20120109150 OR 20150199458 OR 20150283703 OR 20160282862 OR 20160309973	8
☐	L37	L18 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L36	L18 and (route same footprint same points)	2
☐	L35	L24 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L34	L24 and (route same footprint same points)	2
☐	L33	L24 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L32	L24 and (route with footprint with points)	2
☐	L31	L29 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L30	L29 and (route same footprint same points)	2
☐	L29	L24 and (route same (pose or poses))	20
☐	L28	L25 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L27	L25 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L26	L25 and (route with footprint with points)	2
☐	L25	L24 and (route with (pose or poses))	9
☐	L24	(autonomous with navigation) and (robot same map same environment)	613
☐	L23	L19 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L22	L19 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L21	L19 and (route same footprint same points)	2
☐	L20	L19 and (route with footprint with points)	2
☐	L19	L18 and (route with (pose or poses))	4
☐	L18	L5 and (autonomous with navigation) and (robot same map same environment)	155
☐	L17	L6 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L16	L6 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L15	L6 and (route same footprint same points)	2
☐	L14	L6 and (route with footprint with points)	2
☐	L13	L1 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L12	L1 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L11	L1 and (route same footprint same points)	2
☐	L10	L1 and (route with footprint with points)	2
☐	L9	L6 and (route same (pose or poses))	3
☐	L8	L6 and (route with (pose or poses))	3

☐	L7	Gabardos.in. and (autonomous with navigation) and (dynamic with route with planning)	3
☐	L6	L5 and (autonomous with navigation) and (dynamic with route with planning)	17
☐	L5	(((((G05D1/0214)))) (((G05D1/0276)))) (((G05D2201/0203)))) or (((G01C21/343)))) (((G01C21/3679)))) (((G01C21/3415))))).cpc.	5871
☐	L4	L1 and (interpolat\$ same route same pose?)	2
☐	L3	L1 and (route same pose?)	5
☐	L2	L1 and (route with pose?)	4
☐	L1	(autonomous with navigation) and (dynamic with route with planning)	43

Interference

DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=ADJ

☐	L52	L49 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	0
☐	L51	L49 and (route same footprint same points)	0
☐	L50	L49 and (route same (pose or poses))	0
☐	L49	((autonomous guided vehicle ? or AGV ?) and (navigat \$ same map same environment))	42
☐	L48	L43 and (route with ((attractive near5 forces) or (repulsive near5 forces))).clm.	2
☐	L47	L43 and (route with footprint with points).clm.	2
☐	L46	L40 and (route same ((attractive near5 forces) or (repulsive near5 forces))).clm.	2
☐	L45	L40 and (route same footprint same points).clm.	2
☐	L44	L43 and (route same (pose or poses)).clm.	2
☐	L43	(autonomous with navigation) and (robot same map same environment).clm.	76
☐	L42	L40 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	2
☐	L41	L40 and (route same footprint same points)	2
☐	L40	L39 and (route same (pose or poses))	7
☐	L39	L38 and (autonomous with navigation) and (robot same map same environment)	210
☐	L38	(((((G05D1/0214))) (((G05D1/0276))) (((G05D2201/0203))) (((G05D1/0088)))) or (((G01C21/343))) (((G01C21/3679))) (((G01C21/3415))))).cpc.	8645

END OF SEARCH HISTORY



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BIB DATA SHEET

CONFIRMATION NO. 6846

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
16/011,499	06/18/2018	701	3661	P23293US01		
RULE						
APPLICANTS Brain Corporation, San Diego, CA INVENTORS Borja Ibarz Gabardos, La Jolla, CA; Jean-Baptiste Passot, Solana Beach, CA; ** CONTINUING DATA ***** This application is a CON of 15/341,612 11/02/2016 PAT 10001780 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 07/06/2018						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and /RUSSELL WARREN Acknowledged FREJD/ Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 12	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 3
ADDRESS REED SMITH LLP P.O. BOX 488 (NYC) PITTSBURGH, PA 15230-0488 UNITED STATES						
TITLE SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION						
FILING FEE RECEIVED 865	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01

CONFIRMATION NO. 6846

26418
REED SMITH LLP
P.O. BOX 488 (NYC)
PITTSBURGH, PA 15230-0488

PUBLICATION NOTICE



OC000000104617285

Title:SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

Publication No.US-2018-0364724-A1

Publication Date:12/20/2018

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 publicly available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

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

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

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

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/011,499		Filing Date 06/18/2018		☐ To be Mailed	
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO									
APPLICATION AS FILED - PART I									
		(Column 1)		(Column 2)					
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A			
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A		N/A		N/A			
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A			
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *				x \$50 =			
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *				x \$230 =			
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							
☐ 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)			
01/03/2019		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)	
Total (37 CFR 1.16(i))		* 20		Minus ** 20		= 0		x \$50 =	
Independent (37 CFR 1.16(h))		* 3		Minus *** 3		= 0		x \$230 =	
☐ 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 (\$)	
Total (37 CFR 1.16(i))		*		Minus **		=		x \$0 =	
Independent (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								LIE	
* 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".								/SHARAIN E MORELAND/	
*** 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.

Electronic Acknowledgement Receipt	
EFS ID:	34746048
Application Number:	16011499
International Application Number:	
Confirmation Number:	6846
Title of Invention:	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION
First Named Inventor/Applicant Name:	Borja Ibarz Gabardos
Customer Number:	26418
Filer:	Sidharth Kapoor/Cody Nye
Filer Authorized By:	Sidharth Kapoor
Attorney Docket Number:	P23293US01
Receipt Date:	03-JAN-2019
Filing Date:	18-JUN-2018
Time Stamp:	10:21:38
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	Amendment/Req. Reconsideration-After Non-Final Reject	P23293US01_-_2018-01-03_-_Response.pdf	532234	no	12
			f3e3737988dea5f134452d45a57b5ebf64f55a0f		
Warnings:					

Information:	
Total Files Size (in bytes):	532234
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: GABARDOS, Bojra, I., et al.

Serial No.: 16/011,499

Attorney Docket No.: P23293US01

Examiner: FREJD, RUSSEL W.

Art Unit: 3661

For: SYSTEMS AND METHODS FOR
DYNAMIC ROUTE PLANNING IN
AUTONOMOUS NAVIGATION

Date: **Nov. 2, 2016**

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION

This amendment and remarks are being timely filed in response to the Non-Final Office Action issued in the present application on October 4, 2018. No new matter is presented via this amendment. The Commissioner is hereby authorized to charge any additional fees, which may be required by this paper, to Deposit Account No. 18-0582.

Amendments to the Claims begin on page 2;

Amendments to Abstract begin on page 9;

Amendments to Specification begin on page 10; and

Remarks begin on page 11.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A robot for maneuvering along a route, comprising:
one or more sensors coupled to the robot, the one or more sensors configured to collect data about an environment proximate to the robot including detected points on one or more objects in the environment; and
a controller configured to execute computer readable instructions to, [[:]]
~~create a map of the environment based at least in part on the collected data;~~
~~determine a route in the on a map in which for the robot [[:]] to travel, the map~~
~~corresponding to the environment and being generated by at least one or more sensors~~
~~coupled to the robot, the route including a plurality of points such that a first point being~~
~~discretized than a second point, each of the plurality of points corresponding to a~~
~~respective pose of the robot, the respective pose of the robot including a plurality of~~
~~points disposed therein, the respective pose corresponding to at least one of position and~~
~~orientation of the robot, and [[:]]~~
~~compute repulsive forces from a point on an object onto the plurality of points of~~
~~the respective pose, the object being on the map.~~
~~generate one or more route poses on the route, wherein each route pose comprises~~
~~a footprint indicative of poses of the robot along the route and each route pose has a~~
~~plurality of points disposed therein;~~
~~determine forces on each of the plurality of points of each route pose, the forces~~
~~comprising repulsive forces from one or more of the detected points on the one or more~~
~~objects and attractive forces from one or more of the plurality of points on others of the~~
~~one or more route poses;~~

~~reposition one or more route poses in response to the forces on each point of the one or more route poses; and~~

~~perform interpolation between one or more route poses to generate a collision-free path between the one or more route poses for the robot to travel.~~

2 – 8. (Cancelled).

9. (Currently Amended) A method for dynamic navigation and route planning of a robot in an environment, comprising:

~~generating a map of the environment using data from one or more sensors;~~

determining a route on ~~[[the]]~~ a map for the robot, the route including one or more route poses, each route pose comprising a footprint indicative at least in part of a pose and a shape of the robot along the route and each route pose having a plurality of points disposed therein, the map corresponding to an environment and being generated by at least one sensor on the robot, the route including a plurality of points such that a first point being discretized than a second point, each of the plurality of points corresponding to a respective pose of the robot, the respective pose of the robot including a plurality of points disposed therein, the respective pose corresponding to at least one of position and orientation of the robot; and

computing repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses~~[[;]].~~

~~repositioning the first route pose in response to at least the repulsive forces; and~~

~~performing an interpolation between the repositioned first route pose and another of the one or more route poses.~~

10 – 17. (Cancelled).

18. (Currently Amended) A non-transitory computer-readable storage apparatus having a plurality of instructions stored thereon, ~~the instructions being executable by a processing apparatus to operate a robot, the instructions configured to, that~~ when executed by the ~~processing apparatus, cause the processing apparatus~~ at least one processor configure the at last one processor to:

~~generate a map of an environment using data from one or more sensors;~~

determine a route on ~~[[the]]~~ a map for a robot, the route comprising one or more route poses, each route pose comprising a footprint indicative at least in part of a pose and a shape of the robot along the route and each route pose having a plurality of points disposed therein, the map corresponding to the environment and being generated by at least one sensor on the robot, the route including a plurality of points such that a first point being discretized than a second point, each of the plurality of points corresponding to a respective pose of the robot, the respective pose of the robot including a plurality of points disposed therein, the respective pose corresponding to at least one of position and orientation of the robot; and

compute repulsive forces from a point on an object in the environment onto the plurality of points of a first route pose of the one or more route poses.

19 – 20. (Cancelled).

21. (New) The robot of claim 1, wherein the respective pose of the robot and a subsequent respective pose of the robot being regularly or irregularly spaced apart from each other on the route such that the respective pose and the subsequent respective pose form a sequence along the route.

22. (New) The robot of claim 1, wherein the respective pose corresponds to a footprint of the robot, the footprint configured to be adjustable between a small footprint and a large footprint, the small footprint having a high likelihood of collision with the object, and the large footprint having a low likelihood of collision with the object, the footprint of the robot configured to be dynamically reshaped.

23. (New) The robot of claim 1, wherein the repulsive forces from the point on the object prevent the robot from colliding with the object,
the repulsive forces from the object is uniform on the respective pose, and
the repulsive forces is dependent on characteristics of where the object is positioned relative to the respective pose.

24. (New) The robot of claim 1, wherein the plurality of points of the respective pose configured to experience the repulsive forces, the plurality of points capable of translating and rotating in response to repositioning of the respective pose.

25. (New) The robot of claim 1, wherein the controller is further configured to execute the computer readable instructions to,
perform interpolation between the respective pose and a subsequent respective route pose to generate a collision-free route between the respective pose and the subsequent respective route pose for the robot to travel.

26. (New) The robot of claim 1, wherein the controller is further configured

to execute the computer readable instructions to,

reposition the respective pose and a subsequent respective pose in response to the repulsive forces on each point of the plurality of points.

27. (New) The method of claim 9, wherein the respective pose of the robot and a subsequent respective pose of the robot being regularly or irregularly spaced apart from each other on the route such that the respective pose and the subsequent respective pose form a sequence along the route.

28. (New) The method of claim 9, wherein the respective pose corresponds to a footprint of the robot, the footprint configured to be adjustable between a small footprint and a large footprint, the small footprint having a high likelihood of collision with the object, and the large footprint having a low likelihood of collision with the object, the footprint of the robot configured to be dynamically reshaped.

29. (New) The method of claim 9, wherein,
the repulsive forces from the point on the object prevent the robot from colliding with the object,

the repulsive forces from the object is uniform on the respective pose, and
the repulsive forces is dependent on characteristics of where the object is positioned relative to the respective pose.

30. (New) The method of claim 9, wherein the plurality of points of the

respective pose configured to experience the repulsive forces, the plurality of points capable of translating and rotating in response to repositioning of the respective pose.

31. (New) The method of claim 9, further comprising:

performing interpolation between the respective pose and a subsequent respective route pose to generate a collision-free route between the respective pose and the subsequent respective route pose for the robot to travel.

32. (New) The non-transitory computer readable medium of claim 18,

wherein the respective pose of the robot and a subsequent respective pose of the robot being regularly or irregularly spaced apart from each other on the route such that the respective pose and the subsequent respective pose form a sequence along the route.

33. (New) The non-transitory computer readable medium of claim 18,

wherein the respective pose corresponds to a footprint of the robot, the footprint configured to be adjustable between a small footprint and a large footprint, the small footprint having a high likelihood of collision with the object, and the large footprint having a low likelihood of collision with the object, the footprint of the robot configured to be dynamically reshaped.

34. (New) The non-transitory computer readable medium of claim 18,

wherein,

the repulsive forces from the point on the object prevent the robot from colliding with the object,

the repulsive forces from the object is uniform on the respective pose, and
the repulsive forces is dependent on characteristics of where the object is positioned
relative to the respective pose.

35. (New) The non-transitory computer readable medium of claim 18,
wherein the plurality of points of the respective pose configured to experience the repulsive
forces, the plurality of points capable of translating and rotating in response to repositioning of
the respective pose.

36. (New) The non-transitory computer readable medium of claim 18,
wherein the at least one processor is further configured to execute the computer readable
instructions to,
perform interpolation between the respective pose and a subsequent respective route pose
to generate a collision-free route between the respective pose and the subsequent respective route
pose for the robot to travel.

37. (New) The non-transitory computer readable medium of claim 18,
wherein the at least one processor is further configured to execute the computer readable
instructions to,
reposition the respective pose and a subsequent respective pose in response to the
repulsive forces on each point of the plurality of points.

*****END OF CLAIM LISTING*****

Amendment to Abstract

Please amend Abstract of the present application as follows:

Systems and methods for dynamic route planning in autonomous navigation are disclosed. In some exemplary implementations, a robot can have one or more sensors configured to collect data about an environment including detected points on one or more objects in the environment. The robot can then plan a route in the environment, where the route can comprise one or more route poses. The route poses can include a footprint indicative at least in part of a pose, size, and shape of the robot along the route. Each route pose can have a plurality of points therein. Based on forces exerted on the points of each route pose by other route poses, objects in the environment, and others, each route ~~poses~~ pose can reposition. Based at least in part on interpolation performed on the route poses (some of which may be repositioned), the robot can dynamically route.

Amendment to Specification

Please amend paragraph [0001] of the specification as follows:

[0001] This application is a continuation of, and claims the benefit of priority to, co-owned and co-pending U.S. Patent Application Serial No. 15/341,612, which is now U.S. Patent 10,001,780, of the same title filed November 2, 2016, the contents of which being incorporated herein by reference in its entirety.

REMARKS

Claims 1, 9, 18 and 21-37 are pending in the present application. Claims 2-8, 10-17, and 19-20 have been cancelled without prejudice. Claims 1, 9 and 18 have been amended and new claims 21-37 have been added. No new matter has been added via present amendment.

Objection to Abstract and Specification

In view of the amendments made to the abstract and specification via present amendment, Applicants' respectfully request the Examiner to withdraw the objections set forth in the outstanding Office Action with respect to abstract and specification.

Double Patenting Rejection

Without conceding to Examiner's contentions on pages 3-4 of the outstanding Office Action with respect to double patenting rejection, Applicants' have amended the claims set forth herein via present amendment such that they are patentably distinguishable over U.S. Pat. 10,001,780. Amendments presented herein render pending claims distinguishable over the claims of the aforementioned patent. Thereby, rendering filing of a terminal disclaimer moot.

Applicants' respectfully request the Examiner to reconsider and withdraw the aforementioned double patenting rejection.

Conclusion

Applicants' respectfully request the Examiner to enter an allowance in the present application. In the event the Examiner believes an Examiner's Amendment would place the application in condition for allowance, Examiner is welcome to contact Applicants' undersigned

counsel to discuss the potential Examiner's Amendment. Please apply any necessary charges or credits to Deposit Account 18-0582, referencing the above attorney docket number.

Date: January 3, 2019

Respectfully submitted,

/Sidharth Kapoor/
Sidharth Kapoor
Reg. No. 68,159
T: 609-524-2077
skapoor@reedsmith.com
Customer Number 26418
REED SMITH LLP

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 16/011,499	Filing Date 06/18/2018	☐ To be Mailed
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO							
APPLICATION AS FILED – PART I							
(Column 1)		(Column 2)					
FOR	NUMBER FILED	NUMBER EXTRA			RATE (\$)	FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A			N/A		
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A			N/A		
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A			N/A		
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*			X \$ =		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*			X \$ =		
☐ 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	01/21/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x \$50 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	x \$230 =	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 (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ 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. ** 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 number found in the appropriate box in column 1.							

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REED SMITH LLP
P.O. BOX 488 (NYC)
PITTSBURGH, PA 15230-0488

EXAMINER

FREJD, RUSSELL WARREN

ART UNIT

PAPER NUMBER

3661

DATE MAILED: 04/04/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01	6846

TITLE OF INVENTION: SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	07/05/2019

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

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

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

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01	6846

TITLE OF INVENTION: SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	07/05/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
FREJD, RUSSELL WARREN	3661	701-025000

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, 1 _____
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- 3 _____

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(A) NAME OF ASSIGNEE

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

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

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

- ☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01	6846
26418	7590	04/04/2019	EXAMINER	
REED SMITH LLP			FREJD, RUSSELL WARREN	
P.O. BOX 488 (NYC)				
PITTSBURGH, PA 15230-0488				
			ART UNIT	PAPER NUMBER
			3661	
DATE MAILED: 04/04/2019				

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

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

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

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

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

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

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/011,499	Applicant(s) Ibarz Gabardos et al.	
	Examiner RUSSELL FREJD	Art Unit 3661	AIA (FITF) Status Yes

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

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

1. ☒ This communication is responsive to the documents received on 1/3/19.
☐ 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 1,9,18 and 21-37. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

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

* Certified copies not received: ____.

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

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

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

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

Attachment(s)

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

/RUSSELL FREJD/ Primary Examiner, Art Unit 3661	
--	--

<i>Notice of References Cited</i>	Application/Control No. 16/011,499		Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.	
	Examiner RUSSELL FREJD		Art Unit 3661	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-9534899-B2	01-2017	Gutmann; Jens-Steffen	G05D1/0231	1/1
	B					
	C					
	D					
	E					
	F					
	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					
	O					
	P					
	Q					
	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.

Issue Classification 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

CPC						
Symbol					Type	Version
G05D	/	1	/	0214	F	2013-01-01
G01C	/	21	/	343	I	2013-01-01
G01C	/	21	/	3415	I	2013-01-01
A47L	/	11	/	4011	I	2013-01-01
A47L	/	11	/	4061	I	2013-01-01
G05D	/	1	/	0274	I	2013-01-01
G05D	/	1	/	0088	I	2013-01-01
G05D	/	1	/	0276	I	2013-01-01
A47L	/	2201	/	04	A	2013-01-01
G05D	/	2201	/	0203	A	2013-01-01

CPC Combination Sets						
Symbol			Type	Set	Ranking	Version
	/		/			

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/RUSSELL FREJD/ Primary Examiner, Art Unit 3661 (Primary Examiner) _____ (Date) _____		30 March 2019 (Date)	O.G. Print Claim(s) 1 O.G. Print Figure 7

Issue Classification 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

INTERNATIONAL CLASSIFICATION			
CLAIMED			
G05D1/00	/	1	/ 00
G05D1/02	/	1	/ 02
A47L11/40	/	11	/ 40
G01C21/34	/	21	/ 34
NON-CLAIMED			
/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
701	25

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

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/RUSSELL FREJD/ Primary Examiner, Art Unit 3661 (Primary Examiner) _____ (Date) 30 March 2019		O.G. Print Claim(s) 1	O.G. Print Figure 7

Issue Classification 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

☐ 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	-	10	-	19	10	28	20	37						
-	2	-	11	-	20	11	29								
-	3	-	12	2	21	12	30								
-	4	-	13	3	22	13	31								
-	5	-	14	4	23	15	32								
-	6	-	15	5	24	16	33								
-	7	-	16	6	25	17	34								
-	8	-	17	7	26	18	35								
8	9	14	18	9	27	19	36								

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/RUSSELL FREJD/ Primary Examiner, Art Unit 3661 (Primary Examiner) _____ (Date) _____		30 March 2019 (Date)	O.G. Print Claim(s) 1 O.G. Print Figure 7

<i>Index of Claims</i> 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS									
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47									
CLAIM		DATE							
Final	Original	09/29/2018	03/30/2019						
1	1	✓	=						
	2	✓	-						
	3	✓	-						
	4	✓	-						
	5	✓	-						
	6	✓	-						
	7	✓	-						
	8	✓	-						
8	9	✓	=						
	10	✓	-						
	11	✓	-						
	12	✓	-						
	13	✓	-						
	14	✓	-						
	15	✓	-						
	16	✓	-						
	17	✓	-						
14	18	✓	=						
	19	✓	-						
	20	✓	-						
2	21		=						
3	22		=						
4	23		=						
5	24		=						
6	25		=						
7	26		=						
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10	28		=						
11	29		=						
12	30		=						
13	31		=						
15	32		=						
16	33		=						
17	34		=						
18	35		=						
19	36		=						
20	37		=						

<i>Search Notes</i> 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

CPC - Searched*		
Symbol	Date	Examiner
G05D: 1/0214, 1/0088, 1/0276, 2201/0203	9/28/18	RF
A47L: 11/4011, 11/4061, 2201/04	"	"
G01C: 21/343, 21/3415	"	"

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
G05D: 1/0214, 1/0088, 1/0276, 2201/0203	9/28/18	RF
A47L: 11/4011, 11/4061, 2201/04	"	"
G01C: 21/343, 21/3415	"	"
WEST	"	"
UPDATE SEARCH: WEST	3/30/19	RF

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<i>Search Notes</i> 	Application/Control No. 16/011,499	Applicant(s)/Patent Under Reexamination Ibarz Gabardos et al.
	Examiner RUSSELL FREJD	Art Unit 3661

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
G05D	1/0214, 1/0088, 1/0276, 2201/0203, 1/0274	3/30/19	RF
A47L	11/4011, 11/4061, 2201/04	"	"
G01C	21/343, 21/3415	"	"
PGPUBS TEXT SEARCH		"	"

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WEST Search History

DATE: Saturday, March 30, 2019

<u>Hide?</u>	<u>Set</u>	<u>Query</u>	<u>Hit</u> <u>Count</u>
<i>Interference</i>			
	<i>DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=ADJ</i>		
☐	L96	L94 and (pose same position same orientation same robot).clm.	0
☐	L95	L94 and (route same point same discretized).clm.	0
☐	L94	L93 and (route same footprint same points).clm.	3
☐	L93	L92 and (autonomous with navigation) and (robot same map same environment).clm.	67
☐	L92	(((G05D1/0214) (G05D1/0276) (G05D1/0088) (G05D2201/0203)) or ((G01C21/343) (G01C21/3415)) or (A47L1/4011 A47L11/4061 A47L2201/04) OR G05D1/0274).cpc.	11778
☐	L91	L86 and (pose same position same orientation same robot).clm.	2
☐	L90	L86 and (route same point same discretized).clm.	0
☐	L89	L87 and (pose same position same orientation same robot).clm.	0
☐	L88	L87 and (route same point same discretized).clm.	0
☐	L87	L86 and (route same footprint same points).clm.	3
☐	L86	L85 or L84	85
☐	L85	(autonomous with navigation) and (robot same map same environment).clm.	85
☐	L84	L83 and (autonomous with navigation) and (robot same map same environment).clm.	39
☐	L83	(((G05D1/0214) (G05D1/0276) (G05D1/0088) (G05D2201/0203)) or ((G01C21/343) (G01C21/3415)) or (A47L1/4011 A47L11/4061 A47L2201/04)).cpc.	10230
☐	L52	L49 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	0
☐	L51	L49 and (route same footprint same points)	0
☐	L50	L49 and (route same (pose or poses))	4
☐	L49	((autonomous guided vehicle ? or AGV ?) and (navigat \$ same map same environment))	50
☐	L48	L43 and (route with ((attractive near5 forces) or (repulsive near5 forces))).clm.	3
☐	L47	L43 and (route with footprint with points).clm.	3
☐	L46	L40 and (route same ((attractive near5 forces) or (repulsive near5 forces))).clm.	3
☐	L45	L40 and (route same footprint same points).clm.	3
☐	L44	L43 and (route same (pose or poses)).clm.	3
☐	L43	(autonomous with navigation) and (robot same map same environment).clm.	85

☐	L42	L40 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L41	L40 and (route same footprint same points)	3
☐	L40	L39 and (route same (pose or poses))	11
☐	L39	L38 and (autonomous with navigation) and (robot same map same environment)	243
☐	L38	((((G05D1/0214))) (((G05D1/0276))) (((G05D2201/0203))) (((G05D1/0088))) or (((G01C21/343))) (((G01C21/3679))) (((G01C21/3415))))).cpc.	10308

Prior Art

DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=ADJ

☐	L82	Gabardos.in. and (autonomous with navigation) and (robot same map same environment)	10
☐	L81	L79 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L80	L79 and (route same footprint same points)	3
☐	L79	L78 and (route same (pose or poses))	7
☐	L78	Ibarz.in. and (autonomous with navigation) and (robot same map same environment)	9
☐	L77	L66 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L76	L67 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L75	L69 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L74	L71 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	0
☐	L73	L71 and (route same footprint same points)	0
☐	L72	L71 and (route same (pose or poses))	0
☐	L71	L66 and ((autonomous guided vehicle? or AGV?) and (navigat\$ same map same environment))	11
☐	L70	L66 ((autonomous guided vehicle? or AGV?) and (navigat\$ same map same environment))	0
☐	L69	L68 and (route same footprint same points)	3
☐	L68	L67 and (route same (pose or poses))	11
☐	L67	L66 and (autonomous with navigation) and (robot same map same environment)	243
☐	L66	(((G05D1/0214) (G05D1/0276) (G05D1/0088) (G05D2201/0203)) or ((G01C21/343) (G01C21/3415)) or A4711/4011,11/4061,2201/04).cpc.	8947
☐	L65	L55 and (interpolation same route same poses same (collision with free) same path)	0
☐	L64	L55 and (route same map same robot same travel)	0
☐	L63	L62 and (route same map same robot same travel)	0
☐	L62	L55 and (robot same sensor? same environment same object?)	2
☐	L61	L60 and (route same footprint same points)	0
☐	L60	L55 and (route same (pose or poses))	2
☐	L59	L55 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	0

☐	L58	L55 and ((autonomous guided vehicle? or AGV?) and (navigat\$ same map same environment))	0
☐	L57	L55 and (autonomous with navigation) and (dynamic with route with planning)	0
☐	L56	L55 and (autonomous with navigation) and (robot same map same environment)	0
☐	L55	L54 OR L53	19
☐	L54	(7212651 OR 7576639 OR 8514236 OR 9746339).PN. OR 20020107649 OR 20120072166 OR 20140002843 OR 20160182502	11
☐	L53	20120109150 OR 20150199458 OR 20150283703 OR 20160282862 OR 20160309973	8
☐	L37	L18 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L36	L18 and (route same footprint same points)	3
☐	L35	L24 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L34	L24 and (route same footprint same points)	3
☐	L33	L24 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L32	L24 and (route with footprint with points)	3
☐	L31	L29 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L30	L29 and (route same footprint same points)	3
☐	L29	L24 and (route same (pose or poses))	26
☐	L28	L25 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L27	L25 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L26	L25 and (route with footprint with points)	3
☐	L25	L24 and (route with (pose or poses))	13
☐	L24	(autonomous with navigation) and (robot same map same environment)	691
☐	L23	L19 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L22	L19 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L21	L19 and (route same footprint same points)	3
☐	L20	L19 and (route with footprint with points)	3
☐	L19	L18 and (route with (pose or poses))	7
☐	L18	L5 and (autonomous with navigation) and (robot same map same environment)	184
☐	L17	L6 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L16	L6 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L15	L6 and (route same footprint same points)	3
☐	L14	L6 and (route with footprint with points)	3
☐	L13	L1 and (route same ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L12	L1 and (route with ((attractive near5 forces) or (repulsive near5 forces)))	3
☐	L11	L1 and (route same footprint same points)	3
☐	L10	L1 and (route with footprint with points)	3
☐	L9	L6 and (route same (pose or poses))	4

☐	L8	L6 and (route with (pose or poses))	4
☐	L7	Gabardos.in. and (autonomous with navigation) and (dynamic with route with planning)	4
☐	L6	L5 and (autonomous with navigation) and (dynamic with route with planning)	22
☐	L5	((((((((G05D1/0214)))))) (((((((G05D1/0276)))))) (((((((G05D2201/0203)))))) or (((((((G01C21/343)))))) (((((((G01C21/3679)))))) (((((((G01C21/3415)))))))).cpc.	6686
☐	L4	L1 and (interpolat\$ same route same pose?)	3
☐	L3	L1 and (route same pose?)	6
☐	L2	L1 and (route with pose?)	5
☐	L1	(autonomous with navigation) and (dynamic with route with planning)	50

END OF SEARCH HISTORY

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

26418 7590 04/04/2019
REED SMITH LLP
P.O. BOX 488 (NYC)
PITTSBURGH, PA 15230-0488

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

Certificate of Mailing or Transmission

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

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01	6846

TITLE OF INVENTION: SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	07/05/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
FREJD, RUSSELL WARREN	3661	701-025000

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 Reed Smith LLP
- 2 Sidharth Kapoor
- 3 _____

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

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

(A) NAME OF ASSIGNEE

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

Brain Corporation

San Diego, California

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. 18-0586

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature /Sidharth Kapoor/

Date June 27, 2019

Typed or printed name Sidharth Kapoor

Registration No. 68,159

Electronic Patent Application Fee Transmittal				
Application Number:		16011499		
Filing Date:		18-Jun-2018		
Title of Invention:		SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION		
First Named Inventor/Applicant Name:		Borja Ibarz Gabardos		
Filer:		Sidharth Kapoor/Cody Nye		
Attorney Docket Number:		P23293US01		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	500	500

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

Electronic Acknowledgement Receipt	
EFS ID:	36427290
Application Number:	16011499
International Application Number:	
Confirmation Number:	6846
Title of Invention:	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION
First Named Inventor/Applicant Name:	Borja Ibarz Gabardos
Customer Number:	26418
Filer:	Sidharth Kapoor/Cody Nye
Filer Authorized By:	Sidharth Kapoor
Attorney Docket Number:	P23293US01
Receipt Date:	27-JUN-2019
Filing Date:	18-JUN-2018
Time Stamp:	10:52:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$500
RAM confirmation Number	062719INTEFSW10530700
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)	P23293US01_-_2019-06-27_-_Issue_Fee_Transmittal.PDF	104496 09031483a89d4079eaa6f35d3983eec989e9f4eb	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30637 57abc930f48b4aceed1e3152bc9711d55d7ecb08	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			135133		
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. <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.					



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/011,499	08/13/2019	10379539	P23293US01	6846
26418	7590	07/24/2019		
REED SMITH LLP P.O. BOX 488 (NYC) PITTSBURGH, PA 15230-0488				

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

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

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

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

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

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

Borja Ibarz Gabardos, La Jolla, CA;
Brain Corporation, San Diego, CA
Jean-Baptiste Passot, Solana Beach, CA;

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Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82A (07-13)

Approved for use through 09/30/2025. 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.

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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/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/011,499
Filing Date	06/18/2018
First Named Inventor	Borja Ibarz Gabardos
Title	SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION
Art Unit	3661
Examiner Name	RUSSELL WARREN FREJD
Attorney Docket Number	035471.076US2

SIGNATURE of Applicant or Patent Practitioner

Signature	/Sidharth Kapoor/	Date (Optional)	
Name	Sidharth Kapoor	Registration Number	68,159
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.			
☒ *Total of <u>1</u> forms are submitted.			

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0035. Public burden for this form is estimated to average 3 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.** If filing this completed form by mail, 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 (07-13)

Approved for use through 09/30/2025. OMB 0651-0035

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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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:

197519

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):

Brain Corporation



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

Andy Ng

Date (Optional)

Name

Andy Ng

Title

General Counsel

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 1 forms are submitted.

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/011,499

RECEIPT DATE / TIME
01/13/2025 06:13:04 PM Z ET

ATTORNEY DOCKET #
P23293US01

Title of Invention

SYSTEMS AND METHODS FOR DYNAMIC ROUTE PLANNING IN AUTONOMOUS NAVIGATION

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	10379539
CONFIRMATION #	6846	FILED BY	Sidharth Kapoor
PATENT CENTER #	68718278	FILING DATE	06/18/2018
CUSTOMER #	26418	FIRST NAMED INVENTOR	Borja Ibarz Gabardos
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
16-011499- POA.pdf	2	Power of Attorney	415 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
16-011499- POA.pdf	07104ECF325BA9C707E58EFCAC4CC2F2EC93B8BBFF283661 03DE966170E9BBCEF652705D305DCFD2986EB545CAD493C2 9C8CEB994911FCEE5D6188F2FF721CA8

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 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.



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/011,499	06/18/2018	Borja Ibarz Gabardos	P23293US01

CONFIRMATION NO. 6846

POWER OF ATTORNEY NOTICE



OC000000083418451

26418
Reed Smith LLP (New York)
P.O. BOX 488
PITTSBURGH, PA 15230-0488

Date Mailed: 01/27/2025

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/13/2025.

- 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.

/mteklemichael/



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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
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/011,499	06/18/2018	Borja Ibarz Gabardos	035471.076US2

CONFIRMATION NO. 6846

POA ACCEPTANCE LETTER



OC000000083418521

197519
Pierson Ferdinand, LLP
1101 Pennsylvania Avenue N.W.
Suite 300
Washington, DC 20005

Date Mailed: 01/27/2025

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/13/2025.

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.

/mtekle michael/