

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

First Named Inventor:	Guy Bar-Nahum	Nonprovisional Application Number (if known):	
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.
---OR---
(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature	/Jong Andrew Park/	Date	9/26/2018
Name (Print/Typed)	Jong Andrew H. Park	Practitioner Registration Number	56917

Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.*

☒ *Total of 1 forms are submitted.

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.

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	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		
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	
	Guy		Bar-Nahum		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Sausalito	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	1933 Davis St., Suite 229				
Address 2					
City	San Leandro	State/Province	CA		
Postal Code	94577	Country	US		

Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Hong-Bin		Yoon		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	San Leandro	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	1933 Davis St., Suite 229				
Address 2					
City	San Leandro	State/Province	CA		
Postal Code	94577	Country	US		

Inventor	3				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Karthik		Govindaswamy		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		

City	Milpitas	State/Province	CA	Country of Residence	US
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Mailing Address of Inventor:

Address 1	1933 Davis St., Suite 229				
Address 2					
City	San Leandro	State/Province	CA		
Postal Code	94577	Country	US		
Inventor	4				Remove
Legal Name					

Prefix	Given Name	Middle Name	Family Name	Suffix	
	Hoang	Anh	Nguyen		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	San Mateo	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	1933 Davis St., Suite 229				
Address 2					
City	San Leandro	State/Province	CA		
Postal Code	94577	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).			
☐ An Address is being provided for the correspondence Information of this application.			
Customer Number	117915		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	FLIGHT CONTROL USING COMPUTER VISION		
Attorney Docket Number	ASPAP008	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	25	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		

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	117915		

Domestic Benefit/National Stage Information:

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

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

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62566449	2017-10-01

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		
Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation in part of	15729581	2017-10-10
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15729581	Claims benefit of provisional	62405972	2016-10-09
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

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

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

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	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		

Authorization or Opt-Out of Authorization to Permit Access:

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

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

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

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

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

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

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

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

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

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

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		

Applicant Information:

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

Applicant	1	Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear		
Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
☐ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
Name of the Deceased or Legally Incapacitated Inventor:		
If the Applicant is an Organization check here. ☒		
Organization Name	Airspace Systems, Inc.	
Mailing Address Information For Applicant:		
Address 1	1933 Davis St., Suite 229	
Address 2		
City	San Leandro	State/Province
Country	US	Postal Code
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		

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

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	/Jong Andrew Park/		Date (YYYY-MM-DD)	2018-09-26
First Name	Jong Andrew	Last Name	Park	Registration Number
				56917
Additional Signature may be generated within this form by selecting the Add button. Add				

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	ASPAP008
		Application Number	
Title of Invention	FLIGHT CONTROL USING COMPUTER VISION		

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.**

Privacy Act Statement

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
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).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Not Assigned
Filing Date	Herewith
First Named Inventor	Guy Bar-Nahum
Title	FLIGHT CONTROL USING COMPUTER VISION
Art Unit	Not Assigned
Examiner Name	Not Assigned
Attorney Docket Number	ASPAP008

SIGNATURE of Applicant or Patent Practitioner

Signature	/Jong Andrew Park/	Date (Optional)	
Name	Jong Andrew Park	Registration Number	56917
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.**

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:

117915

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):

Airspace Systems, Inc.

- ☐ 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	<i>Jasminder Banga</i>	Date (Optional)	
Name	Jasminder S. Banga		
Title	CEO		

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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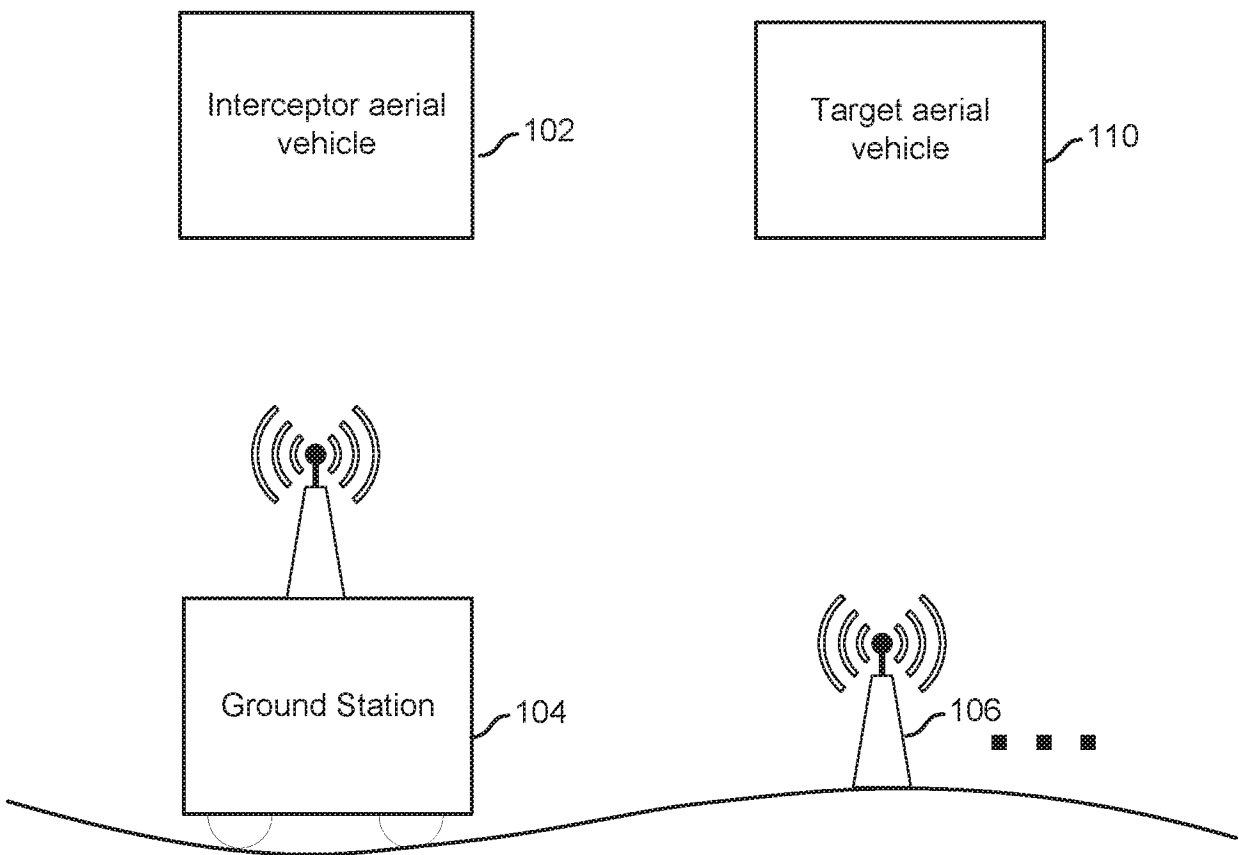


FIG. 1

200

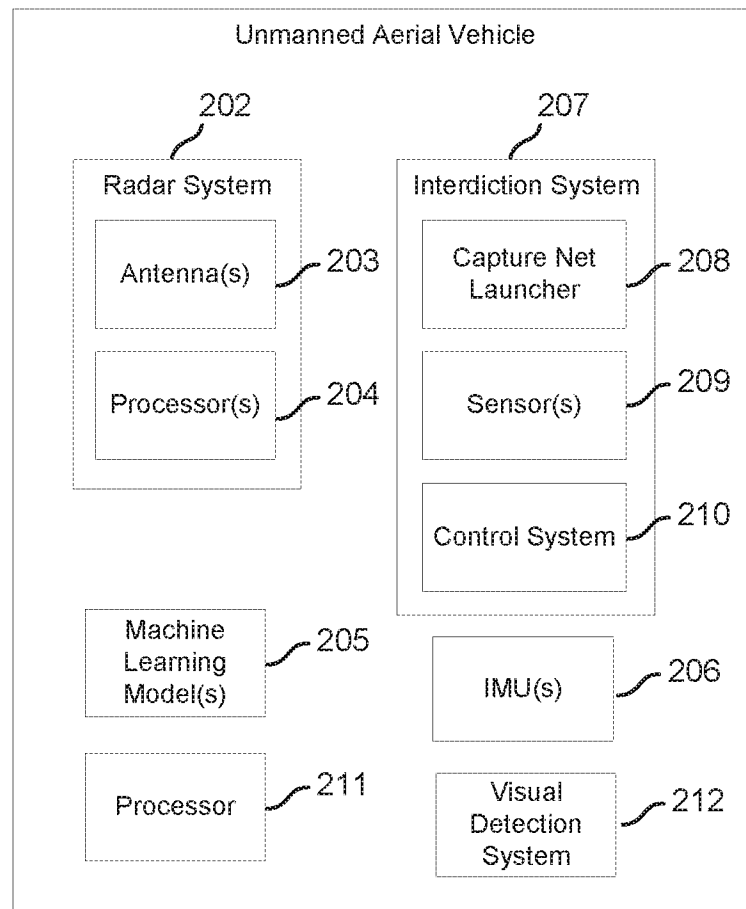


FIG. 2

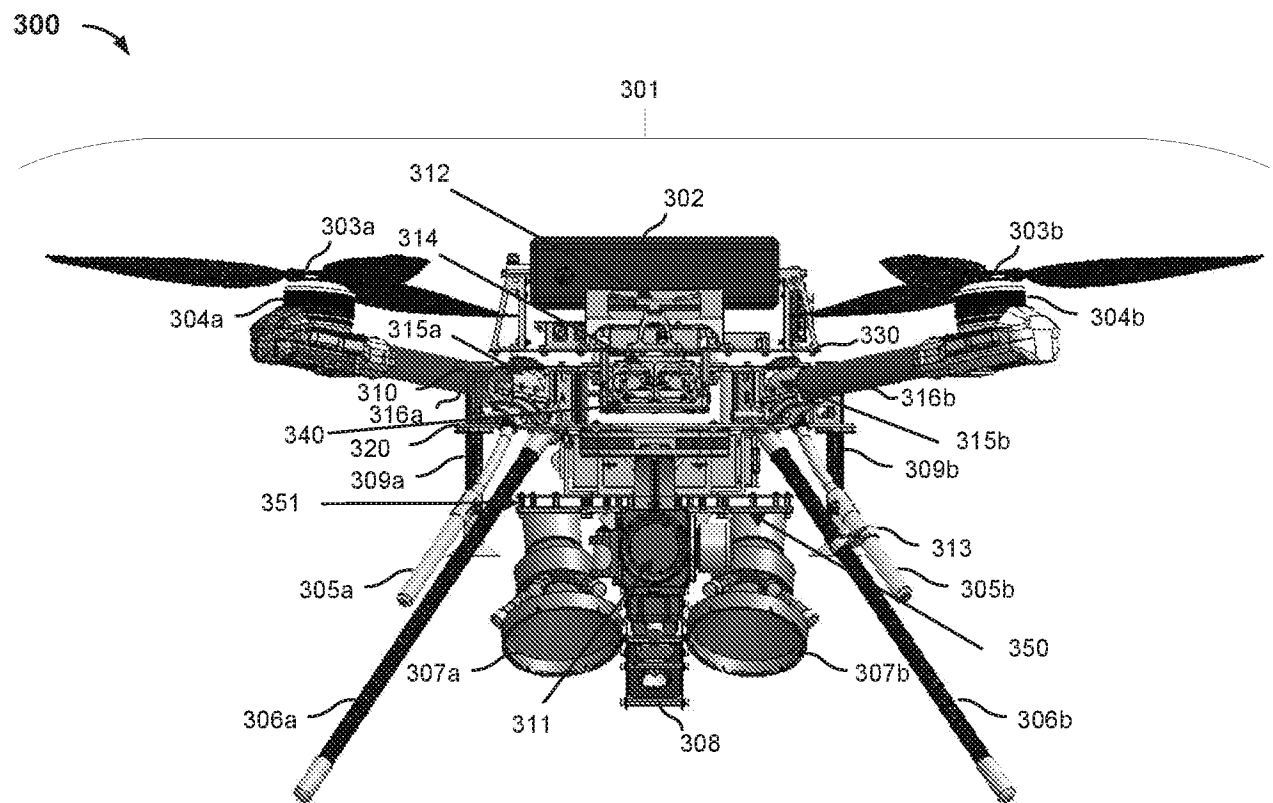


FIG. 3A



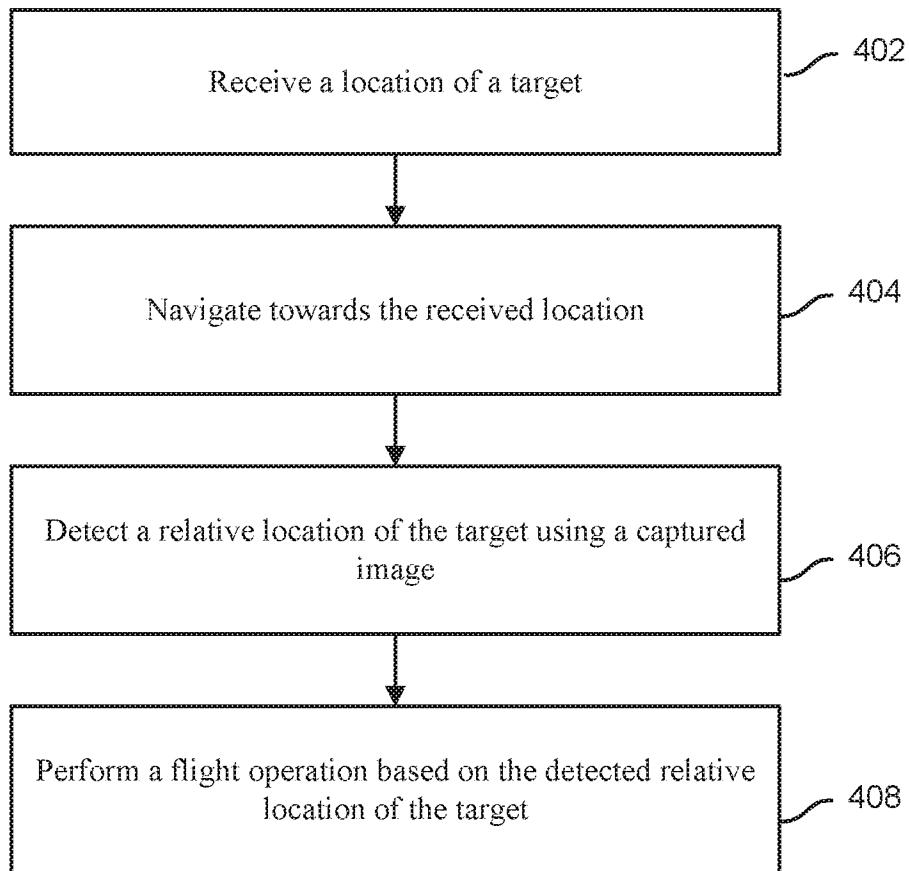


FIG. 4

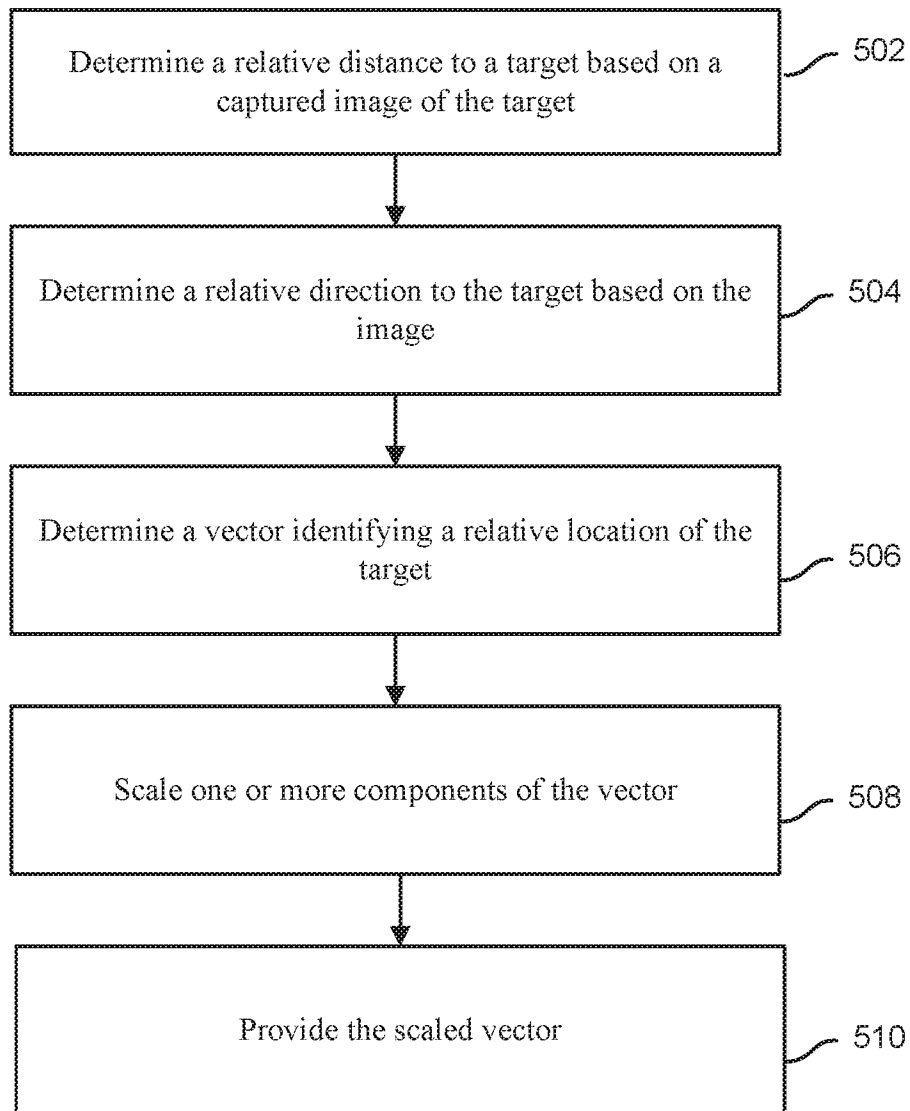


FIG. 5

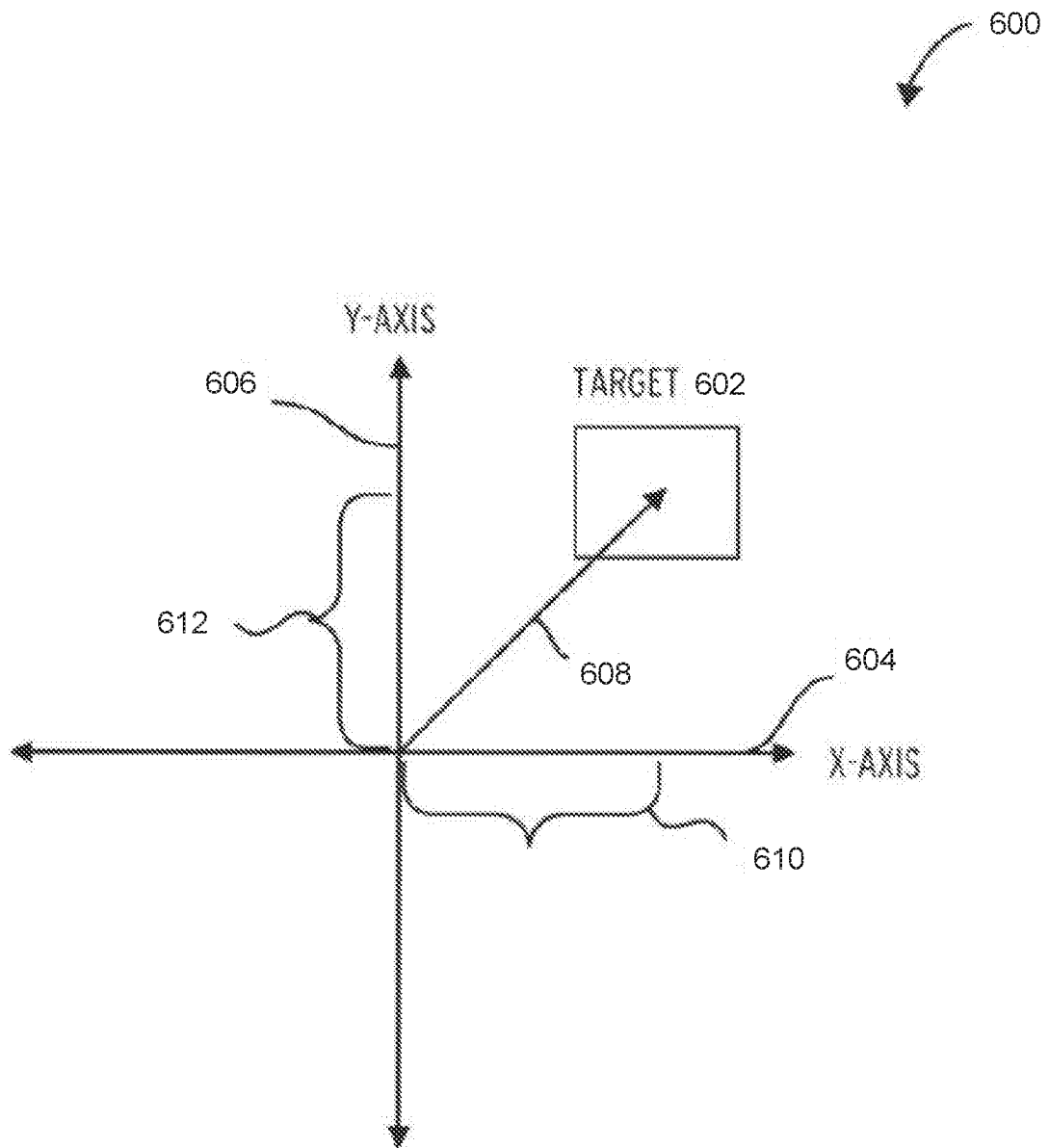


FIG. 6

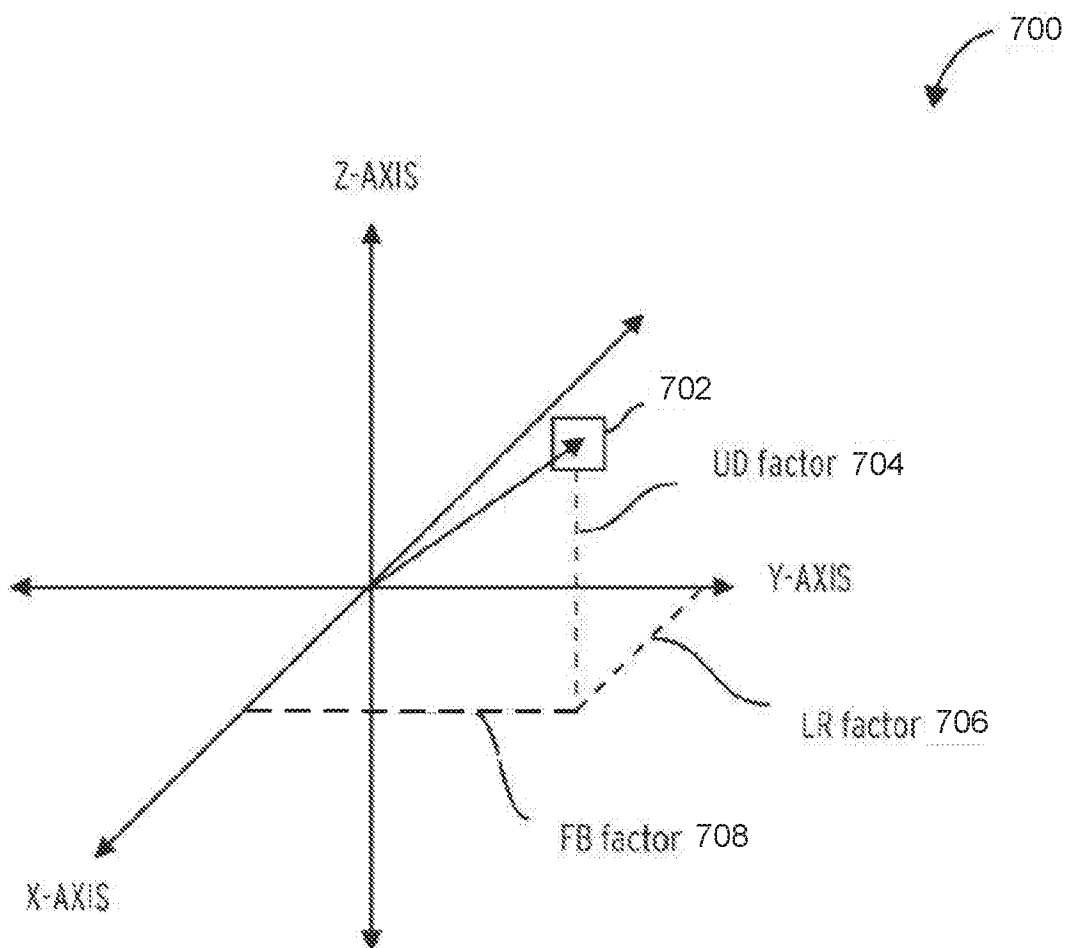


FIG. 7

$$UD = \sin (0.01745 * degY)$$

Equation 1

$$FB = \cos (0.01745 * degY)$$

Equation 2

$$LR = \sin (0.01745 * degX)$$

Equation 3

FIG. 8

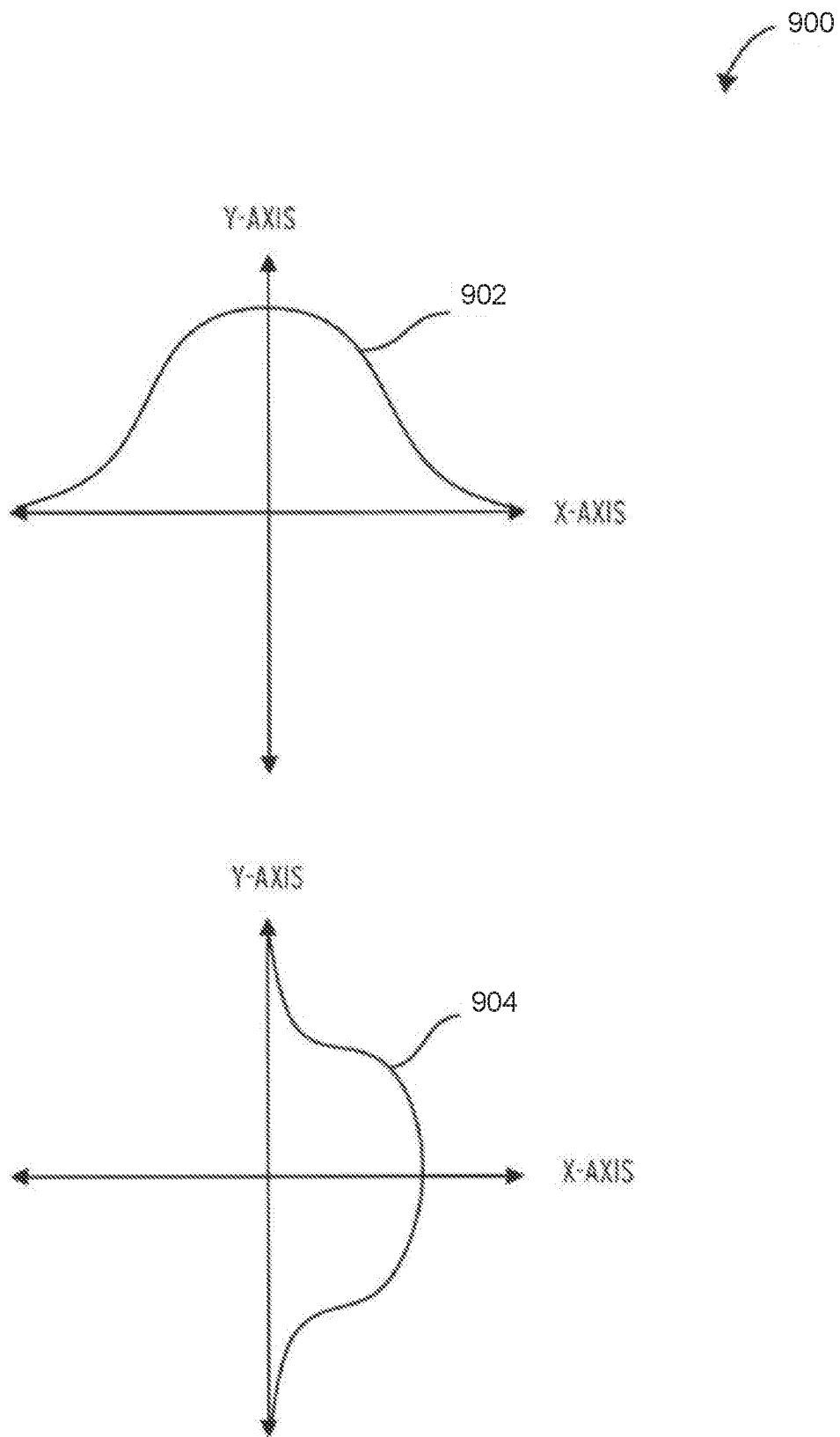


FIG. 9

$$UD_{smooth} = ud_{factor} * UD$$

Equation 4

$$FB_{smooth} = speedfactor * FB$$

Equation 5

$$LR_{smooth} = speedfactor * LR$$

Equation 6

$$speedfactor(degX) = a / (1 + bc^{-degX})$$

Equation 7

$$speedfactor(degY) = a / (1 + bc^{-degY})$$

Equation 8

FIG. 10

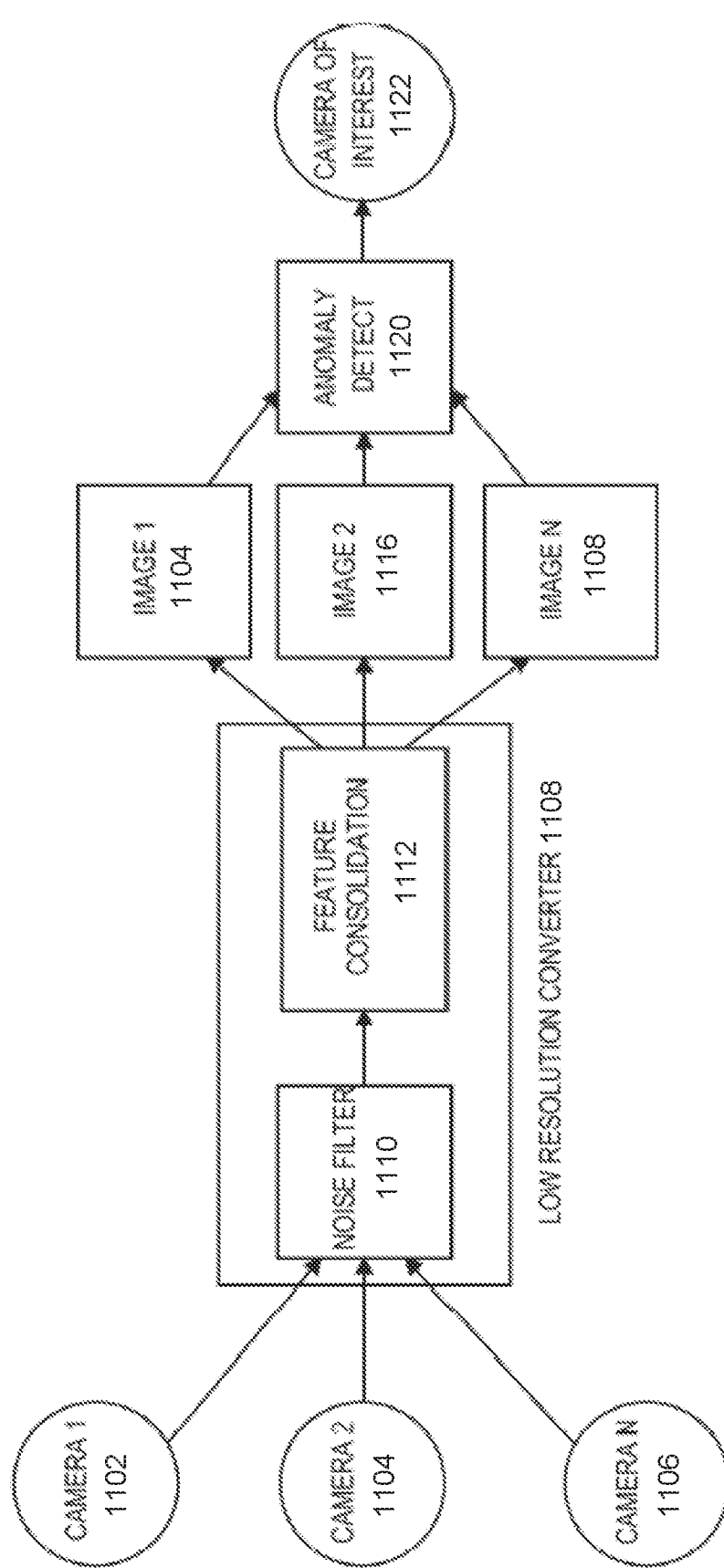


FIG. 11

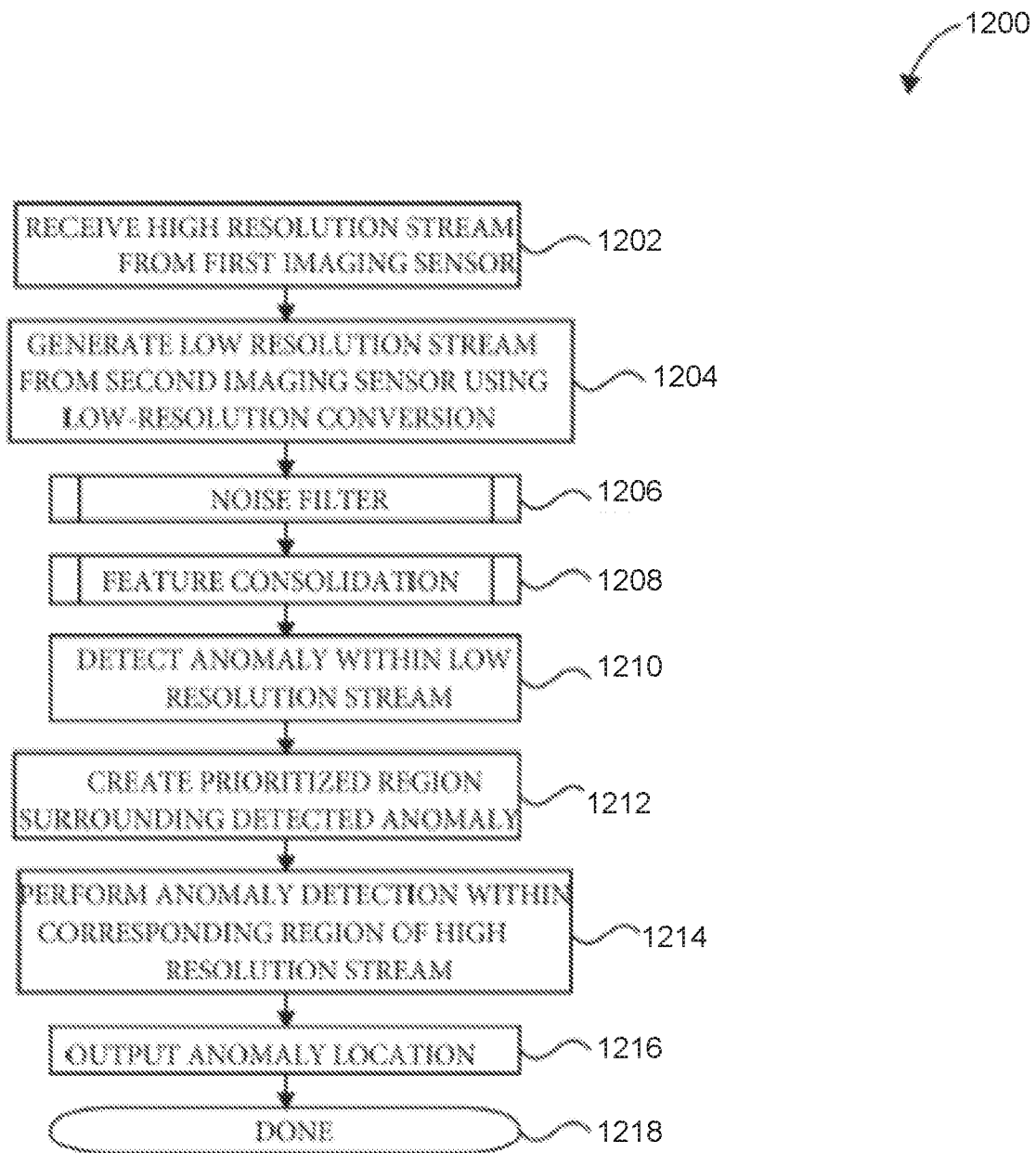


FIG. 12

1300

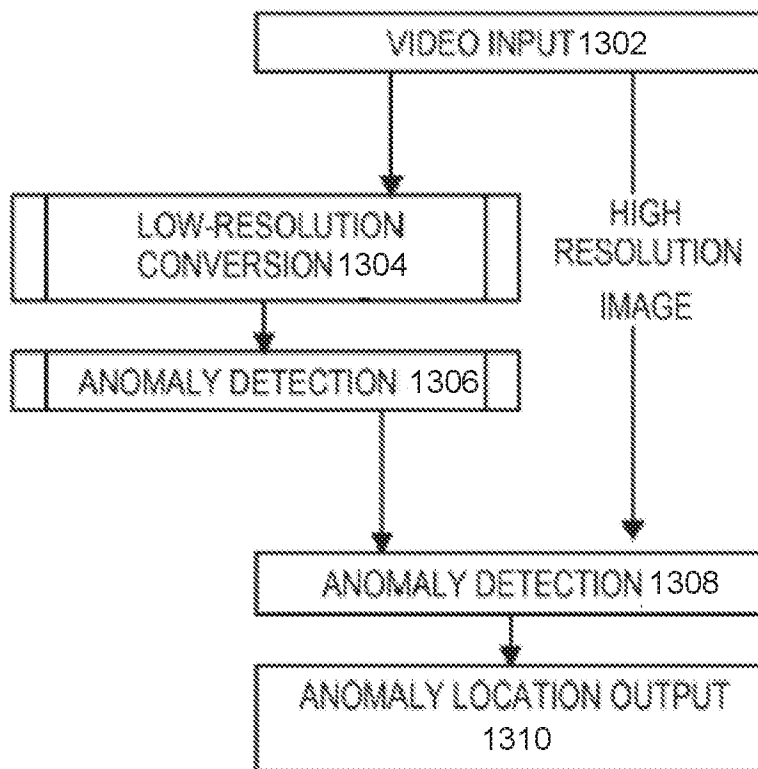


FIG. 13

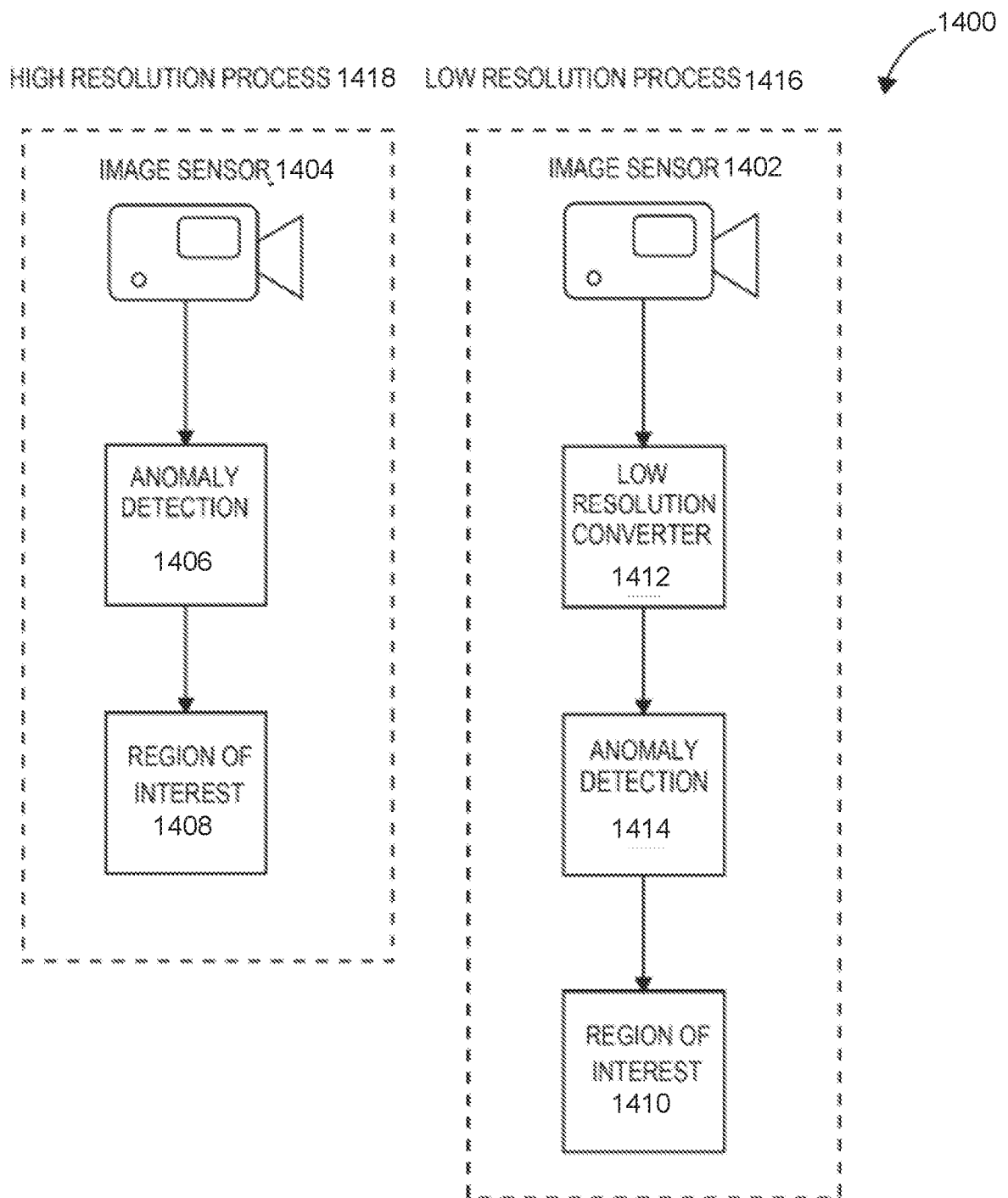


FIG. 14

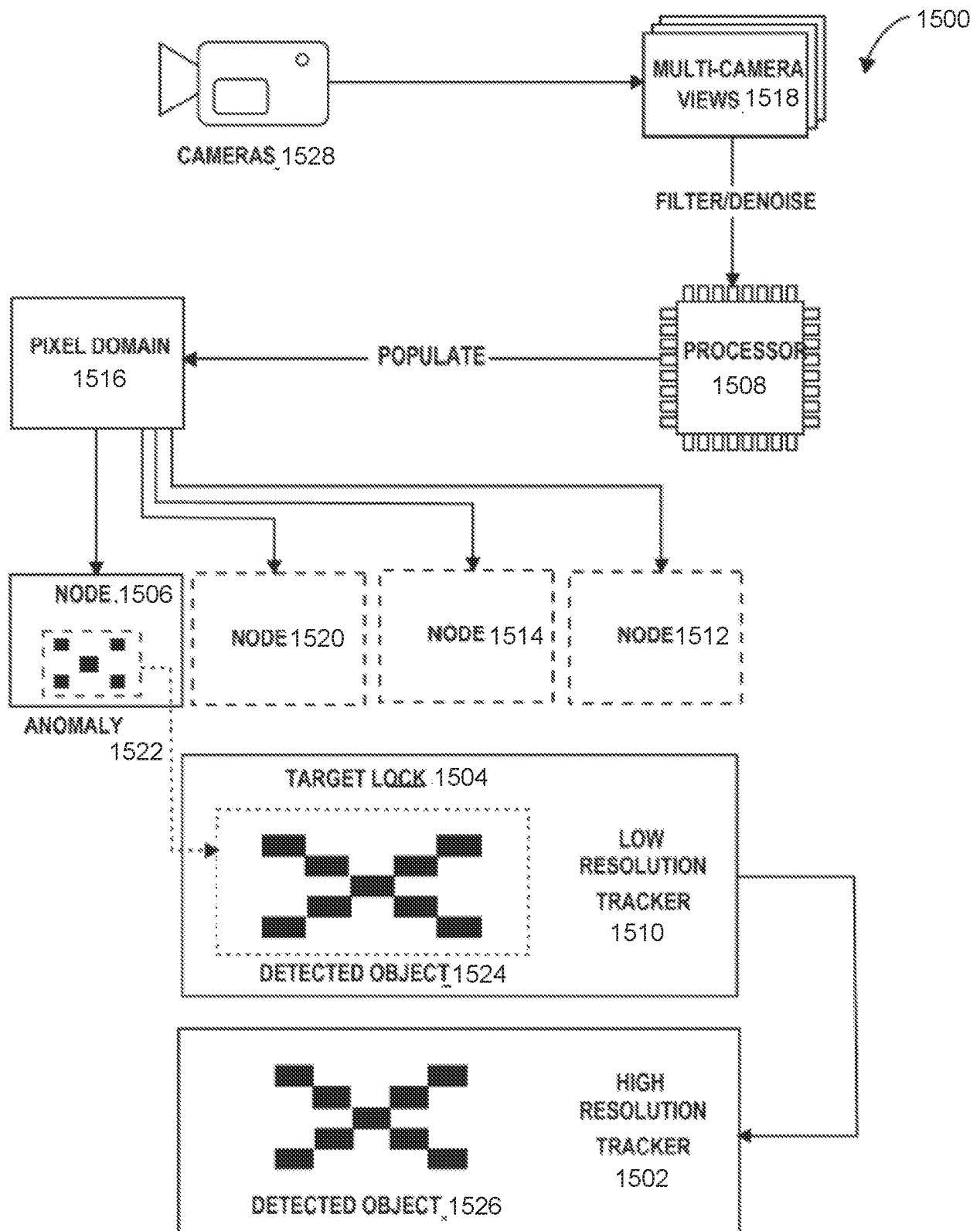


FIG. 15

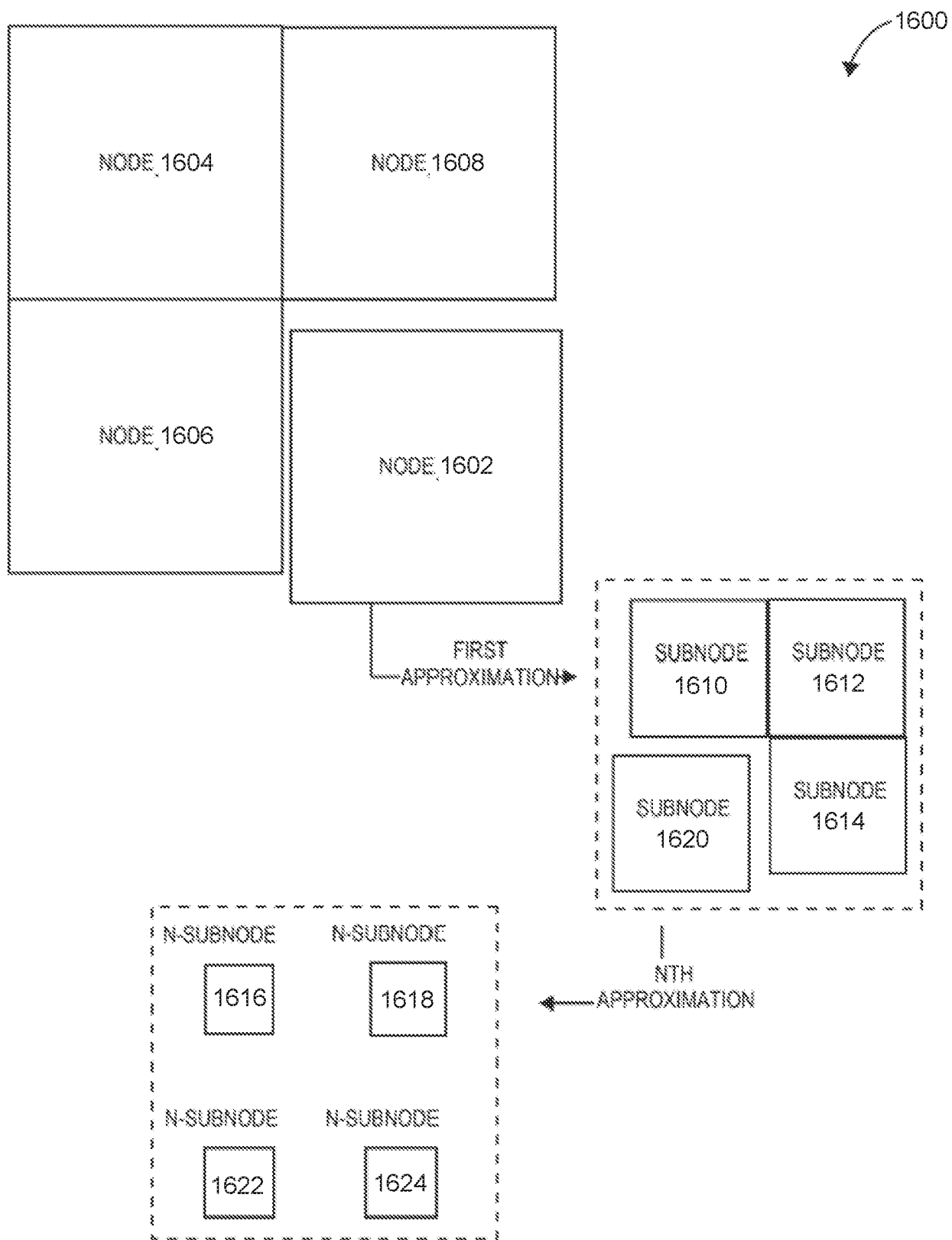


FIG. 16

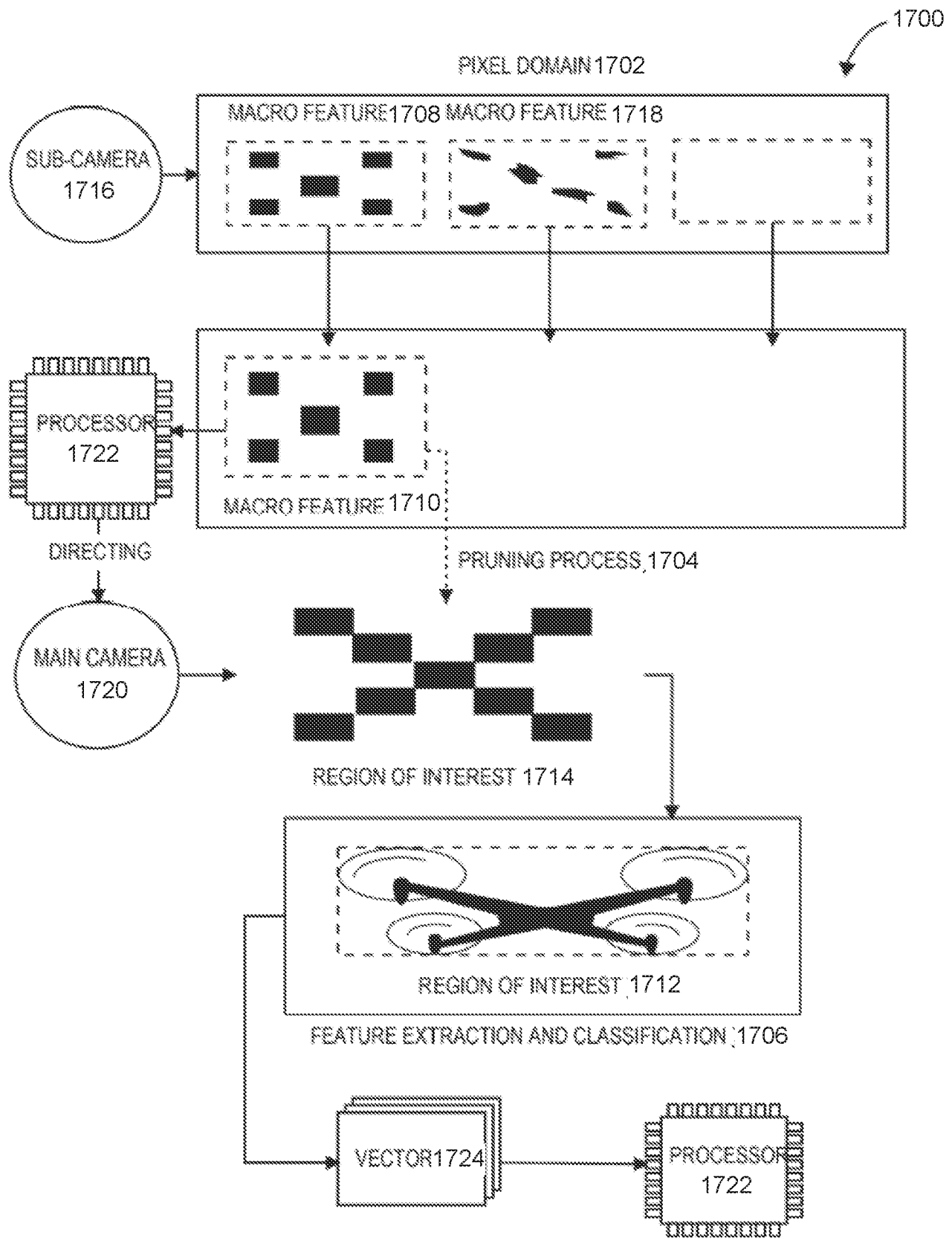


FIG. 17

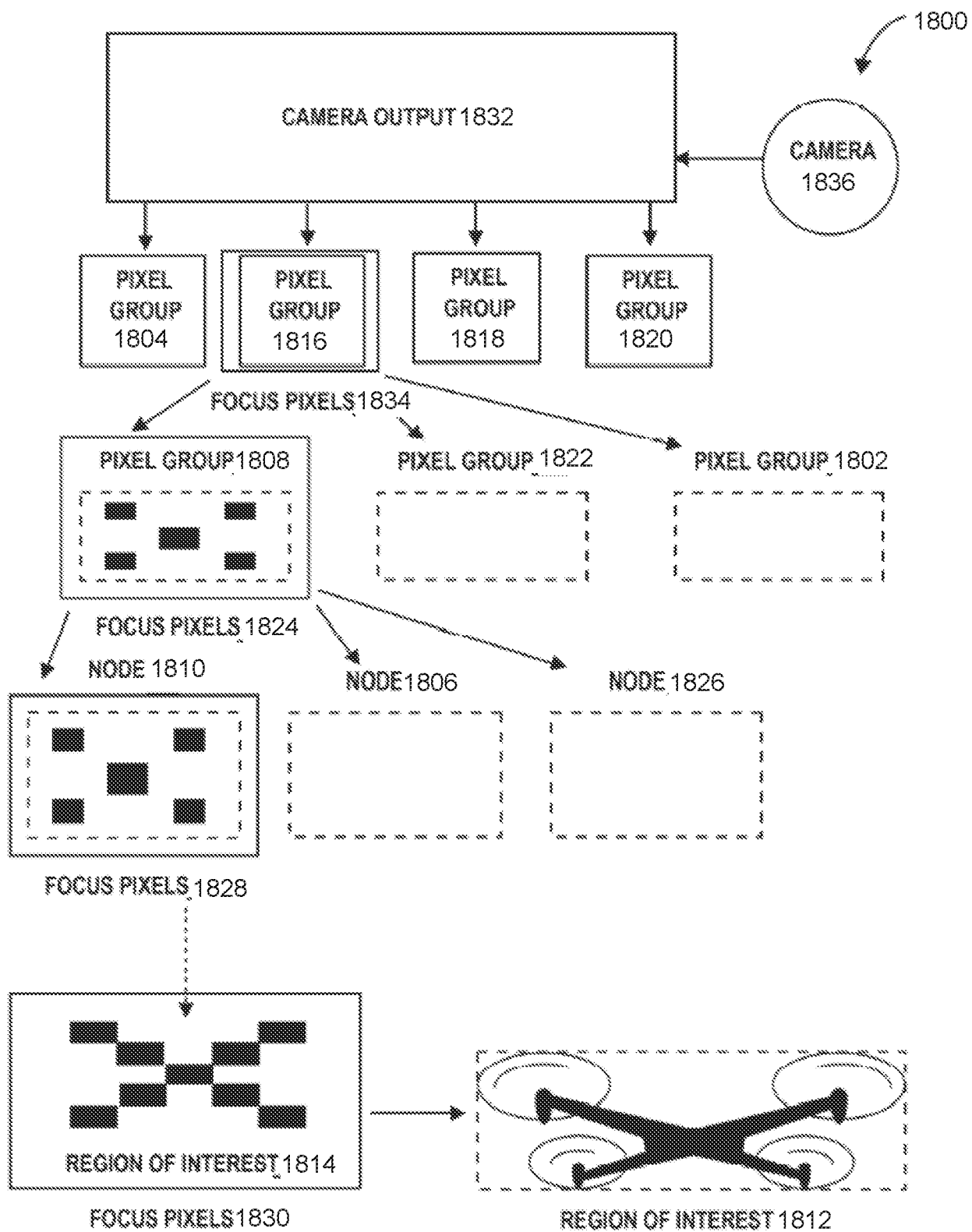


FIG. 18

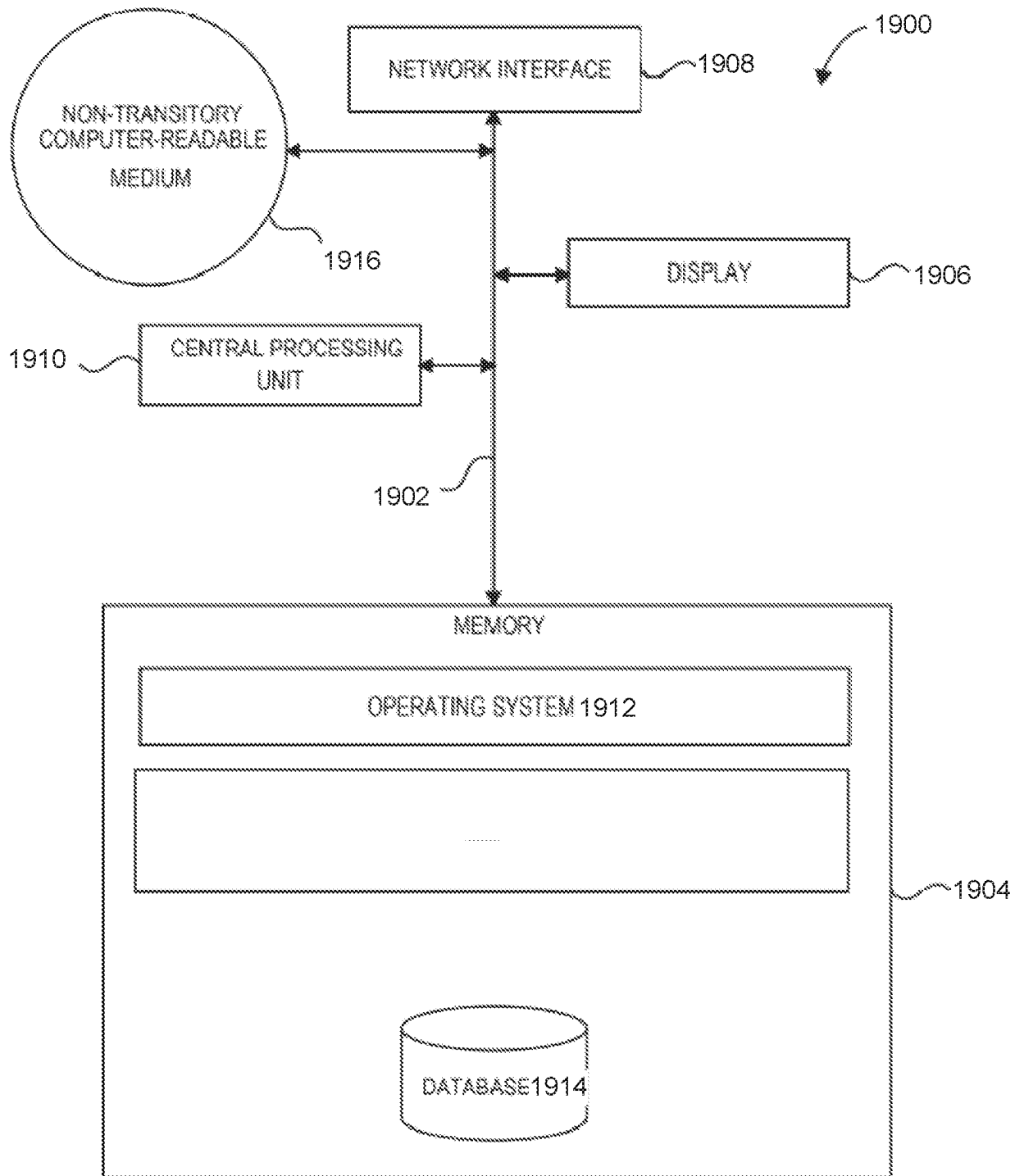


FIG. 19

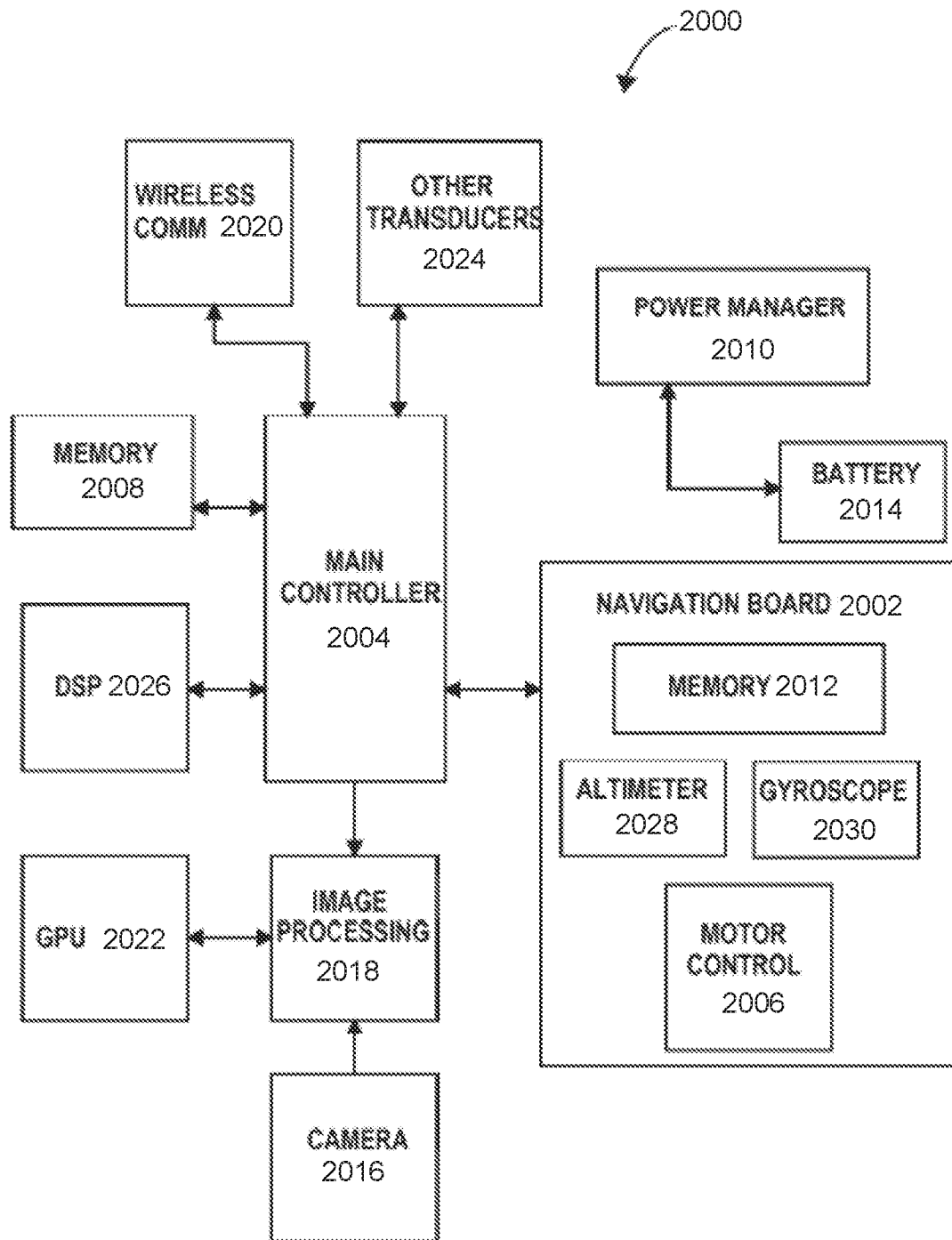


FIG. 20

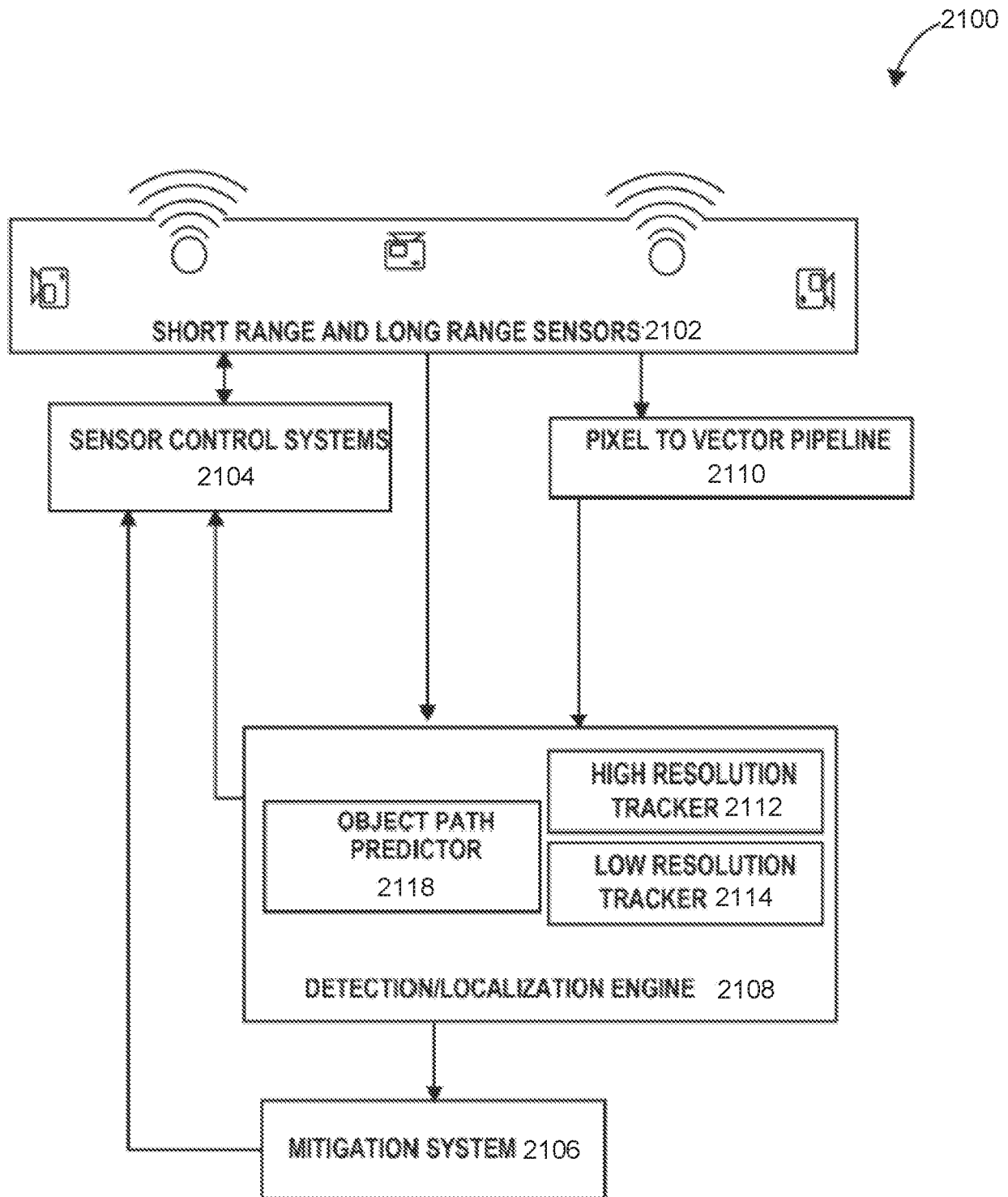


FIG. 21

2200

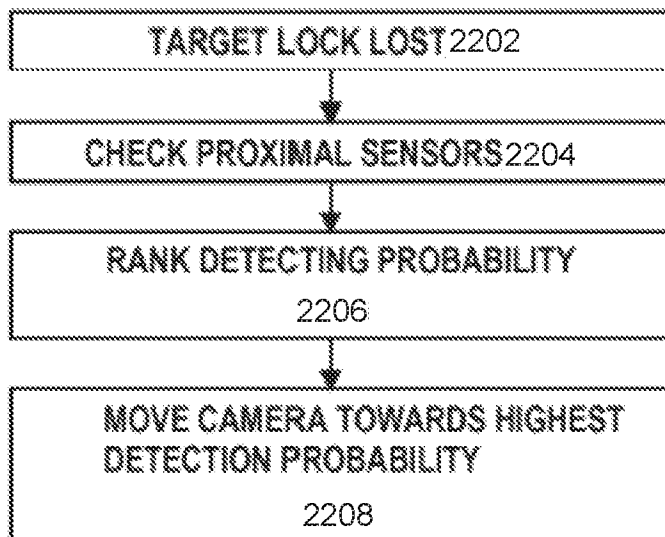


FIG. 22

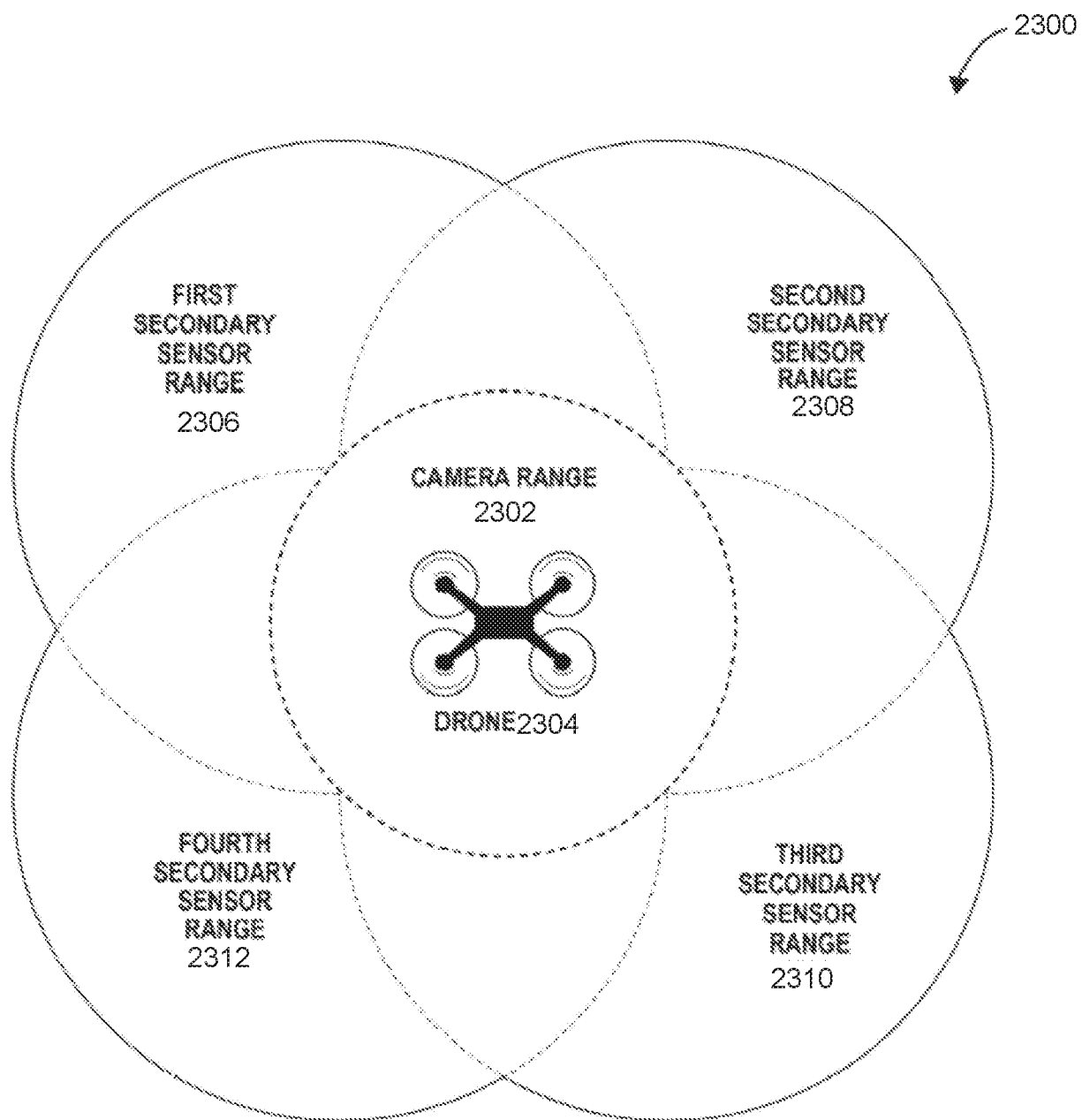


FIG. 23

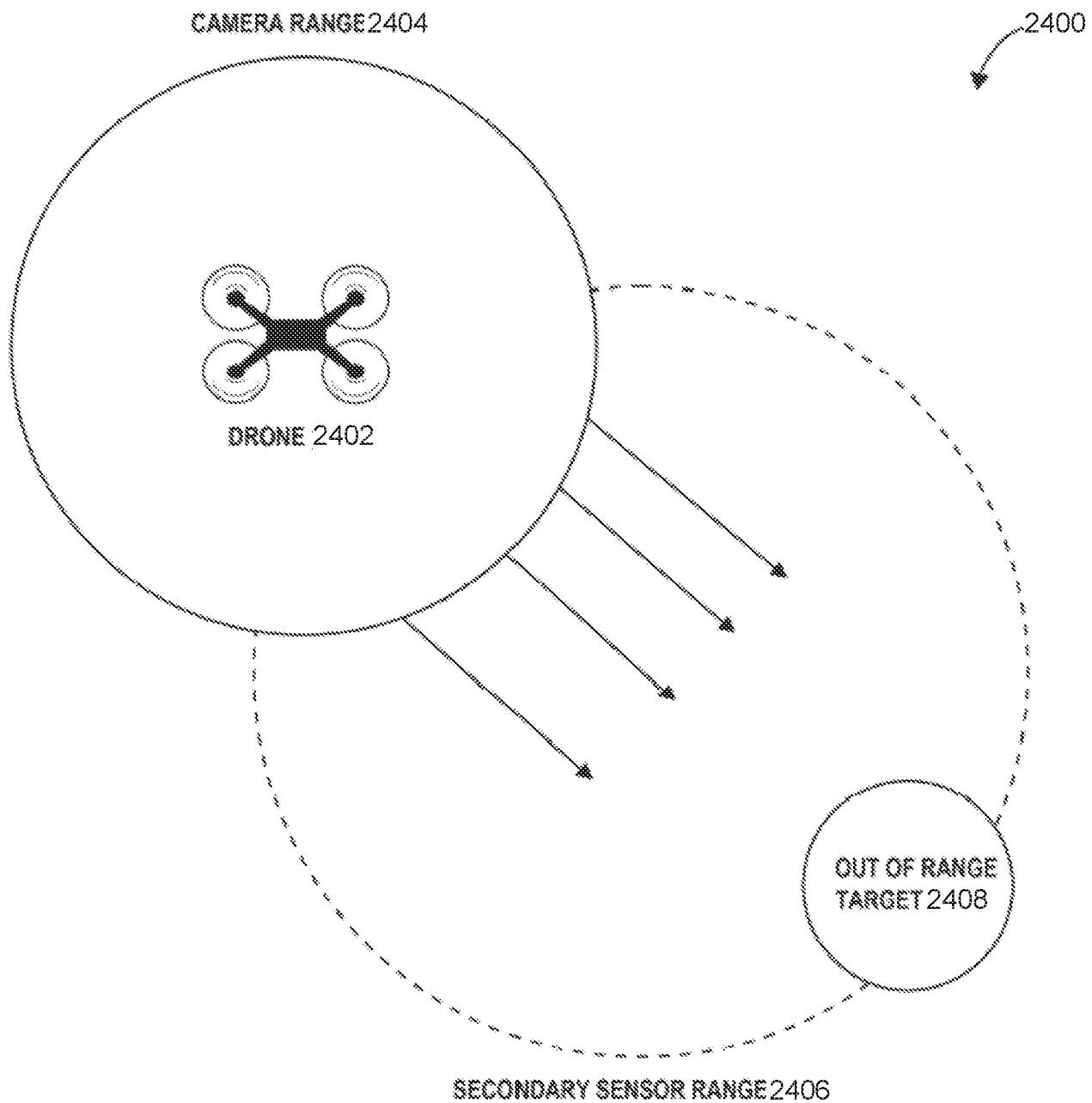


FIG. 24

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION			
First Named Inventor/Applicant Name:	Guy Bar-Nahum			
Filer:	Jong Andrew Hyuk Park			
Attorney Docket Number:	ASPAP008			
Filed as Large Entity				
Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				5860

Electronic Acknowledgement Receipt

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Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Jong Andrew Hyuk Park/Elaine Nguyen
Filer Authorized By:	Jong Andrew Hyuk Park
Attorney Docket Number:	ASPAP008
Receipt Date:	26-SEP-2018
Filing Date:	
Time Stamp:	14:24:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$5860
RAM confirmation Number	092718INTEFSW00000651500685
Deposit Account	500685
Authorized User	Elaine Nguyen

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37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	TrackOne Request	ASPAP008_Track-1_Transmittal.pdf	131424	no	2
			f8e1523031835899aa00b06ad608beaf3895629d		
Warnings:					
Information:					
2	Application Data Sheet	ASPAP008_ADS.pdf	1823223	no	9
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Warnings:					
Information:					
3	Power of Attorney	ASPAP008_POA_AIA82A.pdf	168862	no	1
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Information:					
4	Power of Attorney	ASPA_Executed_POA_AIA82B.pdf	130414	no	1
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Warnings:					
Information:					
5	Specification	ASPAP008_APP.pdf	272643	no	51
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Warnings:					
Information:					
6	Drawings-only black and white line drawings	ASPAP008_APP_Figures.pdf	2859047	no	25
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Information:					

7	Fee Worksheet (SB06)	fee-info.pdf	40187	no	2
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Warnings:					
Information:					
Total Files Size (in bytes):				5425800	
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APPLICATION FOR UNITED STATES PATENT

FLIGHT CONTROL USING COMPUTER VISION

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FLIGHT CONTROL USING COMPUTER VISION

CROSS REFERENCE TO OTHER APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 62/566,449 entitled FLIGHT CONTROL FROM 2D VISION filed October 01, 2017 which is incorporated herein by reference for all purposes.

[0002] This application is a continuation-in-part of co-pending U.S. Patent Application No. 15/729,581 entitled SPATIO-TEMPORAL AWARENESS ENGINE FOR PRIORITY TREE BASED REGION SELECTION ACROSS MULTIPLE INPUT CAMERAS AND MULTIMODAL SENSOR EMPOWERED AWARENESS ENGINE FOR TARGET RECOVERY AND OBJECT PATH PREDICTION filed October 10, 2017, which claims priority to U.S. Provisional Patent Application No. 62/405,972 entitled MULTIMODAL SENSOR EMPOWERED AWARENESS ENGINE FOR TARGET RECOVERY AND OBJECT PATH PREDICTION filed October 9, 2016, both of which are incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

[0003] Typically unmanned aerial vehicles and drones are controlled using flight controllers manually operated by a human user. This requires the human user to have a visual sight of the aerial vehicle and/or an image captured by the aerial vehicle. However, this may be challenging in circumstances where a trained human user is unavailable or unable to react quickly enough to perform a desired flight maneuver. Additionally if communication between the aerial vehicle and the flight controller is lost or becomes unreliable, the aerial vehicle may be unable to complete a desired flight operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Various embodiments of the invention are disclosed in the following detailed description and the accompanying drawings.

[0005] Figure 1 a block diagram illustrating an embodiment of a system for managing an airspace.

[0006] Figure 2 is a block diagram illustrating an embodiment of an aerial vehicle.

[0007] Figure 3A is a diagram illustrating a front view of a UAV in accordance with some embodiments.

[0008] Figure 3B is a diagram illustrating a side view of a UAV in accordance with some embodiments. In some embodiments, unmanned aerial vehicle 301 may be used to implement a UAV, such as UAV 100.

[0009] Figure 4 is a flowchart illustrating an embodiment of a process for automatically controlling flight of a vehicle.

[0010] Figure 5 is a flowchart illustrating an embodiment of a process for determining a vector associated with a target.

[0011] Figure 6 is an illustration illustrating an example of a two dimensional vector determined using an image from a camera feed.

[0012] Figure 7 is an illustration illustrating an example of a three dimensional vector determined using two dimensional measurements.

[0013] Figure 8 shows example equations that can be utilized to determine a three dimensional vector.

[0014] Figure 9 is an illustration illustrating examples of functions utilized to adjust component values of a vector.

- [0015]** Figure 10 shows example equations that can utilized to scale/alter components values of a vector.
- [0016]** Figure 11 illustrates an embodiment of a spacio-temporal awareness engine 1100.
- [0017]** Figure. 12 illustrates an embodiment of a tree based region selection process.
- [0018]** Figure 13 illustrates an embodiment of a tree-based region selection process.
- [0019]** Figure 14 illustrates an embodiment of parallel image processing process 1400.
- [0020]** Figure 15 illustrates a tracking system 1500 in accordance with one embodiment.
- [0021]** Figure 16 illustrates an embodiment of a quadtree 1600.
- [0022]** Figure 17 illustrates an embodiment of a system 1700 for converting camera input into a vector for low resolution tracker 1510.
- [0023]** Figure 18 illustrates an embodiment of a subsystem 1800 for prioritizing a region of interest in the focus of a camera.
- [0024]** Figure 19 illustrates several components of an exemplary region of interest tracking system 1900 in accordance with one embodiment.
- [0025]** Figure 20 illustrates an embodiment of drone operation logic.
- [0026]** Figure 21 illustrates an embodiment of a system operating a multimodal sensor empowered awareness engine.
- [0027]** Figure 22 illustrates an embodiment of a process for operating multimodal sensor empowered awareness engine.
- [0028]** Figure 23 illustrates an embodiment of a system operating a multimodal sensor empowered awareness engine.
- [0029]** Figure 24 illustrates an embodiment of a system operating a multimodal sensor empowered awareness engine.

DETAILED DESCRIPTION

[0030] The invention can be implemented in numerous ways, including as a process; an apparatus; a system; a composition of matter; a computer program product embodied on a computer readable storage medium; and/or a processor, such as a processor configured to execute instructions stored on and/or provided by a memory coupled to the processor. In this specification, these implementations, or any other form that the invention may take, may be referred to as techniques. In general, the order of the steps of disclosed processes may be altered within the scope of the invention. Unless stated otherwise, a component such as a processor or a memory described as being configured to perform a task may be implemented as a general component that is temporarily configured to perform the task at a given time or a specific component that is manufactured to perform the task. As used herein, the term ‘processor’ refers to one or more devices, circuits, and/or processing cores configured to process data, such as computer program instructions.

[0031] A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such embodiments, but the invention is not limited to any embodiment. The scope of the invention is limited only by the claims and the invention encompasses numerous alternatives, modifications and equivalents. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of example and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

[0032] Unmanned Aerial Platforms, including Unmanned Aerial Vehicles (UAV) and Aerial Drones, may be used for a variety of applications. However, some applications may pose a risk to people or property. UAVs have been used to carry contraband, including drugs, weapons, and counterfeit goods across international borders. It is further possible that UAVs may be used for voyeuristic or industrial surveillance, to commit terrorist acts such as spreading toxins or transporting an explosive device. In view of this risk posed by malicious UAVs, it may

be necessary to have a system to intercept, capture, and transport away a UAV that has entered a restricted area.

[0033] An interceptor aerial vehicle may be utilized to monitor and/or capture offending aerial vehicles. For example, when a threatening UAV is detected, the interceptor aerial vehicle may be deployed to fly to the target UAV and capture it (e.g., using a net fired from the interceptor aerial vehicle over the target to capture the target in the net for transport to a safe location). However, because the target UAV can move, the interceptor aerial vehicle needs to be able to follow the target UAV and get close enough until the target UAV is within range of a capture system. For at least the previously mentioned reasons, it may not be desirable to manually control the interceptor aerial vehicle to follow the target UAV. In some embodiments, the interceptor aerial vehicle is able to autonomously track and fly to the target UAV using machine vision based on images captured by a camera of the interceptor aerial vehicle.

[0034] In some embodiments, an image is received and a target aerial vehicle is detected in the image. For example, a stream of images captured by one or more cameras of an interceptor aerial vehicle is analyzed using deep learning, neural networks, and/or other machine learning techniques to recognize a target aerial vehicle in the captured image. A three-dimensional relative location of the target aerial vehicle is determined with respect to a reference aerial vehicle based on the image. For example, azimuth and attitude directions as well as distance from the reference aerial vehicle are determined based on the image. A flight control operation is performed based on three-dimensional relative location. For example, the reference aerial vehicle is guided towards the three-dimensional relative location at a dynamically determined speed.

[0035] Figure 1 a block diagram illustrating an embodiment of a system for managing an airspace. Examples of interceptor aerial vehicle 102 include a drone, a multirotor aircraft, an airplane, a UAV, a helicopter, and any other vehicle capable of flight. Interceptor aerial vehicle 102 may be deployed to patrol a specified airspace and/or monitor/interdict a target aerial vehicle. For example, interceptor aerial vehicle 102 follows and/or navigates to a location associated with the target aerial vehicle (e.g., target aerial vehicle 110). Ground station 104 is used to manage interceptor aerial vehicle 102. Ground station 104 is in communication with

interceptor aerial vehicle 102. For example, ground station 104 provides instructions, commands, sensor data, and/or other data that can be used by interceptor aerial vehicle 102 to monitor an airspace and/or navigate to and/or capture a target aerial vehicle. Interceptor aerial vehicle 102 may provide status and/or reporting data back to ground station 104. Ground station 104 may include one or more sensors utilized to detect a location of aerial vehicles within an airspace. For example, ground station 104 may include one or more radars, cameras, wireless communication sensors, and/or LIDAR sensors monitoring the airspace. Ground station 104 may also receive information from one or more other ground-based sensors. One example of the ground-based sensor is ground-based sensor 106. Examples of ground-based sensor 106 may include one or more of radars, cameras, wireless communication sensors, and/or LIDAR sensors.

[0036] When an unauthorized aerial vehicle is detected (e.g., using sensors of ground station 104 and/or ground-based sensor 106), interceptor aerial vehicle 102 may be deployed to interdict/capture the unauthorized aerial vehicle. An example of the unauthorized aerial vehicle is target aerial vehicle 110 (e.g., a drone, a multicopter aircraft, an airplane, a UAV, a helicopter, or any other vehicle capable of flight). The detected location of target aerial vehicle 110 may be provided to interceptor aerial vehicle 102 to allow it to automatically and autonomously fly towards the direction of the detected location. However, once interceptor aerial vehicle 102 is near target aerial vehicle 110, the location data from ground-based sensors may not be accurate or updated fast enough for interceptor aerial vehicle 102 to get close enough to the moving target aerial vehicle 110 to reliably deploy a capture mechanism. Interceptor aerial vehicle 102 includes one or more computer vision sensors and a processor that can be used to dynamically detect the unauthorized aerial vehicle and autonomously navigate interceptor aerial vehicle 102 towards the target aerial vehicle.

[0037] In some embodiments, ground station 104 is included in a mobile platform that is able to be transported to different physical locations. For example, ground station 104 is on a movable platform with wheels that may be towed or may include an engine to also serve as a vehicle. In some embodiments, ground station 104 includes a hangar that can be used to transport and house interceptor aerial vehicle 102.

[0038] In some embodiments, ground station 104 is able to communicate in real time

with the interceptor aerial vehicle 102 to be able to monitor, and if necessary, redirect detection and tracking based on security or threat level. In the example implementation, the telecommunications structure of ground station 104 is configured to receive and transmit signals. More specifically, the transmission protocol may include but is not limited to RF, wireless/Wi-Fi, Bluetooth/Zigbee, cellular, and others. The telecommunications structure is configured to receive multiple streams of communication in different protocols, and to combine and thread the different communication inputs. Further, the telecommunications structure may also be configured to receive low altitude signals, such as light transmission in various colors, intensities, patterns and shapes, which may be used to identify a target drone. Alternatively, an aerial vehicle launched from the hangar may contain onboard processing capability to perform the substantially same detection, and provide the information to ground station 104.

[0039] The identity of the target aerial vehicle may be further compared and associated with a user by additional criteria, such as authentication of user equipment. For example, if a target drone is identified as friend or foe, at a first level of authentication, an owner or user associated with a mobile computing device may receive a query, such as a text message, email or other communication. The user may be required to authenticate ownership, operation, control, or other association with the target drone, prior to the target drone being cleared for operation. Alternatively, if the first level of authentication does not indicate that the target drone is a “friend,” further targeting and interdiction may occur. Similarly, if the second level of authentication does not result in the user providing sufficient factors or clearances to confirm association with the target drone, even if the target drone is determined to be a “friend” at the first authentication stage, that classification may be converted to “foe,” or the “friend” determination may not be implemented, if the second level or factor of authentication does not result in a confirmation that the user is associated with the target drone, and that the association meets the criteria for “friend” status.

[0040] In some embodiments, interceptor aerial vehicle 102 may be deployed to patrol an airspace. During patrol, the interceptor aerial vehicle and associated interface may be programmed to automatically fly a patrol path. When a target aerial vehicle is detected in proximity, the user interface may transition to another patrol path so that the user can continue to monitor patrol pads for other aerial vehicles. Similarly, the user interface may transition to

interdiction mode. Thus, configurations may be provided where one or more users may continuously be in surveillance for patrol mode, and toggle or switch between multiple aerial vehicles, toggling off of aerial vehicles that have moved from surveillance mode to another mode.

[0041] Figure 2 is a block diagram illustrating an embodiment of an aerial vehicle. UAV 200 is an example of aerial vehicle 102 of Figure 1. In the example shown, UAV 200 comprises a radar system 202, one or more IMUs 206, and an interdiction system 207. UAV 200 may include one or more other systems and/or components that are not shown (e.g., propellers, flight control system, landing control system, power system, etc.).

[0042] Radar system 202 is comprised of one or more antennas 203 and one or more processors 204. The one or more antennas 203 may be a phased array, a parabolic reflector, a slotted waveguide, or any other type of antenna design used for radar. The one or more processors 204 are configured to excite a transmission signal for the one or more antennas 203. The transmission signal has a frequency f_0 . Depending on the antenna design, the transmission signal may have a frequency between 3 MHz to 220 GHz. In some embodiments, the one or more antennas are configured to operate in a frequency range of 79 MHz to 1 GHz. In response to the excitation signal, the one or more antennas 203 are configured to transmit the signal. The transmission signal may propagate through space. The transmission signal may reflect off one or more objects. The reflection signal may be received by the one or more antennas 203. In some embodiments, the reflection signal is received by a subset of the one or more antennas 203. In other embodiments, the reflection signal is received by all of the one or more antennas 203. The strength (amplitude) of the received signal depends on a plurality of various factors, such as a distance between the one or more antennas 203 and the reflecting object, the medium in which the signal is transmitted, the environment, and the material of the reflecting object, etc.

[0043] The one or more processors 204 are configured to receive the reflection signal from the one or more antennas 203. The one or more processors 204 are configured to determine a velocity of the detected object based on the transmission signal and the reflection signal. The velocity may be determined by computing the Doppler shift. A detected object may have one or more associated velocities. An object without any moving parts, such as a balloon, may be

associated with a single velocity. An object with moving parts, such as a car, helicopter, UAV, plane, etc., may be associated with more than one velocity. The main body of the object may have an associated velocity. The moving parts of the object may each have an associated velocity. For example, a UAV is comprised of a body portion and a plurality of propellers. The body portion of the UAV may be associated with a first velocity. Each of the propellers may be associated with corresponding velocities.

[0044] In some embodiments, the one or more antennas 203 are a phased antenna array. In the event the one or more antennas 203 detect an object, a beam associated with the phase antenna array may be directed towards the object. To change the directionality of the antenna array when transmitting, a beam former (e.g., the one or more processors 204) may control the phase and relative amplitude of the signal at each transmitting antenna of the antenna array, in order to create a pattern of constructive and destructive interference in the wave front.

[0045] Radar system 202 is coupled to one or more inertial measurement units 206. The one or more inertial measurement units 206 are configured to calculate attitude, angular rates, linear velocity, and/or a position relative to a global reference frame. The one or more processors 204 may use the measurements from the one or more IMUs 206 to determine an EGO motion of UAV 200. The one or more processors 204 may also use one or more extended Kalman filters to smooth the measurements from the one or more inertial measurement units 206. One or more computer vision-based algorithms (e.g., optical flow) may be used to determine the EGO motion of UAV 200. The one or more processors 204 may be configured to remove the EGO motion data of UAV 200 from the reflection signal data to determine one or more velocities associated with a detected object. From UAV 200's perspective, every detected item appears to be moving when UAV 200 is flying. Removing the EGO motion data from the velocity determination allows radar system 202 to determine which detected objects are static and/or which detected objects are moving. The one or more determined velocities may be used to determine a micro-Doppler signature of an object.

[0046] The one or more processors 204 may generate a velocity profile from the reflected signal to determine a micro-Doppler signature associated with the detected object. The velocity profile compares a velocity of the reflection signal(s) with an amplitude (strength) of the

reflection signal(s). The velocity axis of the velocity profile is comprised of a plurality of bins. A velocity of the reflection signal with the highest amplitude may be identified as a reference velocity and the amplitude associated with the reference velocity may be associated with a reference bin (e.g., bin B_0). The one or more other velocities included in the reflection signal may be compared with respect to the reference velocity. Each bin of the velocity profile represents an offset with respect to the reference velocity. A corresponding bin for the one or more other velocities included in the reflection signal may be determined. A determined bin includes an amplitude associated with one of the one or more other velocities included in the reflection signal. For example, a reflection signal may be a reflection signal associated with a UAV. The UAV is comprised of a main body and a plurality of propellers. The velocity of a UAV body may be represented as a reference velocity in the velocity profile. The velocity of a UAV propeller may be represented in a bin offset from the reference velocity. The bin associated with the reference velocity may store an amplitude associated with the velocity of the UAV body. The bin offset from the reference bin may store an amplitude associated with the velocity of a UAV propeller.

[0047] A direction of a beam of the phased antenna array may be focused towards a detected object such that a plurality of antenna elements 203 receive a reflection signal from the detected object. The plurality of antenna elements that receive a reflection signal may be adjacent to the antenna element that detected the object during the one dimensional MIMO scan. A velocity profile for each of the received corresponding reflection signals may be generated.

[0048] The velocity profile for each of the received corresponding reflection signals may be combined with the velocity profile of the antenna element that detected the object during the one dimensional MIMO scan. The combined velocity profile includes the same bins as one of the velocity profiles, but a bin of the combined velocity profile stores a plurality of amplitudes from the plurality of velocity profiles. A maximum amplitude value (peak) may be selected for each bin of the combined velocity profile. The maximum amplitude bin values may be used in a feature vector to classify the object. For example, the feature vector may include the values $\{B_{0\max}, B_{1\max}, \dots, B_{n\max}\}$.

[0049] Radar system 202 is coupled to processor 211. Radar system 202 may provide the feature vector to processor 211 and the processor 211 may apply the feature vector to one of the machine learning models 205 that is trained to determine whether the object is a UAV or not a UAV. The one or more machine learning models 205 may be trained to label one or more objects. For example, a machine learning model may be trained to label an object as a “UAV” or “not a UAV.” A machine learning model may be trained to label an object as a “bird” or “not a bird.” A machine learning model may be trained to label an object as a “balloon” or “not a balloon.”

[0050] The one or more machine learning models 205 may be configured to implement one or more machine learning algorithms (e.g., support vector machine, soft max classifier, autoencoders, naïve bayes, logistic regression, decision trees, random forest, neural network, deep learning, nearest neighbor, etc.). The one or more machine learning models 205 may be trained using a set of training data. The set of training data includes a set of positive examples and a set of negative examples. For example, the set of positive examples may include a plurality of feature vectors that indicate the detected object is a UAV. The set of negative examples may include a plurality of feature vectors that indicate the detected object is not a UAV. For example, the set of negative examples may include feature vectors associated with a balloon, bird, plane, helicopter, etc.

[0051] In some embodiments, the output of a machine learning model trained to identify UAVs may be provided to one or more other machine learning models that are trained to identify specific UAV models. The velocity profile of a UAV may follow a general micro-Doppler signature, but within the general micro-Doppler signature, different types of UAVs may be associated with different micro-Doppler signatures. For example, the offset difference between a bin corresponding to a baseline velocity and a bin corresponding to a secondary velocity may have a first value for a first UAV and a second value for a second UAV.

[0052] Processor 211 may provide the output from the one or more machine learning models 205 to interdiction system 207. Interdiction system 207 includes a capture net launcher 208, one or more sensors 209, and a control system 210. The control system 210 may be configured to monitor signals received from the one or more sensors 209 and/or radar system

202, and control the capture net launcher 208 to automatically deploy the capture net when predefined firing conditions are met. One of the predefined firing conditions may include an identification of a target UAV. One of the predefined firing conditions may include a threshold range between the target UAV and UAV 200. The one or more sensors 209 may include a global positioning system, a light detection and ranging (LIDAR) system, a sounded navigation and ranging (SONAR) system, an image detection system (e.g., photo capture, video capture, UV capture, IR capture, etc.), sound detectors, one or more rangefinders, etc. For example, eight LIDAR or RADAR beams may be used in the rangefinder to detect proximity to the target UAV. The one or more sensors 209 may include image capture sensors which may be controlled by the interdiction control system 210 to capture images of the object when detected by the range finding sensors. Based on the captured image and the range readings from the ranging sensors, the interdiction system may identify whether or not the object is the target UAV that is identified by radar system 202.

[0053] When the interdiction control system 210 determines that the object is a target UAV, it may also determine if the target UAV is in optimal capture position relative to the defending UAV. If the relative position between the target UAV and the defending UAV is not optimal, interdiction control system 210 may provide a recommendation or indication to the remote controller of the UAV. Interdiction control system 210 may provide or suggest course corrections directly to the processor 211 to maneuver the UAV into an ideal interception position autonomously or semi-autonomously. Once the ideal relative position between the target UAV and the defending UAV is achieved, interdiction control system 210 may automatically trigger capture net launcher 208. Once triggered, capture net launcher 208 may fire a net designed to ensnare the target UAV and disable its further flight.

[0054] The net fired by the capture net launcher may include a tether connected to UAV 200 to allow UAV 200 to move the target UAV to a safe area for further investigation and/or neutralization. The tether may be connected to the defending UAV by a retractable servo controlled by the control system 210 such that the tether may be released based on a control signal from the control system 210. Control system 210 may be configured to sense the weight, mass, or inertia effect of a target UAV being tethered in the capture net and recommend action to prevent the tethered target UAV from causing UAV 200 to crash or lose maneuverability. For

example, control system 210 may recommend UAV 200 to land, release the tether, or increase thrust. Control system 210 may provide a control signal to the UAV control system (e.g., processor 211) to allow the UAV to autonomously or semi-autonomously take corrective actions, such as initiating an autonomous or semi-autonomous landing, increasing thrust to maintain altitude, or releasing the tether to jettison the target UAV in order to prevent the defending UAV from crashing.

[0055] Unmanned Aerial Vehicle 200 may include a camera system 212. Camera system 212 may be used to visually detect a UAV. Camera system 212 may visually detect an object and provide visual data (e.g., pixel data) to one of the one or more machine learning models 205. A machine learning model may be trained to label an object as “a UAV” or “not a UAV” based on the visual data. For example, a set of positive examples (e.g., images of UAVs) and a set of negative examples (e.g., images of other objects) may be used to train the machine learning model. Processor 211 may use the output from the machine learning model trained to label an object as a UAV based on the radar data and/or visual data to determine whether to activate the interdiction system 207. Processor 211 may activate interdiction system 207 in the event the machine learning model trained to label an object as a UAV based on radar data and the machine learning model trained to label the object as a UAV based on visual data indicate that the object is a UAV.

[0056] UAV 200 may use radar system 202 to detect an object that is greater than a threshold distance away. UAV 200 may use camera system 212 to detect an object that is less than or equal to the threshold distance away. UAV 200 may use both radar system 202 and camera system 212 to confirm that a detected object is actually a UAV. This reduces the number of false positives and ensures that the capture active mechanism is activated for actual UAVs.

[0057] Figure 3A is a diagram illustrating a front view of a UAV in accordance with some embodiments. Unmanned aerial vehicle 301 is an example of UAV 200 of Figure 2 and/or aerial vehicle 102 of Figure 1

[0058] In the example shown, front view 300 includes unmanned aerial vehicle 301 comprising computing chassis 302, first rotor 303a, second rotor 303b, first motor 304a, second motor 304b, first antenna 305a, second antenna 305b, first landing strut 306a, second landing

strut 306b, first net launcher 307a, second net launcher 307b, first guide collar 309a, second guide collar 309b, interdiction sensor module 308, first structural isolation plate 310, visual detection system 311, disruption signal antenna 312, antenna clip 313, one or more cooling fans 314, first rotor arm bracket 315a, second rotor arm bracket 315b, first rotor arm 316a, second rotor arm 316b, second structural isolation plate 320, vibration isolation plate 330, vibration isolation plate 340, vibration isolation plate 350, and dampers 351.

[0059] Computing chassis 302 is configured to protect the CPU of UAV 301. The CPU is configured to control the overall operation of UAV 301. The CPU may be coupled to a plurality of computing modules. For example, the plurality of computing modules may include an interdiction control module, an image processing module, a safety module, a flight recorder module, etc. The CPU may provide one or more control signals to each of the plurality of computing modules. For example, the CPU may provide a control signal to the interdiction control module to activate one of the net launchers 307a, 307b to deploy a net. The CPU may provide a control signal to the image processing module to process an image captured by the visual detection system 311. The CPU may be configured to perform one or more flight decisions for the UAV. For example, the CPU may provide one or more flight commands to a flight controller module. For example, a flight command may include a specified speed for the UAV, a specified flight height for the UAV, a particular flight path for the UAV, etc. In response to the one or more flight commands, the flight controller module is configured to control the motors associated with the UAV (e.g., motors 304a, 304b) so that UAV 301 flies in a manner that is consistent with the flight commands. In some embodiments, the CPU is configured to receive flight instructions from a remote command center. In other embodiments, the CPU is configured to autonomously fly UAV 301.

[0060] The image processing module is configured to process images acquired by visual detection system 311. The image processing module may be configured to determine whether a visually detected object is a UAV based on the visual data associated with the detected object. The image processing module may include a plurality of machine learning models that are trained to label a detected object based on the visual data. For example, the image processing module may include a first machine learning model that is configured to label objects as a UAV,

a second machine learning model that is configured to label objects as a bird, a third machine learning model that is configured to label objects as a plane, etc.

[0061] First structural isolation plate 310 is configured to isolate computing chassis 302 and its associated computing components from one or more noisy components. First structural isolation plate 310 is also configured to isolate the one or more noisy components from the electromagnetic interference noise associated with the computing components of computing chassis 302. The one or more noisy components isolated from computing chassis 302 and its associated computing components by first structural isolation plate 310 may include a communications radio (not shown in the front view) and a communications disruption signal generator (not shown in the front view).

[0062] First structural isolation plate 310 may include a foil made from a particular metallic material (e.g., copper) and the foil may have a particular thickness (e.g., 0.1 mm). First structural isolation plate 310 and second structural isolation plate 320 may act as a structural frame for UAV 301. First structural isolation plate 310 may be coupled to second structural isolation plate 320 via a plurality of rotor arm brackets (e.g., rotor arm brackets 315a, 315b) and a plurality of side wall components (not shown in the front view). The rotor arm brackets are coupled to a corresponding rotor arm. The first structural isolation plate 310 may be attached to one or more rotor arm clips (not shown in the front view). The one or more rotor arm clips are configured to lock and unlock corresponding rotor arms of UAV 301. The one or more rotor arm clips are configured to lock the rotor arms in a flight position when UAV 301 is flying. The one or more rotor arm clips are configured to unlock the rotor arms from a flight position when UAV 301 is not flying. For example, the rotor arms may be unlocked from the rotor arm clips when UAV 301 is being stored or transported to different locations.

[0063] First structural isolation plate 310 is coupled to vibration isolation plate 330 via a plurality of vibration dampers. First structural isolation plate 310 may be coupled to one or more dampers configured to reduce the amount of vibration to which a plurality of vibration sensitive components are subjected. The plurality of vibration sensitive components may include the computing modules included in computing chassis 302, connectors, and heat sinks. The performance of the vibration sensitive components may degrade when subjected to vibrations.

The one or more dampers may be omnidirectional dampers. The one or more dampers may be tuned to the specific frequency associated with a vibration source. The vibrations may be mechanical vibrations caused by the motors of the UAV (e.g., motors 304a, 304b) and the rotors of the UAV (e.g., rotors 303a, 303b). First structural isolation plate 310 in combination with vibration isolation plate 330 and the plurality of dampers are configured to shield the plurality of computing components from vibrations, noise, and EMI.

[0064] Vibration isolation plate 330 is coupled to antenna 312 associated with a communications disruption signal generator. Antenna 312 may be a highly directional antenna (e.g., log periodic, parabolic, helical, yagi, phased array, horn, etc.) that is configured to transmit a communications disruption signal. The communications disruption signal may have a frequency associated with one or more wireless communications devices that the communications disruption signal is attempting to disrupt. For example, the communications disruption signal may have a frequency between 2.1 GHz and 5.8 GHz.

[0065] UAV 301 includes second structural isolation plate 320. A UAV may also be designed to include an isolation plate to isolate the noisy components from the radiating components and vice versa. Second structural isolation plate 320 is configured to isolate the one or more noisy components from one or more antennas and one or more sensors and vice versa. Second structural isolation plate 320 is also configured to act as a ground plane for the one or more antennas associated with a radio communications system of UAV 301.

[0066] Structural isolation plate 320 may also be coupled to one or more dampers to reduce an amount of vibration to which the noisy components are subjected. The combination of structural isolation plate 310 and structural isolation plate 320 acts as a Faraday cage for the noisy components. The combination of structural isolation plate 310 and structural isolation plate 320 is configured to isolate one or more high noise generating components of the UAV from the other components of the UAV. For example, a radio communications system and a communication disruption signal generator may be isolated from a plurality of computing components and a plurality of antennas. As a result, the influence that vibrations, noise, and EMI have on the overall performance of the UAV is reduced. One or more cooling fans 314 are coupled to and may be positioned in between vibration isolation plate 330 and vibration isolation

plate 340. The high noise generating components of the UAV may generate a lot of heat during operation. One or more cooling fans 314 are configured to direct air towards the high noise generating components such that a temperature of the high noise generating components of the UAV is reduced during operation. A portion of the one or more cooling fans 314 may be placed adjacent to one of the openings of the structural frame comprising first structural isolation plate 310 and second structural isolation plate 320.

[0067] First rotor arm bracket 315a is coupled to first rotor arm 316a and second rotor arm bracket 315b is coupled to second rotor arm 316b. First rotor arm 316a is coupled to motor 304a and rotor 303a. Second rotor arm 316b is coupled to motor 304b and rotor 303b. Rotor arm brackets 315a, 315b are configured to engage rotor arms 316a, 316b, respectively. UAV 301 may lift off from a launch location and fly when rotor arms 316a, 316b are engaged with their corresponding rotor arm brackets 315a, 315b. When rotor arms 316a, 316b are engaged with their corresponding rotor arm brackets 315a, 315b, motors 304a, 304b may provide a control signal to rotors 303a, 303b to rotate.

[0068] A radio communications system of UAV 301 may be associated with a plurality of antennas (e.g., antenna 305a, antenna 305b). Each antenna may operate at a different frequency. This enables the radio communications system to switch between frequency channels to communicate. The radio communications system may communicate with a remote server via antenna 305a. For example, the radio communications system may transmit the data associated with the one or more sensors associated with UAV 301 (e.g., radar data, lidar data, sonar data, image data, etc.). The frequency channel associated with antenna 305a may become noisy. In response to the frequency channel associated with antenna 305a becoming noisy, the radio communications system may switch to a frequency channel associated with antenna 305b. The antennas associated with the radio communications system may be daisy chained together. The persistent systems radio may communicate with one or more other UAVs and transmit via antennas 305a, 305b a signal back to a source through the one or more other UAVs. For example, another UAV may act as an intermediary between UAV 301 and a remote server. UAV 301 may be out of range from the remote server to communicate using antennas 305a, 305b, but another UAV may be in range to communicate with UAV 301 and in range to communicate with the remote sever. UAV 301 may transmit the data associated with one or

more sensors to the other UAV, which may forward the data associated with one or more sensors to the remote server.

[0069] The radio communications system of UAV 301 may be associated with three antennas (e.g., antenna 305a, antenna 305b, antenna 305c). The antennas may be approximately 90 degrees apart from each other (e.g., $90^\circ \pm 5^\circ$). The antennas may be coupled to the landing struts of UAV 301 (e.g., landing strut 306a, landing strut 306b, landing strut 306c) via an antenna clip, such as antenna clip 313. This allows the antennas to have a tripod configuration, which allows the antennas to have enough fidelity to transmit the needed bandwidth of data. For example, the tripod configuration allows the antennas to have sufficient bandwidth to transmit video data or any other data obtained from the one or more sensors of UAV 301.

[0070] UAV 301 may include a fourth antenna (not shown) that is also coupled to one of the landing struts of UAV 301. UAV 301 may be remotely controlled and the fourth antenna may be used for remote control communications. In some embodiments, the antennas coupled to the landing struts of UAV 301 may be integrated into the landing strut, such that an antenna is embedded within a landing strut.

[0071] UAV 301 may include guide collars 309a, 309b. Guide collars 309a, 309b may be coupled to a plurality of launch rails. UAV 301 may be stored in a hangar that includes the plurality of launch rails. Guide collars 309a, 309b are hollow and may be configured to slide along the launch rails to constrain lateral movement of UAV 301 until it has exited the housing or hangar.

[0072] UAV 301 may include a vibration isolation plate 350 that is coupled to a battery cage via a plurality of dampers 351. The vibration plate 350 may be coupled to net launchers 307a, 307b and interdiction sensor system 308. Interdiction sensor system 308 may include at least one of a global positioning system, a radio detection and ranging (RADAR) system, a light detection and ranging (LIDAR) system, a sounded navigation and ranging (SONAR) system, an image detection system (e.g., photo capture, video capture, UV capture, IR capture, etc.), sound detectors, one or more rangefinders, etc. For example, eight LIDAR or RADAR beams may be used in the rangefinder to detect proximity to the target UAV. Interdiction sensor system 308 may include one or more LEDs that indicate to bystanders whether UAV 301 is armed and/or has

detected a target. The one or more LEDs may be facing away from the back of UAV 301 and below UAV 301. This enables one or more bystanders under UAV 301 to become aware of a status associated with UAV 301.

[0073] Interdiction sensor system 308 may include image capture sensors which may be controlled by the interdiction control module to capture images of the object when detected by the range finding sensors. Based on the captured image and the range readings from the ranging sensors, the interdiction control module may identify whether or not the object is a UAV and whether the UAV is a UAV detected by one of the sensor systems.

[0074] When the interdiction control module determines that the object is a target UAV, it may also determine if the target UAV is in optimal capture position relative to the defending UAV. The position between UAV 301 and the target UAV may be determined based on one or more measurements performed by interdiction sensor system 308. If the relative position between the target UAV and the defending UAV is not optimal, the interdiction control module may provide a recommendation or indication to the remote controller of the UAV. An interdiction control module may provide or suggest course corrections directly to the flight controller module to maneuver UAV 301 into an ideal interception position autonomously or semi-autonomously. Once the ideal relative position between the target UAV and the defending UAV is achieved, the interdiction control module may automatically trigger one of the net launchers 307a, 307b. Once triggered, one of the net launchers 307a, 307b may fire a net designed to ensnare the target UAV and disable its further flight.

[0075] The net fired by the capture net launcher may include a tether connected to UAV 301 to allow UAV 301 to move the target UAV to a safe area for further investigation and/or neutralization. The tether may be connected to the defending UAV by a retractable servo controlled by the interdiction control module such that the tether may be released based on a control signal from the interdiction control module. The CPU of the UAV may be configured to sense the weight, mass, or inertia effect of a target UAV being tethered in the capture net and recommend action to prevent the tethered target UAV from causing UAV 301 to crash or lose maneuverability. For example, the CPU may recommend UAV 301 to land, release the tether, or increase thrust. The CPU may provide a control signal to allow the UAV to autonomously or

semi-autonomously take corrective actions, such as initiating an autonomous or semi-autonomous landing, increasing thrust to maintain altitude, or releasing the tether to jettison the target UAV in order to prevent the defending UAV from crashing.

[0076] UAV 301 may include visual detection system 311. Visual detection system 311 may include one or more cameras. Visual detection system 311 may be used by a remote operator to control a flight path associated with UAV 301. Visual detection system 311 may provide visual data to an image processing module configured to visually detect an object and provide visual data (e.g., pixel data) to one or more machine learning models. The one or more machine learning models may be trained to label an object as a UAV based on the visual data. The image processing module may provide an output indicating that an object is labeled as a UAV to the interdiction control module. The interdiction control module may be configured to activate net launchers 307a, 307b based on the label. For example, in the event the visually detected object is labeled a UAV and the visually detected object is within a threshold range from UAV 301, the interdiction control module may output a control signal that causes one of the net launchers 307a, 307b to deploy a net.

[0077] Figure 3B is a diagram illustrating a side view of a UAV in accordance with some embodiments. In some embodiments, unmanned aerial vehicle 301 may be used to implement a UAV, such as UAV 100.

[0078] In the example shown, side view 360 includes unmanned aerial vehicle 301 comprising computing chassis 302, UI panel 350, flight controller module 352, second rotor 303b, third rotor 303c, second motor 304b, third motor 304c, second antenna 305b, third antenna 305c, second landing strut 306b, third landing strut 306c, battery 317, battery cage 318, second net launcher 307b, interdiction sensor module 308, second guide collar 309b, first structural isolation plate 310, visual detection system 311, disruption signal antenna 312, antenna clip 313, second structural isolation plate 320, gimbal 335, tether mechanism 325, vibration dampers 332a, 332b, vibration isolation plate 340, and vibration isolation plate 350.

[0079] UI panel 350 is coupled to a safety module that is included in computing chassis 302. UI panel 350 comprises one or more switches, knobs, buttons that enable an operator to arm and disarm UAV 301. An operator may interact with UI panel 350 and based on the

operator interactions, the safety module is configured to arm/disarm UAV 301. For example, first net launcher 307a and second net launcher 307b may be disarmed based on one or more interactions of an operator with UI panel 350. This may allow the operator to inspect and/or perform maintenance on UAV 301.

[0080] Flight controller module 352 is configured to control a flight of UAV 301. The flight controller module may provide one or more control signals to the one or more motors (e.g., 304a, 304b) associated with UAV 301. The one or more control signals may cause a motor to increase or decrease its associated revolutions per minute (RPM). UAV 301 may be remotely controlled from a remote location. UAV 301 may include an antenna that receives flight control signals from the remote location. In response to receiving the flight control signals, the CPU of UAV 301 may determine how UAV 301 should fly and provide control signals to flight controller module 352. In response to the control signals, flight controller module 352 is configured to provide control signals to the one or more motors associated with UAV 301, causing UAV 301 to maneuver as desired by an operator at the remote location.

[0081] Antenna 305c is coupled to landing strut 306c. Antenna 305c is one of the antennas associated with a communications radio system of UAV 301. Antenna 305c is configured to operate at a frequency that is different than antennas 305a, 305b. A communications radio system may be configured to switch between frequency channels to communicate. The communications radio system may communicate with a remote server via antenna 305a. The frequency channel associated with antenna 305a may become noisy. For example, the radio communications system may transmit the data associated with the one or more sensors associated with UAV 301 (e.g., radar data, LIDAR data, sonar data, image data, etc.). In response to the frequency channel associated with antenna 305a becoming noisy, the radio communications system may switch to a frequency channel associated with antenna 305b. The frequency channel associated with antenna 305b may become noisy. In response to the frequency channel associated with antenna 305b becoming noisy, the radio communications system may switch to a frequency channel associated with antenna 305c.

[0082] Battery 317 is configured to provide power to UAV 301. UAV 301 is comprised of a plurality of components that require electricity to operate. Battery 317 is configured to

provide power to the plurality of components. In some embodiments, battery 317 is a rechargeable battery. Battery 317 is housed within battery cage 318. Battery cage 318 may be coupled to vibration isolation plate 350 via a plurality of dampers. Vibration isolation plate 350 may be coupled to interdiction sensor module 308, net launchers 307a, 307b, tether mechanism 325, and a persistent availability plug.

[0083] Gimbal 335 is coupled to visual detection system 311 and second structural isolation plate 320. A gimbal is a pivoted support that allows the rotation of visual detection system 311 about a single axis. Gimbal 335 is configured to stabilize an image captured by visual detection system 311.

[0084] Tether mechanism 325 is coupled to net capture launchers 307a, 307b. When a net is deployed by one of the net capture launchers 307a, 307b, the net remains tethered to UAV 301 via tether mechanism 325. Tether mechanism 325 may be configured to sense the weight, mass, or inertia effect of a target UAV being tethered in the capture net. In response to the sensed signals, a CPU of UAV 301 may be configured to recommend action to prevent the tethered target UAV from causing UAV 301 to crash or lose maneuverability. For example, the CPU of UAV 301 may recommend UAV 301 to land, release the tether, or increase thrust. The CPU of UAV 301 may provide a control signal to allow the UAV to autonomously or semi-autonomously take corrective actions, such as initiating an autonomous or semi-autonomous landing, increasing thrust to maintain altitude, or releasing the tether to jettison the target UAV in order to prevent the defending UAV from crashing.

[0085] Vibration dampers 332a, 332b are coupled to structural isolation plate 310 and vibration isolation plate 330. Vibration dampers 332a, 332b may be omnidirectional dampers. Vibration dampers 332a, 332b may be configured to reduce the amount of vibration to which a plurality of vibration sensitive components are subjected. The plurality of vibration sensitive components may include different electronics modules (e.g., components included in computing chassis 302, connectors, and heat sinks). The performance of the vibration sensitive components may degrade when subjected to vibrations. Vibration dampers 332a, 332b may be tuned to the specific frequency associated with a vibration source. The vibrations may be mechanical vibrations caused by the motors of the UAV (e.g., motors 304a, 304b) and the rotors of the UAV

(e.g., rotors 303a, 303b). Vibration dampers 332a, 332b may be tuned to the mechanical vibrations caused by the motors of the UAV and the rotors of the UAV. Vibration dampers 332a, 332b may be comprised of a vibration damping material, such as carbon fiber. In some embodiments, one or more vibration dampers may be included in between a motor and a motor mount.

[0086] Figure 4 is a flowchart illustrating an embodiment of a process for automatically controlling flight of a vehicle. In some embodiments, the process of Figure 4 is performed by interceptor aerial vehicle 102 of Figure 1, UAV 200 of Figure 2, and/or UAV 301 of Figures 3A and 3B.

[0087] At 402, a location of a target is received. An example of the location is geographical location coordinate and an example of the target is a vehicle detected to be not allowed in a monitored airspace (e.g., target aerial vehicle 110 of Figure 1). In some embodiments, the location is a geographical location coordinate that has been determined using one or more remote sensors. For example, the location of target aerial vehicle 110 is provided by ground station 104 via a wireless communication to interceptor aerial vehicle 102, and ground station 104 has determined the location based on information from sensors of ground station 104 and/or ground-based sensor 106 of Figure 1. In some embodiments, the location is received directly from one or more different sensors (e.g., from one or more ground-based sensors). In some embodiments, the location is relative to a reference aerial vehicle. For example, the location (e.g., including azimuth angle, altitude angle, distance) is determined using an on-vehicle sensor (e.g., radar sensor of UAV 301).

[0088] In some embodiments, the received location has been filtered (received as filtered) and/or is filtered (e.g., filtered using a processor on an aerial vehicle) based on one or more sensor measurements. For example, once a likely geographical location has been determined for the target, the location is filtered using a Kalman filter (e.g., linear Kalman filter) to reduce noise and inaccuracies. The filter may take into account a model of a target vehicle and its movement/flight properties and capabilities to determine the location based on a series of sensor measures over time. The location of the target may be updated and continually received as a new or updated location of the target is determined. For example, the received location is a part

of a stream of locations tracked for the target.

[0089] At 404, the received location is utilized to navigate towards the received location. For example, the location is received at a navigation component and/or a flight controller of an interceptor aerial vehicle and the direction and/or speed of the aerial vehicle is automatically and autonomously adjusted to turn and fly towards the received location in a navigation mode based on the received location. This allows the interceptor aerial vehicle to be approached and become closer to the vicinity of the target. However, because the received location may represent a rough and/or approximate location of the target, the received location may not represent the exact location of a moving target required to be known to successfully deploy an interdiction/capture mechanism.

[0090] At 406, a relative location of the target is detected using a captured image. For example, once an image sensor/camera on a reference system (e.g., interceptor aerial vehicle 102 of Figure 1) is within range to acquire an image of the target, the reference system is able to more accurately detect and automatically navigate to the location of the target based at least in part on the image sensor/camera data. In some embodiments, once the reference system is within a predetermined distance (e.g., 20 meters) from the received location and the image sensor/camera is pointing towards the direction of the received location, captured images are analyzed using a processor of the reference system in an attempt to detect the target aerial vehicle in the image using computer machine vision. If the target aerial vehicle is not detected in the captured image, the reference system continues to proceed towards the received location in the received location-based navigation mode. However, once the target is detected in a captured image, the navigation of the reference system may now be performed based on the image rather than or in addition to the received location. If the image of the target is lost, the reference system may fall back to the previous received location-based navigation until the target is detected again in a captured image. The detection of the target in the captured image may be performed using machine/computer vision. For example, using a machine learning model trained using training data of various different example targets, captured images of one or more image sensors are analyzed to identify a likely target in the image. In some embodiments, the relative location is specified by an azimuth angle and an altitude angle. A distance value to the target and/or desired speed/acceleration may also be specified for the relative location. In some embodiments, the

relative location is specified by a three-dimensional vector determined based on the detected image of the target. For example, the three-dimensional vector is specified by values corresponding to three axial values.

[0091] At 408, a flight operation is performed based on the detected relative location of the target. For example, a flight direction and/or speed of an interceptor aerial vehicle are automatically and autonomously adjusted based on a location and size of the target within the captured image (e.g., adjust direction to center the target within subsequently captured images). This allows the flight path of the interceptor aerial vehicle to be dynamically adjusted to track and follow a moving target, allowing the interceptor aerial vehicle to come within a threshold distance where an interdiction/capture system (e.g., a net fired from the interceptor aerial vehicle) can be effectively deployed. In some embodiments, a scaled three-dimensional vector based on the relative location of the target and determined based on the detected image of the target is used to adjust a flight path of the interceptor aerial vehicle in the direction and intensity of the three-dimensional vector. For example, the three-dimensional vector specifies directional and speed/acceleration changes to be performed by the interceptor aerial vehicle to direct the flight path of the interceptor aerial vehicle at a desired rate of change towards the target aerial vehicle.

[0092] Although the examples were discussed with respect to aerial vehicles, in various other embodiments, the techniques discussed herein may be applied to other types of vehicles such as terrestrial and aquatic vehicles.

[0093] Figure 5 is a flowchart illustrating an embodiment of a process for determining a vector associated with a target. In some embodiments, the process of Figure 5 is performed by interceptor aerial vehicle 102 of Figure 1, UAV 200 of Figure 2, and/or UAV 301 of Figures 3A and 3B. In some embodiments, at least a portion of the process of Figure 5 is performed in 406 and/or 408 of Figure 4. The process of Figure 5 may be repeated when a target aerial vehicle is detected in an image being continually captured by an interceptor aerial vehicle.

[0094] At 502, a relative distance to a target is determined based on a captured image of the target. In some embodiments, the image is acquired from a camera onboard an interceptor aerial vehicle (e.g., camera 212 of Figure 2). For example, an image sensor/camera of the

interceptor aerial vehicle continually captures a stream of images in one or more directions including in the direction of travel of the interceptor aerial vehicle and each captured image is analyzed to identify a target aerial vehicle in the image, if possible. The detection of the target in the captured image may be performed using machine/computer vision. For example, using a machine learning model trained using training data of various different images of targets, the captured image is analyzed to identify the target aerial vehicle in the image. The output of the image analysis (e.g., output from applying the machine learning model) may include a bounding box outlining an area within the image that includes the image portion with the target (e.g., bounding box outlines the minimum sized box that includes detected features of the target) and/or a classification of the detected target (e.g., type, model, class, manufacturer, size, etc. of the detected target).

[0095] In some embodiments, the relative distance to the target identifies the relative distance between a reference system (e.g., interceptor aerial vehicle) and the target (e.g., target aerial vehicle). The relative distance may be determined based on a size of the bounding box within the entire captured image and a detected classification of the target. For example, the target that is further away will appear smaller in the image as compared to the target that is closer to the reference location, and thus the size of the detected target within the image can be used as a proxy for the distance to the target. However, different types of target aerial vehicles may be different sizes and the actual physical size of the target needs to be taken into account when using the target size within the image as a proxy for relative distance. In some embodiments, the machine learning model has been trained using different examples of types of aerial vehicles (e.g., different models, types, manufacturers, sizes, etc.) to be able to classify and identify the specific type of the detected target aerial vehicle and a corresponding size profile corresponding to the specific type. If a specific type of the target cannot be reliably determined, a default size profile corresponding to a general type may be utilized. Thus, a measurement of the target within the image (e.g., width of the bounding box, length of the bounding box, diagonal length of the bounding box, area of the bounding box, number of pixels in the bounding box, number of pixels across a dimension of the bounding box, etc.) can be mapped to a distance value based on a determined size corresponding to the detected type/classification of the target. A table and/or formula for the mappings may be predetermined for different types/classifications. In some embodiments, the mapping to the distance value may also take into account one or more

properties of the camera utilized to capture the image. For example, the sensor size, sensor pixel configuration, a zoom setting, and/or a field of view of the camera is utilized in adjusting or normalizing the distance value and/or the measurement of the target image portion within the overall image. In some embodiments, images from different cameras are utilized and analyzed together to determine the direction to the target.

[0096] At 504, a relative direction to the target is determined based on the image. Because the camera that captured the image is affixed to the reference aerial vehicle at a known location and orientation, the direction captured by each pixel of the camera sensor is known and can be predetermined. For example, based on the known height and width of the image sensor (e.g., number of pixels in height and width), optical properties of the camera lens (e.g., the field of view of the camera), and the capture direction/orientation of the camera with respect to the reference aerial vehicle, each location within the image (e.g., each pixel) can be mapped to a specific relative direction with respect to the reference aerial vehicle. For example, the output of the image analysis (e.g., output from applying the machine learning model) may include a bounding box identifying an area within the image that includes the target and the center of the bounding box can be used as a representative central point for the target. In other examples, another type of point on the target within the image may be selected as the representative point for the target (e.g., specifically identified point on a body of the target). The location (e.g., x and y location) of this representative point within the image is determined (e.g., pixel location). This two-dimensional location represents the relative direction of the target with respect to the reference as this two-dimensional location can be mapped to a corresponding azimuth angle and altitude angle. For a specific camera, image sensor, and capture direction/orientation, a table and/or formula for the mapping between the pixel/image location and corresponding azimuth angle and altitude angle may be predetermined. In some embodiments, images from different cameras are utilized and analyzed together to determine the relative direction of the target.

[0097] At 506, a vector identifying the relative location of the target is determined using at least the determined relative direction of the target. For example, determined angular directions (e.g., azimuth angle and altitude angle) can be mapped to a three-dimensional vector identified by three axial components (e.g., x-axis, y-axis, and z-axis values). In some embodiments, a predetermined relationship between the relative direction angles and the vector

components are utilized to determine the vector. In some embodiments, the vector is at least in part defined using a distance and/or speed value. For example, the distance value determined in 502 is mapped to a desired speed of travel to reach the target (e.g., greater speed desired for further distance and slower speed desired for shorter distance to allow more time for direction correction) and the length of the vector is based on the determined distance and/or speed. In one example, the vector is defined by the azimuth angle, the altitude angle, and a factor based on an associated distance or speed. In some embodiments, the vector is defined by three-dimensional coordinate-based values and the vector is to be provided along with the associated distance and/or speed.

[0098] At 508, the vector is scaled. In some embodiments, scaling the vector includes modifying a speed and/or acceleration associated with the vector as well as smoothing and limiting the rate of change associated with the vector. In some embodiments, the scaling the vector includes modifying one or more directional component values of the vector.

[0099] Modifying the speed and/or acceleration associated with the vector includes adjusting a factor used to control the speed and/or acceleration of the interceptor aerial vehicle based on an amount of directional change specified by the vector. For example, when a large directional change is required by the interceptor aerial vehicle to fly towards the target, a slower speed is desirable to allow the directional change to take place at a slower speed over a shorter distance as compared to a faster speed that is desirable to reach the target quicker when no or minor directional change is required. In some embodiments, the speed and/or acceleration factor is multiplied by one or more scalar values that change in magnitude based on a directional deviation of the vector from a current direction of movement (e.g., deviation of the target in the image from the center of the image representing the current heading direction of the interceptor aerial vehicle). For example, plotting the scalar value with respect to a directional deviation results in a bell curve where the highest scalar value is associated with the center of the graph corresponding to no change in directional deviation (e.g., the directional deviation given by a component value of the vector) and the scalar value decreases exponentially on either side of the center as the directional deviation increases. In other examples, the scalar value may decrease linearly on either side of the center as the directional deviation increases. In some embodiments, the scalar value is a function of one or more of a plurality of directional axes of the vector. For

example, the scalar value is a combination of one scalar value that varies based on a relationship (e.g., function) with one component value of the vector and another scalar value that varies based on a different relationship (e.g., a different function) with another component value of the vector. In some embodiments, the factor used to control the speed and/or acceleration of the interceptor aerial vehicle includes limiting its rate of change and/or value (e.g., either by a reduction scalar or a maximum change limit) so that the interceptor aerial vehicle does not change its speed in a manner that is too sudden or difficult to achieve given flight hardware limitations. For example, a magnitude of change of the speed and/or acceleration is allowed up to a predetermined maximum limit.

[00100] In some embodiments, the scaling the vector includes modifying one or more directional component values of the vector. For example, a rate of change and/or a value of one or more components of the vector is limited (e.g., either by a reduction scalar value or a limit) so that the interceptor aerial vehicle does not change directions in a manner that is too sudden or difficult to achieve given flight hardware limitations. In one example, a magnitude of change of a component value of the vector is limited by a predetermined maximum limit. In some embodiments, the one or more component values of the vector are multiplied by one or more scalar values that change in magnitude based on a deviation of the corresponding component value from a center reference value (e.g., corresponding to a current direction of movement). For example, plotting the scalar value with respect to a deviation results in a bell curve where the highest scalar value is associated with the center of the graph corresponding to no change in deviation from a reference and the scalar value decreases exponentially on either side of the center as the deviation increases. In other examples, the scalar value may decrease linearly on either side of the reference as the deviation increases. In some embodiments, the scalar value may be specified to a particular directional axis of the vector. For example, different scalar value functions correspond to different component values of the vector.

[00101] At 510, the scaled vector and one or more associated values are provided. For example, the scaled vector and associated directional values and distance, speed, and/or acceleration values are provided for use in navigating the interceptor aerial vehicle towards the target aerial vehicle. In some embodiments, the scaled vector and one or more associated values are provided for use in performing the flight operation in 408 of Figure 4.

[00102] Figure 6 is an illustration illustrating an example of a two dimensional vector determined using an image from a camera feed. Graph representation 600 shows target 602, an x-axis 604, y-axis 606, 2D vector 608, degX 610, and degY 612. The target 602 may comprise pixels associated with a target. The number of pixels associated with the target 602 may be utilized to determine the depth of the target 602 by comparing the number to the total number of pixels. The x-axis 604 may measure the number of degrees the target 602 is located left or right of the center of the camera feed (e.g., the degX 610). In some embodiments, the x-axis 604 measures from -21 degrees to 21 degrees. The y-axis 606 may measure the number of degrees the target 602 is located above or below the center of the camera feed (e.g., the degY 612). In some embodiments, the y-axis 606 measures from -35 degrees to 35 degrees. The 2D vector 608 is the combination of the degX 610 and the degY 612.

[00103] Figure 7 is an illustration illustrating an example of a three dimensional vector determined using two dimensional measurements. 3D vector 700 comprises a target 702, a UD factor 704, an LR factor 706, and an FB factor 708. Target 702, which is associated with a 2D vector, has a 3D vector determined, which may comprise the UD factor 704, the LR factor 706, and the FB factor 708. The UD factor 704, the LR factor 706, and the FB factor 708 may be calculated using the example equations shown in Figure 8.

[00104] Figure 8 shows example equations that can be utilized to determine a three dimensional vector. The equations are based on measurements for two axes of an image, such as an x-axis (degX) and a y-axis (degY). An initial 2D vector may be determined based on the location of the target pixels. The 2D vector is then converted into a 3D vector comprising three factors: an up/down factor (UD), a front/back factor (FB), and a left/right factor (LR). The conversion may be performed utilizing the equations shown in Figure 8. The vector comprising UD, FB, and LR, as well as associated speed value may be scaled and/or smoothed. In some embodiments, associated speed values are utilized to modify the initial vector components UD, FB, and LR. The speed may be utilized as a scalar multiplier, or the speed may affect the components of the 3D vector differently.

[00105] Figure 9 is an illustration illustrating examples of functions utilized to adjust component values of a vector. Logic smoothing functions 900 comprises an x-axis logic

smoothing function 902 and a y-axis logic smoothing function 904. The x-axis logic smoothing function 902 and the y-axis logic smoothing function 904 may depend on the x-axis and y-axis, respectively. The x-axis logic smoothing function 902 and the y-axis logic smoothing function 904 may be applied to vectors, such as 3D vector 700. The x-axis logic smoothing function 902 and y-axis logic smoothing function 904 may be applied to one or more of the components of the vectors. For example, the x-axis logic smoothing function 902 may be applied to the LR factor 706 and the FB factor 708, but not the UD factor 704. The y-axis logic smoothing function 904 may be applied similarly in this example.

[00106] Figure 10 shows example equations that can utilized to scale/alter components values of a vector. For example, a logistical smoother alters the vector to stabilize the motion of a drone. The logistical smoother may utilize the axial measurements (e.g., degX and degY) to alter the vector. The logistical smoother 110 may also utilize predetermined constants to alter the vector. In one embodiment, UD is modified by a constant, and FB and LR are modified by a speed factor, which depends on both degX and degY, which may be converted to their absolute value prior to calculation, as shown in the equations of Figure 10. The ud_{factor} in Equation 4 may be a constant. Equations 7 and 8 may both be applied when determining the speed factor for Equations 5 and 6. In other embodiments, each vector component may utilize a specific component of speed factor (e.g., either Equation 7 or Equation 8). The constants a, b, and c depicted in Equations 7 and 8 may be the same value or they may be different values. That is, each constant for speed factor with respect to degX may be different, and the constant may differ based on whether applied to the speed factor for degX or degY. The final 3D vector can be utilized to perform a flight operation.

[00107] Figure 11 illustrates an embodiment of a spacio-temporal awareness engine 1100. In some embodiments, engine 1100 may be utilized in 406 of Figure 4. The spacio-temporal awareness engine 1100 comprises camera 1 1102, camera 2 1104, camera n 1106, low resolution converter 1108, image 1 1114, image 2 1116, image n 1118, anomaly detect 1120, and camera of interest 1122. The low resolution converter 1108 comprises the noise filter 1110 and feature consolidation 1112. The spacio-temporal awareness engine 1100 may be operated in accordance with the tree based region selection process 1200 and the tree-based region selection process 1300.

[00108] The spatial-temporal (spacio-temporal) awareness engine utilizes the limited resources available on an autonomous robotic systems (ARS) (e.g. drones, self driving cars, etc.). The spacio-temporal awareness engine utilizes a multi-camera view which is processed in parallel by a cascade of noise removal and super pixel feature consolidation and isolation algorithms to bring them to lower resolution images. These images are processed continuously using proprietary anomaly detection and populated in a probability distribution based priority quadtree and/or octree maps for further processing by the main high resolution tracking engine. An anomaly or change detection algorithm uses a combination of traditional edge and contour-based features in combination with a temporal prediction filter. The advantage of this two-tier architecture is the ability to reject and give prioritized areas for heavier, more computationally intensive algorithms.

[00109] On a fixed compute budget there is a negative relation between robustness of an algorithm and the cost and/or latency of the algorithm per spacio-temporal frame. Tight restrictions on available compute cycles limit the responsiveness of the system, especially on autonomous or semi-autonomous drones. By combining multiple algorithms in a way that achieves high combined frame rate with higher quality prediction, the system improves outcomes on a limited resource budget. Deep neural networks (DNN) may be executed to periodically detect objects and distinguish targets. A main high resolution tracking engine executes high-speed feature-based tracking based on disparity of similarity features with live adaptation.

[00110] In addition, the system employs color features and model predictions (Kalman/Particle filters etc.) to filter pixel domain inconsistencies. Once an object is detected in high-resolution mode (i.e. using DNN or manual input) a tracker algorithm takes control and maintains lock on the target. Applying different tracking algorithms and DNN based detections of a target in the video frame provides robustness at a high compute cost. A reduced resource background tracker may incrementally predict the location of a target in the frame with low compute cost and average robustness. This optimization enables the coexistent application of advanced machine vision algorithms in addition specialized lower cost algorithms.

[00111] Described herein are means for optimizing input of video data that is processed to efficiently locate and track items of interest using different processing schemes in view of

effectiveness confidence and local computing resources. An example implementation includes means for determining a response direction to locate and track items of interest to respond to changes in monitored video data.

[00112] An example implementation includes method comprising optimizing resources processing a video data stream from a mobile capture device using a set of processing schemes to track one or more items of interest. A performance score is associated with each processing scheme confidence to track the one or more items of interest. The method includes repeatedly determining an active processing scheme based on the processing scheme with the highest performance score from the set of processing schemes. In response to the performance score of the active processing scheme failing to satisfy a threshold, the method selects another processing scheme to process the video data stream. Processing the video data stream can include identifying one or more items, classifying each of the items; and tracking one or more of items as an item of interest based on the classification. Processing the video data stream can include noise filtering and feature consolidation.

[00113] According to an example, selecting another processing scheme is based on determining a number of items of interest in the video data stream. The set of processing schemes can utilize different resource levels to process the video data stream. In an example, the set of processing schemes process the video data stream using different resolutions. The performance scores can be re-calculated based on a trigger, a resource threshold, or a time interval. For example, the threshold can be based on available computing resources associated with the mobile capture device.

[00114] In another example implementation, a system can include a video capture module, a sensor module, a control module, and one or more processors to direct control based on a detected change in a region of interest monitored by the video capture module or the sensor module. According to an example implementation, the one or more processors are configured to monitor multiple regions of interest in video data from the video capture module, and in response to detecting a change in a region of interest, determine a response direction for the control module based on the sensor module, wherein the response direction indicates an approximate location for an item of interest. The region of interest can include tracking an item of interest and

the change in a region of interest includes not detecting the item of interest in the region of interest. For example, when an item of interest being tracked is not detected in the area of interest, the sensor module can be used to detect the response direction in view of a last detected location for the item of interest.

[00115] The system can control the video capture module, a navigation system of the control module, or feedback interface based on the response direction. For example, based on the response direction indicating an updated location for the item interest, cameras can be moved or re-focused, flight code can be updated, or visual feedback provided directed towards a possible location using the response direction. The updated location can be an approximate or predicted area based on the monitored video data and/or sensor data. The sensor module can include sensors coupled to the control module or the video capture module and/or receive sensor readings from external sensor systems, such as ground-based sensors including radar, radio frequency, proximity, acoustic, thermal imaging, night vision, and global positioning system sensors.

[00116] In further example implementation, a system includes a video capture module and one or more processors configured to process a video data stream using a set of processing schemes to track one or more items of interest, where a performance score is associated with the confidence of each processing scheme to track the one or more items of interest, wherein an active processing scheme is repeatedly determined based on the processing scheme with the highest performance score from the set of processing schemes. In response to the performance score of the active processing scheme failing to satisfy a threshold, the one or more processors select another processing scheme to process the video data stream.

[00117] The system can include a sensor module, where the one or more processors are further configured to: monitor multiple regions of interest in video data stream; and in response to detecting a change in a region of interest, determine a response direction based on the sensor module, wherein the response direction indicates an approximate location for an item of interest. The sensor module can receive readings from at least one of a radar, a radio frequency, proximity, acoustic, thermal imaging, night vision, and global positioning system sensors. In response to detecting the change, the one or more processors are further configured to at least

one of control a navigation system, an interface, and the video capture module based on the response direction.

[00118] Figure 12 illustrates an embodiment of a tree based region selection process. At least a portion of the process of Figure 12 may be performed in 406 of Figure 4. Referring to Figure 12, in block 1202, tree based region selection process 1200 receives a high resolution stream from a first imaging sensor. In block 1204, tree based region selection process 1200 generates a low resolution stream from a second imaging sensor using a low-resolution conversion. In subroutine block 1206, tree based region selection process 1200 noise filters. In subroutine block 1208, tree based region selection process 1200 feature consolidation. In block 1210, tree based region selection process 1200 detects an anomaly within the low resolution stream. In block 1212, tree based region selection process 1200 creates a prioritized region surrounding the detected anomaly. In block 1214, tree based region selection process 1200 performs anomaly detection within a corresponding region of the high resolution stream. In block 1216, tree based region selection process 1200 outputs the anomaly location. In done block 1218, tree based region selection process 1200 ends.

[00119] Figure 13 illustrates an embodiment of a tree-based region selection process. At least a portion of the process of Figure 13 may be performed in 406 of Figure 4. Referring to Figure 13, in block 1302, tree based tree-based region selection process 1300 receives a video input from a plurality of cameras. In subroutine block 1304, applies a low-resolution conversion. In subroutine block 1306, the tree-based region selection process 1300 detects anomalies in the video input. In block 1308, the tree-based region selection process 1300 detects anomalies within the region of interest in the high-resolution image. In block 1310 the tree-based region selection process 1300 outputs the anomaly location.

[00120] Figure 14 illustrates an embodiment of parallel image processing process 1400. At least a portion of the process of Figure 14 may be performed in 406 of Figure 4. The parallel image processing process 1400 comprises the high resolution process 1418 and the low resolution process 1416. The high resolution process 1418 comprises image sensor 1404, anomaly detection 1406, and region of interest 1408. The low resolution process 1416 comprises the image sensor 1402, the low resolution converter 1412, the anomaly detection 1414, and the

region of interest 1410.

[00121] Figure 15 illustrates a tracking system 1500 in accordance with one embodiment. One or more components of system 1550 may be utilized in 406 of Figure 4. The tracking system 1500 comprises a cameras 1528 producing multi-camera views 1518 that are input to a processor 1508. The processor operates to filter and de-noise the multi-camera views 1518 to populate a pixel domain 1516. The pixel domain 1516 is divided into nodes (e.g., node 1506, node 1520, node 1514, and node 1512 that are then analyzed by a high resolution tracker 1502. Output of the high resolution tracker 1502 is input to a fast, low power consumption low resolution tracker 1510. In this example, the node 1506 comprises an anomaly 1522. The high resolution tracker 1502 identifies the anomaly 1522 as a detected object 1524, which is then tracked by the low resolution tracker 1510.

[00122] Figure 16 illustrates an embodiment of a quadtree 1600. The quadtree 1600 comprises: node 1604, node 1608, node 1606, subnode 1610, subnode 1612, subnode 1614, n-subnode 1616, n-subnode 1618, n-subnode 1622, and n-subnode 1624.

[00123] Two dimensional areas are recursively subdivided into quarters. For example, node 1602 may be divided into subnode 1610, subnode 1612, subnode 1614, and subnode 1620. Subnode 1620 may be divided into n-subnode 1616, n-subnode 1618, n-subnode 1622, and n-subnode 1624. In this example, an input image is divided into node 1604, node 1608, node 1606, and node 1602. Based on a resolution and probability target, node 1602 is selected as the most likely to contain the drone. Node 1602 is then divided into subnode 1610, subnode 1612, subnode 1620 and subnode 1614, and the process is repeated n-times to an nth approximation until the resolution and probability target is reached. In this manner, a region of interest is determined.

[00124] Figure 17 illustrates an embodiment of a system 1700 for converting camera input into a vector for low resolution tracker 1510. One or more components of system 1700 may be utilized in 406 of Figure 4. One of the system cameras (e.g., sub-camera 1716) generates a pixel domain 1702 image including sets of macrofeatures (e.g., macro feature 1718 and macro feature 1708). By operation of a processor 1722, these undergo a pruning process 1704 to generate more specific (pruned) macro features (e.g., macro feature 1710). In this example, macro feature 1718

was pruned as being characteristic of a non-target object (e.g., a bird in flight).

[00125] Primary macro features are identified from the pruned set as a region of interest 1714 and vectorized (converted from the pixel domain to a vector or parameterized description) into a region of interest 1712 using a feature extraction and classification 1706 process. This results in a final vector 1724 that may be applied to operate a mitigation system and direct the drone's main camera 1720.

[00126] Figure 18 illustrates an embodiment of a subsystem 1800 for prioritizing a region of interest in the focus of a camera. One or more components of subsystem 1800 may be utilized in 406 of Figure 4. A camera 1836 produces a camera output 1832 that is divided into pixel groups (pixel group 1804, pixel group 1816, pixel group 1818, and pixel group 1820 in this example). The focus pixels 1834 includes pixel group 1816 that is divided into subgroups (pixel group 1808, pixel group 1822, pixel group 1802, etc.) The focus pixels 1824 include pixel group 1808 which is divided into nodes (node 1810, node 1806, node 1826 etc.) The focus pixels 1828 includes node 1810 from which the region of interest 1814 is identified, and focused, to produce focused region of interest 1812. In this manner, the focus of the camera 1836 is progressively narrowed onto the eventual region of interest 1812.

[00127] Figure 19 illustrates several components of an exemplary region of interest tracking system 1900 in accordance with one embodiment. One or more components of system 1900 may be utilized in 406 of Figure 4. The region of interest tracking system 1900 may be included on a drone device (e.g., as a printed circuit board) to provide the capability to perform operations such as those described herein. In some embodiments, region of interest tracking system 1900 may include many more components than those shown in Figure 19. However, it is not necessary that all of these generally conventional components be shown in order to disclose an illustrative embodiment. Collectively, the various tangible components or a subset of the tangible components may be referred to herein as "logic" configured or adapted in a particular way, for example as logic configured or adapted with particular software or firmware.

[00128] In various embodiments, the region of interest tracking system 1900 may comprise one or more physical and/or logical devices that collectively provide the functionalities described herein. In some embodiments, the region of interest tracking system 1900 may

comprise one or more replicated and/or distributed physical or logical devices.

[00129] In some embodiments, the region of interest tracking system 1900 may comprise one or more computing resources provisioned from a "cloud computing" provider, for example, Amazon Elastic Compute Cloud ("Amazon EC2"), provided by Amazon.com, Inc. of Seattle, Washington; Sun Cloud Compute Utility, provided by Sun Microsystems, Inc. of Santa Clara, California; Windows Azure, provided by Microsoft Corporation of Redmond, Washington, and the like.

[00130] Region of interest tracking system 1900 includes a bus 1902 interconnecting several components including a network interface 1908, a display 1906, a central processing unit 1910, and a memory 1904. Memory 1904 can comprises a random access memory ("RAM") and permanent non-transitory mass storage device, such as a hard disk drive or solid-state drive. Memory 1904 stores an operating system 1912. These and other software components may be loaded into a memory 1904 of the region of interest tracking system 1900 using a drive mechanism (not shown) associated with a non-transitory computer-readable medium 1916, such as a memory card, or the like. Memory 1904 also includes database 1914. In some embodiments, region of interest tracking system 1900 may communicate with database 1914 via network interface 1908, a storage area network ("SAN"), a high-speed serial bus, and/or via the other suitable communication technology. In some embodiments, database 1914 may comprise one or more storage resources provisioned from a "cloud storage" provider, for example, Amazon Simple Storage Service ("Amazon S3"), provided by Amazon.com, Inc. of Seattle, Washington, Google Cloud Storage, provided by Google, Inc. of Mountain View, California, and the like.

[00131] A multimodal sensor empowered awareness system for target recovery and object path prediction provides for a fast recovery of lost targets by empowering an autonomous robotic system (ARS) awareness engine with multimodal sensors. The system tracks targets visually using a combination of visual and acoustic tracking sensors.

[00132] The system employs a main tracking sensor (e.g., optical video) that feeds into a spatiotemoral engine on the ARS. Proximal sensors complement the main tracking sensor. Using non-visual fast processing sensors that give rough directionality of the signal allows for prioritization of the visual target scanning process. The sensors may include sound, RF, LIDAR,

RADAR, GPS, and potentially other proximity sensors that do not isolate the location of a possible target, but provide a general direction to be scanned as a priority. The system may thus implement multi-object path and collision prediction.

[00133] Figure 20 illustrates an embodiment of drone operation logic. The drone operation logic 2000 illustrated in Figure 20 may be utilized to implement a system operating a multimodal sensor empowered awareness engine 2100 and a multimodal sensor empowered awareness engine 2200 as illustrated in Figure 21 and Figure 22, respectively.

[00134] Referring to Figure 20, drone operation logic 2000 comprises a main controller 2004 that controls and coordinates the operation of other components as well as providing general computational capabilities (e.g., to execute image processing 2018). The main controller 2004 may comprise a central processing unit and/or one or more controllers or combinations of these components. The drone operation logic 2000 will typically comprise memory 2008 which may be utilized by the main controller 2004 and other components (e.g., the DSP 2026 and/or the GPU 2022) to read and write instructions (commands) and data (operands for the instructions).

[00135] At least one camera 2016 may interface to image processing 2018 logic to record images and video from the environment. The image processing 2018 may operate to provide image/video enhancement, compression, feature extraction, and other transformations, and provide these to the main controller 2004 for further processing and storage to memory 2008. The image processing 2018 may further utilize a navigation board 2002 and/or DSP 2026 toward these ends. Images and video stored in the memory 2008 may also be read and processed by the main controller 2004, DSP 2026, and/or the GPU 2022. The drone operation logic 2000 may operate on power received from a battery 2014. The battery 2014 capability, charging, and energy supply may be managed by a power manager 2010.

[00136] The drone operation logic 2000 may transmit wireless signals of various types and range (e.g., cellular, WiFi, Bluetooth, and near field communication i.e. NFC) using the wireless communication logic 2020 and/or other transducers 2024. The drone operation logic 2000 may also receive these types of wireless signals. Wireless signals are transmitted and received using one or more antenna. Other forms of electromagnetic radiation may be used to interact with proximate devices, such as infrared (not illustrated). The drone operation logic 2000 may include

a navigation board 2002 which includes a motor control 2006 using flight code (to operate propellers and/or landing gear), an altimeter 2028, a gyroscope 2030, and local memory 2012.

[00137] Referencing Figure 21, a system operating a multimodal sensor empowered awareness engine 2100 comprises a short range and long range sensors 2102, a sensor control systems 2104, a pixel to vector pipeline 2110, a detection/localization engine 2108, and a mitigation system 2106. The detection/localization engine 2108 comprises an object path predictor 2118, high resolution tracker 2112, and a low resolution tracker 2114. The system operating a multimodal sensor empowered awareness engine 2100 may be operated in accordance with the process described in Figure 22.

[00138] Referencing Figure 22, a multimodal sensor empowered awareness engine 2200 detects that a lock on the tracked target has been lost (block 2202). The multimodal sensor empowered awareness engine 2200 checks the proximal sensors to identify the lost target (block 2204). The multimodal sensor empowered awareness engine 2200 ranks the probability of detecting the target based object path prediction (block 2206). The multimodal sensor empowered awareness engine 2200 moves the camera towards a proximal sensor with the highest detection probability (block 2208).

[00139] Referencing Figure 23, a system operating a multimodal sensor empowered awareness engine 2300 illustrates a drone 2304 comprising a camera range 2302 as the range of the main tracking sensor and a first secondary sensor range 2306, second secondary sensor range 2308, a third secondary sensor range 2310, and a fourth secondary sensor range 2312, as the range of the complementary proximal sensors.

[00140] Referencing Figure 24, a system operating a multimodal sensor empowered awareness engine 2400 comprises a drone 2402 and an out of range target 2408 from a camera range 2404, in a secondary sensor range 2406.

[00141] An example aspect includes optimized video processing scheme scheduling. In an example implementation, processing schemes include localization algorithms that process video frames of one or more video data streams. The processing schemes produce a prediction of objects within the video frame, as well as a confidence number that is a measure of quality for

that prediction. The confidence number can be normalized to a canonical range (0-1) and used to compare the confidence of each different processing scheme to track an item of interest.

[00142] Costs on all data inputs for the processing schemes can be pre-determined, estimated, or calculated. For example, a type of algorithm that operates on visual "features" can be dependent on the number of features in the video frame, and its cost estimated based on the number of features. As the number of features increases the cost can increase dramatically.

[00143] According to other examples, algorithms may differ in their effectiveness based on the type of input received. Robustness of each algorithm (e.g., processing scheme) can be compared by measuring a population of inputs that are selected as representative of sample conditions (e.g., real-life data sets) and prioritized by application requirements.

[00144] The example implementation can statically assign each processing scheme in a set of processing schemes to a group based on each processing scheme's determined cost and/or robustness estimations on the selected input group.

[00145] For example, processing schemes can be grouped as:

(i) High cost (low refresh rate), high robustness algorithm (e.g., processing schemes that produce an object location estimation independent of historical information);

(ii) Medium cost, medium robustness algorithms (e.g., processing schemes that use a last known location of the object location estimation and/or use a fast validation method to validate the estimation); or

(iii) Low cost (high refresh rate), low robustness algorithms (e.g., processing schemes that use a known location of the object location estimation and or a fast validation method to validate the estimation).

[00146] In an example implementation, a set of processing schemes (e.g., algorithms) are examined from group to group, and the process cycles through the processing schemes to produce a detection of an object. According to the example implementations, if the confidence number is higher than an activation number, an action is performed to stop or change a running group (i) and select or switch to group (ii). For example, a processing scheme from the group of

(i) High cost (low refresh rate), high robustness algorithm can select a cheaper processing scheme from the group of (ii) Medium cost, medium robustness algorithms. Medium cost algorithms can be run from group (ii) in higher refresh rate, while monitoring the confidence level of the result.

[00147] According to an example implementation, a voting system is provided that fuses estimations from high confidence results, and validates the result with an independent validation method. If the confidence is below low threshold, falls outside of a range, or the validation method fails, group (i) processing is performed. If the confidence is determined to be high, then group (iii) algorithms can be applied to optimize resources. Different Groups of algorithms (e.g., group (iii) and group (ii)) may be similar and selected based on different secondary factors to optimize local computing resources. For example, group (iii) algorithms may operate like group (ii) with a similar validation method but have secondary factors such as faster and more brittle performance.

[00148] In an example implementation, processing schemes may have no confidence measure and depend solely on the validation method to determine a performance score or detect a failure. For example, if the confidence is low in group (iii) or the validation method fails, group (ii) processing is selected to be the active processing scheme for processing the video data.

[00149] In some examples, the input can allow the system to invoke the group or processing scheme from the set of processing schemes that can detect the object, and constantly optimize the processing scheme that isolates the object from the background detected in the video data. For example, a processing scheme may more efficiently process video data to detect and track items from a white background.

[00150] Processing scheme examples for a group (i) High cost (low refresh rate) - high robustness can include modified tiny You only look once (YOLO) Convolutional Neural Networks (CNN) on 448 pixels input tiles in the frame; a modified SSD (Single Shot Detection) CNN on 300 pixels multi-scale classification; a modified Faster R-CNN (Region Proposal Networks), segmentation analysis of the frame + classifier for each candidate, etc.

[00151] Processing scheme examples for a group (ii) & (iii) can include using SqueezeNet

super fast rejection CNN as the validation method on the estimated location produced by the algorithms. A 227 pixels input can be run in the location predicted by the algorithms and used as a part of the score for the result estimation. Group (ii) Medium cost - medium robustness processing scheme examples can include: color-based tracking - hue, saturation, value (HSV) channel statistical modeling; feature based tracking - Oriented FAST and rotated BRIEF (ORB) features + descriptors, consensus of movement of keypoints (optical flow); movement based tracking - ego-motion compensation and background subtraction, etc.

[00152] Group (iii) Low-cost - low robustness processing scheme may have no confidence measure and depend solely on the validation method to determine a performance score and/or detect a failure. Group (iii) Low-cost - low robustness processing scheme examples can include: extrapolation of location of object from past locations (e.g., no confidence measure (always max), depend on validation method to reject estimation, etc.); SqueezeNet super fast rejection CNN; template matching to the last known object appearance based on past detections, etc.

[00153] The foregoing algorithms are examples, and the present inventive concept is not limited thereto. Other example algorithms may be substituted therefor without departing from the inventive scope, as would be understood by those skilled in the art. References to "one embodiment" or "an embodiment" do not necessarily refer to the same embodiment, although they may. Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively, unless expressly limited to a single one or multiple ones.

[00154] Additionally, the words "herein," "above," "below" and words of similar import, when used in this application, refer to this application as a whole and not to any particular portions of this application. When the claims use the word "or" in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list, and any combination of the items in the list, unless expressly limited to one or the other. "Logic" refers to machine memory circuits, non-transitory machine readable media, and/or circuitry which by way of its material and/or material-energy

configuration comprises control and/or procedural signals, and/or settings and values (such as resistance, impedance, capacitance, inductance, current/voltage ratings, etc.), that may be applied to influence the operation of a device.

[00155] Magnetic media, electronic circuits, electrical and optical memory (both volatile and nonvolatile), and firmware are examples of logic. Logic specifically excludes pure signals or software per se (however does not exclude machine memories comprising software and thereby forming configurations of matter). Those skilled in the art will appreciate that logic may be distributed throughout one or more devices, and/or may be comprised of combinations of memory, media, processing circuits and controllers, other circuits, and so on. Therefore, in the interest of clarity and correctness, logic may not always be distinctly illustrated in drawings of devices and systems, although it is inherently present therein.

[00156] The techniques and procedures described herein may be implemented via logic distributed in one or more computing devices. The particular distribution and choice of logic will vary according to implementation. Those having skill in the art will appreciate that there are various logic implementations by which processes and/or systems described herein can be affected (e.g., hardware, software, and/or firmware), and that the preferred vehicle will vary with the context in which the processes are deployed.

[00157] "Software" refers to logic that may be readily readapted to different purposes (e.g. read/write volatile or nonvolatile memory or media). "Firmware" refers to logic embodied as read-only memories and/or media. "Hardware" refers to logic embodied as analog and/or digital circuits. If an implementer determines that speed and accuracy are paramount, the implementer may opt for a hardware and/or firmware vehicle; alternatively, if flexibility is paramount, the implementer may opt for a solely software implementation; or, yet again alternatively, the implementer may opt for some combination of hardware, software, and/or firmware.

[00158] Hence, there are several possible vehicles by which the processes described herein may be effected, none of which are inherently superior to the other in that any vehicle to be utilized is a choice dependent upon the context in which the vehicle will be deployed and the specific concerns (e.g., speed, flexibility, or predictability) of the implementer, any of which may vary. Those skilled in the art will recognize that optical aspects of implementations may involve

optically-oriented hardware, software, and or firmware. The foregoing detailed description has set forth various embodiments of the devices and/or processes via the use of block diagrams, flowcharts, and/or examples. Insofar as such block diagrams, flowcharts, and/or examples contain one or more functions and/or operations, it will be understood as notorious by those within the art that each function and/or operation within such block diagrams, flowcharts, or examples can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or virtually any combination thereof.

[00159] Several portions of the subject matter described herein may be implemented via Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs), digital signal processors (DSPs), or other integrated formats. However, those skilled in the art will recognize that some aspects of the embodiments disclosed herein, in whole or in part, can be equivalently implemented in standard integrated circuits, as one or more computer programs running on one or more computers (e.g., as one or more programs running on one or more computer systems), as one or more programs running on one or more processors (e.g., as one or more programs running on one or more microprocessors), as firmware, or as virtually any combination thereof, and that designing the circuitry and/or writing the code for the software and/or firmware would be well within the skill of one of skill in the art in light of this disclosure.

[00160] In addition, those skilled in the art will appreciate that the mechanisms of the subject matter described herein are capable of being distributed as a program product in a variety of forms, and that an illustrative embodiment of the subject matter described herein applies equally regardless of the particular type of signal bearing media used to actually carry out the distribution. Examples of a signal bearing media include, but are not limited to, the following: recordable type media such as floppy disks, hard disk drives, CD ROMs, digital tape, flash drives, SD cards, solid state fixed or removable storage, and computer memory.

[00161] In a general sense, those skilled in the art will recognize that the various aspects described herein which can be implemented individually and/or collectively, by a wide range of hardware, software, firmware, or any combination thereof, can be viewed as being composed of various types of "circuitry." Consequently, as used herein "circuitry" includes, but is not limited to, electrical circuitry having at least one discrete electrical circuit, electrical circuitry having at

least one integrated circuit, electrical circuitry having at least one application specific integrated circuit, circuitry forming a general purpose computing device configured by a computer program (e.g., a general purpose computer configured by a computer program which at least partially carries out processes and/or devices described herein, or a microprocessor configured by a computer program which at least partially carries out processes and/or devices described herein), circuitry forming a memory device (e.g., forms of random access memory), and/or circuitry forming a communications device (e.g., a modem, communications switch, or optical-electrical equipment).

[00162] Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, the invention is not limited to the details provided. There are many alternative ways of implementing the invention. The disclosed embodiments are illustrative and not restrictive.

[00163] WHAT IS CLAIMED IS:

CLAIMS

1. A method of performing a flight control operation of a reference aerial vehicle, comprising:
 - receiving an image captured by an image sensor of the reference aerial vehicle;
 - detecting a target in the image including by applying a machine learning model to the image to identify a portion of the image that includes the target;
 - determining a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image including by determining a distance to the target based on a size of the target within the image; and
 - performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle.
2. The method of claim 1, wherein the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle.
3. The method of claim 1, wherein performing the flight control operation includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target.
4. The method of claim 1, wherein detecting the target in the image includes identifying a model type of the target.
5. The method of claim 1, wherein detecting the target in the image includes identifying a bounding box outlining a portion of the image that includes detected features of the target.
6. The method of claim 5, wherein determining the three-dimensional relative location of the target includes determining the distance to the target based on an area of the bounding box of the target within the image.
7. The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining the distance to the target based on the size of the target within the image and a physical size corresponding to an identified type for the target.
8. The method of claim 7 wherein determining the three-dimensional relative location of the target includes determining a speed adjustment factor based on the determined distance to the target.

9. The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining a direction of the target with respect to the reference aerial vehicle.
10. The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.
11. The method of claim 1, wherein determining the three-dimensional relative location of the target includes converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.
12. The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.
13. The method of claim 12, wherein the speed adjustment factor is greater for a smaller magnitude of deviation as compared to for a greater magnitude of deviation.
14. The method of claim 1, wherein determining the three-dimensional relative location of the target includes scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.
15. The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining a direction adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle and
16. The method of claim 15, wherein determining the three-dimensional relative location of the target includes scaling the direction adjustment factor to smooth and limit a rate of change of a direction of the reference aerial vehicle.
17. The method of claim 1, further comprising:

receiving an approximate geographical location of the target detected using a ground-based sensor;

autonomously navigating the reference aerial vehicle towards the approximate geographical location; and

determining whether to allow image-based navigation.

18. The method of claim 17, wherein determining whether to allow the image-based navigation includes determining whether the reference aerial vehicle is within a threshold distance away from the approximate geographical location.

19. A reference aerial vehicle, comprising:

an image sensor configured to capture an image;

a processor configured to:

detect a target in the image; and

determine a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and

a flight controller configured to perform a flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle.

20. A computer program product for performing a flight control operation of a reference aerial vehicle, the computer program product being embodied in a non-transitory computer readable storage medium and comprising computer instructions for:

receiving an image captured by an image sensor of the reference aerial vehicle;

detecting a target in the image;

determining a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and

performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle.

ABSTRACT OF THE DISCLOSURE

A flight control operation of a reference aerial vehicle is performed. For example, an image captured by an image sensor of the reference aerial vehicle is received. A target is detected in the image. A three-dimensional relative location of the target with respect to the reference aerial vehicle is determined based on the image. The flight control operation is performed based on the three-dimensional relative location of the target with respect to the reference aerial vehicle.

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Application Number: 16142452

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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
16/142,452	09/26/2018		1720	ASPAP008	20	3

CONFIRMATION NO. 4743

FILING RECEIPT

117915
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CUPERTINO, CA 95014



Date Mailed: 10/19/2018

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**

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Domestic Priority data as claimed by applicant

This appln claims benefit of 62/566,449 10/01/2017
and is a CIP of 15/729,581 10/10/2017
which claims benefit of 62/405,972 10/09/2016

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: 10/17/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/142,452**

Projected Publication Date: 01/24/2019

Non-Publication Request: No

Early Publication Request: No
Title

FLIGHT CONTROL USING COMPUTER VISION

Preliminary Class

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

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/142,452				
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			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *			OR	x 100 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *				x 460 =	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			TOTAL	1720			
* 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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743

117915 7590 11/07/2018
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC
10050 N. FOOTHILL BLVD #200
CUPERTINO, CA 95014

EXAMINER

CHU, RANDOLPH I

ART UNIT	PAPER NUMBER
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2667

NOTIFICATION DATE	DELIVERY MODE
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11/07/2018

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):

usptocorrespondence@ip-patent.com



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Doc Code:
TRACK1.GRANT

**Decision Granting Request for
Prioritized Examination
(Track I or After RCE)**

Application No.: 16/142,452

1. THE REQUEST FILED September 26, 2018 IS **GRANTED**.

The above-identified application has met the requirements for prioritized examination

- A. ☒ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination.** The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

- A. filing a **petition for extension of time** to extend the time period for filing a reply;
B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims**, or a multiple dependent claim;
C. filing a **request for continued examination**;
D. filing a notice of appeal;
E. filing a request for suspension of action;
F. mailing of a notice of allowance;
G. mailing of a final Office action;
H. completion of examination as defined in 37 CFR 41.102; or
I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to Cheryl Gibson-Baylor at (571)272-3213, Office of Petitions. In his/her absence, calls may be directed to Brian W. Brown, (571)272-5338.

Cheryl Gibson-Baylor
/Cheryl Gibson-Baylor/
[Signature]

Petitions Paralegal Specialist
(Title)

Office of Petitions: Decision Count Sheet

11

Application No.

16142452



For US serial numbers: enter number only, no slashes or commas. Ex: 10123456

For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official:

GIBSON-BAYLOR, C

Count (1) - Palm Credit

16142452

Decision:

GRANT

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type:

643 - Track One request



Notes:

Count (2)

Decision:

n/a

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type:

NONE

Notes:

Count (3)

Decision:

n/a

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type:

NONE

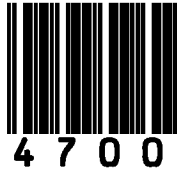
Notes:

Initials of Approving Official (if required)

Printed on: 11/5/2018

Office of Petitions Internal Document - Ver. 5.0

Office of Petitions: Routing Sheet



Application No.

This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application, as indicated below. For details of this decision, please see the document PET.OP.DEC filed on the same date as this document.

☒ **GRANTED**

☐ **DISMISSED**

☐ **DENIED**



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743
117915	7590	11/23/2018		
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC 10050 N. FOOTHILL BLVD #200 CUPERTINO, CA 95014			EXAMINER CHU, RANDOLPH I	
			ART UNIT	PAPER NUMBER
			2667	
			NOTIFICATION DATE	DELIVERY MODE
			11/23/2018	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

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Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptocorrespondence@ip-patent.com

Office Action Summary**Application No.**

16/142,452

Applicant(s)

Bar-Nahum et al.

Examiner

RANDOLPH I CHU

Art Unit

2667

AIA Status

Yes

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1) ☒ Responsive to communication(s) filed on 9/26/2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**.

2b) ☒ This action is non-final.

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

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

Disposition of Claims*

5) ☒ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 1-11, 14 and 19-20 is/are rejected.

8) ☒ Claim(s) 12-13 and 15-18 is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement

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

Application Papers

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

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

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

Certified copies:

a) ☐ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

Attachment(s)

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

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date ____.

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: ____.

Paper No(s)/Mail Date ____.

Notice of Pre-AIA or AIA Status

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

DETAILED ACTION

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

Claim 1 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519).

With respect to claim 1, Martirosyan et al. teach receiving an image captured by an image sensor (camera) of the reference aerial vehicle (UAV); detecting a target (subject) in the image including by applying a machine learning model (trained neural network) to the image to identify a portion of the image that includes the target; determining a three-dimensional relative location (position) of the target with respect to the reference aerial vehicle based on the image (para [0035]); and performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle (para [0057]).

Martirosyan et al. do not teach disclose expressly determining a distance to the target based on a size of the target within the image.

Qin et al. teach determining a distance to the target based on a size of the target within the image (para [0071]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to determine a distance to the target based on a size of the target within the image in the method of Martirosyan et al.

The suggestion/motivation for doing so would have been that well known method to determine distance of subject in the image.

Therefore, it would have been obvious to combine Qin et al. with Martirosyan et al. to obtain the invention as specified in claim 1.

With respect to claim 2, Martirosyan et al. teach that the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle (Fig. 1, 100 UAV).

With respect to claim 3, Martirosyan et al. teach that performing the flight control operation includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target (para [0057]).

With respect to claim 7, Martirosyan et al. teach that determining the three-dimensional relative location of the target includes determining the distance to the target based on the size of the target within the image and a physical size corresponding to an identified type for the target (para [0071]).

With respect to claim 9, Martirosyan et al. teach that determining the three-dimensional relative location of the target includes determining a direction (orientation) of the target with respect to the reference aerial vehicle (para [0035]);

With respect to claims 19 and 20, please refer to rejection for claim 1.

Claim 4 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519) and in further view of Sakashita et al. (US 2018/0270413).

Martirosyan et al. and Qin et al. teach all the limitations of claim 1 as applied above from which claim 4 respectively depend.

Martirosyan et al. and Qin et al. do not teach expressly identifying a model type of the target.

Sakashita et al. teaches identifying a model type of the target (para [0071], (type of object)).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to identify a model type of the target in the method of Martirosyan et al. and Qin

The suggestion/motivation for doing so would have been that to accurately determine the target.

Therefore, it would have been obvious to combine Sakashita et al. with Martirosyan et al. and Qin to obtain the invention as specified in claim 4.

Claim 5-6 are rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519) and in further view of Omari et al. (US 2018/024331).

Martirosyan et al. and Qin et al. teach all the limitations of claim 1 as applied above from which claim 5 respectively depend.

Martirosyan et al. and Qin et al. do not teach expressly detecting the target in the image includes identifying a bounding box outlining a portion of the image that includes detected features of the target.

Omari et al. teaches detecting the target in the image includes identifying a bounding box outlining a portion of the image that includes detected features of the target. (para [0015]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to identify bounding box outlining a portion of the image that includes detected features of the target in the method of Martirosyan et al. and Qin

The suggestion/motivation for doing so would have been that to well-known method to identify the target.

Therefore, it would have been obvious to combine Omari et al. with Martirosyan et al. and Qin to obtain the invention as specified in claim 5.

With respect to claim 6, Omari et al. teach determining the three-dimensional relative location of the target includes determining the distance to the target based on an area of the bounding box of the target within the image (Fig. 6E, para [0106]).

Claim 8 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519) and in further view of Nielsen et al. (US 2011/0054689).

Martirosyan et al. and Qin et al. teach all the limitations of claim 1 as applied above from which claim 8 respectively depend.

Martirosyan et al. and Qin et al. do not teach determining a speed adjustment factor based on the determined distance to the target.

Nielsen et al. teaches determining a speed adjustment factor based on the determined distance to the target. (para [0249]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to determine a speed adjustment factor based on the determined distance to the target in the method of Martirosyan et al. and Qin

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Nielsen et al. with Martirosyan et al. and Qin to obtain the invention as specified in claim 8.

Claim 10 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519) and in further view of Agrawal et al. (US 2018/0331738).

Martirosyan et al. and Qin et al. teach all the limitations of claim 1 as applied above from which claim 10 respectively depend.

Martirosyan et al. and Qin et al. do not teach determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.

Agrawal et al. teach determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle (para [0078] -- [0079]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to determine an azimuth angle and an altitude angle to the target from the reference aerial vehicle in the method of Martirosyan et al. and Qin

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Agrawal et al. with Martirosyan et al. and Qin to obtain the invention as specified in claim 10.

Claim 11 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519) and in further view of Wu (US 2018/0191284).

Martirosyan et al. and Qin et al. teach all the limitations of claim 1 as applied above from which claim 11 respectively depend.

Martirosyan et al. and Qin et al. do not teach converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.

Wu teaches converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location. (para [0040]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to convert a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location in the method of Martirosyan et al. and Qin

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Wu with Martirosyan et al. and Qin to obtain the invention as specified in claim 11.

Claim 14 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Qin et al. (US 2018/0074519) and in further view of Shannon et al. (US 2018/0072417).

Martirosyan et al. and Qin et al. teach all the limitations of claim 1 as applied above from which claim 14 respectively depend.

Martirosyan et al. and Qin et al. do not teach scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.

Shannon et al. scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle. (para [0238]-[0239]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to scale a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle in the method of Martirosyan et al. and Qin

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Shannon et al. with Martirosyan et al. and Qin to obtain the invention as specified in claim 14.

Allowable Subject Matter

1. Claims 12-13, 15-16 and 17-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Randolph Chu whose telephone number is 571-270-1145. The examiner can normally be reached on Monday to Thursday from 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on 571-272-7023. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/RANDOLPH I CHU/
Primary Examiner, Art Unit 2667

<i>Notice of References Cited</i>	Application/Control No. 16/142,452		Applicant(s)/Patent Under Reexamination	
	Examiner RANDOLPH I CHU		Art Unit 2667	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-9031280-B2	05-2015	Pakulski; Peter Jan	G06T7/254	382/103
*	B	US-7995794-B2	08-2011	Hope; Julian Charles	G03B17/38	382/103
*	C	US-20070098218-A1	05-2007	Zhang; Weiwei	G06K9/00228	382/103
*	D	US-20160127641-A1	05-2016	Gove; Robert John	G06T1/0007	348/143
*	E	US-20180046187-A1	02-2018	Martirosyan; Hayk	G05D1/0094	1/1
*	F	US-20180330623-A1	11-2018	FUJITA; Mitsuhiro		1/1
*	G	US-20160219248-A1	07-2016	Reznik; Yuriy	H04N21/2343	1/1
*	H	US-9412278-B1	08-2016	Gong; Ming	H04L63/101	1/1
*	I	US-20050021282-A1	01-2005	Sammur, Dennis J.	F41G1/38	702/150
*	J	US-20180074519-A1	03-2018	Qin; Yusen	B64C39/024	1/1
*	K	US-20180204331-A1	07-2018	Omari; Sammy	H04N5/23222	1/1
*	L	US-20180164799-A1	06-2018	Hong; YooJung	G05D1/00	1/1
*	M	US-20160136482-A1	05-2016	Askew, Jr.; Mark West	G01S19/19	700/91

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>Notice of References Cited</i>	Application/Control No. 16/142,452		Applicant(s)/Patent Under Reexamination	
	Examiner RANDOLPH I CHU		Art Unit 2667	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20160307447-A1	10-2016	Johnson; Eric David	G05D1/0044	1/1
*	B	US-20110054689-A1	03-2011	Nielsen; Curtis W.	G05D1/0088	700/258
*	C	US-20180331738-A1	11-2018	AGRAWAL; Sachin Kumar	H04B7/0608	1/1
*	D	US-20180288586-A1	10-2018	Tran; Bao	A63B69/38	1/1
*	E	US-20160253808-A1	09-2016	METZLER; Bernhard	B64C39/024	382/103
*	F	US-20180218618-A1	08-2018	Rysdyk; Rolf	B64C39/024	1/1
	G					
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	K					
	L					
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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. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2667

✓	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	11/18/2018								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
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	15	○								
	16	○								
	17	○								
	18	○								
	19	✓								
	20	✓								

<i>Search Notes</i> 	Application/Control No. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2667

CPC - Searched*		
Symbol	Date	Examiner

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
Inventor Name Search	11/16/2018	ric
EAST	11/16/2018	ric
NPL, Internet	11/16/2018	ric

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

/RANDOLPH I CHU/ Primary Examiner, Art Unit 2667	
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Bibliographic Data

Application No: 16/142,452

Foreign Priority claimed: ☐ Yes ☒ No

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

Verified and Acknowledged: /RANDOLPH I CHU/

Examiner's Signature

Initials

Title:

FLIGHT CONTROL USING COMPUTER VISION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/26/2018	382	2667	ASPAP008
RULE			

APPLICANTS

Airspace Systems, Inc., San Leandro, CA, UNITED STATES

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Hoang Anh Nguyen San Mateo, CA, UNITED STATES

CONTINUING DATA

This application is a CIP of 15729581 10/10/2017

This application has PRO of 62566449 10/01/2017

15729581 has PRO of 62405972 10/09/2016

FOREIGN APPLICATIONS

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10/17/2018

STATE OR COUNTRY

UNITED STATES

ADDRESS

VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC

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CUPERTINO, CA 95014

UNITED STATES

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\$5,860

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:19
L2	170399	speed near5 distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:21
L3	1730	1 and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:21
L4	2483614	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:22
L5	1314820	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:32
L6	16734	4 with 5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:32
L7	30	3 and 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:33
L8	841	3 and 4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
L9	674	3 and 5	US-PGPUB; USPAT;	ADJ	OFF	2018/11/17 23:53

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L10	5477	speed near7 based adj2 distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
L11	88	1 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
L12	42	11 and 4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
L13	34	11 and 5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
L14	23	12 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
L15	179564	determin\$4 adj3 angle	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
L16	1277	1 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
L17	726	4 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
L18	36699	azimuth angle	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:28
L19	60	17 and 18	US-PGPUB; USPAT;	ADJ	OFF	2018/11/18 00:28

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L20	8369	convert\$4 with two-dimensional with three-dimensional	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:05
L21	10964	convert\$4 with ((two adj dimensional) or 2D or ("2" adj dimensional) or ("2" adj D) or 2-d) near3 ((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:06
L22	94	1 and 21	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:07
L23	0	rate near2 speed near3 (adjust\$4) with2 smooth\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:18
L24	4414	rate near2 speed near3 (adjust\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:19
L25	11	1 and 24	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:19
L26	17500	rate near2 speed near3 (adjust\$4 or chang\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
L27	120	1 and 26	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
L28	109	27 not 25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
L29	455	image based navigation	US-PGPUB; USPAT;	ADJ	OFF	2018/11/18 01:46

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L30	11	1 and 29	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:47
L31	11	1 and 29 and navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:55
L32	0	1 and 29 and navigation near5 (select\$4 or choos\$4 or threshold)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:58
S1	0	15/729581	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 01:47
S2	26	382/103.ccls. and randolph near2 chu	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 01:49
S3	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:31
S4	0	S3 and track\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:33
S5	2	S3 and (item or object)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:34
S6	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:33
S7	0	S6 and mobile	US-PGPUB; USPAT;	ADJ	OFF	2018/02/17 23:33

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S8	1	S6 and portable	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:33
S9	2	S6 and "100"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:34
S10	1	S6 and match\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:56
S11	0	S6 and match\$4 near5 object	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:58
S12	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/19 11:34
S13	1	S12 and score	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/19 11:34
S16	0	(object near2 detect%5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S17	0	(object near2 detect%5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S18	10	different resolutions near5 (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S19	79470	(camera or image sensor) near7 (radar or radio frequency or	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 02:42

		proximity or acoustic or thermal imaging or night vision or global positioning system or gps)	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S20	330579	(object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S21	10547	S19 and S20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S22	860	"382".clas. and S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S23	15372	382/103.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S24	340	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S25	422197	(change near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S26	31727	S20 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S27	26891	S20 and S25 and control\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S28	959	S20 and S25 and control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S29	5810	S20 and S25 and control\$4 near3 (navigation or interface or	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 02:50

		captur\$4)	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S30	70	"382".clas. and S28	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S31	30	S20 and S25 same control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:52
S32	4	"382".clas. and S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:52
S33	330579	(object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S34	422197	(change near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S35	30	S33 and S34 same control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S36	83	(Bar-Nahum near2 Guy).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:11
S37	0	(Nguyen near2 Hoang near2 Anh).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:11
S38	5	S36 and (track\$4 or detect) near5 (object or item)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:13
S39	3	S36 and ((track\$4 or detect) near5 (object or item)).clm.	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 05:13

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S40	0	S36 and ((track\$4 or detect) near5 (object or item) and scheme).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:14
S41	28	382/103.ccls. and resolution near2 (low\$4) near7 convert\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:08
S42	28	(@ad<="20161009" or @rlad<="20161009") and S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:09
S43	7	382/103.ccls. and resolution near2 (low\$4) near7 convert\$4 with detect\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:11
S44	21	(different or plural\$5 or multiple) adj2 resolutions near5 (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:50
S45	48	(different or plural\$5 or multiple) adj2 resolutions with (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S46	7957	resolution near2 (low\$4) near7 convert\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S47	0	S45 and S46	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S48	145863	track\$4 near4 (object or item or person or intruder or interest)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S49	82	(different or plural\$5 or multiple) adj2 resolutions with (object near2	US-PGPUB; USPAT;	ADJ	OFF	2018/06/25 09:41

		detect\$5)	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S50	27	(different or plural\$5 or multiple) adj2 resolutions with S48	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S51	373	resolution near2 (low\$4) near7 convert\$4 with detect\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:44
S52	0	S50 and S51	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:45
S53	1	"20100034464".pn. and resolution	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 10:00
S54	1	"20070201694".pn. and resolution	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 10:02
S55	12	("20030081813" "20050094849" "6075557" "6650704" "7200247").PN. OR ("8098885").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/06/25 11:34
S56	1	"20070201694".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:38
S57	0	"20100034464".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:39
S58	2	"20070098218".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:39
S59	1	"20070098218".pn. and location	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/06/25 13:43

			DERWENT; IBM_TDB			
S60	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:17
S61	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:17
S63	8634917	(automatic\$5 or autonomous\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:22
S64	7713	S60 and S61 and S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:22
S65	6359	S60 and S61 and S63 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:25
S66	237252	S61 near5 (location or position or coordinat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:26
S67	2509	S60 and S66 and S63 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S68	58782	S61 with S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S69	593	S67 and S68	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S70	1032564	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 12:11

			DERWENT; IBM_TDB			
S71	134	S69 and S70	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:12
S72	0	S69 and S70 and surveilanc\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:50
S73	93	S69 and S70 and Surveillance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:51
S74	1670995	(automatic\$5 or autonomous\$4) near5 (Navigat\$4 or control\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S75	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S76	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S77	237252	S76 near5 (location or position or coordinat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S78	1411	S75 and S77 and S74 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S79	8634917	(automatic\$5 or autonomous\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:36
S80	58782	S76 with S79	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 17:36

			DERWENT; IBM_TDB			
S81	413	S78 and S80	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:36
S82	1032564	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S83	114	S81 and S82	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S84	84	S81 and S82 and Surveillance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S85	73	fortem	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:55
S86	0	S84 and S85	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:55
S87	0	fortem and dronehunter	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S88	0	dronehunter	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S89	0	fortem and drike	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S90	0	fortem and drone	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 18:57

			DERWENT; IBM_TDB			
S91	2	"20170144756".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 19:02
S92	17399	delft	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S93	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S94	47	delft and S93	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S95	1	"20170144756".pn. and image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S96	0	"20170144756".pn. and image and 3D	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:24
S97	1	delft and S93 and 3e	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S98	15	delft and S93 and 3d	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S99	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S100	16	delft and S93 and S99	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 23:25

			DERWENT; IBM_TDB			
S101	12721	radar imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:51
S102	1313848	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:52
S103	102	S99 and S101 and S102 and S93	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:53
S104	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S105	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S106	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S107	438	S105 with S106 and S104	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S108	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:08
S109	186	S107 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:08
S110	94	S107 and S108 and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/15 23:15

			DERWENT; IBM_TDB			
S111	1032912	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:46
S112	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S113	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S114	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S115	438	S113 with S114 and S112	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S116	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S117	186	S115 and S116	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S118	11	S117 and S111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S119	94	S115 and S116 and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S120	11	S119 and S111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/16 00:47

			DERWENT; IBM_TDB			
S121	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/16 15:31
S122	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S123	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S124	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S125	438	S123 with S124 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S126	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S127	186	S125 and S126	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S128	1	S127 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/16 15:32
S129	122	S121 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:45
S130	2481315	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/17 01:56

			DERWENT; IBM_TDB			
S132	3	"20180074519".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:56
S134	1	S130 and S132	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:57
S135	2351	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 01:58
S136	82060	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:58
S137	2	S135 and S136 and bounding box	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:58
S139	1	"20180074519".pn. and (GPS or geograph\$7 or map)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 02:20
S140	1	"20180074519".pn. and (GPS or geograph\$7 or map) and based	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 02:20
S141	0	15/600948	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:46
S142	2508560	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S143	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2018/11/17 16:49

			DERWENT; IBM_TDB			
S144	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S145	2	S143 and S144 and bounding box and S142	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S146	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 17:09
S147	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 17:09
S148	76	S146 and S147 and identif\$6 near5 type	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 17:09

EAST Search History (I nterference)

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11/ 18/ 2018 2:02:52 AM
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16142452
	Filing Date		2018-09-26
	First Named Inventor	Guy Bar-Nahum	
	Art Unit	2667	
	Examiner Name	Randolph I. Chu	
	Attorney Docket Number	ASPAP008	

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

Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

CERTIFICATION STATEMENT

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

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

OR

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

See attached certification statement.

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

A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Jong Andrew Park/	Date (YYYY-MM-DD)	2018-12-12
Name/Print	Jong Andrew H. Park	Registration Number	56917

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Electronic Acknowledgement Receipt

EFS ID:	34569442
Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Jong Andrew Hyuk Park/Chelsea Watkins
Filer Authorized By:	Jong Andrew Hyuk Park
Attorney Docket Number:	ASPAP008
Receipt Date:	12-DEC-2018
Filing Date:	26-SEP-2018
Time Stamp:	19:20:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	ASPAP008_IDS.pdf	1052802	no	4
			d9e3eeceab7b25d861c4f25aa8b18a28423248e9		

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008

CONFIRMATION NO. 4743

117915
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC
10050 N. FOOTHILL BLVD #200
CUPERTINO, CA 95014

PUBLICATION NOTICE



OC000000105306758

Title: FLIGHT CONTROL USING COMPUTER VISION

Publication No. US-2019-0025858-A1

Publication Date: 01/24/2019

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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.

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**DECLARATION
FOR ORIGINAL U.S. PATENT APPLICATION**

Attorney's Docket No. ASPAP008

As a below-named inventor, I hereby declare that:

I believe that I am the original inventor (if only one name is listed below) or an original joint inventor (if plural names are listed below) of a claimed invention in the application entitled: **FLIGHT CONTROL USING COMPUTER VISION**, the specification of which,

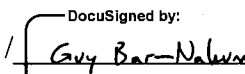
- (check one) 1. ☐ is attached hereto.
2. ☒ was filed on September 26, 2018 as
U.S. Application No. 16/142,452
and was amended on _____.
3. ☐ was filed on _____ as
International PCT Application No. _____
and was amended on _____.

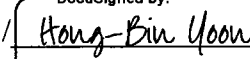
I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

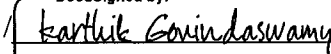
The above-identified application was made or authorized to be made by me.

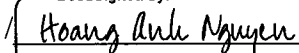
I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and I acknowledge that any willful false statement made in this declaration is punishable under 18 USC 1001 by fine or imprisonment of not more than five (5) years, or both.

Full name of inventor	Guy Bar-Nahum	
Signature of inventor	DocuSigned by:  F1C32F6F2DF1465...	Date: 11/7/2018 9:44:58 AM PST

Full name of inventor	Hong-Bin Yoon	
Signature of inventor	DocuSigned by:  E046562E8F1A457...	Date: 2018년11월7일

Full name of inventor	Karthik Govindaswamy	
Signature of inventor	DocuSigned by:  3623D57FFAB244E	Date: November 7, 2018

Full name of inventor	Hoang Anh Nguyen	
Signature of inventor	DocuSigned by:  4179A8BA791A48E	Date: January 28, 2019

Electronic Acknowledgement Receipt

EFS ID:	34984797
Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Jong Andrew Hyuk Park/Chelsea Watkins
Filer Authorized By:	Jong Andrew Hyuk Park
Attorney Docket Number:	ASPAP008
Receipt Date:	28-JAN-2019
Filing Date:	26-SEP-2018
Time Stamp:	19:35:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	ASPAP008_Executed_Dec.pdf	319053	no	2
			650d47142eb2830b825a306860fddc55e8f c0f5e		

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Information:	
Total Files Size (in bytes):	319053
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.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16142452
	Filing Date		2018-09-26
	First Named Inventor	Guy Bar-Nahum	
	Art Unit	2667	
	Examiner Name	Randolph I. Chu	
	Attorney Docket Number	ASPAP008	

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	1	20160068267		2016-03-10	LIU ANG	
	2	20160202695		2016-07-14	DEROOS BRADLEY G	
	3	20160246297		2016-08-25	SONG ZHEN	
	4	20170161907		2017-06-08	MALECKI ROBERT S	

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

Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

1							
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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
1			

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EXAMINER SIGNATURE

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

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

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

Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

CERTIFICATION STATEMENT

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

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

OR

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

See attached certification statement.

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

A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Timothy H. Hwang/	Date (YYYY-MM-DD)	2019-02-15
Name/Print	Timothy H. Hwang	Registration Number	61145

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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:

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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).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	35170070
Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Timothy H. Hwang/Monique Huang
Filer Authorized By:	Timothy H. Hwang
Attorney Docket Number:	ASPAP008
Receipt Date:	15-FEB-2019
Filing Date:	26-SEP-2018
Time Stamp:	16:58:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	ASPAP008_IDS_02.pdf	1053093	no	4
			7aadaaac35bd1c9a112672aba6879bc36e2d2300		

Warnings:

Information:	
Total Files Size (in bytes):	1053093
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Electronic Acknowledgement Receipt

EFS ID:	35199507
Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Jong Andrew Hyuk Park/Chelsea Watkins
Filer Authorized By:	Jong Andrew Hyuk Park
Attorney Docket Number:	ASPAP008
Receipt Date:	20-FEB-2019
Filing Date:	26-SEP-2018
Time Stamp:	12:20:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	ASPAP008_AMD_A.pdf	139852	no	6
			5fbc056b58229fa6336058e4575fa07f14e857ff		

Warnings:

Information:	
Total Files Size (in bytes):	139852
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:	16/142,452	Examiner:	Randolph I. Chu
Filed:	September 26, 2018	Art Unit:	2667
Confirmation No.:	4743	Docket No.:	ASPAP008
First Inventor:	Guy Bar-Nahum		
Title:	FLIGHT CONTROL USING COMPUTER VISION		

AMENDMENT A

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

Dear Sir:

This is in response to the Office Action mailed November 23, 2018. The following amendment and remarks are respectfully submitted.

Applicant(s) believe that no (additional) fees are required beyond any fees submitted herewith. If required fees are missing or any additional fees are required during the pendency of the subject application, please charge such fees or credit any overpayment to Deposit Account No. 50-0685 (ASPAP008).

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of performing a flight control operation of a reference aerial vehicle, comprising:
receiving a geographical location associated with a target detected at least in part using a ground-based sensor;
autonomously navigating the reference aerial vehicle towards the received geographical location;
determining to allow image-based navigation;
receiving an image captured by an image sensor of the reference aerial vehicle;
detecting [[a]] the target in the image including by applying a machine learning model to the image to identify a portion of the image that includes the target;
determining a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image including by determining a distance to the target based at least in part on a size of the target detected within the image; and
performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle.
2. (Original) The method of claim 1, wherein the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle.
3. (Original) The method of claim 1, wherein performing the flight control operation includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target.
4. (Original) The method of claim 1, wherein detecting the target in the image includes identifying a model type of the target.
5. (Original) The method of claim 1, wherein detecting the target in the image includes identifying a bounding box outlining a portion of the image that includes detected features of the target.
6. (Original) The method of claim 5, wherein determining the three-dimensional

relative location of the target includes determining the distance to the target based on an area of the bounding box of the target within the image.

7. (Currently Amended) The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining the distance to the target based on ~~[[the]]~~ a size of the target within the image and a physical size corresponding to an identified type for the target.

8. (Currently Amended) The method of claim 7 wherein ~~determining the three-dimensional relative location of the target~~ performing the flight control operation includes determining a speed adjustment factor based on the determined distance to the target.

9. (Original) The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining a direction of the target with respect to the reference aerial vehicle.

10. (Original) The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.

11. (Original) The method of claim 1, wherein determining the three-dimensional relative location of the target includes converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.

12. (Currently Amended) The method of claim 1, wherein ~~determining the three-dimensional relative location of the target~~ performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.

13. (Original) The method of claim 12, wherein the speed adjustment factor is greater for a smaller magnitude of deviation as compared to for a greater magnitude of deviation.

14. (Currently Amended) The method of claim 1, wherein ~~determining the three-dimensional relative location of the target~~ performing the flight control operation includes scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.

15. (Currently Amended) The method of claim 1, wherein ~~determining the three-dimensional relative location of the target~~ performing the flight control operation includes determining a direction adjustment factor based on a magnitude of deviation of a direction of the three-

dimensional relative location with respect to a current flight direction of the reference aerial vehicle, and

16. (Currently Amended) The method of claim 15, wherein ~~determining the three-dimensional relative location of the target~~ performing the flight control operation includes scaling the direction adjustment factor to smooth and limit a rate of change of a direction of the reference aerial vehicle.

17. (Currently Amended) The method of claim 1, wherein the distance to the target is determined based at least in part a radar. ~~further comprising:~~

~~receiving an approximate geographical location of the target detected using a ground-based sensor;~~

~~autonomously navigating the reference aerial vehicle towards the approximate geographical location; and~~

~~determining whether to allow image-based navigation.~~

18. (Currently Amended) The method of claim 1 ~~[[17]]~~, wherein ~~determining whether it is determined~~ to allow the image-based navigation includes determining based on whether the reference aerial vehicle is within a threshold distance away from the ~~approximate received~~ geographical location.

19. (Currently Amended) A reference aerial vehicle, comprising:

an image sensor configured to capture an image;

a processor configured to:

detect a target in the image; and

determine a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and

a flight controller configured to perform a flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle;

wherein the reference aerial vehicle is configured to: receive a geographical location associated with the target detected at least in part using a ground-based sensor; autonomously navigate the reference aerial vehicle towards the received geographical location; and determine to allow image-based navigation.

20. (Currently Amended) A computer program product for performing a flight control operation of a reference aerial vehicle, the computer program product being embodied in a non-

transitory computer readable storage medium and comprising computer instructions for:

receiving a geographical location associated with a target detected at least in part using a ground-based sensor;

autonomously navigating the reference aerial vehicle towards the received geographical location;

determining to allow image-based navigation;

receiving an image captured by an image sensor of the reference aerial vehicle;

detecting [[a]] the target in the image;

determining a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and

performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle.

REMARKS

Claims 1, 7-8, 12, and 14-20 have been amended to clarify the subject matter regarded as the invention. Claims 1-20 are pending.

Subject Matter Indicated as Being Allowable

The Examiner has indicated that claims 12-13, 15-16, and 17-18 contain allowable subject matter. The independent claims have been amended and examples of support for these amendments can be found in allowed claim 17 referenced by the Office Action.

Dependent claims 7-8, 12, and 14-18 have been amended to clarify the subject matter regarded as the invention.

The foregoing amendments are not to be taken as an admission of unpatentability of any of the claims prior to the amendments.

Reconsideration of the application and allowance of all claims are respectfully requested based on the preceding remarks. If at any time the Examiner believes that an interview would be helpful, please contact the undersigned.

Respectfully submitted,

Dated: 2/20/2019

/Jong Andrew Park/

Jong Andrew H. Park
Registration No. 56917
408-973-2577

VAN PELT, YI & JAMES LLP
10050 N. Foothill Blvd., Suite 200
Cupertino, CA 95014
Fax 408-973-2595

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/142,452		Filing Date 09/26/2018		☐ 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 \$100 =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *				x \$460 =					
☐ 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	02/20/2019	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 \$100 =		0	
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0			x \$460 =		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 \$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			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								LIE			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/TERRANCE R LAWRENCE/			
*** 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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743
117915	7590	03/12/2019		
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC 10050 N. FOOTHILL BLVD #200 CUPERTINO, CA 95014			EXAMINER CHU, RANDOLPH I	
			ART UNIT	PAPER NUMBER
			2663	
			NOTIFICATION DATE	DELIVERY MODE
			03/12/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Notice of Pre-AIA or AIA Status

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

DETAILED ACTION

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

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4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

Claims 1-3, 7, 9, 17 and 19-20 are rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519).

With respect to claim 1, Martirosyan et al. teach

receiving a geographical location associated with a target detected at least in part using a ground-based sensor (para [0031], signal monitor(standard wireless sniffer)); autonomously navigating the reference aerial vehicle towards the received geographical location; determining to allow image-based navigation (para [0020]);

receiving an image captured by an image sensor (camera) of the reference aerial vehicle (UAV); detecting the target (subject) in the image including by applying a machine learning model (trained neural network) to the image to identify a portion of the image that includes the target; determining a three-dimensional relative location (position) of the target with respect to the reference aerial vehicle based on the image (para [0035]); and performing the flight control operation based on the three-

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dimensional relative location of the target with respect to the reference aerial vehicle (para [0057]).

Martirosyan et al. do not teach disclose expressly determining a distance to the target based at least part on a size of the target detected within the image.

Torii et al. teach determining a distance to the target based at least part on a size of the target detected within the image (para [0121]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to determine a distance to the target based on a size of the target within the image in the method of Martirosyan et al.

The suggestion/motivation for doing so would have been that well known method to determine distance of subject in the image.

Therefore, it would have been obvious to combine Torii et al. with Martirosyan et al. to obtain the invention as specified in claim 1.

With respect to claim 2, Martirosyan et al. teach that the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle (Fig. 1, 100 UAV).

With respect to claim 3, Martirosyan et al. teach that performing the flight control operation includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target (para [0057]).

With respect to claim 7, Martirosyan et al. teach that determining the three-dimensional relative location of the target includes determining the distance to the target based on the size of the target within the image and a physical size corresponding to an identified type for the target (para [0071]).

With respect to claim 9, Martirosyan et al. teach that determining the three-dimensional relative location of the target includes determining a direction (orientation) of the target with respect to the reference aerial vehicle (para [0035]);

With respect to claim 17, Martirosyan et al. teach that the distance to the target is determined based at least in part a radar (para [0107]).

With respect to claims 19 and 20, please refer to rejection for claim 1.

Claim 4 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519) and in further view of Sakashita et al. (US 2018/0270413).

Martirosyan et al. and Torii et al. teach all the limitations of claim 1 as applied above from which claim 4 respectively depend.

Martirosyan et al. and Torii et al. do not teach expressly identifying a model type of the target.

Sakashita et al. teaches identifying a model type of the target (para [0071], (type of object)).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to identify a model type of the target in the method of Martirosyan et al. and Torii et al.

The suggestion/motivation for doing so would have been that to accurately determine the target.

Therefore, it would have been obvious to combine Sakashita et al. with Martirosyan et al. and Torii et al. to obtain the invention as specified in claim 4.

Claim 5-6 are rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519) and in further view of Omari et al. (US 2018/024331).

Martirosyan et al. and Torii et al. teach all the limitations of claim 1 as applied above from which claim 5 respectively depend.

Martirosyan et al. and Torii et al. do not teach expressly detecting the target in the image includes identifying a bounding box outlining a portion of the image that includes detected features of the target.

Omari et al. teaches detecting the target in the image includes identifying a bounding box outlining a portion of the image that includes detected features of the target. (para [0015]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to identify bounding box outlining a portion of the image that includes

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detected features of the target in the method of Martirosyan et al. and Torii et al.

The suggestion/motivation for doing so would have been that to well-known method to identify the target.

Therefore, it would have been obvious to combine Omari et al. with Martirosyan et al. and Torii et al. to obtain the invention as specified in claim 5.

With respect to claim 6, Omari et al. teach determining the three-dimensional relative location of the target includes determining the distance to the target based on an area of the bounding box of the target within the image (Fig. 6E, para [0106]).

Claim 8 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519) and in further view of Nielsen et al. (US 2011/0054689).

Martirosyan et al. and Torii et al. teach all the limitations of claim 1 as applied above from which claim 8 respectively depend.

Martirosyan et al. and Torii et al. do not teach determining a speed adjustment factor based on the determined distance to the target.

Nielsen et al. teaches determining a speed adjustment factor based on the determined distance to the target. (para [0249]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to determine a speed adjustment factor based on the determined distance to the target in the method of Martirosyan et al. and Torii et al.

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Nielsen et al. with Martirosyan et al. and Torii et al. to obtain the invention as specified in claim 8.

Claim 10 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519) and in further view of Agrawal et al. (US 2018/0331738).

Martirosyan et al. and Torii et al. teach all the limitations of claim 1 as applied above from which claim 10 respectively depend.

Martirosyan et al. and Torii et al. do not teach determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.

Agrawal et al. teach determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle (para [0078] – [0079]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to determine an azimuth angle and an altitude angle to the target from the reference aerial vehicle in the method of Martirosyan et al. and Torii et al.

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Agrawal et al. with Martirosyan et al. and Torii et al. to obtain the invention as specified in claim 10.

Claim 11 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519) and in further view of Wu (US 2018/0191284).

Martirosyan et al. and Torii et al. teach all the limitations of claim 1 as applied above from which claim 11 respectively depend.

Martirosyan et al. and Torii et al. do not teach converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.

Wu teaches converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location. (para [0040]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to convert a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location in the method of Martirosyan et al. and Torii et al.

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Wu with Martirosyan et al. and Torii et al. to obtain the invention as specified in claim 11.

Claim 14 is rejected under 35 USC 103 as being unpatentable over Martirosyan et al. (US 2018/0046187) in view of Torii et al. (US 201/0074519) and in further view of Shannon et al. (US 2018/0072417).

Martirosyan et al. and Torii et al. teach all the limitations of claim 1 as applied above from which claim 14 respectively depend.

Martirosyan et al. and Torii et al. do not teach scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.

Shannon et al. scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle (para [0238]-[0239]).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to scale a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle in the method of Martirosyan et al. and Torii et al.

The suggestion/motivation for doing so would have been that to safely navigate around the target.

Therefore, it would have been obvious to combine Shannon et al. with Martirosyan et al. and Torii et al. to obtain the invention as specified in claim 14.

Allowable Subject Matter

1. Claims 12-13, 15-16 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Randolph Chu whose telephone number is 571-270-1145. The examiner can normally be reached on Monday to Thursday from 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on 571-272-7023. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

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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).

/RANDOLPH I CHU/

Primary Examiner, Art Unit 2667

<i>Notice of References Cited</i>	Application/Control No. 16/142,452		Applicant(s)/Patent Under Reexamination Bar-Nahum et al.	
	Examiner RANDOLPH I CHU		Art Unit 2663	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20190019141-A1	01-2019	TORII; Junji	B64C39/024	1/1
	B					
	C					
	D					
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<i>Notice of References Cited</i>	Application/Control No. 16/142,452		Applicant(s)/Patent Under Reexamination Bar-Nahum et al.	
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U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20160307447-A1	10-2016	Johnson; Eric David	G05D1/0044	1/1
*	B	US-20110054689-A1	03-2011	Nielsen; Curtis W.	G05D1/0088	700/258
*	C	US-20180331738-A1	11-2018	AGRAWAL; Sachin Kumar	H04B7/0608	1/1
*	D	US-20180288586-A1	10-2018	Tran; Bao	A63B69/38	1/1
*	E	US-20160253808-A1	09-2016	METZLER; Bernhard	B64C39/024	382/103
*	F	US-20180218618-A1	08-2018	Rysdyk; Rolf	B64C39/024	1/1
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<i>Search Notes</i> 	Application/Control No. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2663

CPC - Searched*		
Symbol	Date	Examiner

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
Inventor Name Search	11/16/2018	ric
EAST	11/16/2018	ric
NPL, Internet	11/16/2018	ric
Updated EAST Search	03/06/2019	ric
Updated NPL, Internet Search	03/06/2019	ric

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

/RANDOLPH I CHU/ Primary Examiner, Art Unit 2667	
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Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

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Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

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	1	20160068267		2016-03-10	LIU ANG	
	2	20160202695		2016-07-14	DEROOS BRADLEY G	
	3	20160246297		2016-08-25	SONG ZHEN	
	4	20170161907		2017-06-08	MALECKI ROBERT S	
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EXAMINER SIGNATURE

Examiner Signature	/RANDOLPH I CHU/	Date Considered	03/06/2019
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Attorney Docket Number	ASPAP008

CERTIFICATION STATEMENT

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

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

OR

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

See attached certification statement.

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

A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Timothy H. Hwang/	Date (YYYY-MM-DD)	2019-02-15
Name/Print	Timothy H. Hwang	Registration Number	61145

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

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Doc description: Information Disclosure Statement (IDS) Filed

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	2	20080252903	A1	2008-10-16	BOESSER HANS-ARTUR	

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

Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

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EXAMINER SIGNATURE

Examiner Signature	/RANDOLPH I CHU/	Date Considered	03/06/2019
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	16142452
Filing Date	2018-09-26
First Named Inventor	Guy Bar-Nahum
Art Unit	2667
Examiner Name	Randolph I. Chu
Attorney Docket Number	ASPAP008

CERTIFICATION STATEMENT

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

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

OR

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

See attached certification statement.

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

A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Jong Andrew Park/	Date (YYYY-MM-DD)	2018-12-12
Name/Print	Jong Andrew H. Park	Registration Number	56917

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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.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	10	(allow\$4 or approv\$4 or authoriz\$6 or enabl\$4 or grant\$4) near4 navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:28
L2	476	image based navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:36
L3	3	image based navigation with distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:36
L4	1	"20180046187".pn. and radar	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 17:47
L5	0	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) near4 navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:49
L6	2	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) with navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:50
L7	59	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) with navigat\$4 same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:51
L8	2	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) with navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:52
L9	1179638	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT;	ADJ	OFF	2019/03/06 18:52

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L10	4	("20160068267" "20160202695" "20160246297" "20170161907").PN.	US-PGPUB	ADJ	OFF	2019/03/06 18:53
L11	2	("20020196330" "20080252903").PN.	US-PGPUB	ADJ	OFF	2019/03/06 18:53
L12	6	L10 or L11	US-PGPUB	ADJ	OFF	2019/03/06 18:53
L13	2	9 and 12	US-PGPUB	ADJ	OFF	2019/03/06 18:53
L14	4	(L10 or L11) and distance	US-PGPUB	ADJ	OFF	2019/03/06 18:55
S1	0	15/729581	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 01:47
S2	26	382/103.ccls. and randolph near2 chu	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 01:49
S3	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:31
S4	0	S3 and track\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:33
S5	2	S3 and (item or object)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:34
S6	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:33
S7	0	S6 and mobile	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:33
S8	1	S6 and portable	US-PGPUB; USPAT;	ADJ	OFF	2018/02/17 23:33

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S9	2	S6 and "100"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:34
S10	1	S6 and match\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:56
S11	0	S6 and match\$4 near5 object	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:58
S12	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/19 11:34
S13	1	S12 and score	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/19 11:34
S16	0	(object near2 detect%5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S17	0	(object near2 detect%5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S18	10	different resolutions near5 (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S19	79470	(camera or image sensor) near7 (radar or radio frequency or proximity or acoustic or thermal imaging or night vision or global positioning system or gps)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S20	330579	(object near2 detect\$5)	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 02:42

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S21	10547	S19 and S20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S22	860	"382".clas. and S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S23	15372	382/103.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S24	340	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S25	422197	(change near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S26	31727	S20 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S27	26891	S20 and S25 and control\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S28	959	S20 and S25 and control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S29	5810	S20 and S25 and control\$4 near3 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S30	70	"382".clas. and S28	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 02:50

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S31	30	S20 and S25 same control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:52
S32	4	"382".clas. and S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:52
S33	330579	(object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S34	422197	(change near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S35	30	S33 and S34 same control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S36	83	(Bar-Nahum near2 Guy).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:11
S37	0	(Nguyen near2 Hoang near2 Anh).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:11
S38	5	S36 and (track\$4 or detect) near5 (object or item)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:13
S39	3	S36 and ((track\$4 or detect) near5 (object or item)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:13
S40	0	S36 and ((track\$4 or detect) near5 (object or item) and scheme).clm.	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 05:14

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S41	28	382/103.ccls. and resolution near2 (low\$4) near7 convert\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:08
S42	28	(@ad<="20161009" or @rlad<="20161009") and S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:09
S43	7	382/103.ccls. and resolution near2 (low\$4) near7 convert\$4 with detect\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:11
S44	21	(different or plural\$5 or multiple) adj2 resolutions near5 (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:50
S45	48	(different or plural\$5 or multiple) adj2 resolutions with (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S46	7957	resolution near2 (low\$4) near7 convert\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S47	0	S45 and S46	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S48	145863	track\$4 near4 (object or item or person or intruder or interest)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S49	82	(different or plural\$5 or multiple) adj2 resolutions with (object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S50	27	(different or plural\$5 or multiple) adj2 resolutions with S48	US-PGPUB; USPAT;	ADJ	OFF	2018/06/25 09:41

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S51	373	resolution near2 (low\$4) near7 convert\$4 with detect\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:44
S52	0	S50 and S51	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:45
S53	1	"20100034464".pn. and resolution	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 10:00
S54	1	"20070201694".pn. and resolution	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 10:02
S55	12	("20030081813" "20050094849" "6075557" "6650704" "7200247").PN. OR ("8098885").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/06/25 11:34
S56	1	"20070201694".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:38
S57	0	"20100034464".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:39
S58	2	"20070098218".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:39
S59	1	"20070098218".pn. and location	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 13:43
S60	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 11:17

			DERWENT; IBM_TDB			
S61	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:17
S63	8634917	(automatic\$5 or autonomous\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:22
S64	7713	S60 and S61 and S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:22
S65	6359	S60 and S61 and S63 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:25
S66	237252	S61 near5 (location or position or coordinat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:26
S67	2509	S60 and S66 and S63 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S68	58782	S61 with S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S69	593	S67 and S68	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S70	1032564	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:11
S71	134	S69 and S70	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 12:12

			DERWENT; IBM_TDB			
S72	0	S69 and S70 and surveilanc\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:50
S73	93	S69 and S70 and Surveillance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:51
S74	1670995	(automatic\$5 or autonomous\$4) near5 (Navigat\$4 or control\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S75	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S76	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S77	237252	S76 near5 (location or position or coordinat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S78	1411	S75 and S77 and S74 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S79	8634917	(automatic\$5 or autonomous\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:36
S80	58782	S76 with S79	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:36
S81	413	S78 and S80	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 17:36

			DERWENT; IBM_TDB			
S82	1032564	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S83	114	S81 and S82	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S84	84	S81 and S82 and Surveillance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S85	73	fortem	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:55
S86	0	S84 and S85	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:55
S87	0	fortem and dronehunter	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S88	0	dronehunter	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S89	0	fortem and drike	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S90	0	fortem and drone	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S91	2	"20170144756".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 19:02

			DERWENT; IBM_TDB			
S92	17399	delft	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S93	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S94	47	delft and S93	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S95	1	"20170144756".pn. and image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S96	0	"20170144756".pn. and image and 3D	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:24
S97	1	delft and S93 and 3e	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S98	15	delft and S93 and 3d	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S99	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S100	16	delft and S93 and S99	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S101	12721	radar imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 23:51

			DERWENT; IBM_TDB			
S102	1313848	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:52
S103	102	S99 and S101 and S102 and S93	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:53
S104	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S105	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S106	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S107	438	S105 with S106 and S104	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S108	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:08
S109	186	S107 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:08
S110	94	S107 and S108 and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:15
S111	1032912	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/16 00:46

			DERWENT; IBM_TDB			
S112	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S113	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S114	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S115	438	S113 with S114 and S112	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S116	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S117	186	S115 and S116	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S118	11	S117 and S111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S119	94	S115 and S116 and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S120	11	S119 and S111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S121	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2018/11/16 15:31

			DERWENT; IBM_TDB			
S122	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S123	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S124	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S125	438	S123 with S124 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S126	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S127	186	S125 and S126	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S128	1	S127 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/16 15:32
S129	122	S121 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:45
S130	2481315	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:56
S132	3	"20180074519".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/17 01:56

			DERWENT; IBM_TDB			
S134	1	S130 and S132	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:57
S135	2351	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 01:58
S136	82060	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:58
S137	2	S135 and S136 and bounding box	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:58
S139	1	"20180074519".pn. and (GPS or geograph\$7 or map)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 02:20
S140	1	"20180074519".pn. and (GPS or geograph\$7 or map) and based	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 02:20
S141	0	15/600948	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:46
S142	2508560	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S143	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 16:49
S144	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/17 16:49

			DERWENT; IBM_TDB			
S145	2	S143 and S144 and bounding box and S142	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S146	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 17:09
S147	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 17:09
S148	76	S146 and S147 and identif\$6 near5 type	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 17:09
S149	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:19
S150	170399	speed near5 distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:21
S151	1730	S149 and S150	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:21
S152	2483614	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:22
S153	1314820	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:32
S154	16734	S152 with S153	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/17 23:32

			DERWENT; IBM_TDB			
S155	30	S151 and S154	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:33
S156	841	S151 and S152	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
S157	674	S151 and S153	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
S158	5477	speed near7 based adj2 distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
S159	88	S149 and S158	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S160	42	S159 and S152	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S161	34	S159 and S153	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S162	23	S160 and S161	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S163	179564	determin\$4 adj3 angle	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
S164	1277	S149 and S163	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/18 00:27

			DERWENT; IBM_TDB			
S165	726	S152 and S164	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
S166	36699	azimuth angle	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:28
S167	60	S165 and S166	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:28
S168	8369	convert\$4 with two-dimensional with three-dimensional	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:05
S169	10964	convert\$4 with ((two adj dimensional) or 2D or ("2" adj dimensional) or ("2" adj D) or 2-d) near3 ((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:06
S170	94	S149 and S169	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:07
S171	0	rate near2 speed near3 (adjust\$4) with2 smooth\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:18
S172	4414	rate near2 speed near3 (adjust\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:19
S173	11	S149 and S172	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:19
S174	17500	rate near2 speed near3 (adjust\$4 or chang\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/18 01:26

			DERWENT; IBM_TDB			
S175	120	S149 and S174	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
S176	109	S175 not S173	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
S177	455	image based navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:46
S178	11	S149 and S177	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:47
S179	11	S149 and S177 and navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:55
S180	0	S149 and S177 and navigation near5 (select\$4 or choos\$4 or threshold)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:58
S181	1	16/142452	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:01
S182	1	16/142452 and ground-based sensor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:02
S183	3	"20180046187".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:42
S184	1	"20180046187".pn. and "408"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2019/03/06 11:47

			DERWENT; IBM_TDB			
S185	1	"20180046187".pn. and "210" and "212"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:49
S186	1	"20180046187".pn. and "408" and "410"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 13:27
S187	4	("20020196330" "20080252903").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 14:09
S188	4	("20020196330" "20080252903").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 14:34
S189	4	("20160068267" "20160202695" "20160246297" "20170161907").PN.	US-PGPUB	ADJ	OFF	2019/03/06 14:35
S190	2	("20020196330" "20080252903").PN.	US-PGPUB	ADJ	OFF	2019/03/06 14:35
S191	6	S189 or S190	US-PGPUB	ADJ	OFF	2019/03/06 14:35
S192	1	"20180046187".pn. and navigat\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 14:50
S193	1	"20180046187".pn. and navigat\$4 near6 auto\$7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 14:51
S194	1	"20180046187".pn. and ground	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 15:17
S195	3	"20180074519".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 16:14
S196	1	"20180074519".pn. and size	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2019/03/06 16:15

			EPO; JPO; DERWENT; IBM_TDB			
S197	4090	distance with based adj6 size same image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 16:18
S199	183	S197 and (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 16:18

EAST Search History (Interference)

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3/ 6/ 2019 7:10:14 PM
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Electronic Patent Application Fee Transmittal

Application Number:	16142452			
Filing Date:	26-Sep-2018			
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION			
First Named Inventor/Applicant Name:	Guy Bar-Nahum			
Filer:	Jong Andrew Hyuk Park/Elaine Nguyen			
Attorney Docket Number:	ASPAP008			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 1 month with \$0 paid	1251	1	200	200
Miscellaneous:				
Total in USD (\$)				200

Electronic Acknowledgement Receipt

EFS ID:	36562204
Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Jong Andrew Hyuk Park/Elaine Nguyen
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Application Type:	Utility under 35 USC 111(a)

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Payment Type	DA
Payment was successfully received in RAM	\$200
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The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response After Final Action	ASPAP008_AMD_B.pdf	144680	no	7
			e58ea217d7353dda05bb67049fbc834cc5d aaa0e		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30582	no	2
			829039d88ff979f01ae5db6cfe502958c7e6f f0c		

Warnings:

Information:

Total Files Size (in bytes):	175262
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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:	16/142,452	Examiner:	Randolph I. Chu
Filed:	September 26, 2018	Art Unit:	2663
Confirmation No.:	4743	Docket No.:	ASPAP008
First Inventor:	Guy Bar-Nahum		
Title:	FLIGHT CONTROL USING COMPUTER VISION		

AMENDMENT B

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

Dear Sir:

This is in response to the Office Action mailed March 12, 2019. The following amendment and remarks are respectfully submitted.

Applicant(s) believe that no (additional) fees are required beyond any fees submitted herewith. If required fees are missing or any additional fees are required during the pendency of the subject application, please charge such fees or credit any overpayment to Deposit Account No. 50-0685 (ASPAP008).

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of performing a flight control operation of a reference aerial vehicle, comprising:
~~receiving a geographical location associated with a target detected at least in part using a ground-based sensor;~~
~~autonomously navigating the reference aerial vehicle towards the received geographical location;~~
~~determining to allow image-based navigation;~~
receiving an image captured by an image sensor of the reference aerial vehicle;
detecting ~~[[the]]~~ a target in the image including by applying a machine learning model to the image to identify a portion of the image that includes the target;
determining a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image including by determining a distance to the target based at least in part on a size of the target detected within the image; and
performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.
2. (Original) The method of claim 1, wherein the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle.
3. (Original) The method of claim 1, wherein performing the flight control operation includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target.
4. (Original) The method of claim 1, wherein detecting the target in the image includes identifying a model type of the target.
5. (Original) The method of claim 1, wherein detecting the target in the image includes

identifying a bounding box outlining a portion of the image that includes detected features of the target.

6. (Original) The method of claim 5, wherein determining the three-dimensional relative location of the target includes determining the distance to the target based on an area of the bounding box of the target within the image.

7. (Previously Presented) The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining the distance to the target based on a size of the target within the image and a physical size corresponding to an identified type for the target.

8. (Previously Presented) The method of claim 7 wherein performing the flight control operation includes determining a speed adjustment factor based on the determined distance to the target.

9. (Original) The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining a direction of the target with respect to the reference aerial vehicle.

10. (Original) The method of claim 1, wherein determining the three-dimensional relative location of the target includes determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.

11. (Original) The method of claim 1, wherein determining the three-dimensional relative location of the target includes converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.

12. (Currently Amended) ~~The method of claim 1, wherein performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle~~

further comprising:

receiving a geographical location associated with the target detected at least in part using a ground-based sensor;

autonomously navigating the reference aerial vehicle towards the received geographical location; and

determining to allow image-based navigation.

13. (Currently Amended) The method of claim 1 [[12]], wherein the speed adjustment factor is greater for a smaller magnitude of deviation as compared to for a greater magnitude of deviation.
14. (Previously Presented) The method of claim 1, wherein performing the flight control operation includes scaling a speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.
15. (Previously Presented) The method of claim 1, wherein performing the flight control operation includes determining a direction adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.
16. (Previously Presented) The method of claim 15, wherein performing the flight control operation includes scaling the direction adjustment factor to smooth and limit a rate of change of a direction of the reference aerial vehicle.
17. (Currently Amended) The method of claim 1, wherein the distance to the target is determined based at least in part using a radar.
18. (Previously Presented) The method of claim 1, wherein it is determined to allow the image-based navigation based on whether the reference aerial vehicle is within a threshold distance away from the received geographical location.
19. (Currently Amended) A reference aerial vehicle, comprising:
an image sensor configured to capture an image;
a processor configured to:
detect a target in the image; and
determine a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and
a flight controller configured to perform a flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein the flight controller is configured to perform the flight control operation including by being configured to determine a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle;
~~wherein the reference aerial vehicle is configured to receive a geographical location~~

~~associated with the target detected at least in part using a ground-based sensor; autonomously navigate the reference aerial vehicle towards the received geographical location; and determine to allow image-based navigation.~~

20. (Currently Amended) A computer program product for performing a flight control operation of a reference aerial vehicle, the computer program product being embodied in a non-transitory computer readable storage medium and comprising computer instructions for:

~~receiving a geographical location associated with a target detected at least in part using a ground-based sensor;~~

~~autonomously navigating the reference aerial vehicle towards the received geographical location;~~

~~determining to allow image-based navigation;~~

receiving an image captured by an image sensor of the reference aerial vehicle;

detecting ~~[[the]]~~ a target in the image including by applying a machine learning model to the image to identify a portion of the image that includes the target;

determining a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image including by determining a distance to the target based at least in part on a size of the target detected within the image; and

performing the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.

INTERVIEW SUMMARY

A telephonic interview in the above-referenced case was conducted on July 10, 2019 between the Examiner and the Applicants' undersigned representative. The Office Action mailed on March 12, 2019 was discussed. Specifically, the rejections of claim 1 in light of the cited references and the proposed amendments set forth herein were discussed with the intent to place the claims in better condition for allowance or appeal.

The Applicants thank the Examiner for the interview.

REMARKS

Claims 1, 12, 13, 17, 19 and 20 have been amended to clarify the subject matter regarded as the invention. Claims 1-20 are pending.

Subject Matter Indicated as Being Allowable

The Examiner has indicated that claims 12-13, 15-16 and 18 contain allowable subject matter. Claim 12 was also indicated as being allowable in a previous Office Action mailed November 23, 2018. Claim 1 has been amended based on the allowable claim 12 of the current Office Action as well as the previous Office Action mailed November 23, 2018.

Claim 12 has been amended based on originally filed claim 17.

The foregoing amendments are not to be taken as an admission of unpatentability of any of the claims prior to the amendments.

Reconsideration of the application and allowance of all claims are respectfully requested based on the preceding remarks. If at any time the Examiner believes that an interview would be helpful, please contact the undersigned.

Respectfully submitted,

Dated: 7/11/2019

/Jong Andrew Park/

Jong Andrew H. Park
Registration No. 56917
408-973-2577

VAN PELT, YI & JAMES LLP
10050 N. Foothill Blvd., Suite 200
Cupertino, CA 95014
Fax 408-973-2595



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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NOTICE OF ALLOWANCE AND FEE(S) DUE

117915 7590 08/02/2019
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC
10050 N. FOOTHILL BLVD #200
CUPERTINO, CA 95014

EXAMINER

CHU, RANDOLPH I

ART UNIT

PAPER NUMBER

2663

DATE MAILED: 08/02/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743

TITLE OF INVENTION: FLIGHT CONTROL USING COMPUTER VISION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	11/04/2019

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.

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

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.

117915 7590 08/02/2019
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC
10050 N. FOOTHILL BLVD #200
CUPERTINO, CA 95014

Certificate of Mailing or Transmission

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.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743

TITLE OF INVENTION: FLIGHT CONTROL USING COMPUTER VISION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	11/04/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHU, RANDOLPH I	2663	382-103000

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 _____

(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.

2 _____

3 _____

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

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

(A) NAME OF ASSIGNEE

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

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

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

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

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

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

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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

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

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743
117915	7590	08/02/2019	EXAMINER	
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC 10050 N. FOOTHILL BLVD #200 CUPERTINO, CA 95014			CHU, RANDOLPH I	
			ART UNIT	PAPER NUMBER
			2663	
DATE MAILED: 08/02/2019				

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. 16/142,452	Applicant(s) Bar-Nahum et al.	
	Examiner RANDOLPH I CHU	Art Unit 2663	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 amendment filed on 7/11/2019.
☐ 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 1-20. 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)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/RANDOLPH I CHU/ Primary Examiner, Art Unit 2663	
---	--

Notice of Pre-AIA or AIA Status

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

Allowable Subject Matter

1. Claims 1-16 are allowed.

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

Claims 1, 19 and 20 are allowable over the prior art of record because none of the prior art of record teaches the combined claimed elements as set forth in the claims 1, 19 and 20.

None of the prior art of record teaches or fairly suggests that image processing method that performing the flight control operation of a reference aerial vehicle based on the three-dimensional relative location of the target with respect to the reference aerial vehicle which is based on the image, wherein performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle, and together with combination of other claimed elements as set forth in the independent claims 1 and 10. Therefore, the claim 1 and 10 are over the prior art of records.

Claims 2-18 are allowed because they are depended on independent claim 1.

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

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RANDOLPH I. CHU whose telephone number is (571)270-1145. The examiner can normally be reached on Monday through Thursday 7:30 am - 4 pm.

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

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on 571-272-7023. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published

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

/RANDOLPH I CHU/

Primary Examiner, Art Unit 2663

Issue Classification 	Application/Control No. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2663

CPC						
Symbol					Type	Version
G05D	/	1	/	12	F	2013-01-01
G08G	/	5	/	0078	I	2013-01-01
G05D	/	1	/	0088	I	2013-01-01
B64C	/	39	/	024	I	2013-01-01
G05D	/	1	/	101	I	2013-01-01
G06K	/	9	/	0063	I	2013-01-01
B64D	/	47	/	08	I	2013-01-01
G08G	/	5	/	0013	I	2013-01-01
G08G	/	5	/	0069	I	2013-01-01
B64C	/	2201	/	141	A	2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
/				

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/RANDOLPH I CHU/ Primary Examiner, Art Unit 2663 (Primary Examiner) _____ (Date) 23 July 2019		O.G. Print Claim(s) 1	O.G. Print Figure 4

Issue Classification 	Application/Control No. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2663

INTERNATIONAL CLASSIFICATION			
CLAIMED			
G06K	/	9	/ 00
NON-CLAIMED			
/	/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/RANDOLPH I CHU/ Primary Examiner, Art Unit 2663	23 July 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

Issue Classification 	Application/Control No. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2663

☐ 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	10	19	19										
2	2	11	11	20	20										
3	3	12	12												
4	4	13	13												
5	5	14	14												
6	6	15	15												
7	7	16	16												
8	8	17	17												
9	9	18	18												

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/RANDOLPH I CHU/ Primary Examiner, Art Unit 2663 (Primary Examiner) _____ (Date) _____		23 July 2019	O.G. Print Claim(s) 1
			O.G. Print Figure 4

Search Notes 	Application/Control No. 16/142,452	Applicant(s)/Patent Under Reexamination Bar-Nahum et al.
	Examiner RANDOLPH I CHU	Art Unit 2663

CPC - Searched*		
Symbol	Date	Examiner

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
Inventor Name Search	11/16/2018	ric
EAST	11/16/2018	ric
NPL, Internet	11/16/2018	ric
Updated EAST Search	03/06/2019	ric
Updated NPL, Internet Search	03/06/2019	ric
Updated EAST Search	07/23/2019	ric
Updated NPL, Internet Search(IP.com, Global Dossier, Google)	07/23/2019	ric

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	PG Pub, UPAD Text search, see interference search print out	07/23/2019	ric

/RANDOLPH I CHU/ Primary Examiner, Art Unit 2667	
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EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L7	131225	((speed or velocity) near3 (control\$4 or alter\$4 or alteration or multipl\$3 or modif\$4 or modification\$1 or conform\$3 or amend\$3 or adjust\$4)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 17:56
L8	901	"6" and 7 and ((orientation or angle or degree or skew or vertical or horizontal or longitudinal or diagonal or transverse) near3 (diviation or difference or variation or fluctuation)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 17:56
S1	0	15/729581	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 01:47
S2	26	382/103.ccls. and randolph near2 chu	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 01:49
S3	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:31
S4	0	S3 and track\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:33
S5	2	S3 and (item or object)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 21:34
S6	2	"9031280".pn.	US-PGPUB;	ADJ	OFF	2018/02/17

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			23:33
S7	0	S6 and mobile	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:33
S8	1	S6 and portable	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:33
S9	2	S6 and "100"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:34
S10	1	S6 and match\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:56
S11	0	S6 and match\$4 near5 object	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/17 23:58
S12	2	"9031280".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/19 11:34
S13	1	S12 and score	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/19 11:34
S16	0	(object near2 detect%5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	OFF	2018/02/20 02:36

			IBM_TDB			
S17	0	(object near2 detect%5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S18	10	different resolutions near5 (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:36
S19	79470	(camera or image sensor) near7 (radar or radio frequency or proximity or acoustic or thermal imaging or night vision or global positioning system or gps)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S20	330579	(object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S21	10547	S19 and S20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:42
S22	860	"382".clas. and S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S23	15372	382/103.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S24	340	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:43
S25	422197	(change near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO;	ADJ	OFF	2018/02/20 02:48

			JPO; DERWENT; IBM_TDB			
S26	31727	S20 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S27	26891	S20 and S25 and control\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:48
S28	959	S20 and S25 and control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S29	5810	S20 and S25 and control\$4 near3 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S30	70	"382".clas. and S28	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:50
S31	30	S20 and S25 same control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:52
S32	4	"382".clas. and S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 02:52
S33	330579	(object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S34	422197	(change near2 detect\$5)	US-PGPUB; USPAT;	ADJ	OFF	2018/02/20 05:09

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S35	30	S33 and S34 same control\$4 (navigation or interface or captur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:09
S36	83	(Bar-Nahum near2 Guy).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:11
S37	0	(Nguyen near2 Hoang near2 Anh).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:11
S38	5	S36 and (track\$4 or detect) near5 (object or item)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:13
S39	3	S36 and ((track\$4 or detect) near5 (object or item)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:13
S40	0	S36 and ((track\$4 or detect) near5 (object or item) and scheme).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/02/20 05:14
S41	28	382/103.ccls. and resolution near2 (low\$4) near7 convert\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:08
S42	28	(@ad<="20161009" or @rlad<="20161009") and S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:09

S43	7	382/103.ccls. and resolution near2 (low\$4) near7 convert\$4 with detect\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:11
S44	21	(different or plural\$5 or multiple) adj2 resolutions near5 (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:50
S45	48	(different or plural\$5 or multiple) adj2 resolutions with (object detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S46	7957	resolution near2 (low\$4) near7 convert\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S47	0	S45 and S46	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 00:51
S48	145863	track\$4 near4 (object or item or person or intruder or interest)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S49	82	(different or plural\$5 or multiple) adj2 resolutions with (object near2 detect\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S50	27	(different or plural\$5 or multiple) adj2 resolutions with S48	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:41
S51	373	resolution near2 (low\$4) near7 convert\$4 with detect\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/06/25 09:44

			DERWENT; IBM_TDB			
S52	0	S50 and S51	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 09:45
S53	1	"20100034464".pn. and resolution	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 10:00
S54	1	"20070201694".pn. and resolution	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 10:02
S55	12	("20030081813" "20050094849" "6075557" "6650704" "7200247").PN. OR ("8098885").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/06/25 11:34
S56	1	"20070201694".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:38
S57	0	"20100034464".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:39
S58	2	"20070098218".pn. and lower	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 11:39
S59	1	"20070098218".pn. and location	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/06/25 13:43
S60	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	OFF	2018/11/13 11:17

			IBM_TDB			
S61	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:17
S63	8634917	(automatic\$5 or autonomous\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:22
S64	7713	S60 and S61 and S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:22
S65	6359	S60 and S61 and S63 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:25
S66	237252	S61 near5 (location or position or coordinat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:26
S67	2509	S60 and S66 and S63 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S68	58782	S61 with S63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S69	593	S67 and S68	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 11:28
S70	1032564	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO;	ADJ	OFF	2018/11/13 12:11

			JPO; DERWENT; IBM_TDB			
S71	134	S69 and S70	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:12
S72	0	S69 and S70 and surveilanc\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:50
S73	93	S69 and S70 and Surveillance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 12:51
S74	1670995	(automatic\$5 or autonomous\$4) near5 (Navigat\$4 or control\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S75	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S76	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S77	237252	S76 near5 (location or position or coordinat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S78	1411	S75 and S77 and S74 and imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:35
S79	8634917	(automatic\$5 or autonomous\$4)	US-PGPUB; USPAT;	ADJ	OFF	2018/11/13 17:36

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S80	58782	S76 with S79	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:36
S81	413	S78 and S80	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:36
S82	1032564	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S83	114	S81 and S82	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S84	84	S81 and S82 and Surveillance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 17:37
S85	73	fortem	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:55
S86	0	S84 and S85	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:55
S87	0	fortem and dronehunter	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57

S88	0	dronehunter	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S89	0	fortem and dribe	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S90	0	fortem and drone	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 18:57
S91	2	"20170144756".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 19:02
S92	17399	delft	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S93	82795	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S94	47	delft and S93	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S95	1	"20170144756".pn. and image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:18
S96	0	"20170144756".pn. and image and 3D	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/13 23:24

			DERWENT; IBM_TDB			
S97	1	delft and S93 and 3e	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S98	15	delft and S93 and 3d	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S99	2506263	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S100	16	delft and S93 and S99	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:25
S101	12721	radar imag\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:51
S102	1313848	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:52
S103	102	S99 and S101 and S102 and S93	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/13 23:53
S104	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S105	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR;	ADJ	OFF	2018/11/15 23:05

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S106	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S107	438	S105 with S106 and S104	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:05
S108	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:08
S109	186	S107 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:08
S110	94	S107 and S108 and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/15 23:15
S111	1032912	learning model or AI or artificial intelligence or (neural near network) or ((learning or training or intelligent) near2 algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:46
S112	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S113	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S114	1314673	relativ\$4 near2 (cordinat\$4 or	US-PGPUB;	ADJ	OFF	2018/11/16

		location or position)	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			00:47
S115	438	S113 with S114 and S112	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S116	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S117	186	S115 and S116	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S118	11	S117 and S111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S119	94	S115 and S116 and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S120	11	S119 and S111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 00:47
S121	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/16 15:31
S122	82907	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	OFF	2018/11/16 15:32

			IBM_TDB			
S123	2507857	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S124	1314673	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S125	438	S123 with S124 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S126	1144969	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S127	186	S125 and S126	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:32
S128	1	S127 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/16 15:32
S129	122	S121 and S122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/16 15:45
S130	2481315	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:56
S132	3	"20180074519".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO;	ADJ	OFF	2018/11/17 01:56

			JPO; DERWENT; IBM_TDB			
S134	1	S130 and S132	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:57
S135	2351	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 01:58
S136	82060	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:58
S137	2	S135 and S136 and bounding box	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 01:58
S139	1	"20180074519".pn. and (GPS or geograph\$7 or map)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 02:20
S140	1	"20180074519".pn. and (GPS or geograph\$7 or map) and based	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 02:20
S141	0	15/600948	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:46
S142	2508560	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S143	2363	distance with based adj4 size with image	US-PGPUB; USPAT;	ADJ	ON	2018/11/17 16:49

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S144	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S145	2	S143 and S144 and bounding box and S142	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 16:49
S146	2363	distance with based adj4 size with image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2018/11/17 17:09
S147	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 17:09
S148	76	S146 and S147 and identif\$6 near5 type	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 17:09
S149	83184	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:19
S150	170399	speed near5 distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:21
S151	1730	S149 and S150	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:21

S152	2483614	((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:22
S153	1314820	relativ\$4 near2 (cordinat\$4 or location or position)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:32
S154	16734	S152 with S153	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:32
S155	30	S151 and S154	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:33
S156	841	S151 and S152	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
S157	674	S151 and S153	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
S158	5477	speed near7 based adj2 distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:53
S159	88	S149 and S158	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S160	42	S159 and S152	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	OFF	2018/11/17 23:54

			DERWENT; IBM_TDB			
S161	34	S159 and S153	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S162	23	S160 and S161	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/17 23:54
S163	179564	determin\$4 adj3 angle	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
S164	1277	S149 and S163	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
S165	726	S152 and S164	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:27
S166	36699	azimuth angle	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:28
S167	60	S165 and S166	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 00:28
S168	8369	convert\$4 with two-dimensional with three-dimensional	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:05
S169	10964	convert\$4 with ((two adj dimensional) or 2D or ("2" adj dimensional) or ("2" adj D) or 2-d)	US-PGPUB; USPAT; USOCR;	ADJ	OFF	2018/11/18 01:06

		near3 ((three adj dimensional) or 3D or ("3" adj dimensional) or ("3" adj D) or 3-d)	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S170	94	S149 and S169	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:07
S171	0	rate near2 speed near3 (adjust\$4) with2 smooth\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:18
S172	4414	rate near2 speed near3 (adjust\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:19
S173	11	S149 and S172	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:19
S174	17500	rate near2 speed near3 (adjust\$4 or chang\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
S175	120	S149 and S174	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
S176	109	S175 not S173	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:26
S177	455	image based navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:46
S178	11	S149 and S177	US-PGPUB;	ADJ	OFF	2018/11/18

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			01:47
S179	11	S149 and S177 and navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:55
S180	0	S149 and S177 and navigation near5 (select\$4 or choos\$4 or threshold)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2018/11/18 01:58
S181	1	16/142452	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:01
S182	1	16/142452 and ground-based sensor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:02
S183	3	"20180046187".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:42
S184	1	"20180046187".pn. and "408"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:47
S185	1	"20180046187".pn. and "210" and "212"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 11:49
S186	1	"20180046187".pn. and "408" and "410"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	ON	2019/03/06 13:27

			IBM_TDB			
S187	4	("20020196330" "20080252903").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 14:09
S188	4	("20020196330" "20080252903").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 14:34
S189	4	("20160068267" "20160202695" "20160246297" "20170161907").PN.	US-PGPUB	ADJ	OFF	2019/03/06 14:35
S190	2	("20020196330" "20080252903").PN.	US-PGPUB	ADJ	OFF	2019/03/06 14:35
S191	6	S189 or S190	US-PGPUB	ADJ	OFF	2019/03/06 14:35
S192	1	"20180046187".pn. and navigat\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 14:50
S193	1	"20180046187".pn. and navigat\$4 near6 auto\$7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 14:51
S194	1	"20180046187".pn. and ground	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 15:17
S195	3	"20180074519".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 16:14
S196	1	"20180074519".pn. and size	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 16:15
S197	4090	distance with based adj6 size same image	US-PGPUB; USPAT; USOCR;	ADJ	ON	2019/03/06 16:18

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S199	183	S197 and (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 16:18
S200	10	(allow\$4 or approv\$4 or authoriz\$6 or enabl\$4 or grant\$4) near4 navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:28
S201	476	image based navigation	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:36
S202	3	image based navigation with distance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:36
S203	1	"20180046187".pn. and radar	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/03/06 17:47
S204	0	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) near4 navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:49
S205	2	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) with navigat\$4 with distance same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:50
S206	59	(disallow\$4 or disapprov\$4 or unauthoriz\$6 or disabl\$4 or reject\$4) with navigat\$4 same (UAV or drone)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 17:51
S207	2	(disallow\$4 or disapprov\$4 or	US-PGPUB;	ADJ	OFF	2019/03/06

		unauthoriz\$6 or disabl\$4 or reject\$4) with navigat\$4 with distance same (UAV or drone)	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			17:52
S208	1179638	(autonomous or automat\$6) near3 (navigation or control or pilot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/03/06 18:52
S209	4	("20160068267" "20160202695" "20160246297" "20170161907").PN.	US-PGPUB	ADJ	OFF	2019/03/06 18:53
S210	2	("20020196330" "20080252903").PN.	US-PGPUB	ADJ	OFF	2019/03/06 18:53
S211	6	S209 or S210	US-PGPUB	ADJ	OFF	2019/03/06 18:53
S212	2	S208 and S211	US-PGPUB	ADJ	OFF	2019/03/06 18:53
S213	4	(S209 or S210) and distance	US-PGPUB	ADJ	OFF	2019/03/06 18:55
S214	8	("2018/0046187").URPN.	USPAT	ADJ	ON	2019/07/10 10:26
S215	114415	(drone or UAV or Unmanned aerial vehicle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 13:36
S216	1513011	(speed or velocity) near3 (control\$4 or alter\$4 or alteration or multipl\$3 or modif\$4 or modification\$1 or conform\$3 or amend\$3 or adjust\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 14:07
S217	7758	S215 and S216	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 14:08
S218	437	S215 and S216 with (location)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 14:15
S219	1708	S215 and S216 with (location or position or coordinate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	OFF	2019/07/23 14:15

			IBM_TDB			
S220	0	S215 and S216 with (location) with (orientation or angle or degree or skew or vertical or horizontal or longitudinal or diagonal or transverse) near3 (diviation or difference or variation or fluctuation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 14:46
S221	10	S215 and S216 with (orientation or angle or degree or skew or vertical or horizontal or longitudinal or diagonal or transverse) near3 (diviation or difference or variation or fluctuation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 14:47
S222	5	S219 and S221	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2019/07/23 14:48

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	7831	(drone or UAV or Unmanned aerial vehicle).clm.	US-PGPUB; USPAT	ADJ	OFF	2019/07/23 17:55
L9	131225	((speed or velocity) near3 (control\$4 or alter\$4 or alteration or multipl\$3 or modif\$4 or modification\$1 or conform\$3 or amend\$3 or adjust\$4)).clm.	US-PGPUB; USPAT	ADJ	OFF	2019/07/23 17:57
L10	6	6 and 9 and ((orientation or angle or degree or skew or vertical or horizontal or longitudinal or diagonal or transverse) near3 (diviation or difference or variation or fluctuation)).clm.	US-PGPUB; USPAT	ADJ	OFF	2019/07/23 18:00

7/ 23/ 2019 6:07:47 PM
C:\ Users\rchu\ Documents\ EAST\ Workspaces\ 16142452.wsp



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
16/142,452	09/26/2018	Airspace Systems, Inc.	ASPAP008	97786

Acknowledgement of Change to Small Entity Status

The entity status change request below filed through Private PAIR on 10/15/2019 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

× Applicant asserting small entity status. See 37 CFR 1.27.

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

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Jong Andrew Park/
Name:	Jong Andrew Park
Registration Number:	56917

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)

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.

117915 7590 08/02/2019
VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC
10050 N. FOOTHILL BLVD #200
CUPERTINO, CA 95014

Certificate of Mailing or Transmission

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.

Elaine Nguyen	(Typed or printed name)
/Elaine Nguyen/	(Signature)
October 31, 2019	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	09/26/2018	Guy Bar-Nahum	ASPAP008	4743

TITLE OF INVENTION: FLIGHT CONTROL USING COMPUTER VISION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	~~UNDISCOUNTED~~ SMALL	~~\$1000~~ \$500	\$0.00	\$0.00	~~\$1000~~ \$500	11/04/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHU, RANDOLPH I	2663	382-103000

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 Van Pelt, Yi & James LLP

2

3

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

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

(A) NAME OF ASSIGNEE

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

Airspace Systems, Inc.

San Leandro, CA

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

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

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

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

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-0685

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 /Jong Andrew Park/

Date 10/31/2019

Typed or printed name Jong Andrew H. Park

Registration No. 56917

Electronic Patent Application Fee Transmittal

Application Number:	16142452			
Filing Date:	26-Sep-2018			
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION			
First Named Inventor/Applicant Name:	Guy Bar-Nahum			
Filer:	Jong Andrew Hyuk Park/Elaine Nguyen			
Attorney Docket Number:	ASPAP008			
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:	37610244
Application Number:	16142452
International Application Number:	
Confirmation Number:	4743
Title of Invention:	FLIGHT CONTROL USING COMPUTER VISION
First Named Inventor/Applicant Name:	Guy Bar-Nahum
Customer Number:	117915
Filer:	Jong Andrew Hyuk Park/Elaine Nguyen
Filer Authorized By:	Jong Andrew Hyuk Park
Attorney Docket Number:	ASPAP008
Receipt Date:	31-OCT-2019
Filing Date:	26-SEP-2018
Time Stamp:	15:03:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 500
RAM confirmation Number	E20190UF03346291
Deposit Account	500685
Authorized User	Elaine Nguyen

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	ASPAP008_IF_Transmittal.pdf	1285222	no	1
			d4beb2105db30ca6b608bd12611d3c317fd079b7		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30319	no	2
			2977638ed73e5ba7c46fe8d6fa9301c6af89db06		

Warnings:

Information:

Total Files Size (in bytes):	1315541
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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.



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/142,452	12/24/2019	10514711	ASPAP008	4743

117915 7590 12/04/2019

VAN PELT, YI & JAMES LLP AND AIRSPACE SYSTEMS, INC
10050 N. FOOTHILL BLVD #200
CUPERTINO, CA 95014

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):

Guy Bar-Nahum, Sausalito, CA;
Airspace Systems, Inc., San Leandro, CA
Hong-Bin Yoon, San Leandro, CA;
Karthik Govindaswamy, Milpitas, CA;
Hoang Anh Nguyen, San Mateo, CA;

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